
Protective clothing for users of hand-held chainsaws —

**Part 2:
Performance requirements and test
methods for leg protectors**

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*Vêtements de protection pour utilisateurs de scies à chaîne tenues à la main —
Partie 2: Exigences de performance et méthodes d'essai pour
protège-jambes*

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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 voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document 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 ISO Technical Committee TC 94, *Personal safety – Personal protective equipment*, Subcommittee SC 13, *Protective clothing*, in accordance with the agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 11393-2:1999), which has been technically revised. The main changes compared to the previous edition are as follows:

- in the Introduction, the term “hand-held chainsaws primarily constructed for cutting wood” has been added;
- the normative references have been updated;
- the terms and definitions [3.1](#), [3.2](#), [3.3](#), [3.4](#), [3.5](#), [3.6](#), [3.7](#), [3.9](#), [3.10](#), [3.12](#), [3.14](#) and [3.17](#) have been added;
- in [Clause 4](#), subclauses have been added, PPE for users of left-handed chainsaws has been added, the previous “design B” has been deleted, a new “design B” has been added to describe chaps, the definition for trousers has been specified and a definition valid for chaps has been added;
- in [Clause 5](#), the definition has been specified;
- in [Clause 6](#), the clause has been completely revised, pre-treatment regulation for testing has been changed; the definitions in [6.2](#), [6.3](#), [6.5](#) and [6.7](#) have been specified, a definition valid for chaps has been added, cuts of the smallest and largest sizes have been added, measuring of chaps has been added, a test method ergonomic testing has been added;
- in [Clause 7](#), marking requirements have been revised;
- in [Clause 9](#), information requirements have been revised;
- in [Clause 9](#), the definition has been specified.

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A list of all parts in the ISO 11393 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document forms part of a series concerned with personal protective equipment (PPE) designed to protect against the risks arising from the use of hand-held chainsaws primarily constructed for cutting wood.

No PPE can ensure a 100 % protection against cutting from a hand-held chainsaw. Nevertheless, experience has shown that it is possible to design PPE that offers a certain degree of protection.

Different functional principles may be applied in order to give protection. These include:

- a) chain slipping: on contact the chain does not cut the material;
- b) clogging: fibres are drawn by the chain into the drive sprocket and block chain movement;
- c) chain braking: fibres have a high resistance to cutting and absorb rotational energy, thereby reducing the chain speed.

Often more than one principle is applied.

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Protective clothing for users of hand-held chainsaws —

Part 2: Performance requirements and test methods for leg protectors

1 Scope

This document specifies the performance requirements, test methods, design requirements, identification and marking information for leg protectors that offer protection against cutting by hand-held chainsaws.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 5077, *Textiles — Determination of dimensional change in washing and drying*

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

ISO 11393-1:2018, *Protective clothing for users of hand-held chainsaws — Part 1: Test rig for testing resistance to cutting by a chainsaw*

ISO 13688:2013, *Protective clothing — General requirements*

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 17249, *Safety footwear with resistance to chain saw cutting*

ISO 20345, *Personal protective equipment — Safety footwear*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

attachment

connection (usually stitching) between the protective insert and the outer or lining fabric

3.2

attachment force

force that the connection between the protective insert and any structural fabric can withstand, independent of the way the protective insert is attached to the outer fabric

3.3

chaps

leg protectors (3.11) that cover the front of a leg and fasten around the waist and the back of the leg

3.4

crotch

point between the legs where the two side *seams* (3.17), which run up the inside of each leg, meet

Note 1 to entry: In cases where the side seams do not lie along the edge of the trousers when they are flattened out, the theoretical crotch point effectively becomes the point where the two edges of the trousers converge.

3.5

cut-through

any visible change on the underside of the innermost layer of the test sample caused by the saw chain

3.6

damage

<pre-treatment> condition where some yarns of the protective fabric lose their position in the structure due to a broken ladder during the *pre-treatment* (3.12) cycle

Note 1 to entry: The broken ladder is often caused by a broken knitting yarn.

3.7

fly

fastening in the *front* (3.8) of a pair of trousers

3.8

front

<leg protector> forward 50 % of the leg circumference

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3.9

joins

place or line where two or more parts of the *protective insert* (3.14) are connected or fastened together, e.g. by *seams* (3.17) or zippers

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3.10

leggings

seat-less trousers

3.11

leg protectors

any type of protective garment that protects at least the *specified protective area* (3.18) to a specified level of resistance for the leg

3.12

pre-treatment

standard way of preparing the samples before testing

Note 1 to entry: 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.

3.13

protective coverage

area of the garment that is covered by *protective material* (3.15)

3.14

protective insert

fabric, usually placed between the outer fabric and the lining of a garment, that is able to stop the chain by clogging, braking or repelling the chain

3.15**protective material**

material that is designed to protect the wearer against the cutting effect of a hand-held chainsaw

Note 1 to entry: The protective material may include the outer fabric of the garment.

3.16**rear**

<leg protector> backwards 50 % of the leg circumference

Note 1 to entry: Depending upon the design and construction, and due to many layers of clogging material, it can be difficult to establish the *front* (3.8) and the rear of a leg protector. It is nevertheless of great importance to establish the front and the rear before *pre-treatment* (3.12) and testing.

3.17**seam**

join where two or more layers of fabric, leather or other materials are held together with stitches

3.18**specified protective area**

minimum required *protective coverage* (3.13)

4 Requirements**4.1 General**

General requirements not specifically covered in this document shall be in accordance with ISO 13688.

Tested samples shall conform to all the requirements of this document.

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4.2 Innocuousness

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Leg protectors shall not adversely affect the health or hygiene of the user. The materials shall not release or degrade to release substances generally known to be toxic, carcinogenic, mutagenic, toxic to reproduction or otherwise harmful in the foreseeable conditions of normal use. The specific innocuousness requirements of ISO 13688:2013, 4.2, shall be met.

4.3 Sizing

Leg protectors shall be marked with their size in accordance with ISO 13688.

4.4 Ergonomics

The leg protectors shall be designed to minimize discomfort and any impediment to movement while wearing them. When tested according to 6.6.2, the average score shall be 2 or less. The construction around the crotch shall facilitate lunges. When tested according to 6.6.2, all adjustment systems shall not become incorrectly adjusted without the user's knowledge.

NOTE Lunges means to take a long step forward keeping the trailing foot still while bending the knee of the leading leg.

When tested according to 6.6.3, the design shall be without any appendages below the knee region, which can become entangled in machinery or the undergrowth. The only possible exceptions to this requirement are the fastening points of chaps (design B). The leg protector shall be free of rough surfaces, sharp edges, sharp points, etc., which could cause excessive irritation or injuries.

4.5 Dimensional and other changes

4.5.1 Dimensional change

After cleaning according to the manufacturer's instructions, the dimensional change when measured according to [6.2](#) shall be not more than 6 % in any direction.

4.5.2 Other changes as a consequence of cleaning

After cleaning according to the manufacturer's instructions, and after cleaning one sample according to [6.1.2](#) at 60 °C and spin-drying, and examining according to [6.4.5.4](#), there shall be no damage in the protective material due to cleaning.

4.6 Protective coverage

4.6.1 General designs of leg protectors

This document defines three designs: design A and design C for trousers and leggings, and design B for chaps. Design A, design B and design C have different specified protective areas as stated in [4.6.2](#), [4.6.3](#), [4.6.4](#), respectively. The protective coverage shall be assessed according to [6.3](#).

Guidance on selecting design A, design B or design C is given in [Annex A](#).

Between the crotch and the fly, a gap of not more than 10 mm wide is permitted. It is recommended to keep this gap as small as possible. For zippers, buttons, etc., an opening gap in the centre front of not more than 10 mm is allowed. Peripheral openings at the right side at the waist region may be up to 30 mm.

Each layer of the protective insert of one garment shall be continuous from the top to the bottom. There shall be no joins in the protective material within the specified protective area. Designs incorporating joins down the legs of design C are acceptable according to [4.6.4 c\)](#) and [e\)](#).

The two halves of leggings and chaps shall be joined together from the top of the waistband down to the point of the crotch at the front.

Braces and belts shall have a minimum width of 30 mm.