
**Protective clothing for users of hand-held
chain-saws —**

**Part 6:
Test methods and performance
requirements for upper body protectors**

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*Vêtements de protection pour utilisateurs de scies à chaîne tenues à la
main*

Partie 6: Méthodes d'essai et exigences pour vestes de protection

ISO 11393-6:2007

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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 11393-6 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*.

ISO 11393 consists of the following parts, under the general title *Protective clothing for users of hand-held chain-saws*:

- Part 1: Test rig driven by a flywheel for testing resistance to cutting by a chain-saw
- Part 2: Test methods and performance requirements for leg protectors
- Part 3: Test methods for footwear
- Part 4: Test methods and performance requirements for protective gloves
- Part 5: Test methods and performance requirements for protective gaiters
- Part 6: Test methods and performance requirements for upper body protectors

Introduction

This part of ISO 11393 forms part of a series concerned with personal protective equipment designed to protect against the risks arising from the use of hand-held chain-saws.

Accidents occur due to a number of complex reasons, but a common factor is incorrect use of the chain-saw. The importance of correct training and proper use of a chain-saw in preventing accidents cannot be underestimated.

All parts of the upper body have been shown to be at risk when using a chain-saw.

In this part of ISO 11393, specifications for the protective coverage and performance of the upper body protectors are given. No personal protective equipment can ensure a 100 % protection against cutting from a hand-held chain-saw.

Nevertheless, experience has shown that it is possible to design personal protective equipment that offers a certain degree of protection.

Different functional principles may be applied in order to give protection, such as:

- 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 in chain-saw protective clothing. Upper body protectors meeting this part of ISO 11393 are meant to be used whilst working off the ground, and where risk assessment shows that there is a significant risk to be cut by the moving chain on the upper part of the body such as when working from a sky lift and carrying out tree surgery.

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Protective clothing for users of hand-held chain-saws —

Part 6:

Test methods and performance requirements for upper body protectors

1 Scope

This part of ISO 11393 specifies requirements for the protection offered by upper body protectors against cutting by a hand-held chain-saw.

It also specifies the procedures for sampling and pre-treatment of upper body protectors, the measurement of the protective coverage, the apparatus and test methods for assessing resistance to cutting, and the practical performance test for evaluating ergonomic properties.

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 3175-2:1998, *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 2: Procedure for testing performance when cleaning and finishing using tetrachloroethene*

ISO 6330:2000, *Textiles — Domestic washing and drying procedures for textile testing*

ISO 13934-2:1999, *Textiles — Tensile properties of fabrics — Part 2: Determination of maximum force using the grab method*

ISO 11092, *Textiles — Physiological effects — Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded-hotplate test)*

ISO 11393-1:1998, *Protective clothing for users of hand-held chain-saws — Part 1: Test rig driven by a flywheel for testing resistance to cutting by a chain-saw*

ISO 11393-3:1999, *Protective clothing for users of hand-held chain-saws — Part 3: Test methods for footwear*

ISO 13688, *Protective clothing — General requirements*

3 Terms and definitions

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

3.1

upper body protector

any type of protective garment, which protects at least the specified area to the level of resistance to cutting by a chain-saw specified within this part of ISO 11393 for the upper part of the body, e.g. jacket

3.2

front

(of an upper body protector) part of a garment covering the forward 50 % of the upper body circumference

3.3

rear

(of an upper body protector) part of a garment covering the rear 50 % of the upper body circumference

NOTE Depending upon design and construction, and due to many layers of protective material, it can be difficult to establish the division between the front and the rear of an upper body protector. It is nevertheless of great importance to establish this before pre-treatment and testing.

3.4

top of shoulder

top of shoulder as shown in Figure 1

3.5

protective material

material which is designed to protect the wearer against the cutting effect of a hand-held chain-saw

NOTE This protective material may include the cloth of the garment.

3.6

unit of protective material

cut out piece or panel of protective material consisting of all the fabric or other layers that constitute the protective material that go into the construction of a garment

NOTE A unit has no seams or joins within it. Units can be joined together to provide the complete protective coverage required, before insertion and attachment to garments, but such units retain their individuality for testing purposes.

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3.7

protective coverage

area of the garment which consists of protective material

3.8

specified protective area

required protective coverage defined in this part of ISO 11393

4 Requirements

4.1 General

Upper body protectors for chain-saw users shall meet an overall requirement that they are safe and fit for the purpose. They shall meet requirements listed in 4.2 to 4.7.

4.2 Innocuousness

Upper body protectors for chain-saw users shall be designed and manufactured to provide protection when used in accordance with the manufacturer's instructions, without endangering the user or others. Construction materials and incorporated substances shall meet the innocuousness requirements in ISO 13688. They shall not endanger those coming into contact with them. The names and concentrations of all substances contained in the product, which are generally known to cause allergies or sensitization, shall be listed in the information supplied by the manufacturer. Upper body protectors for chain-saw users shall be free of hard or sharp components and rough surfaces, that could cause abrasion, bruising, irritation, punctures or cuts to a user coming into contact with them. The manufacturer shall give guidance on the safe destruction and disposal of the products and of any hazards that can arise during mechanically disrupting or incinerating the product.

4.3 Ergonomic requirements

The protective clothing should be as lightweight as possible.

The design shall be without appendages, which can become entangled in machinery or the undergrowth.

The construction around the sleeve shall facilitate bending and lifting the arm.

The water vapour resistance of the garment outside the specific protected area shall be no more than 5 ($\text{m}^2 \cdot \text{Pa/W}$) when tested in accordance with 12.1.

The protective garments shall be designed to minimize discomfort and restriction while wearing them. When tested in accordance with 12.2 and 12.3, the mean score of all subjects shall be less than 1,5 for each of comfort and restriction.

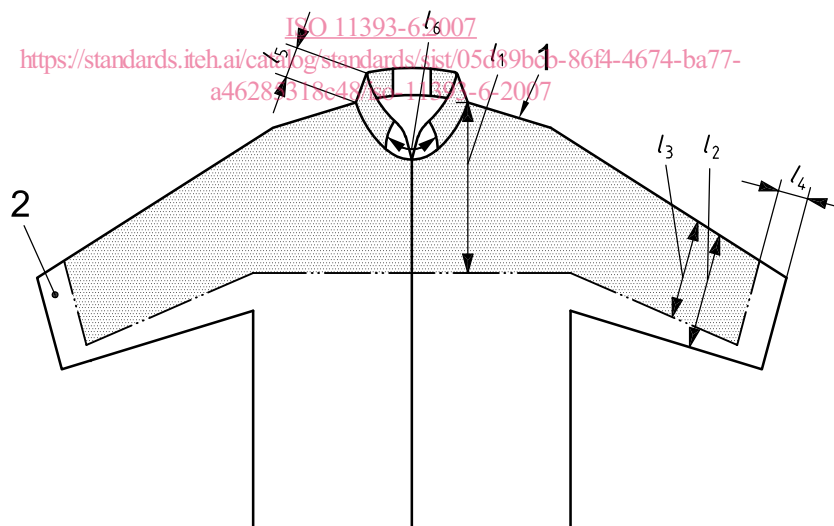
4.4 Specified minimum protective area for upper body protectors

4.4.1 General

The protective coverage shall be measured in accordance with Clause 9.

4.4.2 Front

The specified protective area shall cover the front of the garment from the top of the shoulder downwards for a distance equivalent to at least 25 % of the chest girth of the largest intended user as given in the marking. The protective area shall include the upper 80 % of the surface of the front of the sleeve down to within 70 mm of the lower edge of the cuff of the sleeve. See Figure 1.



Key

- 1 top of shoulder
- 2 cuff

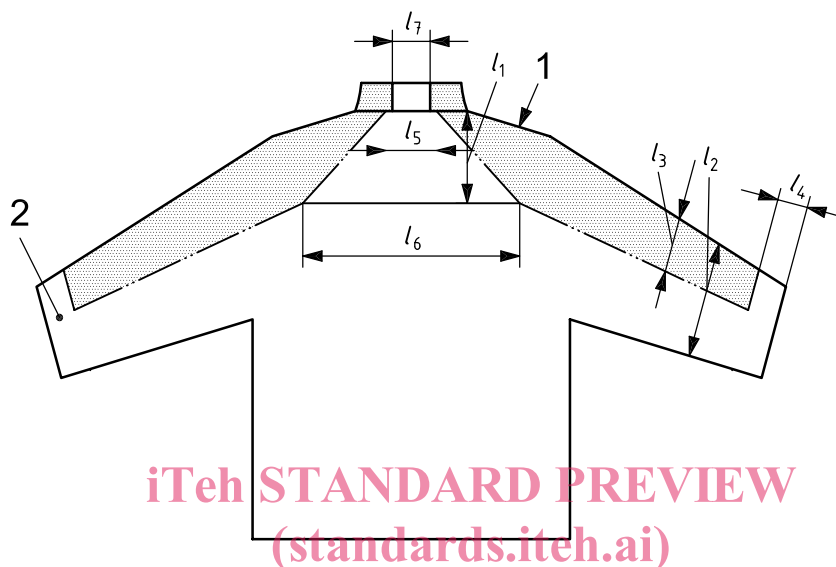
- l_1 minimum height of protective coverage at the front of the garment
- l_2 width of sleeve
- l_3 width of protective coverage on the front of the sleeve (minimum 80 % of l_2)
- l_4 unprotected cuff, width less than 70 mm
- l_5 height of protective coverage in collar, minimum of 30 mm
- l_6 gap in the protective coverage in the collar, maximum of 80 mm

Figure 1 — Specified protective area: front of garment

4.4.3 Back

The protective area shall cover the top of the shoulders plus the superior 40 % of the surface of the back of the sleeve down to within 70 mm of the lower edge of the cuff of the sleeve. See Figure 2.

A gap is permitted in the protective material in the centre of the back. The dimensions of the gap, l_5 and l_6 , are shown in Figure 2. l_5 shall be less than 9 % of the chest girth of the smallest intended user of the garment, as given in the marking, and l_6 shall be less than 35 % of the chest girth of the smallest intended user of the garment.



Key

- 1 top of shoulder
- 2 cuff

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- l_1 minimum height of protective coverage at the back of the garment
- l_2 width of sleeve
- l_3 width of protective coverage on the back of the sleeve (minimum 40 % of l_2)
- l_4 unprotected cuff, width less than 70 mm
- l_5 gap in protective coverage at the level of the top of the shoulders
- l_6 gap in protective coverage at a distance of l_1 below the top of the shoulders
- l_7 gap in the protective coverage in the collar, maximum of 80 mm

Figure 2 — Specified protective area: back of garment

4.4.4 Collar (optional)

If a protective collar is fitted, the protective area shall cover a minimum length of 100 mm on each side of the neck. A gap in the protective material at the centre front of a maximum of 80 mm is permitted and a gap in the protective material at the centre back of a maximum of 80 mm is also permitted. The height of the protective material shall be a minimum of 30 mm. See Figures 1 and 2.

4.4.5 Fastenings/joins

The garment may have a closure down the centre front to facilitate donning and removal. When the garment is fastened, the gap between the edges of the protective material shall be no more than 30 mm. The gap in the protective material at the join between the main body of the garment and the collar shall be less than 8 mm.

4.5 Dimensional change

The dimensional change after washing as measured in accordance with Clause 8 shall be less than 6 %.

4.6 Resistance to chain-saw cutting

When tested in accordance with Clause 10, no cut through is allowed in any test specimen.

4.7 Requirements for attachment of protective padding and strength of closures

The protective material shall be permanently attached to the garment. Attachment shall be continuous along all the edges of the protective material, except around the cuff. When tested in accordance with Clause 11, the mean breaking force of each type of attachment present in the garment shall be at least 200 N.

5 Classification according to chain speed

Testing in accordance with this part of ISO 11393 shall be carried out at one of the following four speeds with classes assigned as follows:

- a) Class 0: $(16,0 \pm 0,2)$ m/s;
- b) Class 1: $(20,0 \pm 0,2)$ m/s;
- c) Class 2: $(24,0 \pm 0,2)$ m/s;
- d) Class 3: $(28,0 \pm 0,2)$ m/s.

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6 Test methods

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6.1 General

Measuring instruments unless otherwise specified shall be accurate to ± 2 % of the pass/fail level of the characteristic being measured.

For each of the required sequences of measurements performed in accordance with this part of ISO 11393 a corresponding estimate of the uncertainty of the final result shall be determined. This uncertainty (U_m) shall be given in the test report in the form $U_m = \pm X$. It shall be used in determining whether a "Pass" performance has been achieved. If the final result minus U_m is below the pass level when the requirement that a certain value shall be exceeded, the sample shall be deemed to have failed.

6.2 Number of test specimens

A set of test specimens shall be supplied that is sufficient to complete all the tests. Note that if two types of pre-treatments are specified, the testing and the numbers of test specimens is effectively doubled and two sets are required. Test specimens which have been used to assess dimensional stability and protective coverage may be used for cut-testing if it has not been necessary to cut them up for these measurements.

The number of garments required for cut testing depends on the number of units of protective material present within them and whether there are any joins or seams between different protective material units such as between the body and the sleeve. Only one test cut shall be carried out on each unit of protective material. Therefore at least three garments are required for cut testing if the design includes a fastening down the centre front of the garment, but no seams between the protective material on the body and in the sleeve. For a design incorporating only one unit of protective material, six garments are required for cut testing.