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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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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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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.

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.

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*

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

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.

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.

The leg opening of the protective coverall or protective suit shall have a closure system, which will restrict the travel of heat or flame up the leg of the wearer, and therefore provide a protective interface overlap with any footwear that may be used for wildland firefighting.

A protective suit shall be provided with an interface overlap area of at least 150 mm overlap between the jacket and the trousers. This interface overlap area shall be maintained while stooping, reaching, stretching, elevating arms and hands directly above the wearer's head and while making a turning movement.

Conformity shall be assessed by visual inspection and practical testing, such as physical measurement of the overlap and checking sizing and correct fit by donning and doffing of the garment.

4.4 Pockets

All pockets with external openings shall be constructed entirely of materials that have performance levels that are equal to or greater than the outer shell.

Where fitted, pocket flaps shall overlap the pocket opening by no less than 10 mm on either side. The overlap shall be sufficient to prevent the entry of heat and other hot materials into the pocket.

Conformity shall be assessed by visual inspection and physical measurement.

4.5 Hardware

Hardware penetrating the outer material shall not be exposed on the innermost surface of component assembly. Personal protective clothing shall be designed to ensure that the hardware shall not have sharp edges, roughness or projections which are likely to cause injury to the wearer.

Conformity shall be assessed by manual and visual inspection.

4.6 Retroreflective and/or fluorescent materials

Retroreflective and fluorescent material, or combined performance material, shall be attached to the outermost surface of the personal protective clothing and shall give all-round visibility by having at least one band encircling the arms, legs and torso regions of the garment(s), and meet the requirements of 9.2.

Conformity shall be assessed by visual inspection and physical measurement.

4.7 Sleeves

The end of the sleeves shall be designed to protect the wrist and shall have a closure system which allows the end of the sleeve to provide a protective interface overlap with gloves used for wildland firefighting. This interface overlap area shall be maintained while reaching, stretching, elevating arms and hands directly above the wearer's head and when making a turning movement.

Conformity shall be assessed by visual inspection and practical testing.

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

4.8 Trousers

Trousers shall have a closure system which will be designed to provide a protective interface between the end of the trousers and any footwear that may be used for wildland firefighting. This interface overlap area shall be maintained while stooping, reaching, stretching, elevating arms and hands directly above the wearer's head and while making a turning movement.

Conformity shall be assessed by visual inspection and practical testing.

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

5 Sampling and pre-treatment

5.1 General

Protective garments that comply with this document shall meet the requirements of Clauses 6, 7, 8 and 9.

Wherever in Clauses 6, 7, 8 and 9, the requirements for a property value are expressed in terms of a minimum or maximum value, the resultant property value shall be determined according to Annex A, Determination of property values for rating and classification.

All tests results in Clauses 6, 7, 8 and 9 shall be evaluated in accordance with Annex A.

5.2 Sampling

Test samples shall be representative of the material or material assembly as used in the protective clothing to be tested. If possible, all samples shall be taken from the garment. The number and size of the test specimens required shall be in accordance with the relevant test methods.

The test shall be carried out on the outer material of the garment unless it is mentioned in the appropriate clause of this document to use the complete material assembly.

5.3 Pre-treatment by cleaning

Before each test specified in Clauses 6 and 7, the test materials and test specimens shall be pre-treated by cleaning. If the manufacturer's instructions indicate that cleaning is not allowed, i.e. single use garments, then testing shall be carried out on new material. In addition, limited flame spread and heat transfer (radiation) shall be carried out in accordance with 6.1 and 6.2 before and after the pre-treatment.

The cleaning shall be in line with the manufacturer's instructions, on the basis of standardized processes. If the number of cleaning cycles is not specified, the tests shall be carried out after five cleaning cycles (a cleaning cycle is one wash and one dry cycle). This shall be reflected in the information supplied by the manufacturer.

If the garment can be washed and dry-cleaned it shall only be washed. If only dry-cleaning is allowed the garment shall be dry-cleaned in accordance with the manufacturer's instructions.

NOTE Manufacturer's instructions typically indicate one or several of the various methods and processes of ISO 15797, ISO 3175-2 or equivalent as standardized processes for cleaning.

5.4 Conditioning

Prior to all tests and after having performed the pre-treatment specified in 5.3, the specimens shall be preconditioned in accordance with ISO 139, with the following modification: relative humidity (65 ± 5) %. Test the specimens within 5 min following their removal from the conditioning atmosphere.

5.5 Exposure surface

In all surface tests, test the outer surface.

5.6 Ageing

Performance tests specified in 6.1 shall also be executed after the maximum number of cleaning procedures indicated by the manufacturer.

6 Thermal requirements

6.1 Flamespread

6.1.1 General

Each material in the component assembly, including rank markings, retroreflective and fluorescent materials, hardware shall be tested separately using 6.1.2 and tested assembled as indicated using 6.1.3, before and after the pre-treatment specified in 5.3. All the individual results of the specimens of a test shall meet the performance requirement.

6.1.2 Face ignition

Carry out the flame spread test in accordance with ISO 15025, Procedure A (face ignition) using a flame application time of 10 s.

For seams, three specimens containing a structural seam shall be tested. Specimens shall be oriented with the seam running up the centreline of the outer surface of the test specimen so that the burner flame impinges directly upon the seam. Seams shall not separate.

The requirements in Table 1 shall be satisfied.

NOTE Tables 1 and 2 are taken from ISO 14116:2015.

Table 1 — Limited Flame Spread Performance Requirements ISO 15025, Procedure A

Properties	Requirement
Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
Flaming debris	No specimen shall give flaming or molten debris.
Hole formation	No specimen shall give hole formation of 5 mm or greater in any direction, except for an inner layer that is used for specific protection other than flame or heat protection.
Afterglow	Afterglow time shall be ≤2 s. A glowing inside the charred area is defined in ISO 15025 as afterglow without combustion and for the purpose of this clause is not regarded as afterglow.
Afterflame	Afterflame time shall be ≤2 s.

6.1.3 Edge ignition

Carry out the flame spread test in accordance with ISO 15025. Procedure B (bottom edge ignition) on a hemmed fabric specimen a flame application time of 10 s. The requirements in Table 2 shall be satisfied.

Table 2 — Limited Flame Spread Performance Requirements ISO 15025, Procedure B

Properties	Requirement
Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
Flaming debris	No specimen shall give flaming or molten debris.
Afterglow	Afterglow time shall be ≤2 s. Glowing inside the charred area is defined in ISO 15025 as afterglow without combustion and for the purpose of this clause is not regarded as afterglow.
Afterflame	Afterflame time shall be ≤2 s.
Char length	Char length shall be ≤100 mm in accordance with of ISO 15025:2016, Annex C.

The hemmed fabric specimen shall be prepared in the same manner as it is used in the construction of the original garment. Retroreflective and fluorescent materials shall be fixed with the bottom edge left unstitched to the fabric specimen.

6.2 Heat transfer (radiation)

Test the single layer, the component assembly or multilayer clothing assembly, excluding any retroreflective or fluorescent materials. Carry out the tests before and after the appropriate cleaning procedures as specified in 5.3. When tested in accordance with Method B of ISO 6942:2002 with a heat flux density of 20 kW/m^2 the single layer, the component assembly or multilayer clothing assembly shall have the minimum level as following:

$RHTI_{24} \geq 11s$ $RHTI_{24}\text{-}RHTI_{12} \geq 4s$ Mean Transmission Factor: $T_F \leq 70\ \%$

6.3 Heat resistance

Test each material including badges, patches, embroideries, rank markings, hardware and closure systems, including retroreflective and/or fluorescent materials separately. Carry out tests after the pretreatment as specified in 5.3. When tested in accordance with ISO 17493 at a temperature of (260 ± 5) °C, for 5 min ± 15 s, no material shall melt, drip, ignite or shrink >10 %.

Hardware, closure systems, and other materials, that are not in contact with the skin and are protected on the outside, shall be tested in accordance with ISO 17493 at a temperature of (180 ± 5) °C for 5 min ± 15 s and shall not melt, drip or ignite. Hardware and closure systems shall remain functional.

6.3.1 Heat resistance of the sewing thread

Specimens of the sewing threads shall be tested as received in accordance with the hot plate test in ISO 3146 and shall not melt at a temperature less than 260 °C.

NOTE In order to test sewing threads a separate sample other than a cloth should be provided to the test centre or laboratory.

6.3.2 Heat resistance of retroreflective/fluorescent materials

The retroreflective and fluorescent materials, when tested in accordance with ISO 17493, after exposure at a temperature (180 ± 5) °C for 5 min ± 15 s shall comply with the visibility requirements of ISO 20471:2013, 6.2.2, 6.2.3 or 6.2.4, and shall comply with the colour performance requirements of ISO 20471:2013, 5.1, as applicable.

7 Mechanical requirements

7.1 Tensile strength

When tested in accordance with ISO 13934-1, the outer material shall give a breaking load in both machine and cross direction ≥600 N.

7.2 Tear strength

When tested in accordance with method B of ISO 4674-1 (coated fabrics) or ISO 13937-2 at a rate of traverse of 5 mm/s, using the electronic device, the outer material shall give a tear strength in both machine and cross direction ≥25 N.

7.3 Main seam strength

When tested in accordance with ISO 13935-2, main seams in the outer garment, shall give a seam strength ≥300 N.

8 Ergonomic and comfort requirements

8.1 Thermal resistance

When tested in accordance with ISO 11092, the mean thermal resistance of the material or material combination shall give a thermal resistance: ≤0,055 m^2 K/W.

8.2 Water vapour resistance

When tested in accordance with ISO 11092, the mean water vapour resistance of material or material combination shall give a water vapour resistance: ≤10 m^2 Pa/W.

NOTE This test is only valid for base materials and not applicable for areas such as knee pads and retroreflective material.

9 General

9.1 Dimensional change after washing and/or dry-cleaning

Dimensional change shall be measured in accordance with ISO 5077 before and after the samples have undergone five cleaning cycles according to 5.3.

The dimensional change of woven material, in either length or width direction, shall not exceed 3 % and for knitted materials, the dimensional change shall not exceed 5 %.

Dimensional change shall be measured after the specimen has been uncreased and flattened on a plane surface.

9.2 Retroreflective and/or fluorescent performance

Retroreflective and fluorescent separate-performance material (material with both retroreflective and fluorescent elements) and Retroreflective and fluorescent combined-performance material shall not be less than 50 mm wide (see also 4.6).

The minimum area of non-reflective or combined performance fluorescent material attached to the garment shall be not less than 0,2 m^2.

The retro-reflective material shall have a minimum area of not less than 0,13 m^2.

Photometric performance of the retroreflective portion or combined performance material shall be determined in accordance with ISO 20471:2013, 7.3.

The minimum coefficient for new retroreflective material or combined performance material shall be in accordance with ISO 20471:2013, Table 4 or Table 5, as applicable.

The retroreflective material or combined performance material shall comply with the requirements of ISO 20471:2013, 6.2, for retroreflective performance requirements after test exposure.

The fluorescent material or combined performance material shall comply with the requirements of ISO 20471:2013, 5.1, 5.2 and 7.5.1, for colour performance requirements after Xenon test and after cleaning.

NOTE Consideration is given during the selection process, to achieve a colour contrast in fluorescent trim and any fluorescent background material, giving consideration to the general wildland environment.

9.3 Summary of performance requirements

A summary of the performance requirements is provided in Table 3.

Table 3 — Summary of performance requirements

Performance Category	Subclause	Performance Requirement
Thermal Requirements		
Face ignition	6.1.2	Testing in accordance with ISO 15025, Procedure A
		No specimen shall give flaming to the top or either side edge.
		No specimen shall form holes.
		No specimen shall give flaming or molten debris.
		No specimen shall give hole formation of 5 mm or greater in any direction, except for an inner layer that is used for specific protection other than flame or heat protection.
		Afterglow time shall be ≤2 s. A glowing inside the charred area is defined in ISO 15025 as afterglow without combustion and for the purpose of this clause is not regarded as afterglow.
		Afterflame time shall be ≤2 s.
Edge Ignition	6.1.3	Testing in accordance with ISO 15025, Procedure B
		No specimen shall give flaming to the top or either side edge.
		No specimen shall give flaming or molten debris.
		Afterglow time shall be ≤2 s. Glowing inside the charred area is defined in ISO 15025 as afterglow without combustion and for the purpose of this clause is not regarded as afterglow.
		Afterflame time shall be ≤2 s.
Flame behaviour test on main seams	6.1.2	ISO 15025 procedure A, shall not separate, and above Face ignition summary.
Heat transfer (radiation)	6.2	ISO 6942 Method B $RHTI_{24} \geq 11s$ $RHTI_{24}$-$RHTI_{12} \geq 4s$, Mean Transmission Factor: $TF \leq 70\ \%$
Heat resistance	6.3	ISO 17493 (260 ± 5) °C for 5 min, no material shall melt, drip, ignite or shrink >10 %.
Materials thermal stability Yarn, Fibre, Threads	6.3.1	ISO 3146 at a temperature of (260 ± 5) °C, shall not melt.
Hardware	6.3	ISO 17493 (180 ± 5) °C and shall not melt, drip or ignite, and shall remain functional.
Heat resistance of the sewing thread	6.3.1	ISO 3146 and shall not melt at a temperature less than 260 °C.
Retroreflective/fluorescent materials	6.3.2	After exposure to (180 ± 5) °C for 5 min ± 15 s, shall comply with the visibility requirements of ISO 20471:2013, 6.2.2, 6.2.3 or 6.2.4, and shall comply with the colour performance requirements of ISO 20471:2013, 5.1.
Mechanical Requirements		
Tensile strength	7.1	ISO 13934-1 ≥600 N
Tear strength	7.2	ISO 4674-1 Method B or ISO 13937-2 (coated fabrics) ≥25 N
Main seam strength	7.3	ISO 13935-2 ≥300 N
Ergonomic and Comfort Requirements		
Thermal resistance	8.1	≤0,055 m^2 K/W
Water vapour resistance	8.2	≤10 m^2 Pa/W

Table 3 *(continued)*

Performance Category	Subclause	Performance Requirement
General Requirements		
Dimensional change after washing and/or dry cleaning	9.1	The dimensional change of woven material, in either length or width direction, shall not exceed 3 % and for knitted materials, the dimensional change shall not exceed 5 %.
Retroreflective/fluorescent performance	9.2	Photometric performance of the retroreflective portion or combined performance material shall be determined in accordance with ISO 20471:2013, 7.3. The minimum coefficient for new retroreflective material or combined performance material shall be in accordance with ISO 20471:2013, Table 4 or 5, as applicable.
		The fluorescent/combined performance material shall comply with the requirements of ISO 20471:2013, 5.1, 5.2 and 7.5.1, for colour performance requirements of new material, after Xenon test and after cleaning.

10 Marking and labelling

10.1 General

Any labels or accessories shall not adversely affect the performance of any item to which they are attached or present a hazard to the wearer.

Marking requirements shall be as specified in ISO 13688 and in this clause.

10.2 Label durability and legibility

Labels, if examined at a distance of 300 mm in a well-illuminated area by a person with either 6/6 or 20/20 vision or vision corrected to 6/6 or 20/20, shall remain legible after been exposed to the following treatments.

a) laundering as specified in 5.3;

b) by heat resistance, as specified in 6.3, if located on the interior of the PPE next to the skin;

c) abrasion for 200 cycles in accordance with ISO 12947-2, with a 12 kPa pressure and using a wetted felt abrasive.

Label shall remain legible for the life of garment.

Marking requirements shall meet those specified in ISO 13688 and in this clause.

10.3 Compliance marking requirements

Each item of PPE for which compliance with this document is claimed, shall have a label permanently and conspicuously attached, upon which the following information is printed in letters at least 2,0 mm high:

a) designation of the type as appropriate;

b) name, trademark or other means of identifying the manufacturer;

c) style/model designation;

d) size;

e) reference to this document, i.e. ISO 15384:2018;

g) material composition.