BS ISO 11999-1:2015

BSI Standards Publication

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

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National foreword

This British Standard is the UK implementation of ISO 11999-1:2015.

The UK participation in its preparation was entrusted to Technical Committee PH/14, Firefighters' personal protective equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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ISBN 978 0 580 83305 2

ICS 13.340.10

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2015.

Amendments issued since publication

Date	Text affected

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INTERNATIONAL STANDARD

ISO 11999-1

First edition
2015-06-01

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

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 1: Généralités

Reference number
ISO 11999-1:2015(E)

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
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Contents

Page

Foreword ... **iv**

Introduction ... **v**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **2**

4 Abbreviated terms and subscripts ... **10**
4.1 Abbreviated terms ... 10
4.2 Subscripts ... 10

5 Design and performance requirements for PPE items and ensembles ... **11**
5.1 Type 1 and Type 2 items of PPE ... 11
5.1.1 General ... 11
5.1.2 Combination of Type 1 or Type 2 items of PPE ... 11
5.2 Type 1 and Type 2 ensembles ... 11
5.3 Mixed ensemble ... 13

6 Marking ... **13**
6.1 General ... 13
6.2 Label durability and legibility ... 13
6.2.1 Pretreatment by exposure to heat ... 13
6.2.2 Pretreatment by abrasion ... 13
6.3 Compliance marking requirements for an item of PPE ... 14
6.4 Additional marking for clothing ... 14
6.5 Additional marking for gloves ... 15
6.6 Additional marking for footwear ... 15
6.7 Additional marking for helmets ... 15
6.8 Additional marking for face and/or eye protection devices ... 16
6.9 Additional marking for hearing protection devices ... 16
6.10 Additional marking for fire hoods ... 16
6.11 Additional marking for breathing apparatus ... 16
6.12 Additional marking for compatibility ... 16

7 Manufacturer's instructions to be supplied with each item of PPE ... **17**
7.1 Contents ... 17
7.2 Additional information for ISO 11999-3 clothing ... 17
7.2.1 Optional clothing test using an instrumented manikin ... 17
7.2.2 Optional drag rescue devices (DRD) ... 18
7.3 Additional information for ISO 11999-4 gloves ... 18
7.4 Additional information for ISO 11999-5 helmet ... 18
7.5 Additional information for ISO 11999-6 footwear ... 18
7.6 Additional information for ISO 11999-7 face and eye protection ... 18
7.7 Additional information for ISO 11999-8 hearing protection devices ... 19
7.8 Additional information for ISO 11999-9 fire hoods ... 19
7.9 Additional information for ISO 11999-10 respiratory protection ... 19
7.10 Additional information for whole ensembles ... 19
7.11 Additional information about compatibility ... 19
7.12 Availability ... 19

8 Information available upon request from the supplier of a combination of items of PPE or of an ensemble ... **19**

Annex A (informative) **Information on risk assessment** ... **21**

Annex B (normative) **Testing and classification of performance for items of PPE, for combinations of items of PPE, and for ensembles** ... **31**

Bibliography ... **34**

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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).

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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, *Fire-fighters' 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 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 11613-1 to ISO 11999-1. The Committee agreed a new number for this project was appropriate given the scope of the publication of the ISO 11999 series was to cover ensemble standards. It was further agreed that ISO 11613:1999 would remain current.

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Introduction

This International Standard provides minimum design and performance requirements for personal protective equipment (PPE) worn by firefighters to reduce injury and/or the loss of life. Amongst other hazards faced by firefighters is exposure to high thermal loads and to flames.

This International Standard details the design and performance requirements for the various items of PPE covered in all parts and for the compatibility of items of PPE when worn together.

This International Standard specifies, in ISO 11999-2, design and performance requirements for the compatibility of ISO 11999-3, ISO 11999-4, ISO 11999-5, ISO 11999-6, ISO 11999-7, ISO 11999-8, ISO 11999-9, and ISO 11999-10 when all items covered in this International Standard are worn together, thereby creating an ensemble standard. All items have to meet the general requirements for marking and manufacturer's instructions (this part of ISO 11999), as well as the specific marking and manufacturer's instructions of the respective parts of ISO 11999.

Under best practice for health and safety procedures, prior to choosing any PPE, a risk assessment of the workplace is carried out. Where hazards are identified and cannot be removed from a workplace, the items of PPE chosen to protect the personnel need to be fit for their intended use while allowing the personnel to carry out the work required of them. In environments where firefighters may be required to work, not only must the PPE protect the firefighters while enabling them to achieve their objectives at an incident, but it must also safeguard them and allow a safe escape. The PPE chosen must also allow firefighters to carry out their duties without undue stress being caused by the PPE.

Some PPE, particularly PPE to protect against mortal danger, can have failure levels far above the limit of exposures of human beings. On sites where such PPE is being used, it is important to ensure that proper and suitable safety procedures are in place which can identify when personnel should be withdrawn from dangerous or potentially dangerous situations and which can ensure that the relevant medical support is available for firefighters.

Since the decision on which PPE ensemble to use following risk assessment will dictate the parameters for protection of the persons who have to wear it, it is critical that decision-makers have knowledge of the risks against which the PPE is supposed to protect and its limitations. It is recommended that those who make the decision on the choice of PPE for particular workplaces should be competent in their knowledge and understanding of both the workplace hazards and the PPE from which to choose, prior to making these decisions, to ensure that informed decisions are taken.

Further detail on carrying out risk assessment to ascertain the type of PPE required to protect personnel working in specific areas is included in Annex A of this part of ISO 11999.

Hazards in the workplaces of firefighters are varied but can be common from workplace to workplace; therefore, some uses of PPE for firefighters can be multipurpose. Because this International Standard has been developed on a risk assessment approach, a number of different types, levels, or classes are given for certain performance requirements of various parts of a PPE ensemble. Based on their risk assessment, users of this International Standard can make a choice of which levels or classes are required for the particular workplace where their personnel are expected to work. This can include fires in domestic and commercial buildings, fires in industry, including aviation, petrochemical, chemical, pharmaceutical, land-based marine incidents, rescue, etc.

This International Standard includes separate parts for each item of a firefighter's ensemble. As PPE to protect each part of the body can be complex, this International Standard draws from the expertise of other Technical Committees in ISO which specialize in such protection.

The results of the user risk assessment for certain workplaces can require the use of PPE with higher and/or different levels or classes of performance than those in this International Standard. PPE covered in this part of ISO 11999 will not protect from all possible exposures. Nothing in this International Standard is intended to restrict any jurisdiction, purchaser, or manufacturer from exceeding the minimum performance requirements specified in this International Standard.

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Another objective in the Business Plan of ISO/TC 94/SC 14 is to provide guidance on the selection, use, care, and maintenance for firefighters' PPE. Such activities are critical to the lifespan and continuing protective ability of any PPE and policies covering these aspects should be implemented as soon as the PPE is introduced into use. ISO/TC 94/SC 14 has developed a Technical Report on this subject, ISO/TR 21808. Firefighters should be trained in the selection, use, care, and maintenance of their PPE. Firefighters should also be trained in the performance and limitation of their PPE.

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INTERNATIONAL STANDARD ISO 11999-1:2015(E)

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

1 Scope

This International Standard specifies minimum design and performance requirements for 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, types and performance levels for different categories of protection are included.

The scope of this International Standard does not include PPE for use in high-risk fire exposures where, for example, protective clothing with reflective surface according to ISO 15538 might be more appropriate, or for use in long-term firefighting operations in high ambient temperature (for example, bush, wildland, or forest firefighting) where equipment according to ISO 16073 might be more appropriate.

Similarly, this International Standard does not include PPE 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 the general structure of this International Standard, sets design and performance requirements for PPE, and includes requirements for 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/TR 11610, *Protective clothing — Vocabulary*

ISO 11999-3:2013, *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*

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

EN 469, *Protective clothing for firefighters — Performance requirement clothing for firefighting*

EN 960:2006, *Headforms for use in the testing of protective helmets*

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EN 1149-1, *Protective clothing — Electrostatic properties — Part 1. Surface resistivity(test methods and requirements)*

EN 1149-3:2004, *Protective clothing — Electrostatic properties — Part 3.Test methods for measurement of charge decay*

EN 1149-5, *Protective clothing — Electrostatic properties — Part 5. Performance requirements*

NFPA 1971, *Standard on protective ensembles for structural fire fighting and proximity fire fighting*

3 Terms and definitions

For the purposes of this document, the terms and definitions in ISO/TR 11610 and the following apply.

3.1
accessory
additional part that is approved by the manufacturer and can be attached to an item of PPE but is not necessary to fulfil the requirements of this International Standard

EXAMPLE Cable clips, lamp brackets, etc.

3.2
basic plane of the head
plane at the level of the opening of the external auditory meatus and the lower edge of the eye sockets

3.3
basic plane of the headform
plane which corresponds to the basic plane of the human head

3.4
basic shape
outer shape which the helmet would have without comb, brim or any of the fairings or radii associated with these

3.5
brim
ridge protruding outwards from the basic shape of the helmet shell, forming the lower edge of the shell and including its associated fairings and radii

3.6
cellular outsole
cellular outsole having a density of 0,9 g/ml or less with a cell structure visible under 10x magnification

3.7
central vertical axis
construction plane parallel to the basic plane of the headform at a distance from it, which is a function of the size of the headform

3.8
char
formation of a brittle residue when material is exposed to thermal energy

3.9
chinstrap
part of a retention system, including a strap which passes under or on the wearer's chin and which helps to ensure that the helmet is correctly maintained in place

3.10
cleaning cycle
washing/drying cycle or a dry cleaning cycle

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3.11
closure system
method of fastening/unfastening the openings in the garment, including combinations of more than one method of achieving a secure closure

3.12
collar lining
part of the collar fabric composite which is next to the skin when the collar is closed in the raised position

3.13
combination of PPE
two or more items of PPE fulfilling the requirements of this International Standard

3.14
comfort system
material in a helmet which serves to improve comfort for the wearer

3.15
component assembly
combination of all materials of a multilayer item presented exactly as in the finished item's construction

Note 1 to entry: This item does not cover reinforced materials.

3.16
cuff
<coat> finished edge of the coat sleeve opening

3.17
cuff
<glove> circular, flared, or otherwise expanded part of the glove that extends beyond the opening of the glove body to cover the wrist area

3.18
cuff
<trousers> finished edge of the trousers' leg opening

3.19
drag rescue device
device incorporated into the upper torso garment that allows the incapacitated wearer to be moved by dragging

Note 1 to entry: It is not a lifting device.

3.20
drip
to run or fall in drops

3.21
dripping
softening with material movement and consequent detachment

3.22
ear covers
part(s) or accessory of the helmet which protect at least the ears of the wearer

3.23
energy absorption system
material and/or system in a helmet which serves to dampen impact energy

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3.24
ensemble
combination or assembly of multiple items that are individually compliant with the respective parts of this International Standard that provide protection to the head, upper torso together with arms and hands, the lower torso together with feet, and respiratory protection, and that together fulfil all the requirements of ISO 11999-2

3.25
exterior pocket
pocket located on the exterior of the protective garment

3.26
face shield
form of face and eye protection that can be placed in front of the eyes and which cover a large part of the face, sometimes a part or accessory to a helmet

3.27
facial opening
opening at the front of the fire hood interfacing with the eye and face protectors/breathing apparatus face mask

3.28
fighting fires occurring in structures
activity of rescue, fire suppression, and property conservation in buildings, enclosed structures, vehicles, marine vessels, or similar properties that are involved in a fire or emergency situation

3.29
fire hood
item worn directly in contact with the head to protect exposed parts of the head and neck where the protective coat/helmet/respiratory protective device (RPD) facepiece interface

3.30
firefighter's protective clothing
specialized garments providing protection for the firefighter's torso, neck, arms, and legs, but excluding the head, hands, and feet

3.31
firefighter's protective gloves
specialized gloves for protection for the firefighter's hands and wrists

3.32
fitting device
item on a helmet that enables it to be adjusted to a user's head or neck, with the aim to correctly position it for maximum protection and comfort

Note 1 to entry: These features can be incorporated directly into the helmet, the helmet retention system, or the helmet shock absorption system.

3.33
fitting/interface compatibility
physical compatibility between adjacent PPE items

3.34
fluorescence
process by which radiant flux of certain wavelengths is absorbed and re-radiated non-thermally in other, usually longer wavelengths

3.35
fuel oil
aliphatic hydrocarbon constituent of petroleum

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3.36
full face mask
facepiece which covers the eyes, nose, mouth, and chin and provides adequate sealing on the face of the wearer of a respiratory protective device against the ambient atmosphere

3.37
function/performance compatibility
type performance compatibility between two or more PPE items

3.38
garment
single item of clothing which can consist of single or multiple layers

3.39
glove body
part of the glove that extends from the tip of the fingers to 25 mm beyond the wrist crease

3.40
goggles
form of face and eye protection that encloses the orbital area and fits tightly against the face, sometimes a part or accessory to a helmet

3.41
hardware
non-fabric items used in protective clothing, including those made of metal or plastic

EXAMPLE Buttons, zippers, fasteners, and rank markings.

3.42
headform
shape replacing the head which is used for testing

Note 1 to entry: A headform designed to meet EN 960:2006 may be used when testing helmets, face and/or eye protection devices and fire hoods.

3.43
helmet assembly
helmet, together with any optional or mandatory attached protective components such as ear covers, neck protector, face shield, or goggles.

3.44
helmet
headgear intended to ensure protection of the wearer's head (and optionally, the wearer's neck) against hazards which might occur during operations of firefighting in buildings and other structures

Note 1 to entry: This term refers specifically to helmets for structural firefighting.

3.45
helmet shell
component which gives the helmet its general shape and on which could be fixed various helmet accessories

3.46
high-visibility material, trim
retroreflective, fluorescent, or a combination of retroreflective and fluorescent material attached to the outer material for visibility enhancement

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3.47
innermost lining
lining on the innermost face of a component assembly of a garment closest to the wearer's skin

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

3.48
integral additional protective function
part of the helmet, intended by the helmet manufacturer not to be removed by the user, except for maintenance and fitting purposes, and which provide protection to the wearer, other than as provided for by this International Standard

3.49
interface area
area of the body not specifically protected by a protective garment, helmet, face and/or eye protection device, gloves, footwear, or breathing apparatus facepiece or the area such as the neck, wrists, and ankles where items of PPE meet or overlap

EXAMPLE The protective coat/helmet/breathing apparatus, facepiece area, the protective coat/glove area, and the protective trousers/footwear area.

3.50
interface component
item designed to provide limited protection to interface areas

EXAMPLE Fire hood and protective wristlets.

3.51
interior attack
activity of rescue, fire suppression, and property conservation generally performed in the interior or immediate vicinity of the exterior of involved structures, for the purpose of an attack on a fire to directly control or extinguish the fire

3.52
interlining
layer between the outermost layer and the innermost lining in a multilayer garment

3.53
leather
hide or skin tanned to be imputrescible

3.54
longitudinal vertical median plane
vertical plane of symmetry of the headform

3.55
material combination
material produced from a series of separate layers, intimately combined prior to the item's manufacturing stage

EXAMPLE A quilted fabric.

3.56
means of fixing
means by which the ocular of the visor is supported and interfaced with the designated helmet(s)

Note 1 to entry: This means could be an integral part of the helmet, could be fixed permanently or temporarily, or it could be worn separately, but at the same time as the helmet.

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3.57
melt
liquefy a material usually by exposure to heat resulting in a non-reversible change to its state

Note 1 to entry: For the purposes of this International Standard, melting is observed as the response to heat as evidenced by flowing or dripping.

3.58
mixed ensemble
ensemble of PPE in which mixed items fulfil heat and flame requirements of Type1 or Type2

3.59
moisture barrier
part of the component assembly of garments which impedes the transfer of liquids

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 incidents.

3.60
multilayer clothing assembly
series of garments arranged in the order as worn

Note 1 to entry: It could contain multilayer materials, material combinations, or a series of separate garments in single layers.

3.61
neck protector
integral part or accessory which protects the back of the neck from water and/or other liquids, from hot materials, radiant heat, and flames

Note 1 to entry: In this International Standard, neck protectors are only addressed in association with helmets.

3.62
orbital area
area around and including the eye sockets

3.63
outer material
outermost material of which the protective clothing is made

3.64
performance level
performance gradation of the following four categories of performance measures: a) the flame and thermal properties, b) the strength and physical properties, c) the water and liquid resistance properties, and d) the thermal comfort properties

Note 1 to entry: See Table 1.

Note 2 to entry: The performance level for the flame and thermal performance category determines the item's *type* (3.84). The other three performance categories are reported.

Note 3 to entry: Currently, performance levels are available only for clothing and gloves.

3.65
polymeric materials
high molecular weight organic compounds made by attaching repeated smaller compound units, called monomers, into a long chain-type molecule

EXAMPLE Polyurethane or polyvinylchloride and synthetic fibres such as nylon, polyester, and aramid.

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