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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 3: Clothing

Équipement de protection individuelle pour pompiers — Méthodes d'essai et exigences pour les équipements de protection individuelle utilisés par les pompiers qui risquent d'être exposés à des niveaux élevés de chaleur et/ou de flamme lorsqu'ils combattent des incendies dans des structures —

Partie 3: Vêtements

Reference number
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Contents

Page

Foreword ..... **v**
Introduction ..... **vi**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **3**
4 Clothing requirements **3**
4.1 General 3
4.1.1 General requirement 3
4.1.2 Innocuousness 3
4.2 Clothing configuration 3
4.3 Component assembly 4
4.3.1 General 4
4.3.2 Compatibility 4
4.4 Hardware and garment closure systems 4
4.5 Pockets 4
4.6 Garment sizing 5
4.7 Neck protection 5
4.8 Inspection access 5
4.9 Additional requirements 5
4.9.1 General 5
4.9.2 Anti-wicking barrier 5
4.9.3 Protective wristlet 5
4.9.4 High visibility materials 6
4.9.5 Cowl 6
4.9.6 Reinforcement material 6
4.9.7 Smart devices integrated into firefighting garments 6
5 Sampling **6**
5.1 Samples 6
5.2 Sampling levels 6
5.3 Exposure surface 7
6 Pretreatment **7**
6.1 Conditioning 7
6.2 Pretreatment by laundering or dry cleaning 7
7 Clothing — Performance requirements **7**
7.1 General 7
7.2 Heat and flame performance 9
7.2.1 Flame resistance 9
7.2.2 Heat resistance 11
7.2.3 Convective heat transfer (flame exposure) 12
7.2.4 Radiant heat transfer (radiant exposure) 12
7.2.5 Heat transfer (combined flame and radiant exposure) - Optional alternative to 7.2.3 and 7.2.4 12
7.2.6 Residual strength of material following radiant heat exposure 12
7.2.7 Contact heat 13
7.2.8 Conductive compressive heat resistance 13
7.2.9 Thread heat resistance 13
7.3 Mechanical properties 13
7.3.1 General 13
7.3.2 Tensile strength 13
7.3.3 Tear strength 13
7.3.4 Seam strength (woven materials) 14
7.3.5 Abrasion (Optional test) 14

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7.3.6 Cleaning shrinkage resistance/Dimensional stability 14
7.4 Liquid, particulate and virus resistance performance 14
7.4.1 Water penetration resistance 14
7.4.2 Particulate resistance 14
7.4.3 Liquid penetration resistance (runoff method) 14
7.4.4 Viral penetration resistance (optional) 15
7.5 Thermal comfort performance 15
7.6 Hardware corrosion resistance 15
7.7 Garment flame engulfment test using an instrumented manikin (optional) 16
7.8 Additional optional requirements 16
7.8.1 Drag rescue device (DRD)/lifeline 16
7.8.2 Molten aluminium splash 17
7.8.3 High visibility 17
8 Compatibility **17**
9 Marking **17**
10 Manufacturer's information **17**
10.1 Garment assemblies 17
10.2 Detail on test results 18
Annex A (normative) **Determination of property values** **19**
Annex B (normative) **Uncertainty of measurement** **20**
Annex C (normative) **Particulate test** **22**
Bibliography **23**

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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 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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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 — Protective clothing and equipment, Subcommittee SC 14, Firefighters' personal equipment*.

This second edition cancels and replaces the first edition (ISO 11999-3:2015), which has been technically revised.

The main changes are as follows:

— the design requirement have been amended and added to (e.g. cowl, high visibility, inspection access, neck protection)

— all the heat and flame properties have been brought to amended single levels (see Table 1);

— all the mechanical properties have been brought to amended single levels (see Table 1), including adding abrasion requirement;

— all the chemical, particulate and liquid properties have been brought to amended single levels (see Table 1), including particulate testing;

— additional tests have been added or changed (including making optional) including but not limited to high visibility, molten metal, drag rescue device/lifeline; resistance evaporative transfer (RET), garment flame engulfment.

A list of all parts in the ISO 11999 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

In a world where there is an ever-increasing focus on worker occupational health and safety, Fire Services are faced with the dilemma of trying to provide firefighters with as safe a work environment as is reasonably possible whilst also having to deal with the known and unknown risks our firefighters face whilst fighting fires in both the urban and wildland environments.

In the course of their duties firefighters are exposed to many hazardous chemicals that could include smoke, soot, carcinogens, biproducts of combustion such as heavy metals, benzene and per-fluorinated compounds which can be inhaled, ingested, and/or absorbed through the skin of firefighters. Where possible, the level of risk that each hazard presents to firefighters is to be eliminated or reduced to an acceptable level. The guidance given in ISO/TR 21808 indicates how to carry out a Risk Assessment by acknowledging the hazards that may be present, the likelihood of the firefighters becoming exposed to them and possible consequence of such exposure if not addressed.

With the 2023 statement by the World Health Organization (WHO) elevating the classification of occupational exposure as a firefighter to Group 1, ISO TC94 SC14 Project Group on Contaminants are taking all possible steps to reduce the risk from exposures to firefighters by reviewing all Standards pertaining to PPE used by firefighters and making recommendations to address identified shortfalls.

The following is an extract from the 2023 statement released by the WHO:

— International Agency for Research on Cancer (IARC), the cancer agency of the World Health Organization (WHO), has evaluated the carcinogenicity of occupational exposure as a firefighter;

— Working Group of 25 international experts, including 3 Invited Specialists, from 8 countries was convened by the IARC Monographs programme for a meeting in Lyon;

— After thoroughly reviewing the available scientific literature, the Working Group classified occupational exposure as a firefighter as carcinogenic to humans (Group 1), on the basis of sufficient evidence for cancer in humans.

ISO/TR 21808 provides guidance on how to carry out a risk assessment.

The guideline was developed previously based on the work of CEN Technical Committee TC 162, Joint Working Group for firefighters Personal Protective Equipment and has been modified to encompass PPE worn by all emergency service personnel. (CEN/TC 162/JWG FFPPE N 52 “Risk assessment guidelines for choosing the PPE for firefighters”)”.

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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 3: Clothing

1 Scope

This document specifies the minimum design and performance requirements for clothing as part of personal protective equipment (PPE) to be used by firefighters, primarily but not solely to protect against exposure to flame and high thermal loads, and particulates (including other products of combustion).

To assist with choice based on user risk assessment, a single level of heat and flame protection is included with a number of options that can provide additional protection. For more information on firefighter risk assessment consult ISO/TR 21808.

The scope of this document does not include clothing for use in high-risk fire exposures where for example, reflective protective clothing according to ISO 15538 could be more appropriate, or for use in long-term firefighting operations in high ambient temperature, for example bush, wildland, or forest firefighting where clothing according to ISO 15384 (ISO 16073-3) could be more appropriate.

Similarly, this document does not include clothing to protect against chemical and biological hazards, other than against short-term and accidental exposure while engaged in firefighting and associated activities when fighting fires occurring in structures.

This document describes types, design, and performance of clothing, the specific requirements for clothing, marking, and manufacturer's instructions.

2 Normative references

For the purposes of this document, the following terms and definitions given in ISO 11999-1 and ISO 19591 Personal protective equipment for firefighters – Standard terms and definitions apply

ISO 811, *Textiles — Determination of resistance to water penetration — Hydrostatic pressure test*

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

ISO 3175-1, *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 1: Assessment of performance after cleaning and finishing*

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

ISO 6330, *Textiles — Domestic washing and drying procedures for textile testing*

ISO 6530, *Protective clothing — Protection against liquid chemicals — Test method for resistance of materials to penetration by liquids*

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*

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ISO 9151, *Protective clothing against heat and flame — Determination of heat transmission on exposure to flame*

ISO 9185, *Protective clothing — Assessment of resistance of materials to molten metal splash*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

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

ISO 11999-1, *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 1: General*

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

ISO 13506-2, *Protective clothing against heat and flame — Part 2: Skin burn injury prediction — Calculation requirements and test cases*

ISO 13688:2013, *Protective clothing — General requirements*

ISO 13688:2013+Amd.1:2021, *Protective clothing — General requirements — Amendment 1*

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 14116:2015, *Protective clothing — Protection against flame — Limited flame spread materials, material assemblies and clothing*

ISO 15025:2016, *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 17492, *Clothing for protection against heat and flame — Determination of heat transmission on exposure to both flame and radiant heat*

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

ISO/TS 20141, *Personal safety — Personal protective equipment — Guidelines on compatibility testing of PPE*

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

NFPA 1970 (1971)-2025, *Standard on Protective Ensembles for Structural and Proximity Fire Fighting, Work Apparel and Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services, and Personal Alert Safety Systems (PASS)*

ASTM F2299/F2299M 24, *Standard Test Method for Determining the Initial Efficiency of Materials Used in Medical Face Masks to Penetration by Particulates Using Latex Spheres*

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