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**Protective clothing — Gloves and arm  
guards protecting against cuts and stabs  
by hand knives —**

Part 2:

**Gloves and arm guards made of material  
other than chain mail**

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*Vêtements de protection — Gants et protège-bras contre les coupures  
et les coups de couteaux à main —*

*Partie 2: Gants et protège-bras en matériaux autres que la cotte de  
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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 13999-2 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*. It is based on European Standard EN 1082-2:2000.

ISO 13999 consists of the following parts, under the general title *Protective clothing — Gloves and arm guards protecting against cuts and stabs by hand knives*:

- Part 1: Chain-mail gloves and arm guards
- Part 2: Gloves and arm guards made of material other than chain mail
- Part 3: Impact cut test for fabric, leather and other materials

## Introduction

Chain-mail gloves and chain-mail or rigid-plastic or metal arm guards are used in work particularly in the meat industry where a sharp pointed knife is drawn towards the user's hand holding the meat. In work where the knife is generally used to cut away from the hand, or the knives are not finely pointed, it may be appropriate for ergonomic reasons to use gloves and arm guards that are more comfortable though providing less protection than that provided by products fulfilling the requirements of ISO 13999-1. This part of ISO 13999 gives the requirements for such less protective products. The products provide significant protection against slashing cuts but only limited stab protection. It is important that a risk assessment exercise is carried out before these products are accepted as suitable for use in a particular job.

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 use of the of the gloves or arm guards, and these could have implications for the acceptability of particular construction, construction materials and the cleaning methods for protective gloves and arm guards and associated straps and fasteners.

It has been assumed in the drafting of this part of ISO 13999 that the execution of its provisions is entrusted to appropriately qualified and experienced people, for whom guidance 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.

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# Protective clothing — Gloves and arm guards protecting against cuts and stabs by hand knives —

## Part 2:

## Gloves and arm guards made of material other than chain mail

### 1 Scope

This part of ISO 13999 specifies requirements for the design, cut resistance, penetration resistance, and ergonomic characteristics of cut-resistant gloves, arm guards and protective sleeves made of materials other than chain mail and rigid metal and plastics. They provide less cut and stab protection than the products specified in ISO 13999-1 and are intended to be used only in work where the knife is not finely pointed or it is used only to cut away from the hand and arm.

### 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 3758, *Textiles — Care labelling code using symbols*

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

ISO 13997, *Protective clothing — Mechanical properties — Determination of resistance to cutting by sharp objects*

ISO 13999-1:1999, *Protective clothing — Gloves and arm guards protecting against cuts and stabs by hand knives — Part 1: Chain-mail gloves and arm guards*

ISO 13999-3, *Protective clothing — Gloves and arm guards protecting against cuts and stabs by hand knives — Part 3: Impact cut test for fabric, leather and other materials*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13999-1 and the following apply.

#### 3.1

##### **protective sleeve**

flexible garment covering the arm from the wrist to above the elbow

NOTE 1 It may be self-supporting because of its elasticity or held in place by straps or other systems.

NOTE 2 Protective sleeves are normally worn inside the cuff of a glove and lightly grip the wrist.

## 4 Requirements

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

#### 4.1.1 General

The requirements for fabric, leather, soft plastic or composite gloves and arm guards shall be the same as those for chain-mail gloves and chain-mail or rigid arm guards given in ISO 13999-1, except as listed below. Sizes and coverage shall be assessed in accordance with 6.8 and Annex A.

#### 4.1.2 Gloves

The coverage provided by gloves shall be continuous and without a slit on the ulnar side of the palm.

#### 4.1.3 Short cuff gloves

Short cuff gloves shall be designed to provide continuous protection from the fingertips to a distance at least 75 mm proximal to the wrist. The cuff shall retain this coverage when tested in accordance with Annex A.

#### 4.1.4 Long cuff gloves

Long cuff gloves shall be designed to provide continuous protection from the finger tips to a distance less than 75 mm from the upper arm surface when the elbow is flexed at 90°, see ISO 13999-1:1999, Annex B. The cuff shall retain this coverage when tested in accordance with Annex A.

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#### 4.1.5 Glove sizes

Gloves shall be marked with their size based on the hand size that they were designed to fit, in accordance with ISO 13999-1:1999, Table B.1. Sizing shall be verified in accordance with Annex A.

#### 4.1.6 Flexible protective sleeves

Flexible protective sleeves shall provide continuous coverage from the wrist, as defined in ISO 13999-1:1999, 3.1.2, to above the elbow.

#### 4.1.7 Arm guard, or protective sleeve and glove assemblies

##### 4.1.7.1 General

The coverage provided by arm guards, protective sleeves, and arm guard, or protective sleeve and glove assemblies shall be continuous. The coverage and absence of gaps shall be assessed in accordance with 6.4 and Annex A.

##### 4.1.7.2 Coverage by fabric, leather or other flexible arm guards or protective sleeves, and by long arm guards

Flexible arm guards and protective sleeves shall be provided with a means of holding them in place such that the minimum required coverage is maintained when tested in accordance with Annex A. They shall not move more than 40 mm upwards from the wrist when subjected to pulls of 25 N as described in 6.5.



#### 4.1.7.3 Overlap between cuffs and protective sleeves

The overlap of the protection provided by the cuff of a glove and a compatible protective sleeve or arm guard shall be at least 50 mm if there is not a continuous circumferential connection between them. The protective sleeve shall be inside the cuff of the glove. Examination shall be made according to Annex A. The protective sleeve shall resist pulls of 25 N as described in 6.5 and shall not be pulled out of the cuff of the glove.

#### 4.1.7.4 Arm guard and protective sleeve sizes

Arm guards and protective sleeves shall be marked with their minimum length, and where appropriate with the range of stature of persons they are designed to fit and the sizes of compatible gloves (see Clause 7 and Clause 8). Products are examined in accordance with 6.8 and Annex A.

### 4.2 Construction

#### 4.2.1 Dimensions of interstices

The maximum dimensions of interstices in rigid parts of the products, or between hard components, or through the structure of a knit, in gloves, arm guards and protective sleeves shall be such that the 4 mm wide gauge number 2 described in ISO 13999-1:1999, 5.5, is unable to pass through them when applied as described in 6.9.

#### 4.2.2 Attachment of arm guards and protective sleeves

Arm guards or protective sleeves that are attached to gloves shall withstand a pull of 150 N directed up the arm if worn outside the cuff of the glove, or 25 N if worn inside the glove, when tested, as described in 5.2 and 6.5. No gap in coverage shall occur during the test. Gaps shall be assessed as specified in 6.4.

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#### 4.2.3 Knife penetration and cut resistance

##### 4.2.3.1 General

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

##### 4.2.3.2 Fabric, leather, plastic or composite gloves, arm guards and protective sleeves

When tested in accordance with 6.6 and the method given in ISO 13999-3 with an impact energy of 0,65 J, the mean penetration shall not exceed 8 mm and no single penetration shall exceed 14 mm.

##### 4.2.3.3 Cut resistance

All gloves, arm guards and protective sleeves shall require a cutting force of more than 20 N when the cut resistance is measured in accordance with 6.7 in all of the prescribed orientations.

### 4.3 Properties of materials

#### 4.3.1 General

The protective gloves, arm guards and protective sleeves shall not be constructed of materials that are known to cause short- or long-term injury. The names and concentrations of all substances contained in the product, which are generally known to cause allergies or cause sensitization (see Clause 8) shall be listed in the

information supplied by the manufacturer. Gloves and arm guards shall not have injurious rough or sharp surfaces or edges or sharp protruding wire ends.

The materials from which they are made shall not lose their protective properties during the normal service life of gloves, arm guards or protective sleeves when cleaned and sterilized according to the manufacturer's instructions.

Products shall be examined in accordance with Annex A.

#### 4.3.2 Cleaning temperature stability

Cleaning temperature stability shall be as specified in ISO 13999-1:1999, 4.5.2 and 6.6.

#### 4.4 Ergonomic requirements

When tested and examined in accordance with Annex A, the glove and arm guard or protective sleeve shall be found satisfactory for the use intended as indicated in the manufacturer's instructions in the information supplied by the manufacturer.

### 5 Test apparatus

**5.1 General test apparatus**, as specified in ISO 13999-1:1999 5.1 to 5.7, if appropriate for the materials used in the construction of the gloves, arm guards or protective sleeves.

**5.2 Test apparatus for assessing the attachment of arm guards and protective sleeves to gloves.**

A hand held electronic force gauge, spring balance or similar device shall be used. Small clamps or clips shall be provided to attach the gauge to the test item. A flexible connection shall be made between the clamp and the gauge. The gauge shall have a range of 0 N to 200 N or two gauges of 0 N to 30 N and 100 N to 200 N shall be provided. The gauges shall be accurate to  $\pm 3$  N at 25 N and to  $\pm 10$  N at 150 N.

**5.3 Impact-cut test apparatus**, as specified in ISO 13999-3.

**5.4 Cut-resistance test apparatus**, meeting the requirements specified in ISO 13997.

### 6 Test methods

#### 6.1 General

For each of the required sequences of measurements performed in accordance with this part of ISO 13999, make an estimate of the uncertainty of the final result. In the test report, record this uncertainty ( $U_m$ ) in the form  $U_m = \pm X$ . It shall be used in determining whether a "Pass" performance has been achieved. For example, if the final result plus  $U_m$  exceeds the required pass level value, the sample shall be considered to have failed.

#### 6.2 Pre-treatment

Wash and dry all test specimens of products five times before examination or testing in accordance with manufacturer's instructions in the information supplied by the manufacturer. In the absence of such details, wash and dry them in accordance with Procedure 2A specified in ISO 6330:2000. Then tumble dry the test specimens at a temperature not exceeding 70 °C (Procedure E). Products marked as additionally suitable for dry cleaning shall be dry-cleaned five times before the washing cycles, as specified for normal materials in ISO 3175-2:1998, 8.1.

### 6.3 Conditioning

Condition test specimens at  $(20 \pm 2) ^\circ\text{C}$  and a relative humidity of  $(65 \pm 5) \%$ , for at least 24 h before testing. Carry out testing in the conditioning environment or within 5 min of withdrawing the specimens from the conditioning environment.

### 6.4 Examination of coverage

Have an appropriate subject put on the test specimens as indicated by the marking and adjusted according to the manufacturer's instructions in the information supplied by the manufacturer. Test the coverage provided for the hand, wrist and forearm by inspection, measurement and the attempted insertion of a non-injurious blunt probe as described in ISO 13999-1:1999, 5.6.

As a general rule, try to get the probe through any apparent opening. Apply the probe to every slit, opening, or overlap found. Apply the probe at an angle of  $0^\circ$  to  $45^\circ$  with respect to the underlying skin, and at any angle between directly up the arm and directly across the arm. Within this envelope of approach angles, move the probe around on any opening or potential opening, with a force of up to 4 N to ascertain whether it can pass through the test item. Record every penetration as a gap in coverage.

Include the findings of the examination and test in the test report.

### 6.5 Strength of attachment of arm guards and protective sleeves to gloves and the resistance to displacement of protective sleeves from within cuffs and on arms

Have an appropriate subject put on the test specimen as indicated by the marking, and adjusted according to the manufacturer's instructions in the information supplied by the manufacturer. Attach the clamp (see 5.2) in turn to four points approximately evenly spaced around the circumference of the arm guard or protective sleeve ( $40 \pm 5$ ) mm above its attachment to the glove or ( $75 \pm 10$ ) mm above the subject's wrist for unattached products. Attach the force gauge or similar device to the clamp in each position and apply the test force progressively over a period of 5 s to 10 s. Direct the force as nearly as possible up the arm parallel to the skin. Observe the movement of the arm guard or protective sleeve and measure the displacement immediately once the required force has been reached. Reposition the arm guard or protective sleeve before each trial.

Record the results of the test in the test report.

### 6.6 Impact cut testing

#### 6.6.1 General

Carry out the impact cut testing as specified in ISO 13999-3.

#### 6.6.2 Samples and test positions

Test gloves intact, if possible. Place the glove on the specimen support so that six impact cuts can be made on the back of the glove. Make two cuts along the long axis of the glove, two cuts at  $90^\circ$  to these, and two at  $45^\circ$  to them. Make impact points at least 15 mm apart and on undamaged material.

If the fingers of the glove are of apparently weaker construction, prepare and subject test-finger samples to impact cuts as specified in ISO 13999-3. Make a total of six impact cuts.

Test arm guards and protective sleeves for each type of construction of protective material present. If necessary, cut them transversely into short tubes to fit them on the apparatus. Make a total of six impact cuts.

Report the individual test results and their arithmetic means, any observations related to the protective quality of the product, and details of any hazardous edges, fragments, or sharp wire ends, that were produced by the knife impact in the test report.