
Protective clothing for use in welding and allied processes

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

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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 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 safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*, and by Technical Committee CEN/TC 162, *Protective clothing including hand and arm protection and lifejackets* in collaboration.

This second edition cancels and replaces the first edition (ISO 11611:2007) which has been technically revised with the following changes:

- include an introduction;
- include a definition for hole;
- modify the clause in design requirements regarding garment overlaps;
- modify the clause in design requirements regarding garment sizes;
- modify the clause on sampling requirements;
- modify clause for ageing due to washing (maximum number of cleaning procedures as indicated by the manufacturer);
- modify the pre-treatment clause to include the requirements for single use garments;
- include a new requirement for measuring the property value for rating and classification;
- modify the requirements for tear strength;
- specify the test area for burst strength testing;
- modify the requirement that hardware is tested only after pre-treatment;
- include a statement for flame spread testing in regard to interlining materials;
- remove the reference to melting from flame spread requirements;
- modify the afterflame requirement for flame spread;

- modify the afterglow requirement for flame spread;
- modify the test procedure for the flame testing of labels, badges, retro-reflective materials;
- modify requirement for the impact of spatter to state that materials cannot ignite;
- modify the innocuousness clause to include reference to ISO 13688;
- specify the limit for Chromium(VI) Content;
- modify the clause for information to be supplied by the manufacturer;
- include a new annex for measuring property value for rating and classification;
- include a new definition for uncertainty of measurement in [Annex C](#);
- specify that [Annex C](#) is normative.

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Introduction

The purpose of this International Standard is to provide minimum performance requirements for clothing for use in welding and allied processes.

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

Attention is drawn to ISO/TR 2801:2007,^[2] 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.

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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 feet, hand, face, and/or eye protectors.

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 an electric arc used for welding and allied processes, 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.

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

Guidance for the selection of the type of welders clothing for different welding activities is detailed in [Annex A](#).

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 3376:2011, *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: Single edge tear*

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

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*

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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 13938-2, *Textiles — Bursting properties of fabrics — Part 2: Pneumatic 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*

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

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 1 to entry: Ageing is caused by a combination of several factors, such as the following:

- cleaning, maintenance, or disinfecting process;
- 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 allied processes

processes having similar types and levels of risk as welding

EXAMPLE Cutting, arc air gouging, and spraying.

3.3 cleaning

process by which an item of PPE is again made serviceable and/or hygienically wearable by removing any dirt or contamination

Note 1 to entry: A cleaning cycle is typically a washing plus drying or a dry cleaning treatment followed, if required, by ironing, or other finishing.

3.4 clothing assembly

series of garments arranged in the order as worn

Note 1 to entry: They may contain multilayer materials, material combinations or a series of separate garments in single layers.

3.5 conditioning

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

3.6 component assembly

combination of all materials and hardware presented exactly as the finished garment construction

3.7 gaiter

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

3.8 hardware

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

EXAMPLE Metal or plastic buttons or zippers and touch and close fasteners or hook and loop fasteners.

3.9 hole

any opening, break, or discontinuity of any size in the original structure of the test specimen's fabric caused by application of the test flame

[SOURCE: ISO 15025]

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3.10 hood

item of PPE made from flexible material which covers the head and neck and may also cover the shoulders

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3.11 innermost lining

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

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Note 1 to entry: 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

substances excluding hardware, of which an item of clothing is made

3.14 material assembly

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

3.15 material combination

material produced from a series of separate layers, fixed together during the garment manufacturing stage

3.16 multilayer material

material consisting of different layers intimately combined prior to the garment manufacturing stage

EXAMPLE The combining process includes weaving, quilting, coating, or gluing.

3.17

outer material

outermost material of which the item of clothing is made

3.18

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

3.19

pre-treatment

standard way of preparing the samples before testing

Note 1 to entry: This can include e.g. a number of cleaning cycles, submitting the sample to heat, mechanical action, or any other relevant exposure and is completed by conditioning.

3.20

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

3.21

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 coverall.

3.22

seam

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

3.22.1

side seam

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

3.22.2

structural seam

seam that is necessary for the integrity of the garment

3.23

sleeve

removable covering intended to protect part or all of the arm and the wrist in addition to sleeves in a jacket or overall

3.24

welding

process used in joining metal components involving local melting of metal

4 General and design requirements

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 to prevent electrical conduction from the outside to the inside, e.g. by metal fasteners. Conformity shall be checked by visual inspection.

4.2 Protective clothing

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

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

Pleats in the exterior surface of the garment can act as trapping points for hot/molten materials. If pleats are present in the garment, the bottoms of the pleats shall incorporate a means whereby entrapment of molten metal can be prevented, for example by incorporating diagonal stitches or some other feature. Conformity shall be checked by visual inspection.

4.3 Size designation and fit

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

Where protection to the requirements of this International Standard is provided by an outer two piece suit, it shall be determined that, when correctly sized for the wearer, an overlap between the jacket and trousers remains when one standing wearer firstly fully extends both arms above the head and then bends over until the fingertips touch the ground.

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.

In addition, the wrists, lower arms, and ankles shall also remain covered in an upright position; this shall also apply to one piece suits.

4.4 Additional protective garments

Welder's protective garments can be designed to provide extra protection for specific areas of the body when worn in addition to a suit according to 4.2, e.g. neck curtain, hoods, sleeves, apron, and gaiters. Aprons shall cover the front body of the user at least from side seam to side seam.

In the case of hoods, manufacturers shall identify the specific(s) visors to be incorporated into the hood.

Performance testing of additional protective garments shall be carried out on the assembly, comprising the suit plus the additional protective garment. Additional protective garments such as hoods, sleeves, apron, and gaiters shall cover the intended areas when worn with a suit of appropriate size and the additional item alone shall also meet the requirements of this International Standard.

4.5 Pockets and flap closures

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

- a) pockets with external openings, including patch pockets shall be made of material(s) conforming to 6.7 and 6.8;
- b) external opening pockets including pass-through openings shall have a covering flap 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 at least 20 mm wider than the opening (at least 10 mm on each side) to prevent the flap from being tucked into the pocket. They shall be stitched down on each side or capable of covering the pocket opening by fastening. Flap materials shall conform to 6.7 and 6.8.

Conformity shall be checked by visual inspection and physical measurement.