

---

---

**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 —**

**iTeh STANDARD PREVIEW  
Part 4:  
(standards.iteh.ai)  
Gloves**

ISO 11999-4:2015  
https://standards.iteh.ai/catalog/standards/sist/020d8c8a-1255-46ca-bf5e-78546466b931/iso-11999-4-2015  
*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 4: Gants*



**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

ISO 11999-4:2015

<https://standards.iteh.ai/catalog/standards/sist/020dbc8a-1255-4eea-bd5e-78546466b931/iso-11999-4-2015>



**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](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

	Page
<b>Foreword</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>2</b>
<b>4 Glove design requirements</b> .....	<b>2</b>
4.1 Glove body length.....	2
4.2 Wristlet or cuff.....	3
4.3 Glove sizing.....	3
4.3.1 Minimum sizing.....	3
4.3.2 Hand dimensions.....	3
4.3.3 Leather chromium VI content.....	4
4.3.4 Other design requirements.....	4
<b>5 Glove sampling, testing, and pretreatment</b> .....	<b>4</b>
5.1 Sampling levels for testing.....	4
5.2 Sampling level for determining design compliance.....	4
5.3 Testing.....	4
5.4 Pretreatments.....	5
5.4.1 Pretreatment by laundering or dry cleaning.....	5
5.4.2 Conditioning.....	5
5.4.3 Wet pretreatment.....	5
<b>6 Glove performance requirements</b> .....	<b>5</b>
<b>7 Glove thermal performance requirements</b> .....	<b>7</b>
7.1 Flame resistance.....	7
7.2 Heat transfer (flame exposure).....	8
7.3 Heat transfer (radiant exposure).....	8
7.4 Heat transfer (combined flame and radiant exposure).....	9
7.5 Heat transfer (conductive exposure).....	9
7.6 Heat resistance.....	9
7.7 Thread heat resistance.....	10
<b>8 Glove mechanical performance requirements</b> .....	<b>10</b>
8.1 Abrasion resistance.....	10
8.2 Cut resistance.....	10
8.3 Tear resistance.....	11
8.4 Puncture resistance.....	11
<b>9 Glove moisture barrier performance</b> .....	<b>11</b>
9.1 Water penetration resistance.....	11
9.2 Liquid penetration resistance.....	11
9.3 Liquid penetration resistance (runoff method).....	12
9.4 Whole glove integrity.....	12
9.5 Viral penetration resistance.....	12
<b>10 Glove ergonomic performance requirements</b> .....	<b>13</b>
10.1 Dexterity.....	13
10.2 Grip.....	13
10.3 Liner inversion.....	13
10.4 Ease of donning and doffing.....	13

<b>11</b>	<b>Glove test methods</b>	<b>13</b>
11.1	Whole glove integrity test	13
11.1.1	Principle	13
11.1.2	Equipment	13
11.1.3	Specimens	14
11.1.4	Procedure	14
11.1.5	Report	14
11.2	Grip test	14
11.2.1	Principle	14
11.2.2	Equipment	14
11.2.3	Specimens	14
11.2.4	Procedure	14
11.2.5	Report	15
11.3	Liner inversion test	15
11.3.1	Principle	15
11.3.2	Specimens	15
11.3.3	Procedure	15
11.3.4	Determination of baseline donning time	15
11.3.5	Determination of the final donning time	16
11.3.6	Report	16
11.4	Ease of donning and doffing test	16
11.4.1	Principle	16
11.4.2	Specimens	16
11.4.3	Procedure	16
11.4.4	Report	17
<b>12</b>	<b>Compatibility</b>	<b>17</b>
<b>13</b>	<b>Marking</b>	<b>17</b>
<b>14</b>	<b>Manufacturer's information</b>	<b>17</b>
	<a href="https://standards.iteh.ai/catalog/standards/sist/020dbc8a-1255-4eea-bd5e-78546466b931/iso-11999-4-2015">https://standards.iteh.ai/catalog/standards/sist/020dbc8a-1255-4eea-bd5e-78546466b931/iso-11999-4-2015</a>	

iteh STANDARD PREVIEW

(standards.iteh.ai)

ISO 11999-4:2015

<https://standards.iteh.ai/catalog/standards/sist/020dbc8a-1255-4eea-bd5e-78546466b931/iso-11999-4-2015>

## 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](http://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](http://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 protection — 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 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 11613-4 to ISO 11999-4. 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

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[ISO 11999-4:2015](https://standards.iteh.ai/catalog/standards/sist/020dbc8a-1255-4eea-bd5e-78546466b931/iso-11999-4-2015)

<https://standards.iteh.ai/catalog/standards/sist/020dbc8a-1255-4eea-bd5e-78546466b931/iso-11999-4-2015>

# 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 4: Gloves

### 1 Scope

This part of ISO 11999 specifies minimum design and performance requirements for gloves 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.

### 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 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 — Dry cleaning and finishing — Part 1: Procedures for tetrachloroethylene*

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

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

ISO 11999-1:2013, *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 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 12947-2, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 2: Determination of specimen breakdown*

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

ISO 13996, *Protective clothing — Mechanical properties — Determination of resistance to puncture*

## ISO 11999-4:2015(E)

ISO 13997, *Protective clothing — Mechanical properties — Determination of resistance to cutting by sharp objects*

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

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 17075, *Leather — Chemical tests — Determination of chromium(VI) content*

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*

EN 420:2003 A1:2009, *Protective gloves — General requirements and test methods*

EN 13087-1:2000, *Protective helmets — Test methods — Conditions and conditioning*

### 3 Terms and definitions

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

iTeh STANDARD PREVIEW

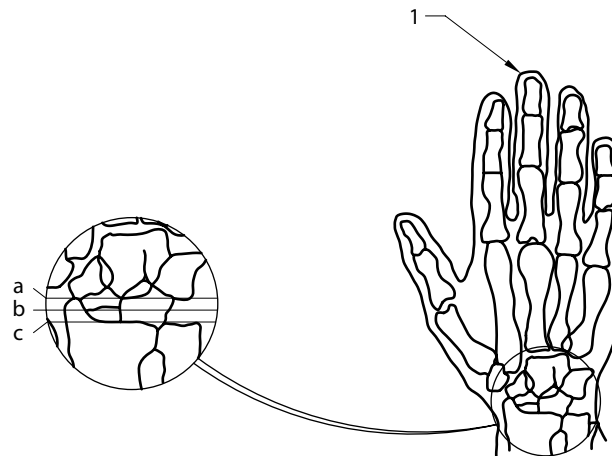
### 4 Glove design requirements (standards.iteh.ai)

Gloves shall consist of a component assembly meeting the design and performance requirements of this part of ISO 11999. The component assembly shall be permitted to be configured as a continuous or joined single layer or as continuous or joined multiple layers. The component assembly shall be permitted to be different for the palm, back, and fingers.

#### 4.1 Glove body length

The glove shall extend circumferentially beyond the wrist crease for not less than 25 mm. The location of the wrist crease shall be determined as shown in [Figure 1](#).





### Key

- 1 dactylion III
- a stylians
- b wrist crease
- c proximal edge of navicular

**Figure 1 — Anatomical landmarks at the base of the hand**

## iTeh STANDARD PREVIEW (standards.iteh.ai)

### 4.2 Wristlet or cuff

Gloves can be provided with either a cuff or a wristlet or both. Where gloves are provided with a cuff or a wristlet, the sample glove body and the cuff or wristlet shall extend circumferentially for at least 50 mm beyond the wrist crease, taking into consideration the requirement specified in 4.1. Where gloves are not provided with a cuff or a wristlet, the sample glove shall extend circumferentially for at least 50 mm beyond the wrist crease, which is a 25 mm addition to the requirement in 4.1.

### 4.3 Glove sizing

Glove sizing shall be as required in 4.3.1 and 4.3.2.

#### 4.3.1 Minimum sizing

Gloves shall be provided in a minimum of six unique and distinct sizes. The manufacturer shall indicate the range in hand circumference and hand length for wearers of each glove size as determined in 4.3.2.

**NOTE** The intent of this requirement is to allow manufacturers to report information to the user that assists in their selection of the appropriate size. Standard sizes are not defined by this part of ISO 11999.

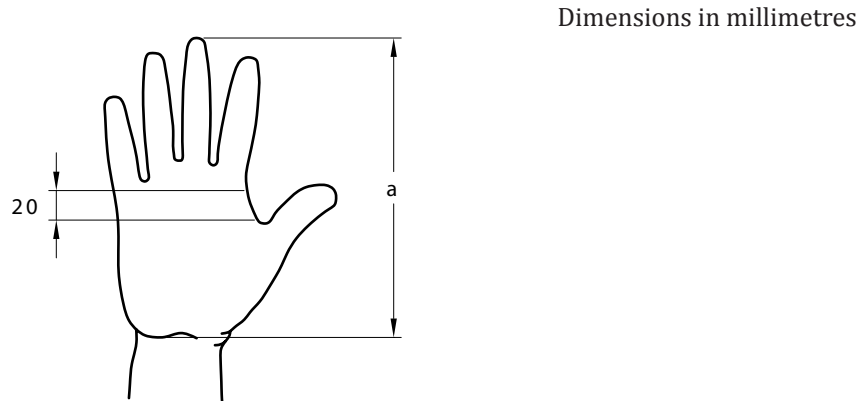
#### 4.3.2 Hand dimensions

Hand dimensions for the selection of proper glove size shall consist of measuring two dimensions, namely hand circumference and hand length, as shown in Figure 2.

Hand circumference shall be measured by placing the measuring tape on a table or other flat surface with the numerals facing downward. The subject shall place the right hand, palm down and fingers together, in the middle of the tape so that the tape can pass straight across the knuckles (metacarpals). The circumference shall be measured to the nearest millimetre, 20 mm from the crotch between the thumb and the index finger, as shown in Figure 2.

Hand length shall be measured by placing the subject's hand, palm down, on a piece of paper with the fingers together and the hand and arm in a straight line. The thumb shall be fully abducted, extended away from the palm as far as possible. The paper shall be marked at the tip of the third, or middle, finger.

A pencil mark shall be placed in the notch at the base of the thumb where the thumb joins the wrist. The straight-line distance between the two points shall be measured to the nearest millimetre, as shown in [Figure 2](#).



**Key**

a hand length

**Figure 2 — Method of measuring hand dimensions for the selection of proper gloves**

**4.3.3 Leather chromium VI content**

Leather used in the construction of gloves shall have a Cr(VI) content of less than 3 mg/kg when tested in accordance with ISO 17075.

**4.3.4 Other design requirements**

Gloves shall be designed to be close fitting at the wrist to restrict the entry of embers or foreign particles through the glove openings.

**5 Glove sampling, testing, and pretreatment**

Sampling shall be as required in [5.1](#) and [5.2](#), testing as required in [5.3](#), and pretreatment as required in [5.4](#).

**5.1 Sampling levels for testing**

Unless otherwise specified, the number and size of specimens for the different tests shall be in accordance with the respective standards.

**5.2 Sampling level for determining design compliance**

Inspection for determining compliance with the design requirements specified in [4.1](#) to [4.3](#) shall be performed on whole gloves with all labels and accessories.

**5.3 Testing**

Testing for determining material and component compliance with the requirements specified in [Clauses 6 to 9](#) shall be performed on samples representative of materials and components used in the actual construction of the protective glove. If suitably sized representative materials and components for the respective test method cannot be obtained, then samples from the glove shall be used as specified in the performance requirement. The responsible testing laboratory organization shall be permitted to also use sample materials cut from representative protective gloves.

In all surface tests, the outermost surface shall be exposed.

In all tests involving measurements, the determination of compliance shall be based on the mean value unless otherwise specified.

## 5.4 Pretreatments

Pretreatments shall be as required in [5.4.1](#) to [5.4.3](#).

NOTE Pretreatments are done to provide uniformly treated materials for testing. Ageing, life expectancy, and washing instructions are not to be confused with the following pretreatments.

### 5.4.1 Pretreatment by laundering or dry cleaning

Pretreatment by laundering or dry cleaning is done to remove finishes and contaminants.

Where specified, test samples shall be subjected to five washing/drying cycles in a front-loading horizontal drum machine using 1 g/l no. 2 (IEC) detergent in soft water in accordance with the procedures of ISO 6330. Washing shall be carried out using procedure 2N at  $60\text{ °C} \pm 3\text{ °C}$  and drying using procedure E (tumble drying) unless otherwise specified in the care labelling.

Materials that are labelled as dry cleanable only shall be dry cleaned five times in accordance with ISO 3175-1.

A laundry bag shall not be used.

After five cycles of washing/drying or dry cleaning, sample gloves shall be donned by a test subject and shall be flexed by making a tight fist 10 times during a 30 s period.

### 5.4.2 Conditioning

ISO 11999-4:2015

Unless otherwise specified in the specific test methods, all specimens shall be conditioned at  $20\text{ °C} \pm 2\text{ °C}$  and relative humidity of  $65\% \pm 5\%$  for a minimum of 24 h prior to testing.

Sample gloves and sample specimens shall be tested within 5 min after removal from conditioning.

### 5.4.3 Wet pretreatment

Sample gloves or sample specimens shall be conditioned by completely immersing the glove or the glove specimen in water at a temperature of  $20\text{ °C} \pm 2\text{ °C}$  for 2 min. If gloves are used, the glove specimen shall be first filled with water prior to immersion.

Sample gloves or sample specimens shall be removed from water, hung in a vertical position with the fingers up for 5 min, and laid horizontal with textile blotting paper both under and over the specimen, under a differential pressure of 3,5 kPa for a period of 20 min.

Sample gloves or sample specimens shall be tested within 5 min of conditioning.

## 6 Glove performance requirements

Gloves, when tested according to the requirements listed in performance level 1 of [Table 1](#), shall achieve at least the minimum performance for all tests. Gloves shall be classified according to the performance they can achieve.