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Mountaineering equipment — Helmets for mountaineers — Safety requirements and test methods

National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

This document (EN 12492:2012) has been prepared by Technical Committee CEN/TC 158 “Head protection”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by August 2012, and conflicting national standards shall be withdrawn at the latest by August 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12492:2000.

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 B provides details of significant technical changes between this European Standard and the previous edition.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The protection given by a helmet depends on the circumstances of the accident and wearing a helmet cannot always prevent death or long term disability.

A proportion of the energy of an impact is absorbed by the helmet, thereby reducing the force of the blow sustained by the head. The structure of the helmet may be damaged in absorbing this energy and any helmet that sustains a severe blow needs to be replaced even if damage is not apparent.

Mountaineers' helmets are fitted with a retention system to retain the helmet on the head. However, there may be a foreseeable risk that helmets could become trapped and thereby cause a risk of strangulation.

1 Scope

This European Standard specifies safety requirements and test methods for safety helmets for use in mountaineering.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 960:2006, *Headforms for use in the testing of protective helmets*

ISO 6487, *Road vehicles — Measurement techniques in impact tests — Instrumentation*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
helmet for mountaineers (hereafter referred to as helmet)
headwear primarily intended to protect the upper part of a wearer's head against hazards which might occur during activities carried out by mountaineers

3.2
shell
hard, smoothly finished material that provides the general outer form of the helmet

3.3
helmet type
helmet which is characterized by:

a) the tradename or mark;

b) the materials and dimensions of the shell;

c) the materials and dimensions of the protective padding;

d) the materials and dimensions of the retention system

3.4
protective padding
material which is used to absorb impact energy

3.5
comfort padding
liner material provided for the wearer's comfort

3.6
sizing padding
liner material used for adjustment of the helmet size

3.7
retention system
complete assembly by means of which the helmet is maintained in position on the head, including any devices for adjustment of the system or to enhance the wearer's comfort

3.8
chin strap
part of the retention system consisting of a strap which passes under the wearer's jaw to retain the helmet in position

3.9
headform
shape replacing the head which is used for testing certain characteristics

Note 1 to entry: The headform is designed in accordance with EN 960:2006.

4 Requirements

4.1 Construction requirements

4.1.1 Materials

For those parts of the helmet that come into contact with the skin, materials which are known to be likely to cause skin irritation or any adverse effect on health shall not be used. For a material not in general use, advice as to its suitability shall be sought before its introduction.

4.1.2 Projections

There shall be no sharp edges, roughness or projection on any part of the helmet which is in contact or potential contact with the wearer when the helmet is worn, such as is likely to cause injury to the wearer.

4.1.3 Retention system

The helmet shall be fitted with a retention system, including a chin strap. The retention system shall have at least three separate points of attachment to the shell. The chin strap shall be adjustable in length. That part of the chin strap which comes into contact with the jaw shall have a minimum width of 15 mm under a load of 250 N.

4.1.4 Ventilation

All helmets shall be ventilated.

The sum of the cross-sectional areas of such ventilation shall not be less than 4 cm^2 when measured on the surface of the helmet.

4.2 Performance requirements

4.2.1 Shock absorption

4.2.1.1 Vertical energy absorption capacity

When a helmet is tested by the method described in 5.5, the force transmitted to the headform shall not exceed 10 kN, for a drop height of (2 000 ± 10) mm of the hemispherical striker described in 5.5.3.4.

4.2.1.2 Front energy absorption capacity

When a helmet is tested by the method described in 5.5, the force transmitted to the headform shall not exceed 10 kN, for a drop height of (500 ± 10) mm of the flat striker described in 5.5.3.4.

4.2.1.3 Side energy absorption capacity

When a helmet is tested by the method described in 5.5, the force transmitted to the headform shall not exceed 10 kN, for a drop height of (500 ± 10) mm of the flat striker described in 5.5.3.4.

4.2.1.4 Rear energy absorption capacity

When a helmet is tested by the method described in 5.5, the force transmitted to the headform shall not exceed 10 kN, for a drop height of (500 ± 10) mm of the flat striker described in 5.5.3.4.

4.2.2 Penetration

When a helmet is tested on two points of impact, apart from each other as at least 50 mm, by the method described in 5.6, there shall be no contact between the striker and the headform, for a drop height of (1 000 ± 5) mm of the conical striker described in 5.6.3.4.

4.2.3 Retention system strength

When a helmet is tested by the method described in 5.7, the maximum elongation of the whole system shall not exceed 25 mm.

4.2.4 Retention system effectiveness (roll off)

When a helmet is tested by the method described in 5.8, for the front way and rear way tests, the helmet shall not come off the headform.

5 Test methods

5.1 Sampling

For every type of helmet, helmet samples shall be submitted for testing in the condition in which they are offered for sale, including any requisite holes in the shell and any means of attachment for accessories specified by the manufacturer.

No helmet that has been subjected to testing shall be offered for sale.

For every type of helmet, 11 helmet samples are required for the tests (see Table 1):

— 6 of the smallest size of the range of the helmet type; and

— 5 of the largest size of the range of the helmet type.

5.2 Helmet adjustment

Before any testing on a headform, the helmet shall be adjusted to the headform size and positioned in accordance with the manufacturer's instructions.

The smallest headform is the smallest size, in accordance with 5.4, which is within the size range specified by the manufacturer for the particular size and type of helmet.

The largest headform is the largest size, in accordance with 5.4, which is within the size range specified by the manufacturer for the particular size and type of helmet.

5.3 Conditioning

5.3.1 General

Before any testing the helmet shall be conditioned in accordance with the conditioning defined in Table 1 and the relevant specifications defined in 5.3.2 to 5.3.4.

Table 1 — Conditioning of test samples and size of test headforms

	Stabilizing procedure	UV ageing	Thermal plus +35 °C	Thermal minus -20 °C	Ambient +20 °C	Helmet N°
Top impact	Yes	Smallest	Largest	Largest		1-2-3
Front impact	Yes	Size and conditioning to be chosen by the laboratory				4
Side impact	Yes	Size and conditioning to be chosen by the laboratory				5
Back impact	Yes	Size and conditioning to be chosen by the laboratory				6
Penetration	Yes	Largest	Smallest	Smallest		7-8-9
Retention strength	Yes	--	--	--	Smallest	10
Roll off front and back	Yes	--	--	--	Smallest	11

5.3.2 U.V. ageing

5.3.2.1 Apparatus

A high pressure xenon 450 Watt lamp with quartz casing, operated in accordance with the lamp manufacturer's instructions.

A means to support the helmet so that it is exposed to the radiation.

5.3.2.2 Procedure

Secure the helmet so that the vertical axis through the crown of the helmet (as worn) is perpendicular to the axis of the lamp and the distance between the crown of the helmet and the axis of the lamp is (150 ± 5) mm.

Expose the helmet to the radiation for (400 ± 4) h. It shall then be removed and allowed to return to laboratory ambient conditions.

NOTE The method described in Annex A may be used as an alternative.

5.3.3 'Thermal plus' conditioning

The helmet shall be exposed to a temperature of (35 ± 2) °C for between 4 h and 24 h.

5.3.4 'Thermal minus' conditioning

The helmet shall be exposed to a temperature of (-20 ± 2) °C for between 4 h and 24 h.

5.4 Headforms

The head forms used shall comply with EN 960:2006. The sizes in Table 2 shall be used, except for determination of shock absorbing capacity, for which only size designations 495, 535, 575, 605 and 625 shall be used.

NOTE Table 2 gives the EN 960:1994 equivalent letter codes to the EN 960:2006 size designations for headforms with similar nominal dimensions. These are as given in EN 960:2006, Annex C. The EN 960:2006 size designation approximates to the circumference of the headform at the reference plane, in mm.

Table 2 — Sizes of headforms

Size designation (circumference of headform at reference plane, mm)	Code letter (EN 960:1994)
495	A
515	C
535	E
555	G
575	J
585	K
605	M
625	O

5.5 Shock absorption

5.5.1 Impact points

The four impact points are shown in Figure 1.

5.5.2 Principle

A specified striker is allowed to fall with specified energy on to a helmet which is fitted to a rigidly mounted headform. The transmitted force is measured by means of a force transducer located beneath the headform.

5.5.3 Apparatus

5.5.3.1 General

The apparatus shall include:

— a base;

— a test headform;

— a striker;

— a guidance system;

— a means to measure impact speed;

— instrumentation to record and analyse the data.

5.5.3.2 Base

The base shall be solid, made of steel or a combination of steel and concrete and have a mass of no less than 500 kg. At least the uppermost 25 mm consist of steel, which shall be firmly attached to the concrete if present. No part of the base and headform mounting assembly shall have a resonant frequency liable to affect the measurements.

NOTE See 5.5.3.7 regarding frequency response.

5.5.3.3 Test headforms

The headforms shall be in accordance with 5.4.

The headform shall be positioned so that the impact axis coincides with those of the force transducer and striker.

5.5.3.4 Striker

The striker shall be made of steel and have a mass of (5 ± 0,05) kg.

The flat striker shall have a flat striking face of diameter (130 ± 3) mm, with the edge of its circumference radiused to nominally 2 mm.

The hemispherical striker shall have a hemispherical striking face of radius (50 ± 1) mm.

5.5.3.5 Guidance system

Means shall be provided for the striker to be dropped in free or guided fall.

The guidance system shall be such as to ensure that the striker:

— shall be positioned above the headform so that its central axis coincides with the central vertical axis of the force transducer; and

— falls on to the required impact point with an impact speed of no less than 95 % of that which would theoretically be obtained for a free fall.

5.5.3.6 Means to measure impact speed

Unless free fall is employed, means shall be provided to measure the striker speed at a distance of no more than 60 mm prior to impact, to within an accuracy of ± 1 %.

The impact speed shall be measured during the commissioning of the apparatus. It need not be done for each impact.

5.5.3.7 Instrumentation to record and analyse data

5.5.3.7.1 Force transducer

The non-inertial force transducer shall be firmly attached to the base and arranged so that its sensitive axis coincides with the axis passing through the Z point of the headform and the centre of the striker. The transducer shall be capable of withstanding a maximum compressive force of 100 kN without damage.

5.5.3.7.2 Signal conditioning instrumentation

The instrumentation shall provide for the complete measuring channel to have a frequency response in accordance with channel frequency class (CFC) 600 of ISO 6487. If digital sampling is employed, a sample rate of at least 10 kHz shall be used. The required 600 Hz low pass filter may be included within the computer software.

Means shall be provided to record the maximum force transmitted during impact, to the nearest 10 N.

5.5.4 Procedure

Within 2 min of its removal from conditioning (this time applies to temperature conditioning only), the helmet shall be fitted to the appropriate headform in accordance with 5.2 and the striker shall be allowed to fall on to the specified impact point.

If the design of the helmet permits direct contact between the headform and the striker, the test shall not be performed and the result shall be declared a failure.

5.5.5 Report

Record and report the maximum force transmitted during the impact, to the nearest 10 N.

5.6 Resistance to penetration

5.6.1 Impact area

The impact area to determine the resistance to penetration of the helmet is defined within a circle of radius 50 mm centred on the top of the helmet. Two tests shall be carried out in this area at least 50 mm apart from each other.

5.6.2 Principle

A specified striker is allowed to fall with specified energy on to a helmet which is fitted to a rigidly mounted test block. Note is taken of whether or not contact is made between the striker and the test block.

5.6.3 Apparatus

5.6.3.1 General

The apparatus shall include:

— a base;

— a test block;

— a restraining system;

— a striker;

— a guidance system;

— a means to measure impact speed.

5.6.3.2 Base

The base shall be solid, made of steel or a combination of steel and concrete and have a mass of no less than 500 kg. At least the uppermost 25 mm shall consist of steel, which shall be firmly attached to the concrete if present.

5.6.3.3 Test block

A hemispherical test block of hardwood with a soft metal insert located at the top of its central vertical axis is mounted on a rigid support. Elasticated restraining straps are provided to assist in retaining the helmet in position during the test. They should be such as not to affect the correct performance of the test. A suitable apparatus is shown in Figure 2.

5.6.3.4 Striker

The characteristics of the conical striker are as follows:

— mass: (3 000 ± 25) g;

— angle of point: (60 ± 1)°;

— radius of point: (0,5 ± 0,1) mm;

— minimum height of cone: 40 mm;

— hardness of tip: (50 to 45) HRC.

5.6.3.5 Guidance system

Means shall be provided for the striker to be dropped in free or guided fall.

The guidance system shall be such as to ensure that the striker:

— shall be positioned above the test block so that its central axis coincides with the point of impact on the helmet; and

— falls on to the required impact position with an impact speed of no less than 95 % of that which would theoretically obtain for a free fall.

5.6.3.6 Means to measure impact speed

Unless free fall is employed, means shall be provided to measure the striker speed at a distance of no more than 60 mm prior to impact, to within an accuracy of ± 1 %.

The impact speed shall be measured during the commissioning of the apparatus. It need not be done for each impact.

5.6.4 Procedure

Within 2 min of its removal from conditioning (this time applies to temperature conditioning only), the helmet shall be fitted to the test block and secure using the restraining system. Rotate the helmet so as to present the required impact point to the striker. The striker shall be allowed to fall on to the specified impact point.

Note whether contact is made between the striker and the test block or whether the surface of the soft metal (or equivalent) insert in the test block is visibly damaged. If necessary, restore the surface of the soft metal (or equivalent) insert in the test block, prior to a subsequent test.

If the design of the helmet permits direct contact between the headform and the striker, the test shall not be performed and the result shall be declared a failure.

5.6.5 Report

Report whether contact was made between the striker and the test block or whether the surface of the soft metal (or equivalent) insert in the test block was visibly damaged.

5.7 Retention system strength

5.7.1 Principle

A helmet is supported on a headform and a specified varying force is applied to the retention system via an artificial jaw. The elongation as well as the ultimate tensile strength of the system is measured.