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## Protective clothing for use in welding and allied processes

*Vêtements de protection utilisés pendant le soudage et les techniques  
connexes*

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ISO 11611:2007

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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 11611 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 11611 cancels and replaces EN 470-1:1995 and EN 470-1:1995/A1:1998, which have been technically revised to:

- <https://standards.iteh.ai/catalog/standards/sist/98Bf54e-81d8-440b-95de-00d32533b4f2/iso-11611-2007>
- a) include additional clothing in the scope;
  - b) specify two classes of protective clothing;
  - c) include additional terms and definitions;
  - d) specify ageing due to washing (maximum number of cleaning procedures as indicated by the manufacturer);
  - e) specify additional tests for heat transfer (radiation) and electrical resistance;
  - f) specify requirements for innocuousness;
  - g) modify requirements for dimensional change on washing to include requirements for knitted fabrics;
  - h) delete test method for the thickness of leather;
  - i) modify requirements for tensile strength and tear strength;
  - j) specify requirements for burst strength and seam strength;
  - k) include test procedure for the flame testing of seams and hemmed edges;
  - l) modify the information to be supplied by the manufacturer;
  - m) specify requirements for care and maintenance;
  - n) include annex for the selection of welders' clothing;

- o) include annex regarding information on UV radiation hazards;
- p) include annex for uncertainty of measurement.

This corrected version contains corrections to the values of radiant heat transfer index (RHTI) given in 6.9 and in Table 1, row 6.9.

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# Protective clothing for use in welding and allied processes

## 1 Scope

This International Standard specifies minimum basic safety requirements and test methods for protective clothing including hoods, aprons, sleeves and gaiters that are designed to protect the wearer's body including head (hoods) and feet (gaiters) and that are to be worn during welding and allied processes with comparable risks. For the protection of the wearer's head and feet, this International Standard is only applicable to hoods and gaiters. This International Standard does not cover requirements for hand protection.

This type of protective clothing is intended to protect the wearer against spatter (small splashes of molten metal), short contact time with flame, radiant heat from the arc, and minimizes the possibility of electrical shock by short-term, accidental contact with live electrical conductors at voltages up to approximately 100 V d.c. in normal conditions of welding. Sweat, soiling or other contaminants can affect the level of protection provided against short-term accidental contact with live electric conductors at these voltages.

This International Standard specifies two classes with specific performance requirements (see Annex A), i.e. Class 1 being the lower level and Class 2 the higher level.

- Class 1 is protection against less hazardous welding techniques and situations, causing lower levels of spatter and radiant heat.
- Class 2 is protection against more hazardous welding techniques and situations, causing higher levels of spatter and radiant heat.

Details are given in Table 1 and Annex B.

For adequate overall protection against the risks to which welders are likely to be exposed, personal protective equipment (PPE) covered by other standards should additionally be worn to protect the head, face, hands and feet.

## 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 3071:2005, *Textiles — Determination of pH of aqueous extract*

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

ISO 3377-1:2002, *Leather — Physical and mechanical tests — Determination of tear load — Part 1: Single edge tear*

ISO 4045:1977, *Leather — Determination of pH*

ISO 4048:1977, *Leather — Determination of matter soluble in dichloromethane*

ISO 5077:2007, *Textiles — Determination of dimensional change in washing and drying*

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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 9150:1988, *Protective clothing — Determination of behaviour of materials on impact of small splashes of molten metal*

ISO 13688, *Protective clothing — General requirements*

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

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

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

EN 1149-2:1997, *Protective clothing — Electrostatic properties — Part 2: Test method for measurement of the electrical resistance through a material (vertical resistance)*

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### 3 Terms and definitions

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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.

#### 3.2

##### **allied processes**

processes having similar types and levels of risk as welding, cutting, arc air gouging and spraying



**3.3****cleaning**

process by which a PPE is again made 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 other finishing.

**3.4****conditioning**

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

**3.5****gaiter**

removable covering intended to protect the part of the leg below the knee and can also cover the upper surface of shoes

**3.6****hood**

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

NOTE Certain hood styles also cover the shoulders.

**3.7****material assembly**

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

**3.8****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.

**3.9****protective clothing**

clothing which covers or replaces personal clothing and which is designed to provide protection for the wearer's upper and lower torso, neck, arms and legs

**3.10****protective garment**

individual item of protective clothing the wearing of which provides protection against specified hazards to the part of the body that it covers

EXAMPLE Protective coat, apron, trousers, gaiters, hoods, boiler suit or overall.

**3.11****side seam**

seam that runs laterally along the garment when it is placed flat on a surface, with the front uppermost

**3.12****sleeve**

removable covering intended to protect part or all of the arm and the wrist

**3.13****welding**

process used in joining metal components involving local melting of metal

## 4 Design

### 4.1 General

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

Welders' protective clothing shall be designed without electrical conduction from the outside to the inside, e.g. by metal fasteners. Conformity shall be checked by visual inspection.

#### 4.1.1 Protective clothing

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

- a) a single garment, e.g. an overall or boiler suit;
- b) or a two-piece garment, consisting of a jacket and a pair of trousers.

The jacket of a two-piece suit shall provide a minimum overlap of 20 cm between the jacket and the top of the trousers. This minimum overlap shall be maintained in all positions and in movements encountered during welding.

Conformity shall be checked by visual inspection and practical testing, such as physical measurement of the overlap in all positions and movements normally encountered during welding.

#### 4.1.2 Additional protective clothing (standards.iteh.ai)

Welder's protective garments may be designed to provide extra protection for specific areas of the body when worn in addition to a suit according to 4.1.1, e.g. neck curtain, hoods, sleeves, apron and gaiters.

Performance testing of partial protective garments shall be carried out on the complete assembly. Additional protective clothing such as hoods, sleeves, apron and gaiters shall cover the intended areas if worn with a suit of appropriate size and shall also meet the requirements of this International Standard.

### 4.2 Sizes

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

Conformity shall be checked by visual inspection including an assessment of fit and physical measuring when the appropriate size of clothing is donned by a wearer.

### 4.3 Pockets

Where garments are constructed with pockets, the pockets shall be constructed to the following design:

- a) pockets with external openings shall be made of material(s) conforming to 6.7 and 6.8.
- b) external opening pockets including pass through openings shall be flapped except for:
  - side pockets below the waist which do not extend more than 10° forward of the side seam;
  - a single rule pocket with an opening not greater than 75 mm placed behind the side seam on one or both legs and measured flat;
- c) all flaps shall be stitched down or capable of fastening the pocket closed. They shall be 20 mm wider than the opening (10 mm on each side) to prevent the flap from being tucked into the pocket.

Conformity shall be checked by visual inspection and physical measurement.

#### 4.4 Closures and seams

Closures shall be designed with a protective cover flap on the outside of the garment. The maximum distance between buttonholes shall be 150 mm. If zippers are used, the slide fastener shall be designed to lock when completely closed. Cuffs may be provided with closures to reduce their width. The closure and any fold which it creates shall be on the underside of the cuff. Cuffs shall not have turn-ups.

Neck openings shall be provided with closures.

Trousers or one-piece suits shall not have turn-ups. They may have side slits which shall have a means of closure and the slit and closure shall be covered.

Overlapping seams on the outside of the garment shall be downward facing and overstitched.

Conformity shall be checked by visual inspection.

### 5 Sampling and pre-treatment

#### 5.1 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 tests shall be carried out on the outer material of the garment unless it is mentioned in the appropriate test clause of this International Standard to use the complete material assembly.

#### 5.2 Pre-treatment of material

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##### 5.2.1 General

Prior to testing, the protective clothing shall be pre-treated. Leather shall not be pre-treated.

If a manufacturer indicates that the performance of the garment is intended for a single use only, then the tests shall only be carried out on new material.

##### 5.2.2 Cleaning

Before each test specified in 6.1 to 6.10 except 6.6, the cleaning of the protective clothing shall be in line with the manufacturer's instructions, on the basis of standardized processes. If the number of cleaning cycles is not specified, five cleaning cycles shall be performed. Tests specified in 6.6, 6.11.2 and 6.11.3 shall be carried out in the new state (as received).

##### 5.2.3 Ageing

Performance tests specified in 6.7 shall also be executed after the maximum number of cleaning procedures indicated by the manufacturer.

#### 5.3 Conditioning

Specimens other than leather shall be conditioned for at least 24 h in an atmosphere having a temperature of  $(20 \pm 2)$  °C and a relative humidity of  $(65 \pm 5)$  %. Leather specimens shall be conditioned for at least 48 h in an atmosphere having a temperature of  $(20 \pm 2)$  °C and a relative humidity of  $(65 \pm 5)$  %. Testing shall be carried out within 5 min of removal from this atmosphere.