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Protective clothing — Body armour —

Part 2:

Bullet resistance — Requirements and test methods

*Vêtements de protection — Protection corporelle —
Partie 2: Résistance aux projectiles — Exigences et méthodes d'essai*
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This final draft International Standard is a draft European Standard developed within the European Committee for Standardization (CEN) in accordance with subclause 5.2 of the Vienna Agreement. Following parallel ISO member body voting and CEN enquiry on the DIS, this final draft, established on the basis of comments received, has been transmitted by CEN to ISO for circulation for a parallel two-month FDIS vote in ISO and formal vote in CEN.

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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 14876 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14876-2 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

ISO 14876 consists of the following parts, under the general title *Protective clothing — Body armour*:

- *Part 1: General requirements*
- *Part 2: Bullet resistance — Requirements and test methods*
- *Part 3: Knife stab resistance — Requirements and test methods*
- *Part 4: Needle and spike stab resistance — Requirements and test methods*

Annex A forms a normative part of this part of ISO 14876. Annexes B and ZA are for information only.

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Foreword

This document (prEN ISO 14876-2:2002) 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, in collaboration with Technical Committee ISO/TC 94 "Personal safety - Protective clothing and equipment".

This document is currently submitted to the parallel Formal Vote.

This document 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 document.

Annex A is normative.

Annex B is informative.

This standard consists of the following Parts:

- | | |
|------------------|--|
| prEN ISO 14876-1 | <i>Protective clothing — Body armour — Part 1: General requirements (ISO/FDIS 14876-1:2001).</i> |
| prEN ISO 14876-2 | <i>Protective clothing — Body armour — Part 2: Bullet resistance — Requirements and test methods (ISO/FDIS 14876-2:2001).</i> |
| prEN ISO 14876-3 | <i>Protective clothing — Body armour — Part 3: Knife stab resistance — Requirements and test methods (ISO/FDIS 14876-3:2001).</i> |
| prEN ISO 14876-4 | <i>Protective clothing — Body armour — Part 4: Needle and spike stab resistance — Requirements and test methods (ISO/DIS 14876-4:2001)</i> |

Introduction

In this part of Standard prEN ISO 14876 testing of the performance of body armour against ballistic threats is described. Five levels of performance against projectiles from rifled barrels have been specified and one level of performance against shotgun slugs. These six levels have been recognised as distinct by manufacturers and users. They represent the significantly different threats from handgun bullets, through shot gun slugs to armour piercing rifle bullets. The threats are normally differently associated with different working situations. The weight, bulk, discomfort and ergonomic cost of wearing body armour meeting the different performance levels usually increases with increasing ballistic performance. To minimise these problems for users multiple performance levels are specified.

Normally a body armour meeting the requirements of one performance level will defeat all ammunition specified in the lower performance levels. However shotgun slug protection is provided by different designs so is a separate independent characteristic of body armour.

Compliance with this part of the Standard prEN ISO 14876 does not imply that the body armour provides protection from knife stabs, or stabs by needles or spikes. Testing according to Parts 3 and 4 of this Standard is necessary to provide this information.

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1 Scope

Part 2 of this of European Standard specifies the performance requirements and test methods for determining the resistance of body armour to impacts by bullets from rifled weapons and to impacts by slugs from shotguns in repetitive single shot testing.

2 Normative references

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 (including amendments).

prEN ISO 14876-1:2001, *Protective clothing — Body armour — Part 1: General requirements (ISO/FDIS 14876-1:2001)*.

EN ISO 13995, *Protective clothing — Mechanical properties — Test method for the determination of the resistance to puncture and dynamic tearing of materials (ISO 13995:2000)*.

3 Terms and definitions

For the purposes of this European Standard the terms and definitions given in prEN ISO 14876-1 apply.

4 Requirements

ISO/FDIS 14876-2
<https://standards.iteh.ai/catalog/standards/sist/20ac8fef-6dd6-464c-a6af-a1bd94c225a3/iso-fdis-14876-2>

4.1 General

Bullet resistant body armour shall meet the general requirements and requirements for labelling and the provisions of information given in Part 1 of this standard.

4.2 Penetration resistance and indentation depth

When tested according to the procedures in clause 6 with the ammunition types in accordance with annex A for a particular performance level, no penetration of the body armour as defined in Part 1 of this standard, shall occur for any accepted shot within an accepted sequence. The indentation depth as defined in Part 1 of this standard, shall not exceed 44 mm for any accepted shots except for those on the breast cups on body armour for female users, for which no measurement of the indentation depth is required to be made.

4.3 Additional cartridges

Additional ammunition may also be specified by agreement between the supplier of the body armour and the Test House. The body armour shall meet the ballistic requirements with this ammunition.

4.4 Wet performance

If a wet test is required the body armour shall meet the penetration and indentation requirements after wet conditioning and testing as described in 6.5.

5 Apparatus

5.1 General

Measuring instruments unless otherwise specified shall have an error limit of $\pm 2\%$ of the pass/fail level of the characteristic being measured.

For each of the required sequences of measurements performed in accordance with this standard a corresponding estimate of the uncertainty of the final result shall be determined. This uncertainty (U_m) shall be given in the test report in the form $U_m = \pm X$. It shall be used in determining whether a "Pass" performance has been achieved. If the final result minus U_m is below the pass level when the requirement that a certain value shall be exceeded, the sample shall be deemed to have failed.

5.2 Test facility

This Standard does not specify the details of the construction and management of the test facility. The test facility shall provide the conditions to meet the requirements of the testing given in the clauses that follow. Appropriate weapons, mounting systems, and sighting systems shall be provided to fire the specified cartridges and obtain projectiles of the required velocity.

The yaw of bullets shortly before impact shall be measurable within a limit deviation of $\pm 0,5^\circ$.

5.3 Test weapons

The rifling of barrels for firing level 1 to level 5 projectiles shall be such as to ensure bullet stability at the point of impact. The recommended maximum twist lengths to be used with particular cartridges are given in informative annex B. The maximum yaw of level 1 to level 5 projectiles shall not exceed 3° from their line of flight at the point of impact. The yaw shall be measured at least as frequently as for every production batch of cartridges used and after any weapon modification.

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5.4 Range length

The distance from the muzzles of weapons firing level 1, 2 and 3 projectiles and shotgun slugs to the strike face of the test specimen shall normally be $(10 \pm 0,5)$ m, and for weapons firing level 4 and 5 projectiles it shall normally be $(25 \pm 0,5)$ m.

Shorter ranges down to 5 m for weapons firing level 1, 2 and 3 projectiles and shotgun slugs, and down to 15 m for weapons firing level 4 and 5 projectiles may be used. However at such ranges the yaw of every projectile shall be measured by a system such as a high speed video camera and image analyser meeting the requirement in 5.2. Only shots meeting the requirement in 5.3 shall be **accepted**.

5.5 Velocity measurement system

The velocity of projectiles shall be measured at less than 2 m from the strike face of the test specimen. The system shall have a limit deviation of $\pm 0,5\%$ of the specified velocity of the projectile. Care shall be exercised to ensure ballistic debris does not cause false readings to be obtained.

5.6 Test specimen support - boxes

Test specimens shall be supported on backing material in rigid framed boxes or trays that are open to the back face of the test specimens and closed on the reverse (see Figure 1). The boxes shall be between 100 mm and 150 mm deep. Boxes shall be available of sizes and shapes that allow the test specimens to be mounted on them with full back face contact in a configuration approximately equivalent to that adopted when the body armour is worn.

The boxes shall be rigidly mounted so that they do not move more than 10 mm when the test specimen is struck by a projectile.

5.7 Test specimen support - frame

The backing material boxes shall be contained within a framework or mannequin that permits the test specimen of body armour to be mounted and retained in position by its own means of attachment and adjustable closures, if this is possible.

Straps shall also be provided to enable the back face of the test specimen to be held in full contact with the backing material if the retention system of the body armour does not achieve this. Straps shall be made of elastic fabric.

5.8 Backing material

Backing material shall be a stiff, oil and mineral powder modelling clay¹⁾. This material can be obtained from any source providing that it is prepared and conditioned to meet the requirements of this standard. The material shall be of even consistency and as far as possible free of air pockets. The consistency may be altered by addition of oil or talc and thorough mechanical mixing. Final control of the consistency of the material shall be by conditioning at an appropriate temperature.

Backing material shall be replaced either after 1 000 impacts, or as soon as it becomes contaminated, or within two years of first use, depending on which is the shortest period.

5.9 Backing material properties

5.9.1 Requirements

The depths of the depressions made by steel ball impacts when the backing material is tested according to the procedure in 5.9.2 shall be (20 ± 2) mm.

The backing material shall meet this indentation requirement during ballistic and stab testing. It shall be tested with three ball drops before commencing testing in any working shift, and shall be re-tested at least as frequently as after all the test sequences with a particular projectile type in ballistic testing, and at the end of stab testing at a particular performance level on a body armour sample, and at the end of the working shift.

If the backing material does not meet the indentation requirements on re-testing, all results from impacts following the last conforming steel ball drop tests shall be rejected.

¹⁾ Modelling clay of the type envisaged is supplied under the following name by the following manufacturer:

"Roma Plastilina No. 1."

Aspen International Ltd
 Unit 11, Apple Industrial Estate
 Whittle Avenue
 Segensworth West
 Fareham
 Hampshire
 UK
 Tel: +44 1489 573888

This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN of the product named. Equivalent products may be used if they can be shown to lead to the same results in indentation and ballistic testing.

5.9.2 Test procedure

The backing material shall be packed into test specimen support boxes so that they are completely filled level with their edges. Air pockets shall be minimised. The boxes shall be kept in a temperature-controlled environment, $\pm 1^\circ\text{C}$, for at least 24 h.

A test specimen box shall be placed on a rigid base such as a concrete floor. A dropping mechanism supporting a steel ball ($63,5 \pm 0,05$) mm in diameter, and weighing ($1\,043 \pm 5$) g shall be provided²⁾. The lower surface of the ball shall be adjusted to be ($2\,000 \pm 5$) mm above the surface of the backing material. The flat surface or the tangential plane to the surface of the backing material at the point of impact of the ball shall be horizontal to an accuracy of ± 50 mm in 1 000 mm. The ball shall be dropped onto the backing material three times. The centres of the points of impact shall be more than 60 mm from any edge of the box and more than 90 mm from any other centre of a point of impact. The depth of the centre of each depression relative to undisturbed backing material or the edge of the box, shall be measured to an accuracy of $\pm 0,5$ mm.

The backing material is acceptable for use at the conditioning temperature that was used $\pm 1^\circ\text{C}$, if the depths of each depression were (20 ± 2) mm. If this result was not obtained the backing material should be re-conditioned at a different temperature, or re-mixed with more oil or talc and re-tested, or discarded.

6 Test procedures

6.1 Marking of test areas and conditioning

Part 1 of this standard should be consulted and shall be followed for the preliminary examination of body armour for performance testing.

Body armour samples examined according to 6.4.4, 6.4.5 and 6.5 of prEN ISO 14876-1:2001 shall be marked on their strike faces with lines to show the areas with different compositions or constructions, and with indications of where specific weak constructions may be present.

Body armour samples shall be marked as described in 6.5 of prEN ISO 14876-1:2001 with lines on the strike face denoting the edges of the minimum areas of the zones of protection as defined in 5.4 and 5.5 of Part 1 of this Standard. The lines are illustrated in the sketch in Figure 2. Note that in armour of types B, C and D the zone of protection is all round the torso and includes any overlaps or closures. Similarly, types C and D have a zone of protection that runs continuously over the shoulder.

Test specimens of body armour shall be prepared with appropriate test area lines marked inside the zone of protection lines. Lines should be placed to match the testing that will be done. For all tests except those for level 1, 2 and 3 tests using 60° angled shots, a line (50 ± 5) mm inside the zone of protection line shall denote the perimeter of the test area. For level 1, 2 and 3 tests using 60° angled shots the test area line shall be drawn (200 ± 10) mm from the zone of protection line furthest from the muzzle and (50 ± 5) mm from all other zone of protection lines

Test specimens containing armour plate modular inserts, (type G) shall be marked with a line (50 ± 5) mm inside the zone of protection line of the insert plate. This marking may be on the cover of the type A, B, C or D armour containing the plate.

Test specimens shall be conditioned at (20 ± 2) $^\circ\text{C}$ and a relative humidity of (65 ± 5) % for at least 24 h before impact testing.

²⁾ Sphere RB-63 is the trade-name of a product supplied by SKF-Kugellager-Fabriken GmbH, D-70336 Stuttgart, which meets the requirements of this standard. This information is given for the convenience of users of this European standard and does not constitute an endorsement by CEN of the product named. Equivalent products may be used if they can be shown to lead to the same result.