INTERNATIONAL STANDARD

**ISO 14116**

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# Protective clothing — Protection against heat and flame — Limited flame spread materials, material assemblies and clothing

*Vêtements de protection — Protection contre la chaleur et la flamme — Matériaux, assemblages de matériaux et vêtements à propagation de flamme limitée*



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# Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 14116 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 162, *Protective clothing including hand and arm protection and lifejackets*, in collaboration with Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).



ISO 14116 supersedes EN 533:1997, which has been technically revised to include:



a) the testing of clothing for limited contact with flames specified;

b) the requirements for the design of clothing specified;

c) the requirements for mechanical performance of clothing specified;

d) the ageing due to washing specified (maximum number of cleaning procedures as indicated by the manufacturer);

e) the marking requirements modified;

f) the information to be supplied by the manufacturer modified.

# Protective clothing — Protection against heat and flame — Limited flame spread materials, material assemblies and clothing

## 1 Scope

This International Standard specifies the performance requirements for the limited flame spread properties of materials, material assemblies and protective clothing in order to reduce the possibility of the clothing burning and thereby itself constituting a hazard. Additional requirements for clothing are also specified.

Protective clothing complying with this International Standard is intended to protect workers against occasional and brief contact with small igniting flames, in circumstances where there is no significant heat hazard and without the presence of another type of heat. When protection against heat hazards is necessary in addition to protection against limited spread flammability, then standards, such as ISO 11612, are more appropriate.



A classification system is given for materials, material assemblies and garments which are tested according to ISO 15025:2000, Procedure A.



## 2 Normative references

The following referenced documents are indispensable for the application 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 13934-1:1999, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method*

ISO 13935-2:1999, *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 13937-2:2000, *Textiles — Tear properties of fabrics — Part 2: Determination of tear force of trouser-shaped test specimens (Single tear method)*

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

EN 340:2003, *Protective clothing — General requirements*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

**3.1**
**ageing**
changing of the product performance over time during use or storage

NOTE Ageing is caused by a combination of several factors, such as:

— cleaning, maintenance or disinfecting process;

— exposure to visible and/or ultra-violet 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.

[ISO 11611:2007, definition 3.1]



**3.2**
**assembly**
two or more separate layers of the same or different materials, or several garments to be worn together



**3.3**
**cleaning**
process by which a PPE is made serviceable and/or hygienically wearable again by removing any dirt or contamination

NOTE A cleaning cycle is typically a washing plus drying or a dry cleaning treatment followed, if required, by ironing or other finishing.

**3.4**
**cleaning index**
letter indicating that the material or material assembly was subjected to a cleansing procedure specified in 5.2.2 before being tested for limited flame spread

**3.5**
**garment**
single item of clothing which may consist of single or multiple layers

**3.6**
**hole**
break in the test specimen of at least 5 mm by 5 mm in size caused by melting, glowing or flaming

**3.7**
**limited flame spread index**
number indicating that the material or material assembly has achieved a specific level of performance

NOTE See Clause 7.

**3.8**
**material**
single fabric or other product, e.g. one layer of a woven, non-woven, knitted, or coated fabric, or multi-layered fabric or other product combined prior to the garment manufacturing process, e.g. laminated or quilted fabric

**3.9**
**pre-treatment**
standard way of preparing the samples before testing

NOTE This can include e.g. a number of cleaning cycles, submitting the sample to heat, mechanical action or any other relevant exposure and is finished by conditioning.

[ISO 11611:2007, definition 3.8]

## 4 Clothing design

**4.1** If a single layer garment contains index 1 materials, those have to be worn over index 2 or 3 garments, and may not come into contact with the skin, e.g. in the neck and wrist area.

If an assembly contains index 1 materials, those may not come into contact with the skin, e.g. in the neck and wrist area.

**4.2** Protective clothing may consist of several, separate garments, or it may be a single garment with one or more layers.



**4.3** Protective clothing covered by this International Standard shall meet the requirements of EN 340:2003.



**4.4** Parts of the clothing manufactured from thermally conductive material that are likely to be exposed to heat shall not be in contact with the skin when worn according to the manufacturer's instructions and shall be assessed by visual inspection.



**4.5** Where protection is provided by an outer two-piece suit, overlap of at least 20 cm shall be maintained on a wearer when attempting to touch his/her toes with the fingertips while standing.

**4.6** Trousers shall not have turn-ups.

## 5 Sampling, pretreatment and ageing

### 5.1 Sampling

Use sufficient material, material assembly or garments to provide the required number and size of specimens for subsequent testing.

Specimens taken for garment testing shall be representative of the garment construction and shall include seams.

### 5.2 Pretreatment

#### 5.2.1 General

Materials, assemblies or protective clothing shall be tested in accordance with Clause 6 before and after pre-treatment, if the manufacture's instructions indicate that cleaning is allowed.

### 5.2.2 Cleaning

Before each test specified in Clause 6, the cleaning of the protective clothing shall be performed in line with the manufacturer's instructions, on the basis of a standardized procedure. If label states that material can be washed or dry cleaned, material assemblies or garments shall be washed only.

If the number of cleaning cycles is not specified, five cleaning cycles shall be performed.

### 5.2.3 Ageing

The performance tests of Clause 6 shall also be performed after the maximum number of washes (i.e. wash and dry cycles) indicated by the manufacturer.

### 5.2.4 Cleaning index

When cleaned by domestic washing in accordance with 5.2.2, the cleaning index shall be in the form:

Number of washes with letter H / washing temperature

When washed industrially in accordance with 5.2.2, the cleaning index shall be in the form:

Number of washes with letter I / washing temperature

When dry-cleaned in accordance with 5.2.2, the cleaning index shall be in the form:



Number of cleansings with letter C / international symbol for dry-cleaning



When materials can neither be washed nor dry-cleaned, the cleaning index shall be in the form:



0 / 0

### 5.2.5 Final Index

The final index to be marked shall be in the form:

limited flame spread index / cleaning index

## 6 Performance requirements

### 6.1 Thermal performance

**6.1.1** The limited flame spread index quoted shall be the lowest value determined either before or after cleansing.

**6.1.2** All materials used in a single layer garment claiming compliance with this International Standard shall achieve a limited flame spread index of 1, 2 or 3 (see Clause 7) when tested in accordance with ISO 15025:2000, Procedure A (surface ignition), before and after the pretreatment in accordance with Clause 5. The flame shall be applied to the outer face.

**6.1.3** All assemblies claiming compliance with this International Standard shall achieve a limited flame spread index of 1, 2 or 3 (see Clause 7) when tested in accordance with ISO 15025:2000, Procedure A, before and after the pretreatment as follows:

a) the assembly shall achieve a limited flame spread index of 1, 2 or 3 when tested in accordance with ISO 15025 with the flame applied to the outer face and index 2 or 3 with the flame applied to the inner face of the assembly (in this case additional sets of specimen are needed); or

b) each layer of an assembly shall comply with index 1, 2 or 3 when tested with the flame applied to the outer face, except the innermost layer which shall comply with index 2 or 3.

**6.1.4** Garments covered by this International Standard shall be manufactured from materials that comply with 6.1.2 or 6.1.3. Seams shall also be tested in accordance with ISO 15025, placed in a vertical position through the centreline of the specimen. Seams shall not separate.

### 6.2 Mechanical performance (garments only)

**6.2.1** When tested in accordance with ISO 13934-1:1999, the tensile strength of the outer material or clothing assembly shall be minimum 150 N for machine and cross direction.

**6.2.2** When tested in accordance with ISO 13937-2:2000, the tear strength of the outer material or clothing assembly shall be minimum 7,5 N.

**6.2.3** When tested in accordance with ISO 13935-2:1999, the seam strength of the outer material or clothing assembly shall be minimum 30 N.

## 7 Classification

### 7.1 Requirements for limited flame spread index 1

Requirements for limited flame spread index 1 are given in Table 1. If protective clothing contains index 1 materials, these materials shall not be worn next to the skin.



**Table 1 — Requirements for limited flame spread index 1**

| Properties | Requirement |
|---|---|
| Flame spread | No specimen shall permit any part of the lowest boundary of any flame or hole to reach the upper or vertical edge. |
| Flaming debris | No specimen shall give off flaming debris. |
| Afterglow | No afterglow shall spread from the carbonized area to the undamaged area after the cessation of flaming. |



### 7.2 Requirements for limited flame spread index 2

Requirements for limited flame spread index 2 are given in Table 2.

**Table 2 — Requirements for limited flame spread index 2**

| Properties | Requirement |
|---|---|
| Flame spread | No specimen shall permit any part of the lowest boundary of any flame to reach the upper or vertical edge. |
| Flaming debris | No specimen shall give off flaming debris. |
| Afterglow | No afterglow shall spread from the carbonized area to the undamaged area after the cessation of flaming. |
| Hole formation | No specimen shall show hole formation |

### 7.3 Requirements for limited flame spread index 3

Requirements for limited flame spread index 3 are given in Table 3.