
**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 personnelle pour pompiers — Méthodes
d'essai et exigences pour les équipements de protection personnelle
utilisés par les pompiers qui sont à risque d'une exposition à des
niveaux élevés de chaleur et/ou de flamme quand la lutte contre les
incendies survient dans les structures —*

Partie 3: Vêtements



Sample Document

get full document from standards.iteh.ai



COPYRIGHT PROTECTED DOCUMENT

© ISO 2015

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	3
4 Clothing requirements	3
4.1 General	3
4.2 Clothing configuration	3
4.3 Multi-layer clothing assemblies	3
4.4 Component assembly	3
4.5 Attachment of interlining and innermost layers	3
4.6 Extension of interlining and innermost layers	4
4.7 Garment closure systems	4
4.8 Hardware	4
4.9 External pocket requirements	4
4.10 Garment sizing	4
4.11 Neck protection	4
4.12 Wrist protection	4
4.13 High-visibility materials	5
4.13.1 General	5
4.13.2 Option 1 — Placement based on minimum area of coverage	5
4.13.3 Option 2 — Placement based on standard pattern	5
4.14 Sampling	7
4.14.1 Samples	7
4.14.2 Sampling levels	7
4.14.3 Exposure surface	7
4.15 Pre-treatment	7
4.15.1 General	7
4.15.2 Pre-treatment by laundering or dry cleaning	7
4.16 Clothing — Performance requirements	8
4.17 Flame and thermal resistance performance	10
4.17.1 General	10
4.17.2 Flame resistance (surface ignition) for performance level A1	11
4.17.3 Flame resistance (bottom-edge ignition) for performance level A2	11
4.17.4 Heat resistance	11
4.17.5 Heat transfer (flame exposure)	12
4.17.6 Heat transfer (radiant exposure)	12
4.17.7 Heat transfer (combined flame and radiant exposure)	12
4.17.8 Residual strength of material following radiant heat exposure	13
4.17.9 Conductive compressive heat resistance	13
4.17.10 Thread heat resistance	14
4.18 Strength and physical hazard resistance performance	14
4.18.1 Tensile strength	14
4.18.2 Tear strength	14
4.18.3 Seam strength (woven materials)	14
4.18.4 Seam strength (knit or stretch woven materials)	14
4.19 Water and liquid resistance performance	14
4.19.1 General	14
4.19.2 Surface wetting	15
4.19.3 Water absorption resistance	15
4.19.4 Water penetration resistance	15
4.19.5 Liquid penetration resistance (runoff method) for performance level c ₁	16
4.19.6 Liquid penetration pressure resistance (hydrostatic method) for	

	performance level c ₂	16
4.19.7	Viral penetration resistance for performance level c ₂	16
4.19.8	Overall garment liquid penetration resistance for performance level c ₂	17
4.19.9	Light degradation resistance for performance level c ₂	17
4.20	Thermal comfort performance.....	17
4.20.1	General.....	17
4.20.2	Water vapour resistance.....	17
4.20.3	Total heat loss.....	18
4.21	Additional requirements.....	18
4.21.1	Cleaning shrinkage resistance.....	18
4.21.2	Hardware corrosion resistance.....	18
4.21.3	Photometric requirements of high-visibility retroreflective/combined performance materials used on garments.....	18
4.21.4	Colour requirements of high-visibility fluorescent/combined performance materials used on garments.....	19
4.21.5	Heat resistance of high-visibility materials used on garments.....	20
4.21.6	Flame spread of high-visibility materials used on garments.....	20
4.21.7	Protective wristlets.....	20
4.21.8	Optional clothing test using an instrumented manikin.....	20
4.21.9	Optional drag rescue device (DRD).....	20
5	Compatibility.....	21
6	Marking.....	21
7	Manufacturer's information.....	21
Annex A (informative)	Comparison of performance requirements for clothing.....	22

Sample Document

get full document from standards.iteh.ai

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 meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 14, *Firefighters' personal equipment*.

ISO 11999 consists of the following parts, under the general title *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 to flame while fighting fires occurring in structures*:

- *Part 1: General*
- *Part 2: Compatibility*
- *Part 3: Clothing*
- *Part 4: Gloves*

The following parts are under preparation:

- *Part 5: Helmets*
- *Part 6: Footwear*
- *Part 7: Face and eye protection*
- *Part 8: Hearing*
- *Part 9: Firehoods*
- *Part 10: Respiratory protection*

NOTE The number of this draft has been changed from ISO/DIS 11613-3 to ISO 11999-3. The committee agreed a new number for this project was appropriate given the scope publication of the ISO 11999 series was to cover ensemble standards. It was further agreed that ISO 11613:1999 would remain current.

Sample Document

get full document from standards.iteh.ai

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 part of ISO 11999 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.

To assist with choice based on user risk assessment, a number of levels of protection are included.

The scope of this part of ISO 11999 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 16073 or ISO 15384 could be more appropriate.

Similarly, this part of ISO 11999 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 part of ISO 11999 describes types, design, and performance of clothing, the specific requirements for clothing, marking, and manufacturer's instructions.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 811:1981, *Textile fabrics — Determination of resistance to water penetration — Hydrostatic pressure test*

ISO 3146:2000, *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 4674-1, *Rubber- or plastics-coated fabrics — Determination of tear resistance — Part 1: Constant rate of tear methods*

ISO 4920:2012, *Textile fabrics — Determination of resistance to surface wetting (spray test)*

ISO 5077:2007, *Textiles — Determination of dimensional change in washing and drying*

ISO 6330:2012, *Textiles — Domestic washing and drying procedures for textile testing*

ISO 6530:2005, *Protective clothing — Protection against liquid chemicals — Test method for resistance of materials to penetration by liquids*

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 9151:1995, *Protective clothing against heat and flame — Determination of heat transmission on exposure to flame*

ISO 9227:2012, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 11092:1993, *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 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*

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 13688:2013, *Protective clothing — General requirements*

ISO 13934-1:2013, *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 13994:2005, *Clothing for protection against liquid chemicals — Determination of the resistance of protective clothing materials to penetration by liquids under pressure*

ISO 15025:2000, *Protective clothing — Protection against heat and flame — Method of test for limited flame spread*

ISO 15384:2003, *Protective clothing for firefighters — Laboratory test methods and performance requirements for wildland firefighting clothing*

ISO 15538:2001, *Protective clothing for firefighters — Laboratory test methods and performance requirements for protective clothing with a reflective outer surface*

ISO 16073:2011, *Wildland firefighting personal protective equipment — Requirements and test methods*

ISO 16604:2004, *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 17491-4:2008, *Protective clothing — Test methods for clothing providing protection against chemicals — Part 4: Determination of resistance to penetration by a spray of liquid (spray test)*

ISO 17492:2003, *Clothing for protection against heat and flame — Determination of heat transmission on exposure to both flame and radiant heat*

ISO 17493:2000, *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*

ASTM F1868-12, *Standard test method for thermal and evaporative resistance of clothing materials using a sweating hot plate*

CIE 054.2:2001, Retroreflection: definition and measurement

NFPA 1971:2007, *Standard on protective ensembles for structural firefighting and proximity firefighting*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11999-1 apply.

4 Clothing requirements

4.1 General

Design requirements for clothing are given in [4.1](#) to [4.13](#). Sampling and pre-treatment are given in [4.14](#) and [4.15](#). Performance requirements are as required in [4.16](#) to [4.20](#). Additional requirements are given in [4.21](#). A comparison of performance requirements for clothing is provided in [Annex A](#).

4.2 Clothing configuration

Firefighters' protective clothing shall provide protection for the firefighter's upper and lower torso, neck, arms, and legs, but excluding the head, hands, and feet. It shall consist of an outer garment which can be, for example

- a one-piece protective cover all designed to cover the upper and lower torso including the neck, arms, and legs,
- a protective coat and a pair of protective trousers with an overlap of sufficient length to provide protection to the wearer (see ISO 11999-2), or
- a series of outer and undergarments designed to be worn together.

4.3 Multi-layer clothing assemblies

Where multi-layer clothing assemblies are used to achieve the specified performance levels, the layers shall be either permanently attached or the various layers shall be clearly labelled:

"IN ORDER TO ACHIEVE THE CLAIMED LEVEL OF PERFORMANCE FOR THE CLOTHING ASSEMBLY, ALL LAYERS BEARING THIS LABEL SHALL ALWAYS BE WORN TOGETHER."

4.4 Component assembly

Protective garments shall consist of a component assembly that provides the necessary number and type of layers for achieving the performance specified in this part of ISO 11999.

Any component assembly reinforcement or padding used in high-wear or load-bearing areas, such as pockets, cuffs, knees, elbows, and shoulders shall meet the requirements of at least flame resistance and heat resistance contained in [4.17](#) equivalent to the level achieved by the garment. Padding can include additional thermal barrier material, meeting the requirements as specified in this part of ISO 11999.

4.5 Attachment of interlining and innermost layers

Component assemblies shall have a means of securing the interlining and innermost lining where present to the outer material.