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Second edition
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Protective clothing for users of hand-held chainsaws —

Part 5: Performance requirements and test methods for protective gaiters

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

Partie 5: Exigences de performance et méthodes d'essai pour guêtres de protection

Reference number
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Foreword

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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).

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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 11393-5:2001), which has been technically revised. The whole document and the Scope have been 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;

— terms and definitions have been added;

— a conjunction of the gaiter to a defined boot for test purposes has become mandatory;

— requirements and test methods for ergonomic properties, twisting resistance, the strength of the attachment system and innocuousness have been added;

— requirements for protective coverage have been changed;

— class 0 has been deleted from the requirements to cut resistance;

— the pre-treatment procedure has been revised.

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.

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.

Protective clothing for users of hand-held chainsaws —

Part 5:
Performance requirements and test methods for protective gaiters

1 Scope

This document specifies requirements and test methods for assessing the resistance to cutting of gaiters by hand-held chainsaws and other properties. It includes a requirement and a test method for assessing the strength of underfoot straps of gaiters.

This document is applicable to gaiters used in conjunction with safety footwear with a steel toecap conforming to ISO 20345 design "C" or "D". These gaiters are designed to be used only in association with a defined model of footwear and tested together.

NOTE These products are intended, but are not limited, to be used in combination with a defined model of orthopaedic footwear.

This document does not apply to gaiters intended for use in situations where there is a significant risk of tripping, such as tree climbing or in forests.

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

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

ISO 11393-2:2018, *Protective clothing for users of hand-held chainsaws — Part 2: Performance requirements and test methods for leg protectors*

ISO 11393-3:2018, *Protective clothing for users of hand-held chainsaws — Part 3: Test methods for footwear*

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

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 system
system comprised of an underfoot strap and closing mechanism

3.2
cut-through
any visible change on the underside of the innermost layer of the test sample caused by the saw chain

3.3
defined boot
type of boot (article) on which the tests for *gaiters* (3.5) are performed and for which the test results are valid

3.4
foot protector
any product that protects the foot and the lower part of the leg (or any part of this area) against cutting by a hand-held chainsaw

3.5
gaiter
removable covering footwear intended to protect the front part of the foot, ankle and lower leg against cutting by a hand-held chainsaw

3.6
orthopaedic footwear
safety boots produced in series, where each item is adapted to fit an individual user, or safety boots produced as a single unit to accommodate the special needs of an individual user

3.7
protective material
material that is designed to protect the wearer against the cutting effect of a hand-held chainsaw

4 Requirements

4.1 General

Different upper designs of the same type of the defined boots (with the same outsole and last) are covered by these tests.

4.2 Fasteners

4.2.1 General

Force transmitting fasteners of the gaiters shall not be of the touch and close type.

4.2.2 Attachment system

When tested according to the procedure described in 6.2, each attachment system shall not fail at a force below 250 N.

4.2.3 Twisting resistance of the gaiter

When tested according to the procedure described in 6.3, the maximum twisting after relieving the load shall be ≤ 10 mm in the direction of the force.

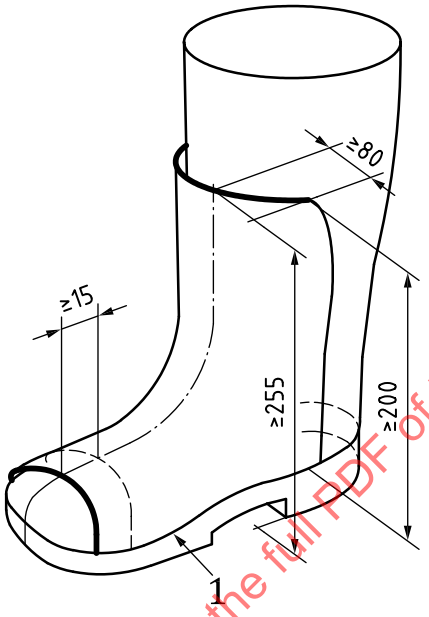
4.3 Innocuousness

Protective gaiters 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.

4.4 Specified protective area

The protective material of the gaiter shall at least cover the area of the defined boot shown in Figure 1, taking care that the front part of the gaiter shall cover the back part of the toecap with an overlap of at least 15 mm. Measure the distance between the two lines at the rear side of the toecap and the front end of the protective material of the gaiter, applied according to 6.3.4.

Dimensions in millimetres



Key

1 feather edge

Figure 1 — Specified protective area

4.5 Classification according to chain speed

The classification shall be made with the following three speeds:

— class of protection 1: 20 m/s ± 0,2 m/s;

— class of protection 2: 24 m/s ± 0,2 m/s;

— class of protection 3: 28 m/s ± 0,2 m/s.

4.6 Cut resistance

When the associated footwear and gaiter system is tested according to 6.1, no cut-through shall occur.

4.7 Ergonomics

The gaiters should be as lightweight as possible. They shall be designed to minimize restriction on movement while wearing them. When tested according to 6.4, the average score shall be 2 or less. When tested according to 6.4, all adjustment systems shall not become incorrectly adjusted without the user's knowledge.

5 Pre-treatment

If the manufacturer's instructions indicate that the product can be cleaned, then it shall be cleaned according to the manufacturer's instructions. Where the manufacturer does not indicate the number of cycles, then five cycles of the cleaning procedure shall be carried out before testing. Where the cleaning instruction just foresees wiping with tissues or sponges, pre-treatment before testing is not necessary.

Line drying after washing shall be carried out in an environment maintained at a temperature of (30 ± 15) °C and a relative humidity of (50 ± 20) % RH.

If tumble-drying is permitted by the manufacturer's instructions, the gaiter shall be tumble-dried after each washing cycle.

NOTE Manufacturers typically indicate one or more of the methods given in ISO 6330, ISO 3175-2, ISO 3175-3, ISO 3175-4, ISO 15797 or an equivalent standardized processes for cleaning.

6 Test methods

6.1 Test samples

The manufacturer shall specify one or more models of a defined type of boots for testing the gaiters. The manufacturer shall provide an adequate number of samples for testing.

6.2 Resistance to the chainsaw

6.2.1 Principle

The gaiter is mounted on the defined footwear. Its resistance to a chainsaw is then assessed by applying a moving chain of known speed and inertia characteristics to the boot and gaiter and determining whether or not the chain cuts through the gaiter.

6.2.2 Test specimens

Five pairs of gaiters are required for each pre-treatment method applied. The gaiters shall represent the size range, including the smallest and the largest size. If the size range contains only one single size, five pairs of this size shall be tested.

6.2.3 Apparatus

6.2.3.1 Test rig

Use the test rig as described in ISO 11393-1.

6.2.3.2 Mounting device for gaiters

The gaiters are tested together with their defined boots using the mounting device described in ISO 11393-3:2018, 6.1.2. The method used to fix the boot and the gaiter to the mount shall not interfere with the gaiter or the way it is fixed to the boot.

6.3 Strength of the attachment system

6.3.1 Principle

Each type of attachment system and each type of underfoot strap of a gaiter shall be tested.

6.3.2 Test samples

Three samples of gaiters, including different sizes, shall be tested. Additional gaiters may be required due to the construction of the gaiter.

6.3.3 Apparatus

Use a tensile testing machine (or other means of applying a known variable force), having a minimum load range from 0 N to 1 000 N and accurate to within ± 1 %, with a rate of (1,5 ± 1) mm/sec.

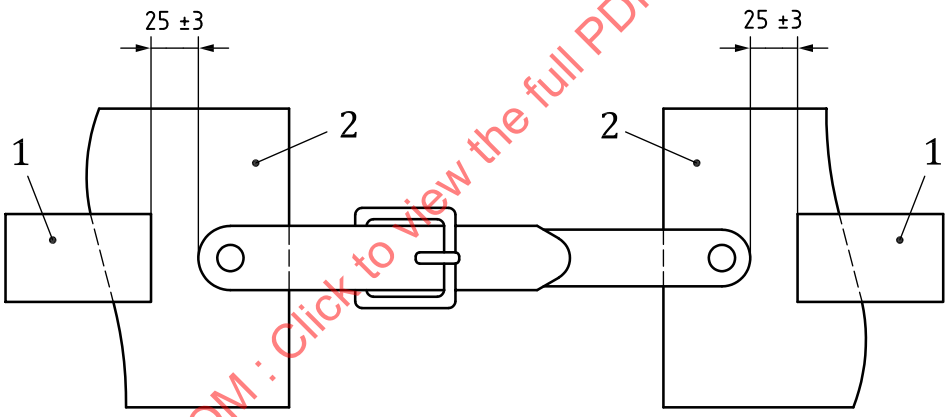
6.3.4 Preparing and fixing of samples for testing and procedure

Use the gaiter of the largest size and mark a line at the centre of the top of the gaiter. To assist in preparation of the test specimens, the gaiter shall be cut along this line.

Adapt the sample, including all layers, to clamps as described in ISO 11393-2:2018, 6.5. The distance from the edge of the fastening to the clamp shall be (25 ± 3) mm. It is permitted to cut off material if it hampers proper clamping. See Figure 2.

The test shall be stopped if the breaking force is reached or can be stopped at a force of 250 N. Record the force at break, or record "it doesn't break at 250 N" and report the result of the lowest value recorded.

Dimensions in millimetres



Key

1 clamp
2 gaiter

Figure 2 — An example for testing the strength of fastening systems

6.4 Twisting resistance of the gaiter

6.4.1 Principle

The test is done to assess the risk of unintentionally unfastening or displacing the gaiter. The twisting resistance shall be measured after the ergonomic tests according to 6.5, while the gaiter and boot are still worn by the test person. The gaiter shall not be re-adjusted after the ergonomic tests are finished.

6.4.2 Test specimens

See 6.4.1.

6.4.3 Test equipment

6.4.3.1 Instrumentation

Use a load cell with an accuracy of ±0,5 N.

6.4.3.2 Fixation

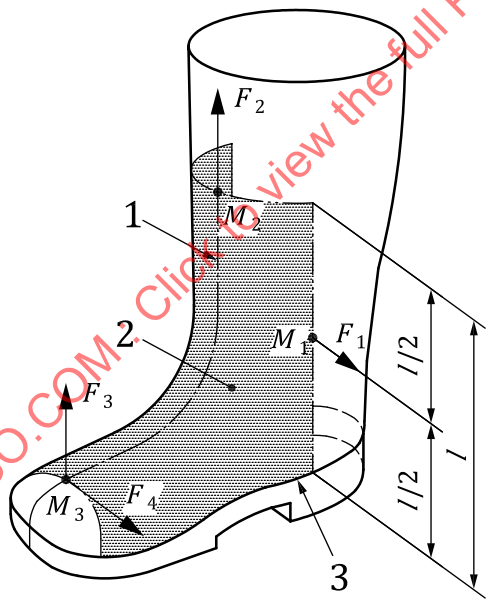
Use a clamp or other suitable device strong enough to enable the application of a load of at least 10 N to the gaiters.

6.4.4 Procedure

Mark all positions M1, M2 and M3 on the gaiter and on the boot with a cross, all positions shall be document. Then, apply a force of (10 ± 2) N to the test positions M1, M2 and M3 and in the direction of F1, F2, F3 and F4 according to Figure 3, with a load cell, for (10 ± 2) s. Then, unburden the system. After this, the displacement of the gaiter for each direction shall be measured and reported.

During the test, the wearer shall stay upright with both feet positioned firmly on the ground. It is permitted to use handholds to maintain steady position.

Mark a line at the rear side of the toecap. The rear side of the toecap shall be indicated sensual or visual. Mark a second line at the front end of the protective material of the gaiter to the boot.



Key

1 centre line
2 protective coverage
3 feather edge

Figure 3 — Test position and directions for tensile testing

6.5 Ergonomic testing

6.5.1 Ergonomic assessment

The gaiters shall be examined to determine whether they are ergonomically satisfactory. The sizes, the fit and the ergonomic characteristics of gaiters shall be determined by two people with different

foot sizes who wear the gaiters, perform a number of prescribed actions and answer questions. The test people do not need to be habitual wearers of this type of protective equipment. The test person shall select the appropriate size of gaiters and boots, according to the instructions supplied by the manufacturer. For this test, test laboratories can request one or more gaiters and the appropriate defined boots in different sizes.

6.5.2 Procedures

The aim of this test is to assess the ergonomic properties of the gaiters, not of the boots, because they are already ergonomically tested.

Two people with different foot sizes shall put on the gaiters and the appropriate defined boots. The gaiters shall be adjusted according to the manufacturer's instructions. The gaiters shall not be re-adjusted during the test procedure. The test people shall perform the movements described below to assess the eventual restriction imposed by the gaiter. The movements shall be typical of those made by users of the gaiters, and shall include:

a) making one lunge (an kneeling step as long as possible with one knee on the ground);

b) kneeling on both knees;

c) walking five metres in normal speed without running;

d) stepping over a tube of diameter (60 ± 5) cm and lying on the ground.

After performing the movements five times, make the following tests three times:

— donning and doffing the gaiters;

— using all settings provided to optimize PPE adaptation to user morphology.

For each test, the test person shall report his or her responses, which shall be scored in accordance with Table 1.

Table 1 — Score of ergonomic response

Score	Response
0	No restriction
1	Slight restriction of movement
2	Restriction of movement
3	More severe restriction of movement
4	Movement very restricted or impossible

After each series of movements/tests, the score of each movement/test will be recorded by the test person. It shall be added up and divided by the number of movements/tests performed. For each score of 3 or more, two further test people shall carry out the procedure. The mean value of the scores shall be calculated.

An average score of all series and all movements/tests is calculated and included in the test report.

7 Test report

The report shall include the following information:

a) a reference to this document and the year, i.e. ISO 11393-5:2018;

b) identification and description of the test specimen, e.g. manufacturer, style number, dimensions;

c) pre-treatment, if any;

d) the results of the assessment of resistance to chainsaws, including:

   1) the test results for each test area (i.e. whether or not the test specimen was cut-through);

   2) the chain speed;

e) the results of the assessment of the strength of the attachment system.

f) any deviations from the procedure;

g) any unusual features observed;.

h) the date of the test.

8 Marking

Protective gaiters for users of hand-held chainsaws shall be visibly and durably marked on the inside of the gaiters with at least the following information:

a) type, identification or style number (company identification of model);

b) size;

c) date of manufacture (year and month);

d) the number of this document and the year, i.e. ISO 11393-5:2018;

e) the statement “Don’t use when damaged” or similar wording;

f) the warning “Only to be worn in conjunction with safety footwear as listed in the manufacturer’s instructions”;

g) washing/cleaning instructions, including warnings against incorrect treatment.

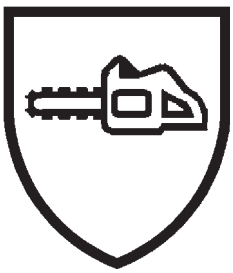
The marking shall remain legible without any visible fading after pre-treatment according to Clause 5, if the manufacturer indicates that gaiters can be cleaned. It can be situated in conjunction with other product marking.

9 Pictogram

The pictograms shall be visible on the outside of the gaiter.

— Gaiters conforming to this document shall be marked with the pictograms shown in Figures 4 and 5. The pictograms shall be placed at any visible place on each gaiter, The pictogram in Figure 4 shall have a minimum size of 30 mm × 30 mm.

— Class of protection shall be given outside the frame of the pictogram, preferably on the bottom of the frame.



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