INTERNATIONAL STANDARD

ISO 11393-4

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

Part 4: Test methods and performance requirements for protective gloves

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

Partie 4: Méthodes d'essai et exigences pour les gants de protection

Reference number
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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 11393-4 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*

Test methods and performance requirements for jackets with protection against cuts by hand-held chain-saws will be the subject of a future part 6 to ISO 11393.

Introduction

This part of ISO 11393 forms part of a series concerned with personal protective equipment designed to reduce the risks arising from the use of hand-held chain-saws. In some areas of work with chain-saws, one third of injuries occur to the hands. However, with different working practices few hand injuries occur. 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.

In some countries, chain-saw users adopt working practices which together with training makes the use of chain-saw protective gloves unnecessary. These usually include the instruction to hold the chain-saw with both hands and to use the chain brake if it becomes necessary to stop cutting and clear away branches, etc.

All parts of the hand (palm, back and fingers) have been shown to be at risk when using a chain-saw. It is generally accepted for ergonomic and health and safety reasons that protecting the palm and the underside of the fingers is not practicable. Neither is it possible to adequately protect the back of the fingers unless a mitt is used. In this part of ISO 11393, specifications for the protective coverage and performance of the back of the left-hand glove are given, though the same specifications can be applied to right-hand gloves.

Further information is provided in Annex A on risk analysis, glove ergonomics and selection.

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 which offers a certain degree of protection. As far as is known, all chain-saws are designed for right-handed use and therefore all protective clothing designs and requirements have assumed right-handed use. Protection cannot be adequate for left-handed use.

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 in chain-saw protective clothing. It should be noted however that none has yet been shown to be fully effective in gloves.

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

Part 4:
Test methods and performance requirements for protective gloves

1 Scope

This part of ISO 11393 specifies the requirements and test methods for gloves that are intended to provide protection against cuts by a hand-held chain-saw, including requirements for identification, marking and information for the user.

The method for measurement of protective coverage, the apparatus and the test method for assessing resistance to cutting, and the ergonomic assessment are specified.

An informative annex on risk analysis, glove ergonomics and glove selection is provided.

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 3175-1:1998, *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 1: Assessment of performance after cleaning and finishing*

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

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*

EN 388:1994, Protective gloves against mechanical risks

EN 420:1994, General requirements for gloves

3 Terms and definitions

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

3.1
chain-saw protective glove
any product which protects a hand against cutting by a hand-held chain-saw

3.2
cuff
that portion of a glove which covers the wrist

3.3
back of the hand
posterior surface of the hand between the wrist and the fingers

3.4
five-finger glove
any glove covering both the back and the palm of the hand and wrist, and having separate individual fingers and thumb

3.5
line of longest length of a glove
perpendicular line joining the seam of the cuff (or equivalent position if no seam is present) with the tip of the second finger (or equivalent position in a mitt or one-finger mitt)

3.6
mitt
any glove covering both the back and the palm of the hand and wrist, and having a separate thumb and a common covering for the fingers

3.7
one-finger mitt
any glove covering both the back and palm of the hand and wrist, and having a separate thumb and a separate forefinger and a common covering for the remaining fingers

3.8
protective material
material which is designed to protect the wearer against the cutting effect of a hand-held chain-saw

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

3.9
protective coverage
that area of the glove which is covered by protective material

3.10
specified protective area
required protective coverage

4 Designs

4.1 Designs of gloves

This part of ISO 11393 defines two designs of chain-saw protective gloves, Design A and Design B. Design A and Design B have different specified protective areas as defined in 4.2 and 4.3.

4.2 Design A

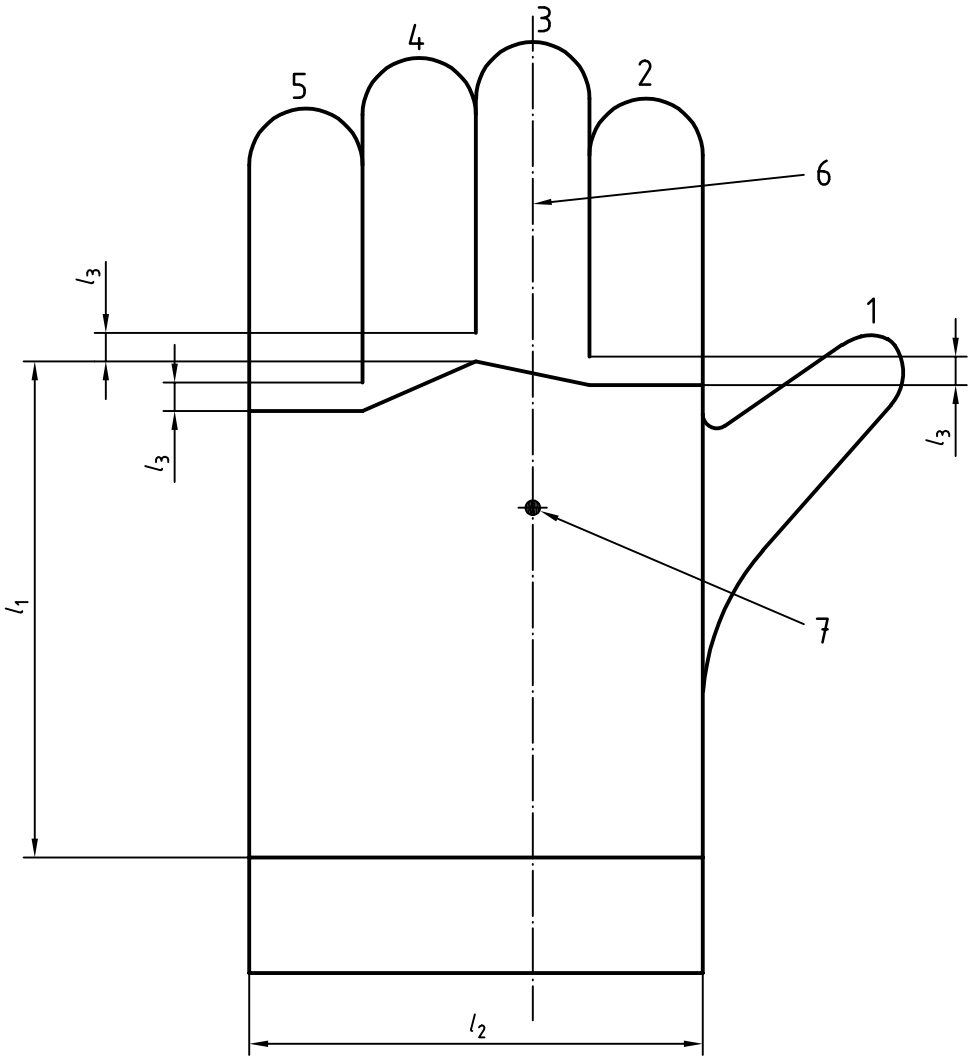
4.2.1 Description

Design A is applicable to five-finger gloves without chain-saw protection in the fingers or thumb.

4.2.2 Specified protective area — Left-hand gloves

The specified protective area is shown in Figure 1. The Design A protected area shall reach across the entire width of the back of the hand and cover both the knuckles and the wrist. Table 1 contains minimum values for dimensions l_1 and l_2, and the maximum value for dimension l_3.

The dimensions shall be measured on one glove from each pre-treatment in accordance with Clause 8.



Key

1 to 5	numbers of the digits
6	line of longest length
7	midpoint of the line of longest length from a finger tip to the cuff seam
l_1	minimum length of protective material measured parallel to the long axis
l_2	minimum width of the protective material
l_3	maximum distance from a crotch to the edge of the protective material

NOTE See Table 1 for dimensions.

Figure 1 — Design A — Specified protective area left-hand glove (back uppermost)

Table 1 — Dimensions of Design A gloves

Dimension	Size					
	6	7	8	9	10	11
l_1	105 mm	110 mm	115 mm	120 mm	125 mm	130 mm
l_2	80 mm	90 mm	100 mm	110 mm	120 mm	130 mm
l_3	8 mm	8 mm	8 mm	8 mm	8 mm	8 mm

4.2.3 Protective coverage — Right-hand gloves

No protective coverage is required. If protection is offered, however, then it shall at least equal that specified for left-hand gloves.

4.3 Design B

4.3.1 Description

Design B is protective gloves or mitts with specific chain-saw protection as in Design A and on the backs of the fingers, but not on the thumb.

4.3.2 Specified protective area — Left-hand gloves

The specified protective area is shown in Figure 2. The Design B protective area shall reach across the entire width of the back of the hand and cover both the backs of the fingertips and the wrists. The minimum dimensions of the protective area are shown in Table 2.

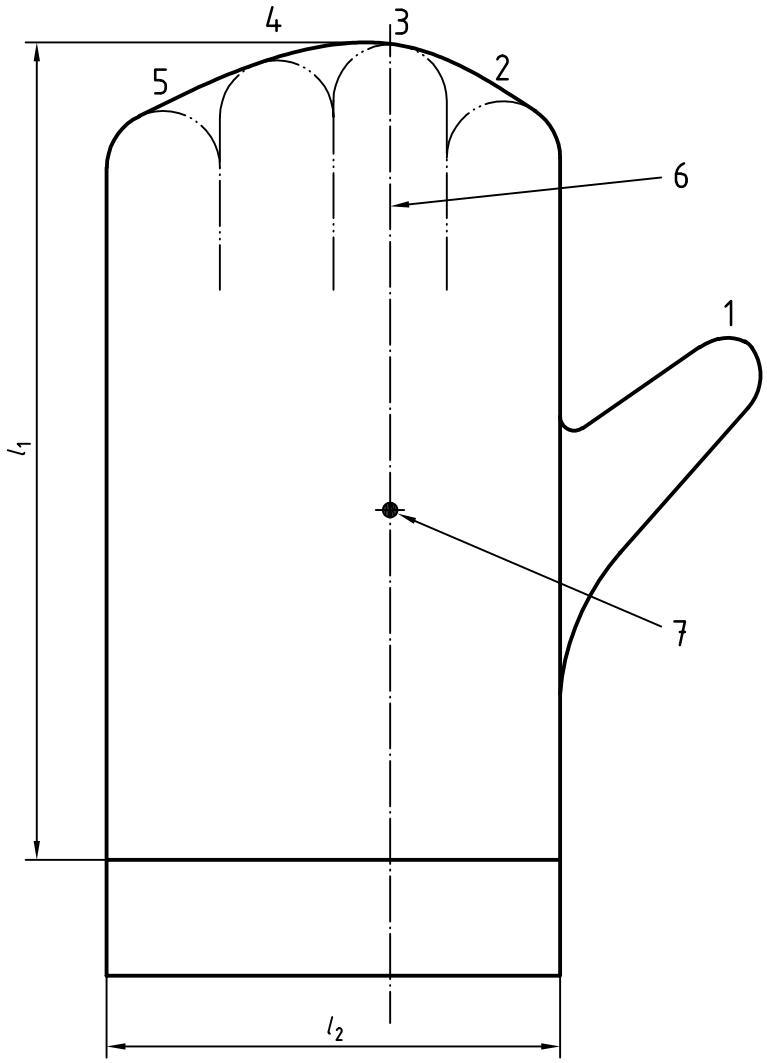
The dimensions shall be measured on one glove from each pre-treatment in accordance with Clause 8.

4.3.3 Protective coverage — Right-hand gloves

No protective coverage is required. If protection is offered, however, then the coverage shall at least equal that specified for left-hand gloves.

4.4 Attachment of protective material

Where the glove is not made entirely of protective material, all the protective materials used shall be sewn or otherwise permanently attached to the remainder of the glove.



Key

1 to 5 numbers of fingers

6 line of longest length

7 midpoint of the line of longest length from a finger tip to the cuff seam

l_1 minimum length of protective material measured parallel to the long axis

l_2 minimum width of the protective material

NOTE See Table 2 for dimensions.

Figure 2 — Design B — Protective area left-hand glove or mitt (back uppermost)

Table 2 — Dimensions of Design B gloves and mitts

Dimension	Size					
	6	7	8	9	10	11
l_1	160 mm	170 mm	180 mm	190 mm	200 mm	210 mm
l_2	80 mm	90 mm	100 mm	110 mm	120 mm	130 mm

5 Performance requirements

5.1 General

All chain-saw protective gloves shall conform to the requirements of EN 420:1994, as specified in Table 3.

Table 3 — General requirements

Subclause in EN 420:1994	Mandatory	Optional
4.1 Design principle	X	
4.2 Glove construction	X	
4.3 High visibility gloves		X
4.4 Innocuousness	X	
4.5 Cleaning		X
5.1 Sizing	X	
5.2 Dexterity		X
5.3 Water vapour transmission and absorption		X

5.2 Protection against general mechanical risks

Both left-hand and right-hand gloves shall conform to the requirements of Table 1 of EN 388:1994, as specified in Table 4.

Table 4 — Performance requirements — Mechanical risks

Test	Test method	Minimum requirement
Abrasion resistance	6.1 of EN 388:1994	500 cycles[a] [b]
Blade cut resistance	6.2 of EN 388:1994	index 1,2[c]
Tear resistance	6.3 of EN 388:1994	25 N[b]
Puncture resistance	6.4 of EN 388:1994	60 N[b]

[a] The abrasion test is only carried out on material taken from the outer layer(s) of the glove; not on the chain-saw protective material.

[b] Performance Level 2 in Table 1 of EN 388:1994.

[c] Performance Level 1 in Table 1.

5.3 Protection against chain-saw cutting

5.3.1 Classification according to chain speed

Protection against chain-saw cutting shall be assessed in accordance with Clause 9 with one of the following chain-saw speed classes designated as follows:

— class of protection 0: 16 m/s ± 0,2 m/s;

— 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.

5.3.2 Requirements for cut resistance

When tested in accordance with Clause 9, no cut through is allowed in any tested specimen.

5.4 Ergonomic requirements

Chain-saw protective gloves shall be designed to minimize the discomfort and inconvenience of wearing them. They shall not have rough or hard material or edges that will be in contact with the hand, nor an outside contour likely to catch on branches or conflict with the operation of the chain-saw.

They shall be constructed of materials that will be innocuous to the users. Gloves shall be fit for the uses indicated in the manufacturer's information for users. They shall be adequately flexible and allow a firm grip to be maintained on the chain-saw handle. Gloves shall be assessed as specified in Clause 10.

6 Test specimens

All test specimens shall be of size 9 as defined in EN 420:1994 when this size is available. If a different size has to be used, it shall be as close to size 9 as possible and the number of test specimens required shall be in accordance with the related mandatory and optional requirements given in Clause 5 as follows:

a) mandatory tests:

   — four left-hand gloves for each pre-treatment applied;

b) optional test:

   — two left-hand gloves for each pre-treatment applied;

   — two right-hand gloves for each pre-treatment applied.

7 Pretreatment

Except in the specific cases detailed below, wash and dry all the test specimens five times before testing.

Wash test specimens in accordance with Procedure 2A of ISO 6330:2000 and then tumble-dry them at a temperature not exceeding 70 °C (Procedure E).

Exceptions to this treatment are permitted in the following cases:

a) Where the gloves are marked as unsuitable for washing or dry cleaning, immerse the outside of the gloves completely in water (20 °C) for 10 min and then allow them to line-dry with the opening turned downwards for at least 48 h at (20 ± 2) °C and (65 ± 5) % relative humidity.

b) Where the gloves are marked as unsuitable for washing but suitable for dry cleaning:

   In such cases, dry-clean the test specimens five times before testing. Perform the dry-cleaning principally in accordance with the conditions described in 9.1 of ISO 3175-1:1998. Do not use any restorative finishing procedure.

c) Where the gloves are marked as suitable for both washing and dry cleaning:

   In such cases, carry out the test on both washed and dry-cleaned test specimens (two sets of test specimens) or, at the request of the manufacturer, first dry-clean then wash the same set of test specimens.

d) Where the gloves are marked as unsuitable for tumble drying:

   In such cases, wash the specimens by the method described above, then line-dry them with the opening turned downwards for at least 48 h at (20 ± 2) °C and (65 ± 5) % relative humidity (Procedure A of ISO 6330:2000).

8 Protective coverage check

Measure the coverage on one glove from each pre-treatment used.

Fit the glove onto an appropriately sized hand. Mark and measure the dimensions of the protective area. Compare the results with the requirements specified in Clause 4.

a) For Design A (see Figure 1)
   - measure the length of the protection area between the cuff and the crotch between digits 3 and 4;
   - the width of the protection area at the mid-point of the line of longest length of the glove.

b) For Design B (see Figure 2)
   - measure the length of the protection area along the line of longest length of the glove;
   - the width of the protection area at the mid-point of the line of longest length of the glove.

Record the measurements and check that the requirements given in Clause 4 have been fulfilled.

9 Resistance-to-cutting test

9.1 Test rig

Set up the test rig as described in ISO 11393-1.

In case the test glove might fail to resist cut-through, it is recommended to fit the test rig with some means of limiting the depth of cut into the artificial hand.

9.2 Chain-saw-protective-glove mounting device

9.2.1 Left and right artificial hands

Artificial hands shall be moulded from a rigid polymer such as polyurethane.

Hardness = Between 90 Shore A and 98 Shore A.

Their shapes and dimensions are shown in Figure 3 and Table 5. Artificial hands shall be constructed with a tolerance of $\pm$ 2 % for each dimension.

NOTE The details given refer to a left hand. Right hands have the same shape and dimensions but are mirror images.

9.2.2 Base

The base shall consist of a means of mounting the artificial hand so that it remains rigid and immovable when impacted by the chain-saw.

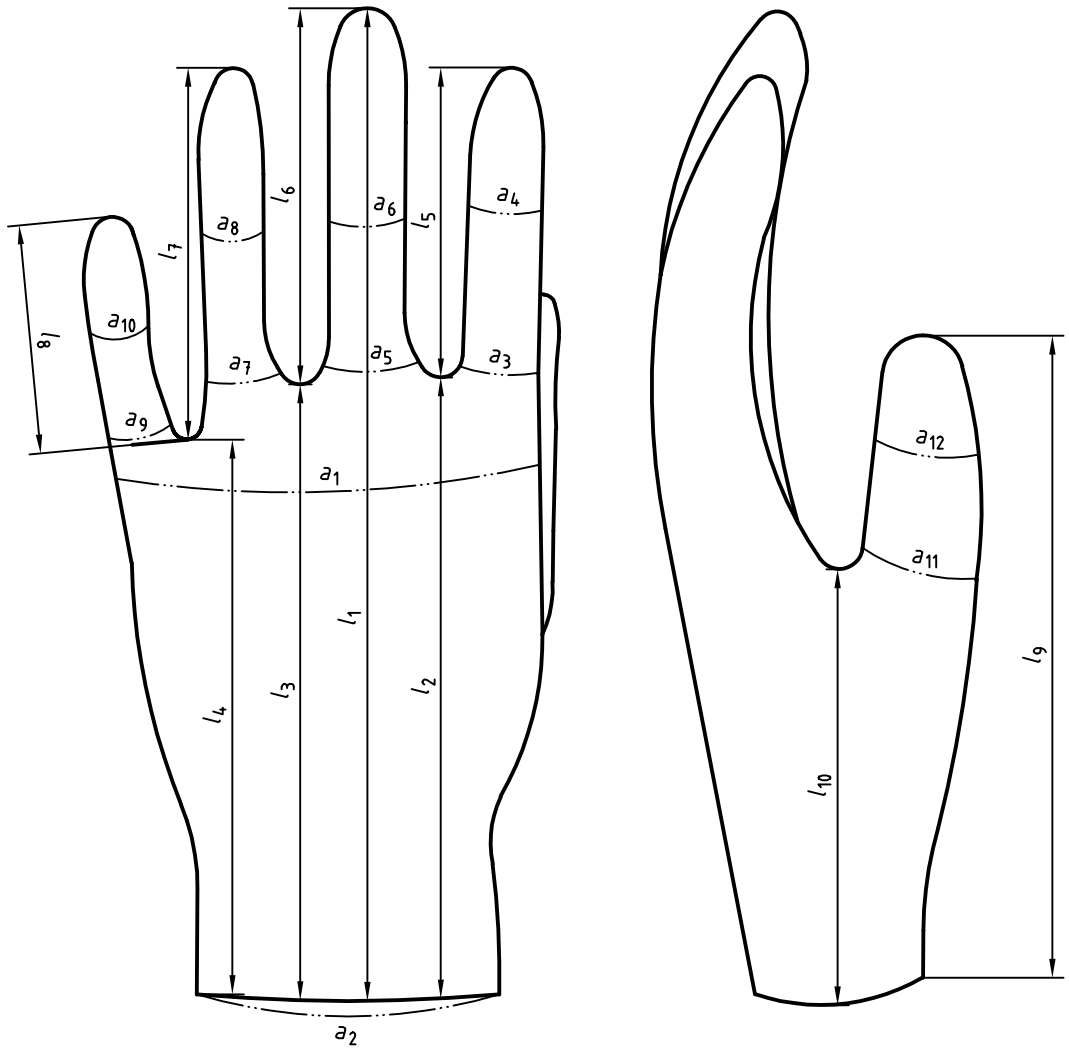
9.3 Test procedure

9.3.1 General

Arrange the chain-saw unit as specified in ISO 11393-1, except that the horizontal distance from the point of contact between chain and sample to the pivot of the test rig shall be (430 $\pm$ 2) mm (see Figure 3 in ISO 11393-1:1998).

The arrangement shall be such that the centre of gravity of the saw unit shall be offset from the pivot of the saw unit in such a way that, at the point of contact, the gravitational force shall be (15,0 $\pm$ 0,5) N (see 5.3.4 in ISO 11393-1:1998).

Perform other calibration methods as specified in ISO 11393-1.



NOTE 1 See Table 5 for dimensions.

Figure 3 — Artificial left-hand

Table 5 — Dimensions of the artificial hand

Dimension	Length	Dimension	Circumference
l_1	190 mm	a_1	197 mm
l_2	120 mm	a_2	164 mm
l_3	116 mm	a_3	60 mm
l_4	104 mm	a_4	55 mm
l_5	60 mm	a_5	69 mm
l_6	78 mm	a_6	57 mm
l_7	65 mm	a_7	60 mm
l_8	45 mm	a_8	54 mm
l_9	135 mm	a_9	51 mm
l_{10}	89 mm	a_{10}	50 mm
—	—	a_{11}	70 mm
—	—	a_{12}	63 mm

9.3.2 Mounting of glove on artificial hand

Fit the glove onto the appropriate (i.e. either left or right) artificial hand in the same manner as it would be in wear. Fasten any fastening devices (e.g. straps, buckles etc.) as in wear. Fix the glove to the artificial hand using staples or other fixings in the palm, so as to keep the glove from rotating during testing.

If any fixings used for this purpose pass through the protective material of the glove, record this fact in the test report.

In order to avoid the possibility that the fixings used might themselves interfere with the evaluation of the performance of the glove, it is desirable that staples or other fixing devices be positioned such that they do not pass through the protective material (of the glove).

NOTE Experience indicates that it is suitable to fix the glove with a line of staples (at least one staple every 30 mm) that pass through the unprotected part of the glove as close as possible to the edge of the glove situated furthest from the pivot of the test rig.

9.3.3 Cutting

9.3.3.1 General

Make test cuts on both Design A and Design B in the positions shown in Figures 4, 5, 6, 7 and 8:

a) mandatory cuts across back of left-hand gloves in Position 1 and Position 2 as shown in Figures 4 and 5;

b) optional cuts:

— across the back of the fingers of left-hand gloves of Design B in Position 3, Figure 6,

— across the back of right-hand gloves in Position 4, Figures 7 and 8.

Where possible, avoid cutting into any fastenings which may be fitted to the glove, as this could lead to anomalous results.

Should this not be possible, however, then record this fact in the test report.

The total number of cuts required for a complete test is as follows:

— mandatory cuts: 2 cuts in Position 1, and 2 cuts in Position 2;

— optional cuts: 2 cuts in Position 3, and 2 cuts in Position 4.

No more than one cut may be made on any one glove.

9.3.3.2 Cuts across the back of left-hand gloves

9.3.3.2.1 Preparation of sample

Fit the glove first onto the left artificial hand as specified in 9.2, then attach the combined assembly securely to the base.

Orient the base in such a manner that

a) the back of the artificial hand is uppermost;

b) the thumb is nearest the pivot of the test rig.

9.3.3.2.2 Cut at an angle of 45°

Perform the test in the positions shown in Figures 4a) and 5a) across the back of the glove at an angle of 45° to the line of longest length of the glove.

For Design A gloves [Figure 4a)], make the test cut at a distance of (60 ± 10) mm from a line level with the edge of the protective coverage at the crotch between digits 3 and 4.

For Design B gloves and mitts [Figure 5a)], make the test cut at a distance of (130 ± 10) mm from the tip of the second finger or at an equivalent position.

9.3.3.2.3 Cut at an angle of 90°

Perform this test in Position 2 shown in Figures 4b) and 5b) across the back of the glove at an angle of 90° to the line of longest length of the glove.

For Design A gloves [Figure 4b)], make the test cut at a distance of (60 ± 10) mm from a line level with the edge of the protective coverage at the crotch between digits 3 and 4.

For Design B gloves and mitts [Figure 5b)], make the test cut at a distance of (130 ± 10) mm from the tip of the second finger or at an equivalent position.

9.3.3.3 Optional cuts across the back of fingers of Design B left-hand gloves (Figure 6: Position 3)

Make the test cut in Position 3 as shown in Figure 6 across the back of the finger region of the glove at an angle of 90° to the line of longest length of the glove and at a distance of (50 ± 10) mm from the tip of the second finger or at an equivalent position.

9.3.3.4 Optional cuts across the back of right-hand gloves of Designs A and B (Figures 7 and 8: Position 4)

Fit the glove first onto the right artificial hand as specified in 9.2, then attach the combined assembly securely to the base. Orient the base in such a manner that

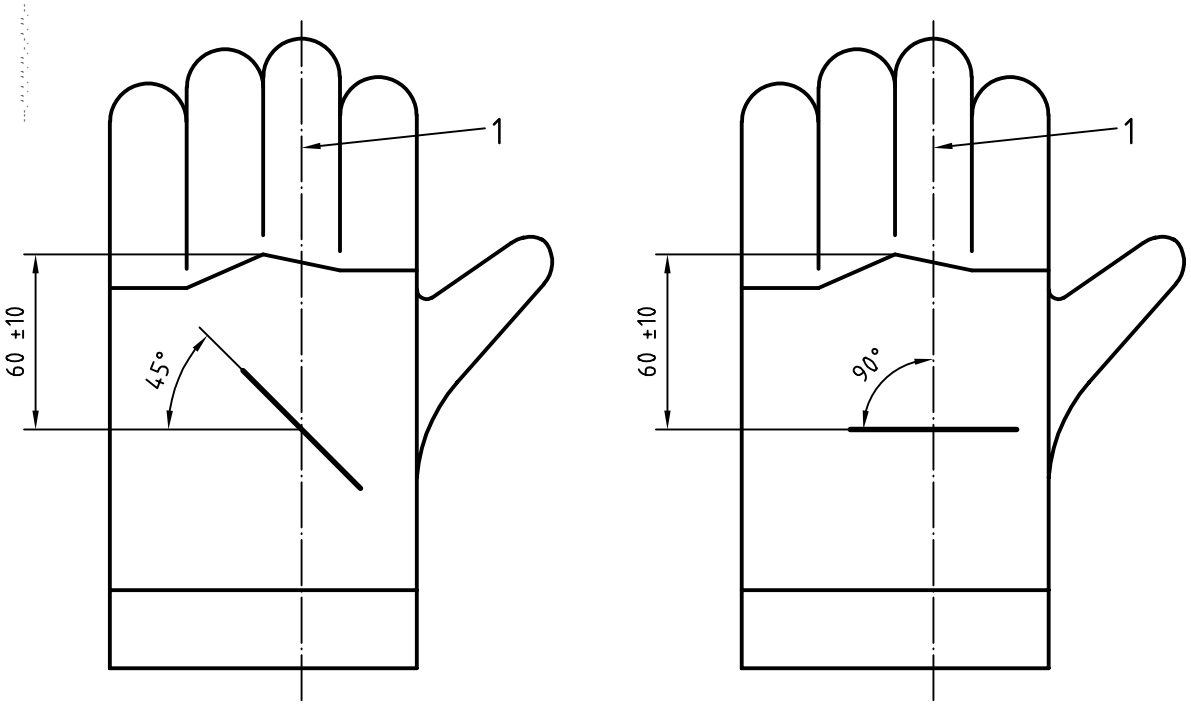
a) the back of the artificial hand is uppermost;

b) the smallest finger (digit 5) is nearest the pivot of the test rig.

For Design A gloves, make the test cut in Position 4 as shown in Figure 7 across the back of the glove at an angle of 45° to the line of longest length of the glove and at a distance of (60 ± 10) mm from a line level with the edge of the protective coverage between digits 3 and 4.

For Design B gloves and mitts, make the test cut in Position 4 as shown in Figure 8 across the back of the glove at an angle of 45° to the line of longest length of the glove and at a distance of (130 ± 10) mm from the tip of the second finger or at an equivalent position.

Dimension in millimetres



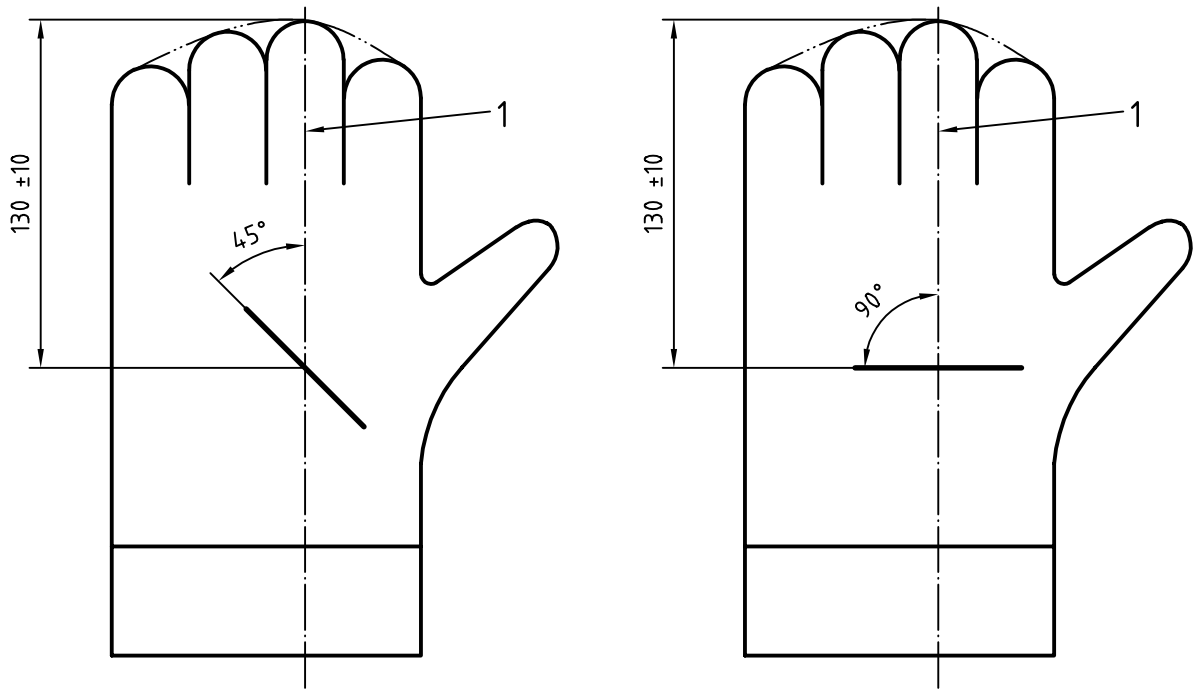
Key

1 line of longest length

a) Position 1 **b) Position 2**

Figure 4 — Mandatory cuts across back of the left-hand glove of Design A

Dimensions in millimetres



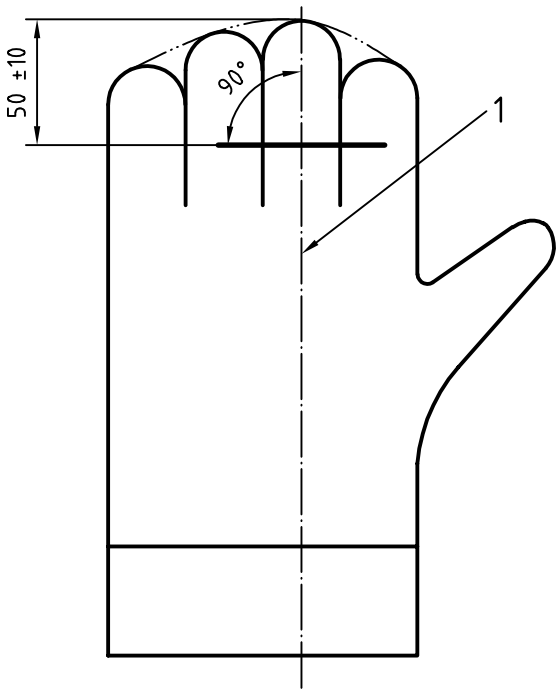
Key

1 line of longest length

a) Position 1 **b) Position 2**

Figure 5 — Mandatory cuts across back of the left-hand glove of Design B

Dimensions in millimetres

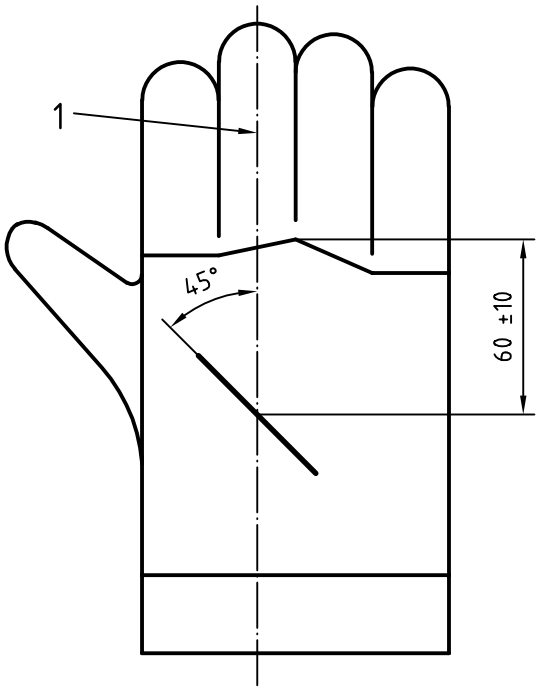


Key

1 line of longest length

Figure 6 — Position 3: Optional cut across the back of the fingers of a left-hand glove of Design B

Dimensions in millimetres

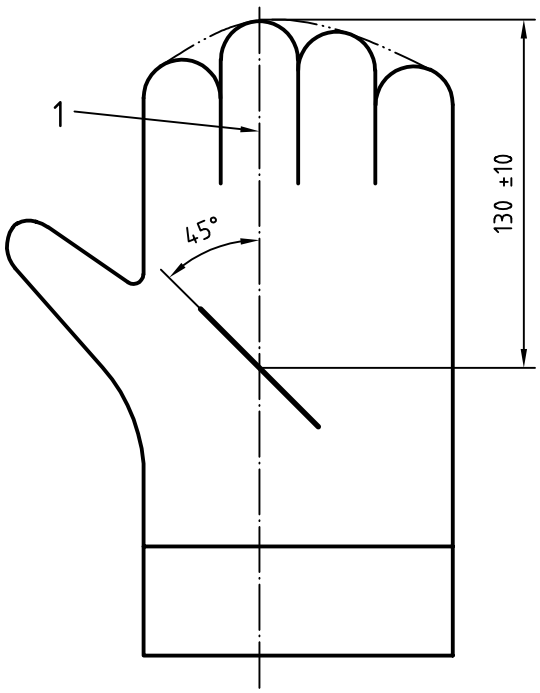


Key

1 line of longest length

Figure 7 — Position 4: Optional cut across the back of the right-hand glove of Design A

Dimensions in millimetres



Key

1 line of longest length

Figure 8 — Position 4: Optional cut across the back of the right-hand glove of Design B

10 Ergonomic assessment

Examine the gloves visually and manually to identify rough or hard material or edges. Examine the outsides of the gloves to identify components that might catch on branches or chain-saw controls. Take into consideration the flexibility, dexterity and tactility of the gloves.

Assess the potential suitability of the gloves for the use(s) indicated in the manufacturer's information for users. Details of manufacturer's wearer trials may be taken into account.

11 Test report

The test report shall include the following information:

a) a reference to this part of ISO 11393, i.e. ISO 11393-4;

b) an identification of the test specimen, e.g. manufacturer, style number, design, size;

c) the pre-treatment;

d) the protective coverage;

e) an ergonomic assessment;

f) any details of deviations from the test procedure;

g) the test result for each test position (i.e. whether or not cut-through occurred);

h) the chain speed/class of protection (see 5.3.1);

i) an evaluation of damage and chain-stopping mechanism.

The test report shall also include information required in Clauses 4 and 5 (if any).

12 Marking

Protective gloves for users of hand-held chain-saws shall be durably marked with at least the following information:

a) the name or trade mark or other means of identification of the manufacturer or legally responsible company;

b) the designation or style number (company identification of model);

c) the design in accordance with Clause 4;

d) the reference to ISO 11393-4;

e) the size designation in accordance with EN 420;

f) the speed classification (see 5.3.1). This information shall be given outside the frame of the pictogram showing a chain-saw, preferably on the bottom of the frame.

13 Information for the user

Chain-saw protective gloves shall be supplied with unambiguous instruction, in the language(s) of the country of destination. The instruction for the user shall contain at least the following:

a) the name, address and telephone number of manufacturer/importer;

b) the type designation or style number;

c) a figure showing the protective coverage to any left-hand glove and to the related right-hand glove when applicable, with the related class;

d) the cleaning instructions;

e) the size designation according to EN 420;

f) the criteria for discarding the glove;

g) the text “Does not offer protection against all risks of cutting by a hand-held chain-saw” or similar;

h) the text “The chain-saw shall be used correctly using both hands according to the instructions from the chain-saw manufacturer”;

i) the information given in the marking;

j) the instructions for correct use;

k) the instructions about repair of the glove, especially pointing out that the protective material cannot be repaired;

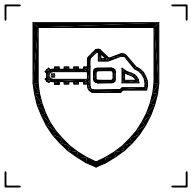
l) the instruction that the protective area and material shall not be altered in any way and that once cut, the glove should be discarded.

14 Pictogram

Chain-saw protective gloves fulfilling the requirements of this part of ISO 11393 shall be marked with the pictogram ISO 7000-2416 shown in Figure 9. The pictogram shall either be printed on the outside of the glove or, if incorporated as part of a label, this shall be sewn to the inside of the glove.

It shall have minimum size of 30 mm × 30 mm.

In cases where only one glove of a pair offers chain-saw protection, only that glove which offers the protection shall carry the pictogram.



X

Key

X class of protection (0, 1, 2 or 3)[a]

[a] See 5.3.1.

Figure 9 — Pictogram ISO 7000-2416 (Protection against chain-saw)

Annex A
(informative)

Chain-saw use and the selection of appropriate gloves

A.1 General

Chain-saws are designed to cut timber. They cut hands very rapidly causing massive tissue loss. Even the best gloves only provide partial protection.

A.2 Risk analysis

The risk of injury while using a chain-saw is dependant on many factors.

Thus a risk analysis for the particular type of job being undertaken should be carried out.

A risk assessment should consider at least the following:

a) **Step 1 — Risk evaluation:**

- the level of training, skill and experience of the operator;
- the frequency with which a chain-saw is used;
- the duration of work;
- the nature of the working environment:
  - slope of the ground,
  - mud, slipping soil or stones,
  - the suitability of the footwear,
  - temperature, wind, rain or snow, and
  - lighting level;
- the nature of the work:
  - whether ground-based or arboreal,
  - the degree of interference by cut material and branches,
  - the type of cutting operations involved,
  - the urgency or stress to complete the work;
- the type of chain-saw (single-hand operated machines are particularly hazardous);
- the technique used to clear away cut material;
- the frequency at which the left hand does not grip the saw handle while the chain is moving.

b) **Step 2 — Risk reduction:**

Risk reduction should be considered. Each of the risk factors should be examined and ways sought to reduce them. If there is a residual risk of hard hand to chain contact, the job is too hazardous. If the residual risk is for infrequent light contact of the back of the hand with the chain, the use of a protective glove is appropriate.

A.3 Ergonomics

Gloves that are intended to provide protection should not increase the risks of an accident. The following are desirable characteristics that should be balanced against the protection that is provided:

— lightness and flexibility;

— good gripping surface on the palm;

— good tactility;

— lack of bulk;

— good fit and moulding to the hand;

— for a right-hand glove, a separate throttle finger;

— improved protection as offered by Design B gloves (see below).

The following can affect the design of gloves:

a) whether the conditions of use will be at freezing temperatures or in frequent rain;

b) whether vibration transmission is a particular problem;

c) whether the users are ever likely to climb while wearing them.

Overall, gloves should be comfortable, secure on the hand and give confidence in handling machines and timber.

They need to give overall protection against mechanical injury and incidentally should prevent soiling of the hand. For use in wet conditions, they should not absorb large quantities of water. For use in warm conditions, they should not trap sweat.

A.4 Choice between Design A and Design B gloves

The gloves specified in this part of ISO 11393 give limited protection against cutting by a hand-held chain-saw to only the back of the hand. Design B provides a similar level of protection to the backs of the fingers as to the back of the palm. Therefore Design B should be the normal choice. However, Design A allows greater finger dexterity and thus might be necessary under some conditions.

A.5 Compatibility of hands, gloves and chain-saws

The chain-saws currently used are normally designed to be held by two hands. The designs are asymmetrical and can only be used safely in a right-handed manner with the left hand holding the front handle and the right hand on the rear handle and controlling the power delivery to the chain. All the specifications for protective clothing in this series of standards assume the chain-saw is held in this right-handed manner. To obtain the protection from their personal protective equipment (PPE) that is intended, left-handed users shall work in a right-handed stance and hold the chain-saw in a right-handed manner.

Accident statistics show the risk of injury to the hands is mainly to the left hand. Therefore this part of ISO 11393 only requires protective material to be provided in the left-hand glove. In the eventuality that left-handed chain-saws are used, the protection will be required in the right-hand glove.

The optional requirements for right-hand gloves are provided because in future chain-saws will possibly be available for left-handed use.

Before using a pair of chain-saw protective gloves, prospective wearers should check that, under the anticipated work condition, the gloves are well fitting and that work can be performed without the gloves causing a risk to safety and health.

They should check that either the gloves are sufficiently well fitting to be easily retained on the hand during normal use, or that they are fitted with wrist fasteners or similar to prevent the gloves unintentionally slipping off the hands.

When making these checks, it is important to consider the size of you own hand, noting particularly

a) girth (circumference) of hand, i.e. if the glove size selected is too big, then the glove can tend to twist around the hand;

b) length of fingers, i.e. glove fingers that are either too long or too short can both give rise to poor grip and fingers that are too short can also impair blood circulation;

c) overall length of hand; i.e. gloves that are too long can impair hand movements.

Be aware that the hand can be closed around the handle of the saw for prolonged periods, and hence the glove should not be too stiff, or too thick in the palm. Wearers should also check that, when gripping, the material of the palm does not flex in such a way as to impair grip.

A.6 Safe working

It is emphasized that correct working practices have to be observed to operate a chain-saw safely. Working practice guides for forest workers or for other appropriate users, should be followed. The instructions provided by the chain-saw manufacturers should also be followed. Gloves will be an appropriate additional safety component if their use is compatible with the above, but not if there is a conflict. It is the responsibility of the user to determine what PPE is appropriate for each task.

A.7 Acceptability

Gloves should be assessed under the normal conditions of use. Users should have the opportunity to assure themselves that they can work safely in the gloves using their normal chain-saws and that unexpected hazards do not arise.

Bibliography

[1] ISO 7000:—[1)], *Graphical symbols for use on equipment — Index and synopsis*

1) To be published. (Revision of ISO 7000:1989)

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