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Protective gloves against mechanical risks

Gants de protection contre les risques mécaniques

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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 of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 13, *Protective clothing*.

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 first edition of ISO 23388 was developed based on the EN 388:2016 including a proposed amendment to EN 388 regarding the cotton canvas (6.2.5). This adoption of EN 388 in to ISO was done at the request of many non-EU countries. At the ISO/TC 94/SC 13 plenary, it was agreed to adopt at ISO the EN 388 without changes but to keep any comments until the next revision date as the document has just been revised at EU level.

Protective gloves against mechanical risks

1 Scope

This document specifies requirements, test methods, marking and information to be supplied for protective gloves against the mechanical risks of abrasion, blade cut, tear, puncture and, if applicable, impact.

This document is intended to be used in conjunction with ISO 21420.

The test methods developed in this document can also be applicable to arm protectors.

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/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO/IEC Guide 98-4, *Uncertainty of measurement — Part 4: Role of measurement uncertainty in conformity assessment*

ISO 1139, *Textiles — Designation of yarns*

ISO 4649:2010, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*

ISO 5084, *Textiles — Determination of thickness of textiles and textile products*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 7211-1, *Textiles — Woven fabrics — Construction — Methods of analysis — Part 1: Methods for the presentation of a weave diagram and plans for drafting, denting and lifting*

ISO 7211-4, *Textiles — Woven fabrics — Construction — Methods of analysis — Part 4: Determination of twist in yarn removed from fabric*

ISO 7211-5, *Textiles — Woven fabrics — Construction — Method of analysis — Part 5: Determination of linear density of yarn removed from fabric*

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

ISO/TR 11827, *Textiles — Composition testing — Identification of fibres*

ISO 12947-1, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 1: Martindale abrasion testing apparatus*

ISO 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method*

ISO 13997:1999, *Protective clothing — Mechanical properties — Determination of resistance to cutting by sharp objects*

ISO 21420, *Protective gloves — General requirements and test methods*

EN 1049-2, *Textiles — Woven fabrics — Construction — Method of analysis — Part 2: Determination of number of threads per unit length*

EN 12127, *Textiles — Fabrics - Determination of mass per unit area using small samples*

EN 13594:2015, *Protective gloves for motorcycle riders — Requirements and test methods*

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
abrasion cycle
completion of all the translational abrasion movements tracing a Lissajous figure comprising 16 rubs, i.e. 16 revolutions of the two outer drives and 15 revolutions of the inner drive of the Martindale abrasion tester

Note 1 to entry: An abrasion rub is one revolution of the outer drives of the Martindale abrasion tester (see ISO 12947-1).

[SOURCE: ISO 12947-1:1998, 3.2]

3.2
arm
part of the body between the wrist and the shoulder

3.3
arm protector
protective sleeve separate from the glove or the clothing that provides protection against at least one of the following mechanical risks: abrasion, blade cut, tear and puncture

3.4
glove made from several layers
glove that is made from two or more layers of materials

3.5
glove made from several un-bonded layers
glove that is made from two or more layers of materials which are not connected together, after preparing the sample for the test

3.6
glove made from several bonded layers
glove that is made from two or more layers of materials which are connected together (e.g. glued, stitched, dipped, impregnated) after preparing the sample for the test

3.7
glove providing a specific protection
glove that is designed to provide an area of improved protection for the whole hand or part of it

Note 1 to entry: For example, palm protection style or protection against impact.

3.8
glove series
single glove style or glove type with the same palm material up to the wrist line where the only variants are size, length, left/right hand and colour

3.9
protective glove against mechanical risks
glove that provides protection against at least one of the following mechanical risks: abrasion, blade cut, tear and puncture

4 Requirements

4.1 General

The protective gloves according to this document shall first meet all the applicable requirements of ISO 21420.

All specimens shall be taken from the palm of different gloves for classification purposes. For arm protectors, specimens shall be taken from the area for which protection is claimed.

A protective glove against mechanical risks shall have performance level of 1 or above for at least one of the properties (abrasion, blade cut, tear and puncture) Table 1 or at least level A of the cut test of ISO 13997:1999 (e.g. TDM) in Table 2.

Gloves meeting the requirements for resistance to puncture may not be suitable for protection against sharply pointed objects such as hypodermic needles.

Table 1 — Levels of performance

Test	Level 1	Level 2	Level 3	Level 4	Level 5
6.1 Abrasion resistance (number of rubs)	100	500	2 000	8 000	—
6.2 Coupe test: Blade cut resistance (index)	1,2	2,5	5,0	10,0	20,0
6.4 Tear resistance (N)	10	25	50	75	—
6.5 Puncture resistance (N)	20	60	100	150	—

Table 2 — Levels of performance for materials tested with ISO 13997

	Level A	Level B	Level C	Level D	Level E	Level F
6.3 Cut resistance (N) (ISO 13997)	2	5	10	15	22	30

NOTE 2 There is no correlation between the levels of performance obtained with the 6.2 and 6.3 test methods.

NOTE 3 Uncertainty of measurement, see Annex B.

If relevant, additional areas of the protective glove shall be tested (e.g. for gloves providing specific protection or for areas which provide lower protection) and the results shall be reported in the user instructions.

4.2 Additional protection (Optional)

4.2.1 General

A glove, whether made of a single layer or made from several layers (bonded or unbonded), providing a specific protection can be claimed when the gloves conform to the requirements defined in the following clause(s).

4.2.2 Impact protection

Each area where impact protection is claimed shall be tested. Due to the test method (test specimens dimensions), protection against impacts on fingers cannot be tested.

A protective glove against mechanical risks can be designed and constructed to provide specific impact attenuation (for example, impact protection of knuckles, back of the hand, palm,). These gloves shall be in accordance with the following requirement.

When the tests were carried out according to 6.6, performance shall conform to Level 1 of EN 13594:2015, Table 7.

5 Sampling and conditioning

5.1 Conditioning of samples and all other test consumables (e.g. abrasive paper, EPDM, cotton canvas) is as follows:

— temperature (23 ± 2) °C;

— relative humidity (50 ± 5) %.

The period of conditioning is at least 24 h. Tests shall preferably be performed in the above mentioned environment.

5.2 If the test is performed in a different environment and if the testing duration does not exceed 15 min, it shall be started within 5 min after removal from the conditioning.

5.3 If special applications require testing in a different environment, it is the responsibility of the manufacturer or his authorized representative to arrange for additional tests and to present the results including a full description of the testing environment in the information supplied by the manufacturer (Clause 8).

6 Test methods

6.1 Abrasion resistance

6.1.1 Principle

Circular specimens of material are abraded under known pressure with a cyclic planar motion in the form of a Lissajous figure (abrasion cycle) which is the result of the simple harmonic motions at right angles to each other. The resistance to abrasion is measured by the number of rubs required for breakthrough to occur.

6.1.2 Consumables

6.1.2.1 Abradant

An abradant shall meet the requirements as laid down in Annex A.

NOTE 1 A suitable abradant has been tested by the standardization group, the Klingspor PL31B, Grit 180[1)] (see Annex A).

1) Klingspor PL31B, Grit 180 is the trade name of a product supplied by KLINGSPOR Schleifsysteme GmbH & Co. KG, Hüttenstraße 36, D-35708 Haiger. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products can be used if they can be shown to lead to the same results.

NOTE 2 At the present time, only one calibration procedure is available using textile reference material. A more robust calibration method for other reference material is still under construction.

6.1.2.2 Double-sided adhesive tape

The double sided adhesive tape shall be used to provide adhesion of the sample during the test to achieve reproducible results. The mean adhesion value shall be of minimum 0,20 N/mm.

Tests shall be carried out according to the method given in Annex C.

NOTE 1 If the adhesion is not sufficient, the sample will move during the test and in this case a tear phenomenon can be observed rather than abrasion.

NOTE 2 Examples of suitable double sided adhesive tapes are provided in C.5. Alternative tapes can be verified for suitability using the test method defined in Annex C.

6.1.3 Apparatus

An abrasion machine of the type described in ISO 12947-1 as a Martindale Wear and Abrasion is required. It shall fulfil the following requirement:

Pressure on specimen: (9,0 ± 0,2) kPa.

6.1.4 Test specimens

Four test specimens shall be taken from four individual gloves of the same glove series. In case of an irregular design of the palm, the test specimen shall be taken in the area where the least protection is expected (remove the reinforcements that do not cover the whole palm).

Where the test specimen is made of several unbounded layers (e.g. glove made from several un-bonded layers), the test is performed on each layer. When the specimen is made of bonded layers (e.g. glove made from several bonded layers), if the layers can be separated without damaging the material, the test shall be performed on each layer independently. Otherwise, the test shall be performed on all layers, taking care not to have a seam in the test area.

6.1.5 Test procedure

6.1.5.1 Setting up the machine

6.1.5.1.1 Mounting test specimens

Cut four test specimens to the correct dimensions, diameter (38,0 ± 0,5) mm. Secure the test specimen without tension carefully and centrally on the metal insert by means of double-sided adhesive tape under a weight of approximately 10 kg applied for at least 5 min. Good adhesion can be achieved through the use of double-sided tape which prevents loosening of the test specimen and the inclusion of air bubbles. Place the ring of the specimen holder in position on the mounting plate provided on the base of the machine.

In order to test the materials that are thicker than the standard ring (for example leather with a thickness greater than 1,2 mm), the diameter of the opening of the clamping ring should be increased (see Figure 1).

Dimensions in millimetres

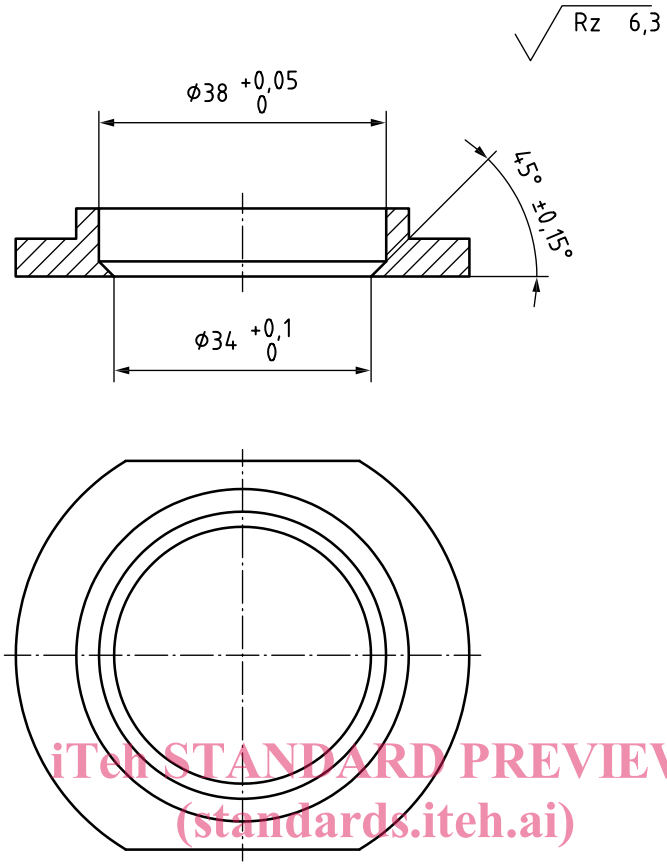

Figure 1 — Alternative clamping ring for thick material

Some materials might need a longer contact time to ensure maximum adhesion between the test specimen and the adhesive tape. Surface treatment (e.g. removal of fluff) can be used in order to improve adhesion between the test specimen and the adhesive tape, provided this treatment will not affect the performance of the material during the test. If a different contact time (>5 min) and/or if a surface treatment is used, this should be reported.

While ensuring that the ring containing the specimen and metal insert is held firmly in the mounting plate, start to screw the top of the specimen holder on to the ring, taking care that the screw threads are not crossed. Having started the screwing down operation, use both hands to maintain a continuous downwards pressure on the assembly against the mounting plate.

This procedure will normally ensure that the specimen is securely retained in the holder in a wrinkle-free condition and that it is ready for testing.

NOTE It is important to use a sufficiently effective double-sided adhesive tape which prevents the movement of the test specimen during the duration of the test (appropriate double-side adhesive tapes can for example be found in the building and construction industry). This information is given for the convenience of users in Annex C.

6.1.5.1.2 Mounting abradant

Secure carefully the abradant (6.1.2.1) by means of double-sided adhesive tape covering the whole surface of the mounting plate. Ensure the abradant is flat by placing the weight supplied with the testing machine for this purpose on its surface, and if a retaining frame is used, then position and tighten it up evenly using diagonally opposite screws in sequence. Make sure that the abradant is held in place firmly and that there are no tucks or ridges.