
**Protective clothing — Clothing to protect
against heat and flame**

*Vêtements de protection — Vêtements de protection contre la chaleur
et les flammes*

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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.

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 11612 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*.

This second edition cancels and replaces the first edition (ISO 11612:1998). It has been prepared in order to:

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- a) introduce the principle of three performance levels for heat transmission performance properties, with the exception of a fourth level for extreme exposure to radiant heat;
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 - b) include new terms and definitions,
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 - c) include a chapter on clothing design;
 - d) include modifications to pre-treatment, pre-treatment by cleaning and ageing;
 - e) include a heat resistance test as a minimum requirement;
 - f) include a second possible procedure for limited flame spread (code letter A);
 - g) include flame spread requirements for seams;
 - h) modify requirements for dimensional change due to cleaning;
 - i) specify additional requirements for tensile, tear, burst and seam strength;
 - j) include the optional requirements of resistance to water penetration and of water vapour resistance (code letter W);
 - k) include guidance for ergonomic assessment of clothing;
 - l) include requirements for maximum fat content of leather;
 - m) specify requirements for innocuousness;
 - n) change from five to three performance levels for exposure to convective heat (code letter B);

- o) readjust the four performance levels for exposure to radiant heat (code letter C) as a consequence of the revision of ISO 6942:1993 to ISO 6942:2002;
- p) include requirement for protection against contact heat (code letter F);
- q) include guidance for optional assessment of protection against the thermal effects of an electric arc;
- r) include optional whole garment testing for prediction of burn injury;
- s) modify marking requirements;
- t) replace the clause “Instructions for use” by a new clause “Information supplied by the manufacturer”;
- u) include an informative annex on guidelines for clothing design;
- v) include an informative annex on prediction of burn injury using an instrumented manikin;
- w) include an informative annex on checking of basic ergonomic features of protective clothing;
- x) include an informative annex on risk assessment;
- y) include an informative annex on protection against the thermal effects of an electric arc event;
- z) include an informative annex for uncertainty of measurement.

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Introduction

The purpose of this International Standard is to provide minimum performance requirements for clothing to protect against heat and flame, which could be worn for a wide range of end uses. All the other standards listed in the Foreword deal also with clothing to protect against heat and fire, but rather for quite specific products or end uses.

Within many of the hazards listed in this International Standard there are three performance levels:

- Level 1 to indicate exposure to perceived low risk;
- Level 2 to indicate exposure to perceived medium risk;
- Level 3 to indicate exposure to perceived high risk.

For protection against extreme exposures to radiant heat, there is a fourth performance level to take into account high performance materials such as aluminized and similar materials. The level of personal protection to be provided is based on the outcome of the risk assessment and some comments on risk assessment are given in Annex E.

In this International Standard, an informative annex on ergonomic features (Annex D) is included in the form of guidelines. Suitable tests for these requirements have not yet been validated internationally.

For complete protection against exposure to heat and/or flame, it is probable that it will be necessary to protect the head, face, hands and/or feet with suitable PPE and in some cases, appropriate respiratory protection might also be considered necessary.

Attention is drawn to CEN Technical Report CEN/TR 14560:2004¹⁾, which sets out guidelines for selection, use, care and maintenance of protective clothing against heat and flame.

Nothing in this International Standard is intended to restrict any jurisdiction, purchaser or manufacturer from exceeding these minimum requirements. It is one of several standards for clothing that have been developed to protect persons against heat and/or flames. Other standards include:

- ISO 11611, *Protective clothing for use in welding and allied processes*;
- ISO 11613, *Protective clothing for firefighters — Laboratory test methods and performance requirements*;
- ISO 14460, *Protective clothing for automobile racing drivers — Protection against heat and flame — Performance requirements and test methods*;
- ISO 15384, *Protective clothing for firefighters — Laboratory test methods and performance requirements for wildland firefighting clothing*;
- ISO 15538, *Protective clothing for firefighters — Laboratory test methods and performance requirements for protective clothing with a reflective outer surface*;
- EN 469, *Protective clothing for firefighters — Performance requirements for protective clothing for firefighting*;
- EN 1486, *Protective clothing for fire-fighters — Test methods and requirements for reflective clothing for specialised fire fighting*;

- EN 13911, *Protective clothing for firefighters — Requirements and test methods for fire hoods for firefighters*;
- EN 15614, *Protective clothing for firefighters — Laboratory test methods and performance requirements for wildland clothing*.

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Protective clothing — Clothing to protect against heat and flame

1 Scope

This International Standard specifies performance requirements for garments made from flexible materials, which are designed to protect the wearer's body, except the hands, from heat and/or flame. For protection of the wearer's head and feet, the only items of protective clothing falling within the scope of this International Standard are gaiters, hoods and overboots. However, concerning hoods, requirements for visors and respiratory equipment are not given.

The performance requirements set out in this International Standard are applicable to garments which could be worn for a wide range of end uses, where there is a need for clothing with limited flame spread properties and where the user can be exposed to radiant or convective or contact heat or to molten metal splashes.

This International Standard is not applicable to protective clothing that is specified by other International Standards, such as for firefighting in structures and for use in welding and allied processes.

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 3071, *Textiles — Determination of pH of aqueous extract*

ISO 3376:2002, *Leather — Physical and mechanical tests — Determination of tensile strength and percentage extension*

ISO 3377-1, *Leather — Physical and mechanical tests — Determination of tear load — Part 1: Double edge tear*

ISO 4045, *Leather — Chemical tests — Determination of Ph*

ISO 4048, *Leather — Chemical tests — Determination of matter soluble in dichloromethane and free fatty acid content*

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 7000, *Graphical symbols for use on equipment — Index and synopsis*

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

ISO 9185, *Protective clothing — Assessment of resistance of materials to molten metal splash*

ISO/TR 11610, *Protective clothing — Vocabulary*

ISO 12127:1996, *Clothing for protection against heat and flame — Determination of contact heat transmission through protective clothing or constituent materials*

ISO 13506, *Protective clothing against heat and flame — Test method for complete garments — Prediction of burn injury using an instrumented manikin*

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 13938-1, *Textiles — Bursting properties of fabrics — Part 1: Hydraulic method for determination of bursting strength and bursting distension*

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

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

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

EN 343:2003, *Protective clothing — Protection against rain*

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3 Terms and definitions

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

3.2

cleaning

process by which a PPE is made again serviceable and/or hygienically wearable 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 finishing.

3.3**clothing assembly**

series of outer and under garments to be worn together

3.4**component**

any material, part or subassembly used in the construction of an item of PPE

3.5**component assembly**

combination of all materials of a multi-layer garment presented exactly as the finished garment construction

3.6**conditioning**

keeping samples under standard conditions of temperature and relative humidity for a minimum period of time

3.7**gaiter**

removable covering intended to protect the part of the leg below the knee and may cover the shoes

3.8**garment**

single item of clothing, which may consist of single or multiple layers

NOTE In this International Standard, where a garment or garments are referred to, this is intended also to include hoods, gaiters and overboots as appropriate.

3.9**hardware**

non-fabric items forming part of or optional extras in a garment

EXAMPLE

Metal or plastic buttons or fasteners etc.

3.10**hood**

Item of PPE made from flexible material, which covers the head and neck

3.11**innermost lining**

innermost face of a component assembly closest to the wearer's skin

NOTE Where the innermost lining forms part of a material combination, the material combination is regarded as the innermost lining.

3.12**interlining**

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

3.13**material**

flexible substance/substances of which the item of clothing is made

3.14**outer material**

outermost material of which the item of clothing is made

3.15**overboots**

single or multiple layers of material covering the footwear to provide protection against heat and/or flame

NOTE Certain types of overboot used for this purpose can also cover parts of the legs and/or ankles.

**3.16
patch pocket**

pocket located on the exterior of a protective garment, which is stitched as a patch over the outer layer of the protective garment

**3.17
pre-treatment**

standard way of preparing the samples before testing

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

**3.18
seam**

any method of permanent fastening between two or more pieces of material

**3.18.1
main seams**

seams that are necessary for the integrity of the garment

**3.18.2
overlapping seam**

seam where all or part of one or more layers of material covers the other layer or layers causing a ridge

4 Clothing design

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4.1 General

General requirements which are not specifically covered in this International Standard shall be in accordance with ISO 13688.

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Where more than one garment is needed to meet the requirements of this International Standard, each garment shall be labelled to ensure that the correct combination is used.

4.2 Sizes

4.2.1 General

Garment sizes shall be in accordance with the requirements of ISO 13688.

4.2.2 Suits

Heat and flame protective suits shall completely cover the upper and lower torso, neck, arms and legs. Suits shall consist of:

- a single garment, e.g. an overall or boiler suit or
- a two-piece garment, consisting of a jacket and a pair of trousers. Jackets shall be of sufficient length to overlap by a minimum of 20 cm with the top of the trousers. This minimum overlap shall be maintained in all positions and in movements expected during use.

Conformity shall be checked by visual inspection, including an assessment of fit and practical testing, such as physical measurement of the overlap in all positions and movements normally encountered during use, when a suit of appropriate size is donned by a wearer.