INTERNATIONAL STANDARD

ISO 13999-3

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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

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

Partie 3: Essai de coupure par impact pour étoffes, cuir et autres matériaux

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 3.

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 part of ISO 13999 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 13999-3 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*. It is based on EN 1082-3:2000.

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*

Annex A of this part of ISO 13999 is for information only.

Introduction

This test is based on the impact penetration test given in ISO 13998. It differs in that the blade-holding block and blade weigh 110 g rather than 1 000 g. The test specimen support is also changed to suit the testing of fabric, leather and other materials. The test is designed particularly to assess the stab resistance of materials for gloves and arm guards. The test is also suitable for assessing gloves exposed to severe abrasion and cutting threats such as motorcyclists' gloves, working gloves for handling concrete blocks or razor wire, or protective leggings and trousers for refuse collectors. Severe abrasion is a process involving multiple cuts and this test is a good indicator of abrasion resistance of the whole thickness of a material or sequence of materials.

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 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.

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

1 Scope

This part of ISO 13999 specifies an impact cut test for use on fabric, leather and other materials used in protective clothing, gloves and arm guards.

Annex A of this part of ISO 13999 gives recommendations for the specification of impact cut tests on materials and products such as gloves and arm guards and gives the list of information which should be specified in the product standard in order to be able to apply this test.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 13999. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 13999 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

EN 388:1994, *Protective gloves against mechanical risks*

3 Terms and definitions

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

4 Principle

This test assesses the resistance of fabric, leather and other materials used in protective clothing, gloves and arm guards to cutting by a sharp, straight knife-edge. The test specimen is tested by impact of a standard knife blade held in a guided falling block. The length of the cut produced by the particular impact energy is proportional to the depth of penetration of the knife, which is easily measured.

5 Test apparatus

An example of the design of a test apparatus is shown in Figure 1. No specific design of the stand is required. Design details such as the means of allowing removal of the block and test blade after impact, and necessary safety guards are not shown.

5.1 Blade-holding block, as shown in Figure 2, for holding the test blade so that it protrudes by (55 ± 5) mm.

The position of the blade tip shall be offset by the distance l_4 which is (8 ± 1) mm from the centreline of the block which shall pass through the centre of gravity of the block. The centre of gravity of the block and blade shall be (100 ± 10) mm above the blade tip level. The mass of the block with test blade shall be (110 ± 5) g.

The block shall be held in its initial position by an electromagnet. The block shall have four sliders made of polytetrafluoroethylene or similar material which guide its drop down the guide rods. There shall be 0,5 mm to 1,5 mm clearance between the sliders and the guide rods. The heights from which the block is released shall be set so that the appropriate energy of impact is achieved.

5.2 Test blade, of which the edge shall be straight and sharp, made of cold-forged stainless steel (hardness > 45 HRC) and having the profile and dimensions as shown in Figure 3.

After machine grinding, the blade edge should be made smooth and sharp by hand finishing on an oilstone. Blades may be re-sharpened after use. When fabrics and leathers are tested re-sharpening is not required after every test. However, before every penetration, test the blade to ensure that it is both straight and sharp. Sharpen the test blade if the results for the calibration material reveal the need for the blade to be re-sharpened.

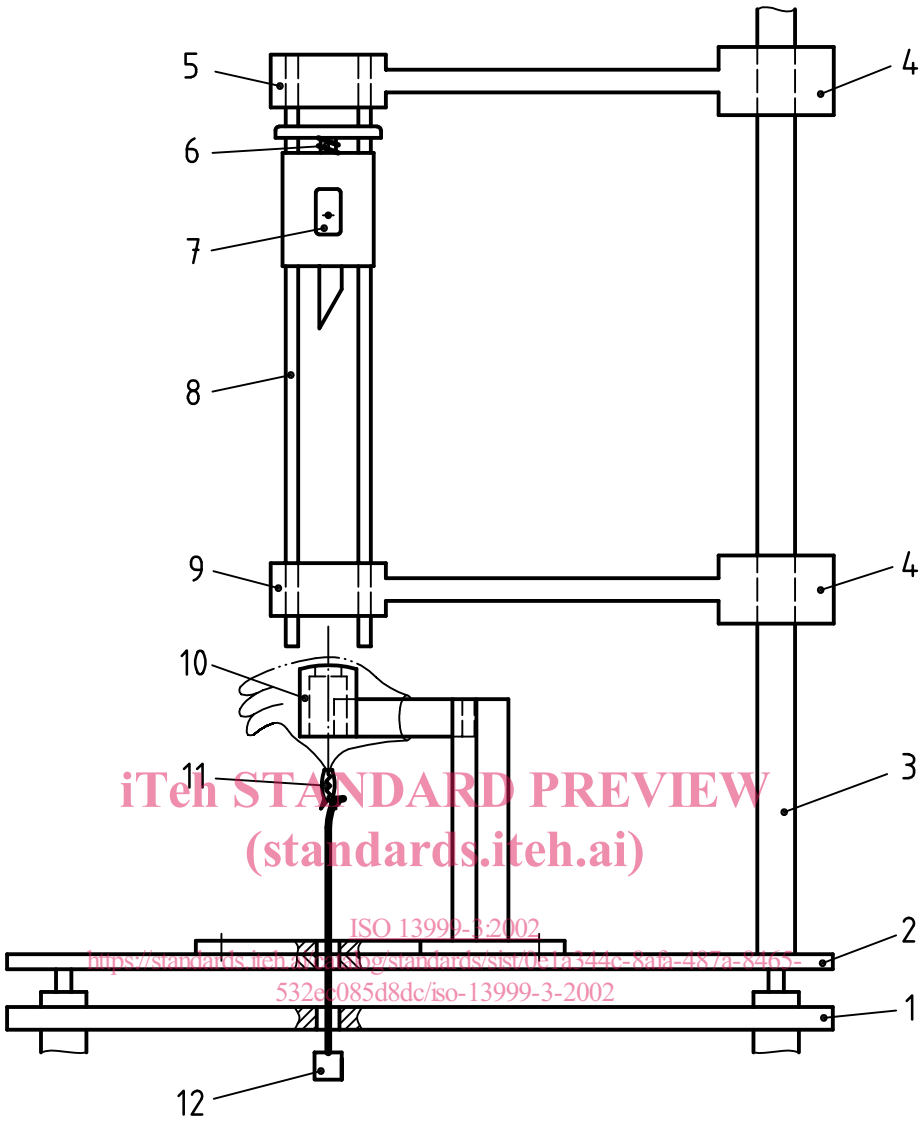
5.3 Test specimen support, as shown in Figure 4.

The material test specimen or glove is supported on a horizontal arm which ends in a circular anvil with a hole in which the knife enters during the test (see Figure 5). It has been found convenient to make the support from mild steel.

The circular metal anvil shall be (50 ± 3) mm in diameter and have a vertical height of approximately 60 mm. The top surface shall be machined to be domed with a radius of curvature of (200 ± 5) mm. The anvil shall have a slot cut in its centre. The slot shall be (3,5 ± 0,05) mm wide and (23 ± 0,2) mm long. The ends shall be semi-circular. The slot shall be vertical and pass through the anvil. The anvil may be machined out from below so that the centre of the anvil is not less than 7 mm thick.

The anvil shall be attached to a horizontal arm such that the axis of the arm is at (45 ± 5)° to the long axis of the slot. The arm shall be attached to the anvil so that its top surface is (30 ± 2) mm below the centre of the top of the anvil. The arm shall be (15 ± 2) mm wide and (35 ± 5) mm deep. The arm shall be attached to a rigid support such that there is at least 180 mm clearance below it and the arm has an unobstructed length of at least 150 mm.

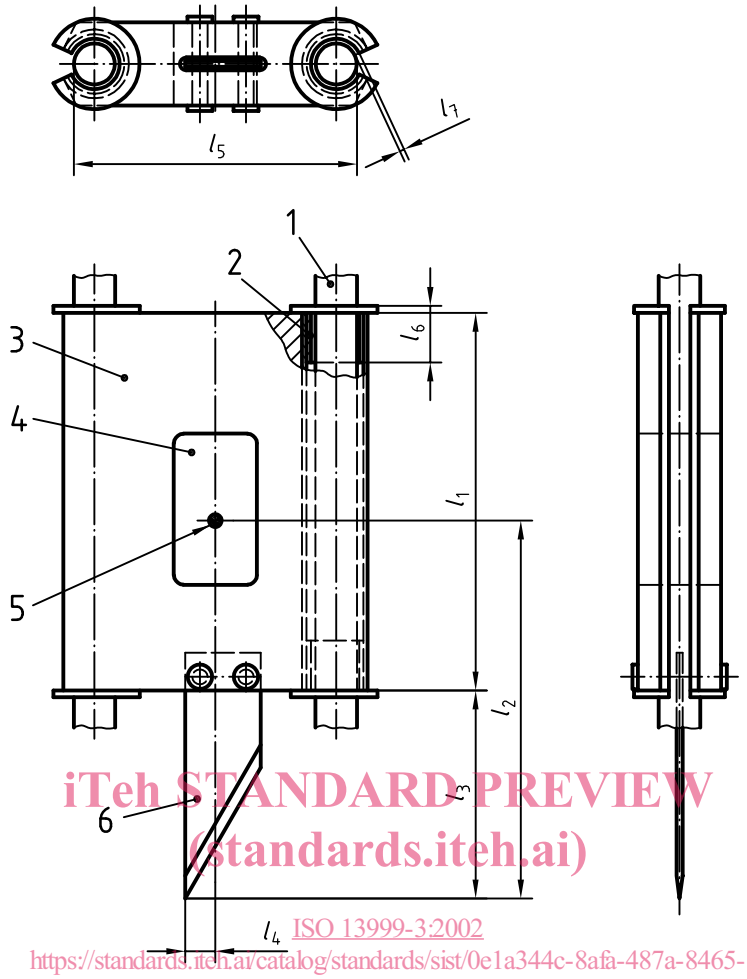
The test specimen support shall be firmly attached to the base plate of the apparatus which shall be provided with a hole at least 50 mm wide directly under the anvil so that a weight piece suspended on a string can be clipped to the lower side of the test specimen on the support.



Key

1 Table
2 Base plate
3 Support
4 Bracket
5 Fixing block for the upper end of the guide rods
6 Electromagnetic release mechanism
7 Falling block and test blade
8 Guide rods
9 Fixing block for the lower end of the guide rods (the falling block passes through it)
10 Test specimen support
11 Clip
12 Weight piece

Figure 1 — Example of an impact cut penetration testing apparatus

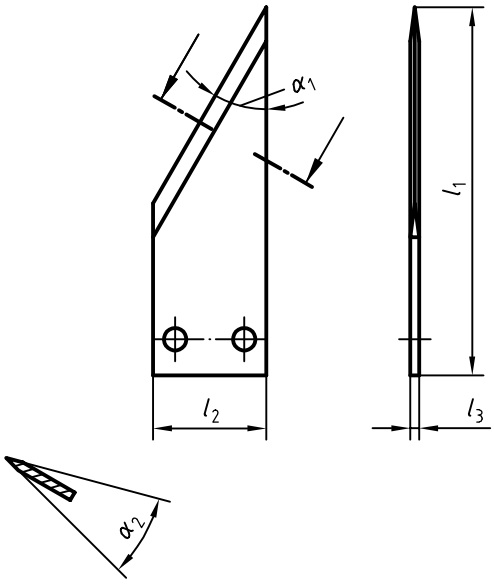


Key

1	Guide rods	l_1	= (100 ± 1) mm
2	Plastic slider	l_2	= (100 ± 10) mm
3	Block	l_3	= (55 ± 5) mm
4	Cut out space to achieve correct mass distribution	l_4	= (8 ± 1) mm
5	Centre of gravity for block and test blade	l_5	= (75 ± 1) mm
6	Test blade	l_6	= (15 ± 1) mm
		l_7	Clearance, 0,5 mm < l_7 < 1,5 mm

The mass of the block and test blade are equal to (110 ± 5) g

Figure 2 — Blade-holding block



Key

α_1 Angle of the sharp edge to the back of the blade, $\alpha_1 = (30 \pm 1)°$

α_2 The included angle of the sharp edge, $\alpha_2 = (30 \pm 3)°$

l_1 Length of the blade, $l_1 \geqslant 65$ mm

l_2 Width of the blade, $l_2 = (20 \pm 0{,}5)$ mm

l_3 Thickness of the blade, $l_3 = (1{,}5 \pm 0{,}05)$ mm

Figure 3 — Test blade