



SLOVENSKI STANDARD

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Varovalna obleka – Rokavice in ščitniki rok za varovanje pred urezninami in vbodom ročnega noža – 1. del: Rokavice pletene iz žice in ščitniki rok

Protective clothing - Gloves and arm guards protecting against cuts and stabs by hand knives - Part 1: Chain mail gloves and arm guards

Schutzkleidung - Handschuhe und Armschützer zum Schutz gegen Schnitt- und Stichverletzungen durch Handmesser - Teil 1: Metallringgeflechthandschuhe und Armschützer

Vêtements de protection - Gants et protege-bras contre les coupures et les coups de couteaux a main - Partie 1: Gants en cote de mailles et protege-bras

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EUROPEAN STANDARD

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English version

**Protective clothing - Gloves and arm guards
protecting against cuts and stabs by hand knives -
Part 1: Chain mail gloves and arm guards**

Vêtements de protection - Gants et protège-bras
contre les coupures et les coups de couteaux à
main - Partie 1: Gants en cotte de mailles et
protège-bras

Schutzkleidung - Handschuhe und Armschützer zum
Schutz gegen Schnitt- und Stichverletzungen
durch Handmesser - Teil 1:
Metallringflechthandschuhe und Armschützer

This European Standard was approved by CEN on 1996-11-14. 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 Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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FOREWORD

This European Standard has been prepared by 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of an identical text or by endorsement, at the latest by June 1997, and conflicting national standards shall be withdrawn at the latest by June 1997.

This European Standard 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(s), see informative Annex ZA, which is an integral part of this European Standard.

The annexes A, B, C and D are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

0 INTRODUCTION

Chain mail gloves and metal or plastic arm guards that offer some protection against stabs are used in those aspects of work where a knife is moved towards the user's hand and forearm, especially when working with hand knives in slaughterhouses, in the meat, fish and shell fish processing industries, in large scale catering establishments, and in manual boning-out operations to process meat, game and poultry. Protective gloves and arm guards against stabs may also offer adequate protection for those working with hand knives in the plastics, leather, textile and paper industries, when laying flooring and similar tasks.

Attention is drawn to legislation and other standards concerning public health in the food industry and hygiene in the meat processing industries, that might apply to the construction, construction materials and cleaning of protective gloves and arm guards and associated straps and fasteners.

It should be noted that the tests specified in this European Standard are designed to be severe, and in some cases destructive, in order to adequately test the products. The requirements in this European Standard based on these tests do not imply that in normal use, knives will penetrate gloves or arm guards by significant distances.

It has been assumed in the drafting of this European Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people, for whose guidance it has been prepared. The apparatus described should only be used by competent persons and requires safeguards to prevent, as far as is reasonably practicable, injury to the operator and other persons.

1 Scope

This European Standard specifies requirements for the design, penetration resistance, ergonomic characteristics, straps, weight, material, marking and instructions for use, of gloves and arm guards. It also specifies the appropriate test methods.

This European Standard applies to protective chain mail gloves and to metal and plastics arm guards for use with hand knives.

2 Normative reference

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies .

EN 412:1993 Protective aprons for use with hand knives

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3 Definitions <https://standards.iteh.ai/catalog/standards/sist/fd6a02ae-c802-4902-93fa-eb081bad1682/sist-en-1082-1-1998>

For the purposes of this European Standard, the following definitions apply.

3.1 Anatomical

The defined terms are illustrated in figure 1.

3.1.1 digit: One of the terminal divisions of the hand. These are numbered from (1) the thumb, to (5) the little finger in figure 1 and the numbers are used to denote the appropriate digits in this European Standard.

3.1.2 wrist: This is the radio-carpal joint. To obtain the surface marking of the wrist level place the hand and forearm, fully relaxed, on a flat surface with the palm upwards. A finger tip is pressed firmly in the direction of the arrow in figure 1, to palpate the styloid process of the ulnar, which is located towards the dorsal surface of the hand. Mark the transverse level of the palpated ulnar styloid process. A plane 10 mm proximal to this level is the plane of the wrist. Note that skin creases are not an adequate guide to the level of the wrist.

3.2 Clothing: The defined terms are illustrated in figure 2.

3.2.1 glove: A hand covering for the whole hand that has protective material extending to the wrist and covers each digit separately, see figure 2a.

3.2.2 short cuff glove: A glove with protective material continuous with it of length (A) in figure 2b proximal to the wrist.

3.2.3 long cuff glove: A glove with a permanently attached stiff but flexible cuff of length (B) in figure 2c covering the forearm to a point which is at a distance (C) in figure 2c from the upper arm surface when the elbow is flexed at 90°.

NOTE: Deprecated: gauntlet: This is an inexact synonym of "Long cuff glove".

3.2.4 arm guard: A protective device covering the forearm. It may be permanently attached to or held in place by a glove with a special short cuff of length (D) in figure 2c while both are used. It extends to a point which is at distance (C) from the upper arm surface when the elbow is flexed at 90°.

3.2.5 arm guard and glove assembly: An arm guard correctly attached to or correctly worn with a compatible glove with a total length (B) in figures 2c and 2d from the wrist.

3.2.6 long arm guard: A protective device that covers the forearm and extends onto the upper arm. It may be secured to the body or to clothing so that it remains in place during use, see figure 2e.

4 Requirements

4.1 Dimensions of the protective surface areas of gloves and arm guards

The coverage provided by gloves shall be assessed in accordance with 6.1.4.

For details of dimensions, sizing and fitting of gloves and arm guards see annexes A, B and D.

4.1.1 Gloves

A five finger glove shall be designed to provide protection to all of the hand up to the wrist. The coverage shall be continuous except for a slit on the ulnar surface of the palm to aid putting on and taking off the glove. When the wrist strap is adjusted as in use the slit shall be closed by overlapping chain mail.

4.1.2 Short cuff gloves

Short cuff gloves shall be designed to provide continuous protection from the finger tips to a length (A) in figure 2b at least 75 mm proximal to the wrist. The cuff shall either be stiffened so that it has a minimum compressed length of 75 mm and so that the difference between its compressed and extended length is less than 20 mm when measured in accordance with 6.2.2, or shall be attached to the upper body or arm or to clothing so that the minimum required coverage is

maintained in use.

4.1.3 Long cuff gloves

Long cuff gloves shall be designed to provide continuous protection from the finger tips to the wrist and up the forearm. The proximal end of the protection should be at a distance (C) in figures 2c and 2d of not more than 75 mm from the upper arm surface when the elbow is flexed at 90°, see annex B.

Long cuff glove cuffs shall either be stiffened so that at least the minimum coverage is provided when the cuff is compressed and measured in accordance with 6.2.2, or shall be attached to the upper body or to the arm or to clothing so that the minimum required coverage is maintained in use.

4.1.4 Glove sizes

Gloves shall be marked with their size based on the hand size they are designed to fit, or with the colour coded strap appropriate to the dimensions of the glove as given in annexes A and B.

4.1.5 Arm guard and glove assemblies

The coverage provided by arm guards and arm guard and glove assemblies shall be assessed in accordance with 6.1.4.

4.1.5.1 Coverage with rigid arm guards

Arm guards shall be designed to provide continuous protection to the hand and forearm: the arm guard covers the forearm from the cuff of a compatible glove. The proximal end of the protection shall be at a distance (C) (See figures 2c and 2d) which should not be less than 45 mm or more than 75 mm from the upper arm surface when the elbow is flexed at 90°, see Annex B. The arm guard shall be attached to, or held in place by, the cuff of the glove.

4.1.5.2 Coverage by chain mail arm guards

Chain mail arm guards shall either be stiffened so that at least the minimum coverage is provided when the guard is compressed and measured in accordance with 6.2.2, or shall be attached to the upper body or to the arm or to clothing so that the minimum required coverage is maintained in use.

4.1.5.3 Coverage and attachment of long arm guards

Long arm guards shall be designed to provide continuous protection of the hand and forearm. The straps or fixing of the proximal end of the arm protector, when correctly adjusted, shall not allow it to slide down to expose the forearm.

4.1.5.4 Cuffs

The overlap of the protection provided by the cuff of the glove and the arm guard shall be at least 8 mm. The cuff of a compatible glove shall be of stiffened chain mail with a compressed length (D) in figure 2d of not less than 30 mm. The difference in extended and compressed lengths of the cuff shall not be more than 20 mm when tested according to 6.2.2.

NOTE: If the stiffening is only at the sides of the wrist, flexing of the wrist will not be impeded.

4.1.5.5 Plastic or other rigid material arm guard shape

Arm guards made from plastic or other smooth material shall be so designed at their proximal end to stop the knife blade. An example of the shape is given in figure 3. The dimensions shall be:

$$\begin{aligned} l_1 & 6 \text{ mm} < l_1 < 15 \text{ mm} \\ l_2 & 2 \text{ mm} < l_2 < 6 \text{ mm} \\ l_3 & > 1,5 \text{ mm} \end{aligned}$$

The protection shall extend for at least 300° around the circumference of the arm guard. The arm guard shall be designed so that the arc without the protection can only be worn on the outside of the forearm directed towards the point of the elbow.

Arm guards formed of a rolled up sheet of rigid material with an overlapping longitudinal junction shall have an overlap of their free edges of at least 30 mm for the whole length of the arm guard.

4.1.5.6 Arm guard and long cuff sizes

Arm guards sizes are their minimum or compressed length in millimetres (see 6.2.2). See annex B for information on sizes of arms and of arm guards and long cuffs.

4.2 Construction

4.2.1 Chain mail gloves

Chain mail shall be made from rings with an internal diameter no greater than 3,2 mm. Chain mail sheet shall have 4 rings passing through each ring.

4.2.2 Dimensions of interstices

The dimensions of interstices between chain mail rings or any other components of the protective surface of gloves and arm guards shall be such that the 6,0 mm wide gauge number 1 described in 5.5 is unable to pass through them when applied as described in 6.3.

The dimensions of interstices between chain mail rings or any other components of the protective surface of gloves and arm guards shall be such that the 4,0 mm wide gauge number 2 described in 5.5 is unable to pass through them when applied as described in 6.3 except at the positions listed below;

Sites where the 4,0 mm gauge number 2 is permitted to pass through the protective material;

a) At not more than three points in each crotch between digits two and three, three and four, and, four and five. Probe number 2 shall not pass through at any point in the crotch between digits one and two;

b) At not more than eight points on the seam on the lateral and medial surfaces of each digit and over the tip of the digit.

Possible sites where the 4,0 mm probe penetrates the glove surface are shown in figure 4.

4.2.3 Straps

Gloves shall have adjustable wrist straps at least 18 mm wide. The length of straps shall be continuously adjustable. They shall be secured by a quick release closure for example a spring

loaded stud fastener. The fixed part of the closure shall be on the strap on the back of the wrist within 10 mm of the centre (i. e. in the centre of the dimension $l_{10} \pm 10$ mm, as in annex A table A.1 and figure A.1). It shall not be possible to remove straps from gloves or arm guards when the straps are fastened. Straps shall be attached to cuffs or shall pass through loops. It shall not be possible to remove closures from straps except by intent.

Any straps on arm guards shall be of similar construction. See also advice in Annex D about avoiding long free ends on the straps.

NOTE: The force required to open the fastener should be greater than any accidental force that is likely to be applied during the work for which the glove is designed.

4.2.4 Mass

Gloves and arm guards shall be constructed of material with a mass per area of less than 4 kg/m². Testing to be in accordance with 6.2.3.

4.3 Tensile strength

4.3.1 Chain mail

When tested in accordance with 6.4.1 no ring, link or plate shall break or open when a force of 100 N is applied.

4.3.2 Attachment of arm guards

Arm guards shall be securely held in place when worn with a compatible glove. This attachment shall withstand a force of 150 N on the arm guard directed towards the elbow as described in 6.4.2.

If attachment is by studs or similar discrete fasteners at least five shall be used. They shall be distributed approximately evenly around the circumference of the junction.

4.4 Penetration resistance

Penetration resistance of a glove or assembly shall be provided over the whole protective surface, including any junction between a glove and its cuff or attached arm guard.

4.4.1 Chain mail gloves cuffs and chain mail arm guards and those including metal plates

Protection shall be provided over the whole protective surface including any junction to another component or material. Testing shall be conducted in accordance with 6.5.1. The mean penetration shall not exceed 10 mm and no single penetration shall exceed 17 mm.

4.4.2 Rigid Plastic or metal arm guards

Testing shall be conducted in accordance with 6.5.2. The mean penetration shall not exceed 12 mm and no single penetration shall exceed 15 mm.

4.4.3 Rigid arm guard attachment

Testing of the region of attachment of the cuff of a compatible glove to the arm guard shall be in accordance with the principles in 6.5.2. The mean penetration shall not exceed 12 mm and no single penetration shall exceed 15 mm.

4.5 Properties of materials

4.5.1 General

The protective clothing shall not be constructed of materials that are known to cause short or long term injury to normal users. The protective clothing shall not have injurious rough or sharp surfaces. It shall not lose its protective properties during its normal service life when cleaned and sterilised according to the manufacturer's instructions.

4.5.2 Cleaning temperature stability

The maximum cleaning temperature that does not harm the item shall be supplied with it. If this temperature is below 82°C it shall be marked on the item. The testing of the stability of plastic arm guards is described in 6.6. No dimension shall have changed by more than 10%, nor shall any dimension fall outside the range given in 4.1.5.5 after testing.

5 Test apparatus

5.1 Visual examination

Visual examinations should be made by a competent person with such light sources and magnification aids as are necessary.

5.2 Tolerances

Unless specified all dimensions are centre values with a tolerance of $\pm 2\%$.

5.3 Tensile Strength testing apparatus

Tensile strength testing apparatus shall be as described EN 412 except that the metal rods to be placed in the rings shall be $(1,2 \pm 0,1)$ mm unless narrower rods are required to pass through the rings, and the force to be exerted shall be up to 100 N.

5.4 Penetration testing apparatus

Penetration testing apparatus shall be as described in EN 412 with the addition of components to support small chain mail samples and rigid arm guards as given below.

5.4.1 Chain mail samples

Rectangular samples of glove chain mail or arm guard chain mail shall be cut (120 ± 10) mm x (120 ± 10) mm. Rigid steel rods are passed through the rings on each side of the sample, leaving approximately 10 mm (3 or 4 rings) unsupported at the ends of each side.

The sample placed on the flesh simulant is tensioned by four 400 g weights. One is attached to the centre of each side by clips and string which is arranged to fall approximately 30° to the horizontal and pass over a hoop of internal diameter not less than 800 mm, to the weight. The outer surface of the glove or arm guard material shall be placed upwards.

Samples of the following types representing all the construction features of the test item are to be tested:

- a) Four ring interlock flat chain mail;

b) Samples of four ring interlock flat chain mail joined by a seam across the middle of the sample. Samples of every seam type present in the glove or arm guard are to be tested. The seams shall not include points at which the 4,0 mm probe is able to pass through the chain mail;

c) Samples of chain mail in which the rings are coated or surrounded by a plastic matrix that impedes their independent movement.

5.4.2 Support for rigid arm guards

Plastics or other rigid arm guards shall be filled with uncooked long-grain polished rice in polythene bags. The rice shall be shaken and vibrated into place. The bags shall be taped into place and the guards shall be taped tightly around the bags, so that no movement occurs during testing. The filled arm guard shall be pressed into the flesh simulant so that its lower surface is fully supported. It shall be taped down by adhesive tape across the tray as shown in figure 5.

NOTE: If the rice is not sufficiently tightly packed the impact energy is absorbed elastically in deformation of the whole guard. The knife and block may even rebound as the arm guard returns to its resting shape. It is important that the rice is tightly packed to avoid this happening.

5.5 Gauges for interstices

The gauges for interstices shall be made of steel ($1 \pm 0,05$) mm thick. Gauge number 1 shall be ($6 \pm 0,1$) mm wide over a length of not less than 50 mm. The end of a gauge shall taper with (60 ± 5)° included angle as shown in figure 6. Gauge number 2 shall be the same as gauge number 1 except that its width shall be ($4 \pm 0,05$) mm. The gauges shall be supported in handles or otherwise so that the force that can be exerted along the long axis of the gauge is limited to ($10 \pm 0,5$) N.

5.6 Blunt probe

The blunt probe for checking the coverage provided by test items in 6.1.4 shall have a smooth approximately hemispherical end on a ($6 \pm 0,5$) mm diameter metal shaft.

5.7 Test arms for measuring the compressed length of cuffs and forearm guards

The test arms shall be made of hard polished material such as varnished wood, metal or hard plastic. The dimensions shall be according to the table below. The shape is shown in figure 7.

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TABLE 1
Test arm dimensions in millimetres
Tolerances $\pm 2\%$ on diameter, $\pm 5\%$ on length

Test arm number	1	2	3	4
Dimensions on figure 7				
l_1	The dimension to be measured			
l_2	60	60	60	60
l_3	100	100	100	100
l_4	60	60	60	60
l_5	20	20	20	20
l_6	15	15	15	15
d_1	80	85	92	100
d_2	80	85	92	100
d_3	50	56	63	70
d_4	45	50	55	60
d_5	45	50	55	60
d_6	75	80	85	90

6 Procedures

6.1 Visual examination

6.1.1 Chain mail

Examine the entire surface of the mail for missing rings, unclosed rings and rough welds which could abrade a user's skin. Examine all seams and the interlocking of rings within them. Test by hand to determine whether fittings have sharp edges, that the fasteners are easy to use and secure, and that there are no long free ends of straps when the glove is worn. Where chain mail is possibly joined within an opaque strap or fitting, expose the chain mail and examine as above. Report findings.

6.1.2 Rigid arm guards

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Examine the whole surface, edges and fittings. Determine whether there are sharp edges, surface crazing or small cracks at edges and around fitment holes. Determine if the whole shape is appropriate. Report findings.

6.1.3 Assembly

Examine the attachment of the arm guard to a compatible glove. Determine the orientation of any openings between them and the compatibility of the assembly. Determine whether unexpected detachment could occur in use. Report findings.

6.1.4 Examination of coverage

The test item shall be put on and correctly adjusted on a subject of the appropriate dimensions determined from the manufacturer's information for users. The relevant requirements in 4.1.1, 4.1.2, 4.1.3, 4.1.5.1, 4.1.5.2, 4.1.5.3 and 4.1.5.4 for coverage of the hand, wrist and forearm shall be tested by inspection, measurement and the attempted insertion of a non-injurious blunt probe described in 5.6.

The probe shall be applied to every slit, opening or overlap found. The probe shall be angled at 0° to 45° with the underlying skin at any angle between directly up the arm and 90° across the arm from the medial to the lateral side. The probe shall be gently moved around with a maximum force of 4 N. Varying its angle of approach to ascertain whether it can pass through the test item. Every penetration shall be recorded as a gap in the coverage. Report findings.

6.2 Dimensions and mass determination

6.2.1 Measurement of glove dimensions

Lay the glove flat and insert appropriate gauges (see annex A) into the digits to measure their length. Measure the remaining dimensions specified. Make allowances where the glove is curved (see annex A). Check the correspondence of the results to the claimed size and marking. Report findings.

6.2.2 Measurement of compressed and extended lengths of cuffs, cuffs and arm guards, and arm guards

Measure the maximum length (extended length) of a cuff and arm guard, or arm guard, when it is suspended by its distal end and hanging freely under its own weight. The dimensions to be measured shall correspond to the appropriate dimensions A, B or D shown in figure 2. The measurement shall be made five times. Between measurements the test item shall be lifted from below to compress it, and it shall be gently released to hang freely again before the next measurement is made.

Measure the compressed length of the same item on a test arm as described in 5.7. Choose the appropriate test arm according to the manufacturer's size marked on the test item. The test item should fit loosely about the test arm. A smaller size test arm should be used if the fit is not loose, and a larger one should be used if the looseness is far in excess of what would be acceptable in the normal use of the test item. The table below is a guide to the selection of test arms.

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