BS EN ISO 11611:2015

BSI Standards Publication

Protective clothing for use in welding and allied processes

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN ISO 11611:2015. It supersedes BS EN ISO 11611:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PH/3/2, Heat and Flame Personal Protective Equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 73908 8

ICS 13.340.10; 25.160.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2015.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 11611

July 2015

ICS 13.340.10; 25.160.01

Supersedes EN ISO 11611:2007

English Version

Protective clothing for use in welding and allied processes (ISO 11611:2015)

Vêtements de protection utilisés pendant le soudage et les techniques connexes (ISO 11611:2015)

Schutzkleidung für das Schweißen und verwandte Verfahren (ISO 11611:2015)

This European Standard was approved by CEN on 19 June 2015.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

European foreword

This document (EN ISO 11611:2015) has been prepared by Technical Committee ISO/TC 94 "Personal safety - Protective clothing and equipment" in collaboration with Technical Committee CEN/TC 162 “Protective clothing including hand and arm protection and lifejackets” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2016, and conflicting national standards shall be withdrawn at the latest by January 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

This document supersedes EN ISO 11611:2007.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 11611:2015 has been approved by CEN as EN ISO 11611:2015 without any modification.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 89/686/EEC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means of conforming to Essential Requirements of the New Approach Directive 89/686/EEC on the approximation of the laws of the Member States relating to personal protective equipment.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this International Standard given in Table ZA.1 confers, within the limits of the scope of this International Standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA 1

Clauses/ subclauses of this European Standard	Basic requirement (EU directive 89/686/EEC, Annex II)	Qualifying remarks/notes
4.1, 4.2, 4.3, 4.5, 4.6, 4.7, 6.6, 6.10 and 6.11	1.2.1 Absence of risks and other inherent nuisance factors	
4.4	1.3.1 Adaptation of PPE to user morphology	
5.2, 8	1.4 Information supplied by the manufacturer	
5.3	2.4 PPE subject to ageing	
6.2, 6.3, 6.4 and 6.5	1.3.2 Lightness and design strength	
6.7,6.8,6.9	Protection against heat and/or fire 3.6.1 PPE constituent materials and other components	
6.8, 6.9	Protection against heat and/or fire 3.6.2 Complete PPE ready for use	
6.1, 6.8, 6.9	1.1.2.2 Classes of protection appropriate to different levels of risk	
7	2.12 PPE bearing identification marks relating to health and safety	

Warning Other requirements and other EU Directives may be applicable to the products falling within the scope of this International Standard

Contents

Page

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.

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.

INTERNATIONAL STANDARD ISO 11611:2015(E)

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*

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]

3.10
hood
item of PPE made from flexible material which covers the head and neck and may also cover the shoulders

3.11
innermost lining
innermost face of a component assembly closest to the wearer's skin

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.

4.6 Closures and seams

Closures shall be designed with a protective cover flap on the outside of the garment. The maximum distance between buttonholes/press studs shall be 150 mm. If zippers are used, the slide fastener shall be designed to lock when completely closed. Cuffs can 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 can have side slits which shall have a means of closure and the slit and closure shall be covered.

Conformity shall be checked by visual inspection.

4.7 Hardware

Hardware penetrating the outer material of a welders' protective garment or garment assembly shall not be exposed to the innermost surface of the garment or the garment assembly.

Conformity shall be checked by visual inspection.

5 Sampling and pre-treatment

5.1 Sampling

The number of samples and the size of the specimens of garment materials or garments presented to the different test methods, shall be in accordance with the respective test standards specified in the requirements of Clause 6. Samples for testing shall be taken from the original garment or shall be representative of the component assembly.

5.2 Pre-treatment of material

Before each test specified in 6.2 to 6.10, the test materials and test specimens shall be pre-treated by cleaning. If the manufacturer's instructions indicate that cleaning is not allowed, i.e. single use garments, then testing will be carried out on new material. In addition, 6.7 requires that the limited flame spread tests shall be carried out both before the pre-treatment and after the pre-treatment.

The cleaning shall be in line with the manufacturer's instructions, on the basis of standardized processes. If the number of cleaning cycles is not specified, the tests shall be carried out after five cleaning cycles (a cleaning cycle is one wash and one dry cycle). This shall be reflected in the information supplied by the manufacturer. If the garment can be washed and dry-cleaned, it shall only be washed. If only dry-cleaning is allowed, the garment shall be dry-cleaned in accordance with the manufacturer's instructions.

Leather materials shall be tested in the new state, except if the manufacturer indicates that cleaning is allowed. In that case, cleaning shall be carried out according to the manufacturer's instructions.

The test specified in 6.11 shall be carried out in the new state (as received).

NOTE The manufacturer's instructions typically indicate one or several of the various methods and processes of ISO 6330,[9] ISO 15797,[10] ISO 3175-2,[11] or equivalent as standardized processes for cleaning.

5.3 Ageing

In the case that the garment should be submitted to some treatment to maintain its limited flame spread property as specified in 6.7, the manufacturer shall indicate the maximum number of cleaning cycles that can be carried out before applying the treatment indicated to maintain the garment protective performance. Limited flame spread test according to 6.7 shall be carried out after the last cleaning cycles before any treatment as indicated by the manufacturer, in both cases, the garment shall comply with the requirement.

5.4 Conditioning

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

Samples for electrical resistance testing specified in 6.10 shall be conditioned and tested in an atmosphere having a relative humidity of (85 ± 5 %) and a temperature of (20 ± 2) °C.

6 General performance requirements

6.1 Classification

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 3 and Annex A

Wherever in Clause 6 the requirements for a property value are expressed in terms of a minimum or maximum value and wherever a minimum or maximum value is to determine a Level or Class for that property, the resultant property value shall be determined according to Annex B. For all tests in Clause 6 shall be evaluated in accordance with Annex C.

6.2 Tensile strength

When tested in accordance with ISO 13934-1, woven outer materials shall have a minimum tensile strength of 400 N in both the machine and cross directions.

When tested in accordance with ISO 3376, leather outer materials shall have a minimum tensile strength of 80 N in two directions at right angles when the standard test specimen defined in ISO 3376:2011, Table 1 is used.

6.3 Tear strength

When tested in accordance with ISO 13937-2, woven outer materials shall have a minimum tear strength of 15 N in both the machine and cross directions for Class 1 welders clothing and 20 N in both the machine and cross directions for Class 2 welders clothing. When tested in accordance with ISO 3377-1, leather outer materials shall have a minimum tear strength of 15 N in two directions at right angles in the plane of the material for Class 1 welders clothing and 20 N in two directions at right angles in the plane of the material for Class 2 welders clothing.

6.4 Burst strength of knitted materials and seams

When tested in accordance with ISO 13938-1 or ISO 13938-2, knitted outer materials and structural seams in knitted materials shall have a minimum burst strength of 100 kPa, when using 50 cm^2 test area, or 200 kPa, when using a 7,3 cm^2 test area.

6.5 Seam strength

When tested in accordance with ISO 13935-2, structural seams of woven outer materials and leather materials of the clothing assembly shall have a minimum seam strength of 225 N.

6.6 Dimensional change of textile materials

Dimensional change shall be measured before and after the samples have undergone five cleaning cycles according to 5.2.

The change in dimensions of woven, non-woven, and sheet materials shall not exceed ±3 % in either length or width direction when measured in accordance with ISO 5077.

The change of dimensions of knitted materials shall not exceed ±5 % when measured in accordance with ISO 5077.

Dimensional change shall be measured after the specimen has been uncreased and flattened on a plane surface.

Dimensional change does not apply to single use garments.

6.7 Limited flame spread

6.7.1 General

Testing of materials and seams shall take place in accordance with ISO 15025, Procedure A (code letter A1) and optionally Procedure B (code letter A2). This test shall be carried out both before and after the pre-treatment specified in 5.2.

6.7.2 Testing in accordance with ISO 15025, Procedure A (code letter A1)

6.7.2.1 When tested in accordance with ISO 15025, Procedure A, specimens from single layer garments shall meet the following requirements.

Table 1 — Limited flame spread performance requirements ISO 15025, Procedure A (code letter A1)

Properties	Requirement
Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
Flaming debris	No specimen shall give flaming or molten debris.
Hole formation	No specimen shall give hole formation of 5 mm or greater in any direction, except for an interlining that is used for specific protection other than heat and flame protection.
Afterglow	Afterglow time shall be ≤2 s. A glowing inside the charred area is defined in ISO 15025 as afterglow without combustion and for the purpose of this clause is not regarded as afterglow.
Afterflame	Afterflame time shall be ≤2 s.

For seams, three specimens containing a structural seam shall be tested in accordance with ISO 15025, Procedure A. Specimens shall be oriented with the seam running up the centreline of outer surface of the test specimen so that the burner flame impinges directly upon the seam. Seams shall not separate. Except for leather, seams shall be tested only after pre-treatment according to 5.2.

6.7.2.2 If the garment is multilayer, specimens of the material assembly including seams, except the innermost seams, shall be tested both by applying the flame to the surface of the outer material of the garment and to the innermost lining of the garment and shall meet the requirements of 6.7.2.1, including that no specimen shall give hole formation except for an interlining that is used for specific protection other than heat protection, for example liquid penetration.

6.7.2.3 Hardware, whether it is exposed or covered when all closure systems in the garment are in the closed position, shall be tested separately, using ISO 15025, Procedure A, after the pre-treatment

specified in 5.2. Samples shall be taken in combination with the garment layer(s) to make it possible to have samples with the dimensions as indicated in ISO 15025, Procedure A. Three specimens containing the hardware shall be tested.

When the hardware is covered, the flame shall be applied to the outer surface of the component assembly containing hardware exactly as designed in the garment so that the burner flame impinges directly upon the place where the hardware is located. When the hardware is directly exposed, the flame shall be applied directly upon the hardware.

When the hardware is covered when all closure systems in the garment are in the closed position, the assembly shall meet the requirements of 6.7.2.1. At least five minutes after completion of the test, it shall be verified that the closure system can be opened at least once.

When the hardware is directly exposed, it shall comply with: no specimen shall melt or giving flaming or molten debris; the afterglow time shall be ≤2 s and the afterflame time shall be ≤2 s. At least five minutes after completion of the test, it shall be verified that the closure system can be opened at least once.

6.7.2.4 Labels, badges, retro-reflective materials,transfers, etc., which are applied to the outermost surface of the garment, shall be tested only after pre-treatment according to 5.2. in combination with the outer layer to make it possible to take samples with the dimensions as indicated in ISO 15025, Procedure A, three specimens containing the item shall be tested. The items shall be oriented with the longer dimensions running up the centreline of the test specimen so that the burner flame impinges directly upon the middle surface of the item, not the edge. The combination with the outermost layer of the garment shall meet the requirements of 6.7.2.1. This requirement is not applicable for labels, embroideries, or other added decorations with a surface area of less than 10 cm^2.

6.7.3 Testing in accordance with ISO 15025, Procedure B (code letter A2)

6.7.3.1 When tested in accordance with ISO 15025, Procedure B, hemmed specimens from single layer garments, shall meet the following requirements

Table 2 — Limited flame spread performance requirements ISO 15025, Procedure B (code letter A2)

Properties	Requirement
Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
Flaming debris	No specimen shall give flaming or molten debris.
Afterglow	Afterglow time shall be ≤2 s. A glowing inside the charred area is defined in ISO 15025 as afterglow without combustion and for the purpose of this Clause is not regarded as afterglow.
Afterflame	Afterflame time shall be ≤2 s.

For seams, three specimens containing a structural seam shall be tested in accordance with ISO 15025, Procedure B. Specimens shall be oriented with the seam running up the centreline of the test specimen so that the burner flame impinges directly upon the seam. Seams shall not separate. Except for leather, seams shall be tested only after pre-treatment according to 5.2.

6.7.3.2 The hemmed fabric specimen shall be taken from the original garment or prepared in the same manner as used in the construction of the clothing.

6.7.3.3 If the garment is multilayer, hemmed specimens of the material assembly including seams shall be tested by applying the flame to the edge of the multilayer assembly and shall meet the requirements of 6.7.3.1.

6.8 Impact of spatter (small splashes of molten metal)

When tested according to ISO 9150, the outer material or material assembly shall require

— at least 15 drops of molten metal to raise the temperature behind the test specimen by 40 K for Class 1, and

— at least 25 drops of molten metal to raise the temperature behind the test specimen by 40 K for Class 2.

Material and material assemblies which ignite during the test do not meet this requirement.

6.9 Heat transfer (radiation)

When tested in accordance with ISO 6942, Method B, at a heat flux density of 20 kW/m^2, single layer or multilayer garments, and/or clothing assemblies that are claimed to offer protection against radiant heat shall meet a radiant heat transfer index (RHTI for 24 °C) of

— for Class 1: RHTI 24 ≥ 7,0, and

— for Class 2: RHTI 24 ≥ 16,0.

If the garment is multi-layered, the test shall be carried out on the complete material assembly with the innermost layer facing the calorimeter and the outermost layer facing the energy source.

6.10 Electrical resistance

Conditioning and testing of the samples shall be carried out at a temperature of (20 ± 2) °C and relative humidity of (85 ± 5) %. When the material assembly is tested in accordance with the test method specified in EN 1149-2 and under an applied potential of (100 ± 5) V, the electrical resistance shall be greater than 10^5 Ω (corresponds to less than 1 mA leakage current) for all assemblies of the clothing. Seams shall be taken into account when preparing test samples.

6.11 Fat content of leather

When tested according to ISO 4048:2008, the fat content of leather shall not exceed 15 %.

6.12 Performance requirements

The summary of performance requirements are summarized in Table 3.

Table 3 — Summary of performance requirements

Subclause	Requirement	Class 1	Class 2
6.2	Tensile strength — woven outer textile material — leather	 400 N 80 N	 400 N 80 N
6.3	Tear strength — woven outer textile material — leather	 15 N 15 N	 20 N 20 N
6.4	Burst strength Test area of 7,3 cm^2 Test area of 50 cm^2	 200 kPa 100 kPa	 200 kPa 100 kPa
[a] For ISO 15025, Procedure B, this requirement is not applicable.			

Table 3 *(continued)*

Subclause	Requirement	Class 1	Class 2
6.5	Seam strength — textile material — leather	 225 N 225 N	 225 N 225 N
6.6	Dimensional change of woven textile materials Dimensional change of knitted textile materials	±3 % ±5 %	±3 % ±5 %
6.7	Flame spread — Procedure A - mandatory — Procedure B - optional	ISO 15025, Procedure A (surface ignition) ISO 15025, Procedure B (edge ignition) No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge. No hole formation[a] No flaming or molten debris afterflame ≤2 s afterglow ≤2 s	ISO 15025, Procedure A (surface ignition) ISO 15025, Procedure B (edge ignition) No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge. No hole formation[a] No flaming or molten debris afterflame ≤2 s afterglow ≤2 s
6.8	Impact of spatter	15 drops	25 drops
6.9	Heat transfer (radiation)	RHTI 24 ≥ 7,0	RHTI 24 ≥ 16.0
6.10	Electrical resistance	$>10^5$ Ω	$>10^5$ Ω
6.11	Fat content of leather	≤15 %	≤15 %

[a] For ISO 15025, Procedure B, this requirement is not applicable.

7 Marking

Welders' protective clothing, for which compliance with this International Standard is claimed, shall be marked in accordance with ISO 13688 and with the following information:

a) classification:

- Class 1: the number and year of this International Standard (ISO 11611) followed by the graphical symbol shown in Figure 1 and the indication "Class 1" and the indication "A1" or "A1 + A2" as appropriate for Limited Flame Spread;
- Class 2: the number and year of this International Standard (ISO 11611) followed by the graphical symbol shown in Figure 1 and the indication "Class 2" and the indication "A1" or "A1 + A2" as appropriate; garments conforming to Class 2 shall meet Class 2 for all performance requirements;
- where garments contain parts of both classes, the garment shall be classified in the lower class.

b) for garments intended for single use only, the garment marking shall indicate "Do not re-use" (or the equivalent term in the language of the country of destination) and in addition with the graphical symbol according to ISO 7000:2014, 1051.

c) instructions for cleaning shall be marked (e.g. on a label).

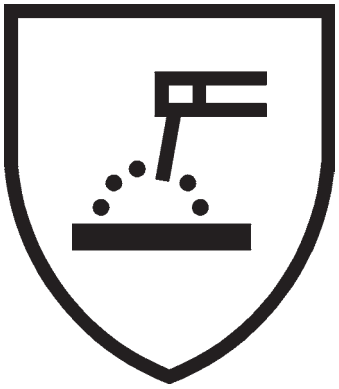

Figure 1 — Graphical symbol for protection against welding hazards (ISO 7000-2683)

8 Information supplied by the manufacturer

8.1 General

When welders' protective clothing is delivered to the consumer, instructions for use shall be provided in accordance with ISO 13688.

The manufacturer shall give as much information as possible on known factors of durability, especially on durability to cleaning. See ISO 13688 for further details.

In the case that applying a finish can maintain the protective properties, the maximum number of cleaning cycles before re-application of the finish and the procedure for re-application shall be clearly indicated in the information notice.

8.2 Intended use

At least the following basic information shall be provided

a) any guidance on the appropriate choice of class of welders' protective clothing, (see Annex A);

b) any identified hazards against which the clothing is intended to protect (e.g. flames, molten metal spatter, radiant heat, and short term accidental electrical contact);

c) for protective clothing, a warning that additional partial body protection may be required, e.g. for welding overhead;

d) a warning that the garment is only intended to protect against brief, inadvertent contact with live parts of an arc welding circuit, and that additional electrical insulation layers will be required where there is an increased risk of electric shock; garments meeting the requirements of 6.10 are designed to provide protection against short term, accidental contact with live electric conductors at voltages up to approximately 100 V d.c.

8.3 Improper use

A warning shall be given about the hazards of improper use.

a) The level of protection against flame will be reduced if the welders' protective clothing is contaminated with flammable materials.

b) An increase in the oxygen content of the air will reduce considerably the protection of the welders' protective clothing against flame. Care should be taken when welding in confined spaces, e.g. if it is possible that the atmosphere may become enriched with oxygen.

c) The electrical insulation provided by clothing will be reduced when the clothing is wet, dirty, or soaked with sweat.

d) For two-piece protective clothing, a warning that both items shall be worn together to provide the specified level of protection.

e) For additional body protection, a warning that the garment is intended for use in addition to protective clothing providing protection against welding hazards.

f) Warnings, regarding other limitations of a garment, as identified by the manufacturer.

8.4 Care and maintenance

Instructions shall be given to advise the user on cleaning procedures, the maximum number of cleaning cycles, maintenance, inspection, and repair of the garment where practical.

Manufacturers shall include the information that welder's protective clothing be cleaned regularly in accordance with the manufacturer's recommendations. After cleaning, the clothing shall be visually inspected for any sign of damage.

Similarly, users should be advised that if they experience sunburn-like symptoms, UVB is penetrating. In either case, the garment should be repaired (if practicable) or replaced and consideration given to the use of additional, more resistant, protective layers in future.

Annex A
(normative)

Guidance for the selection of the type of welders' clothing (Class 1/ Class 2)

Table A.1 — Selection criteria for clothing for use in welding or allied processes (reference points)

Type of welders' clothing	Selection criteria relating to the process:	Selection criteria relating to the environmental conditions:
Class 1	Manual welding techniques with light formation of spatters and drops, e.g.: — gas welding; — TIG welding; — MIG welding (with low current); — micro plasma welding; — brazing; — spot welding; — MMA welding (with rutile-covered electrode).	Operation of machines, e.g.: — oxygen cutting machines; — plasma cutting machines; — resistance welding machines; — machines for thermal spraying; — bench welding.
Class 2	Manual welding techniques with heavy formation of spatters and drops, e.g.: — MMA welding (with basic or cellulose-covered electrode); — MAG welding (with CO_2 or mixed gases); — MIG welding (with high current); — self-shielded flux cored arc welding; — plasma cutting; — gouging; — oxygen cutting; — thermal spraying.	Operation of machines, e.g.: — in confined spaces; — at overhead welding/cutting or in comparable constrained positions.

Annex B
(normative)

Determination of property values for rating and classification

All the individual results of the specimens of a test shall meet the performance requirement.

The average result shall be given.

If a material exhibits differing behaviour for a property in the length and cross directions of the material, the resultant property value shall be the value obtained in the lesser performing direction.

In the event that only one specimen fails, another set of specimens shall be tested and all the individual results of this second set of specimens shall meet the requirements. Otherwise, the sample is considered to have failed the requirement.

Annex C
(normative)

Uncertainty of Measurement

For each of the required measurements performed in accordance with this International Standard, a corresponding estimate of the uncertainty of measurement shall be evaluated. This estimate of uncertainty shall be applied when it may affect the rating or classification of a property.

Bibliography

[1] ISO 2589:2002, *Leather — Physical and mechanical tests — Determination of thickness*

[2] ISO/TR 2801 — Clothing for protection against heat and flame — General recommendations for selection, care and use of protective clothing

[3] ISO 3071:2005, *Textiles — Determination of pH of aqueous extract*

[4] ISO 4045:2008, *Leather — Chemical tests — Determination of pH*

[5] ISO 7000, *Graphical symbols for use on equipment — Registered symbols*

[6] ISO 17075:2007, *Leather — Chemical tests — Determination of chromium(VI) content*

[7] ISO 17227:2002, *Leather — Physical and mechanical tests — Determination of dry heat resistance of leather*

[8] IEC 60974-1, *Arc welding equipment — Part 1: Welding power sources*

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

[10] ISO 15797, *Textiles — Industrial washing and finishing procedures for testing of workwear*

[11] ISO 3175-2, *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 2: Procedure for testing performance when cleaning and finishing using tetrachloroethene*

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™