BS EN 1385:2012

BSI Standards Publication

Helmets for canoeing and white water sports

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National foreword

This British Standard is the UK implementation of EN 1385:2012. It supersedes BS EN 1385:1998 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PH/6/6, Protective helmets for sport and leisure.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 75028 1

ICS 13.340.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2012.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1385

February 2012

ICS 13.340.20

Supersedes EN 1385:1997

English Version

Helmets for canoeing and white water sports

Casques utilisés dans la pratique du canoë-kayak et des sports en eau vive

Helme für den Kanu- und Wildwassersport

This European Standard was approved by CEN on 17 December 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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Foreword

This document (EN 1385:2012) 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of an identical text or by endorsement, at the latest by August 2012, and conflicting national standards shall be withdrawn at the latest by August 2012.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 1385:1997.

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 most common head injury in canoeing and white water sports happens when a person strikes an underwater object after capsizing. Under these circumstances it is extremely unlikely that the speed of impact will be greater than 18 km/h (5 m/s) because this is the highest recorded rate of flow in a white water river. The most common site of injury is the frontal or forehead area or the side of the eye socket.

To achieve the performance of which the helmet is capable, and to ensure stability on the head, it needs to be as close fitting as possible consistent with comfort. The helmet needs to be securely fastened on to the head, and any chin strap has to be under tension at all times.

The protection given by a helmet depends on the circumstances of the accident and wearing a helmet does not 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.

This European Standard includes the International Canoe Federation classification of risks.

1 Scope

This European Standard specifies requirements for helmets for canoeing and white water sports for use in waters of classes 1 to 4 as classified by Clause 4. The levels of protection recognise that most fatalities in canoeing and white water sports result from drowning after concussion and not from brain damage.

This European Standard is not intended to apply to helmets for use in extreme white water situations such as those where the jumping of high waterfalls is undertaken, because the need for impact absorption for such a helmet, and the area of the head to be protected, are greater than those for most canoeing and white water sports. The standard applies to helmets with and without holes in the shell.

NOTE This European Standard does not provide performance requirements for visors, chin-guards or face-guards.

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
canoeing
normal use of a canoe or of a kayak, in white water of classes 1 to 4 classified in accordance with Clause 4

3.2
white water sports
non-powered sporting activities carried out in and/or on moving water as defined by classes 1 to 4 in accordance with Clause 4

3.3
helmet
headwear that is intended to protect the wearer's head from concussion

3.4
shell
material that provides the general outer form of the helmet

3.5
protective padding
lining material used to either absorb impact energy or improve the wearer's comfort

3.6
retention system
entire assembly of components that prevent the helmet coming off the head

3.7
chin strap
strap passing under the wearer's lower jaw that is intended to prevent the helmet coming off the head

3.8
harness
assembly of headband and suspension designed to keep the helmet on the head, and to absorb some kinetic energy

3.9
headband
horizontal band of material that is adjustable to fit the circumference of the wearer's head above the eyes

3.10
suspension
means of resting the helmet on the upper parts of the head

3.11
headform
rigid object designed to simulate a human head for use in testing helmets

3.12
basic plane of the human head
longitudinal plane which passes through the lower level of the eye orbits and the upper level of the external opening of the ear canals

3.13
basic plane of a headform
plane relative to the headform that corresponds to the basic plane of the human head

3.14
reference plane
construction plane parallel to the basic plane of the headform at a distance from it which is a function of the size of the headform

4 White water classification of rivers

NOTE 1 This classification is produced by the International Canoe Federation.

Class 1 Not difficult. Regular current, small waves and riffles, occasional small rapids; pebble banks, no or few obstructions.

Class 2 Moderately difficult. Clear and wide passages; irregular current, rapids bigger waves, easy eddies, stopper and whirlpools; simple obstructions in the passage, small ledges.

Class 3 Difficult. Course not always easily to recognize. High and irregular waves, long rapids, stopper, boils and whirlpools; occasional boulders, drops and various obstructions in the passage.

Class 4 Very difficult. Course difficult to recognize, inspection from shore is advised; big hydraulics, keepers and boils; staggered boulders in main stream, ledges with keepers.

Class 5 Exceedingly difficult. Inspection from shore is mandatory; extreme hydraulics, keepers and boils; narrow in the only line of passage, high drops in cascades with difficult entrances and/or exits.

Class 6 The absolute limit of difficulty. Usually considered unrunnable. All previous mentioned difficulties increased to the limit of practicability. Attempts at certain water levels imply a high risk to life.

NOTE 2 Helmets for use in water classes 5 and 6 are outside the scope of this European Standard. It is expected that these helmets will have performance requirements in excess of this European Standard.

5 Construction

5.1 Materials

The mechanical properties of the materials used in the manufacture of the helmet should not deteriorate significantly during the period of normal use, due to influences such as exposure to sun, to temperature changes or to fresh or salt water. Metal parts used to fasten the chin strap and/or a suspension cradle to the shell, should be protected from or resistant to corrosion. The materials forming the parts of the helmet coming into contact with the skin, should not deteriorate in strength significantly due to contact with sweat and materials which are known to cause skin disorders shall not be used. The thread used for stitching on webbing should be resistant to rotting.

5.2 Extent of shell

When the helmet is placed on a headform of size designation given in Table 1, and the chin strap is secured, the shell, including any holes, shall cover all parts of the headform above the lines ACDF shown in Figure 1 a) and Figure 1 b), except that there may be cut-outs on each side of the helmet to expose the ears for hearing purposes. The dimension “Y” (see Figure 1) for the headforms in Table 1 shall be taken as given in EN 960:2006, Table 1. The point C for each headform (Figure 1 a) and Figure 1 b)) is the midpoint of A–Z and the point D is vertically beneath it on the reference plane.

NOTE Table 1 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 1 — Sizes of headforms

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

5.3 Holes

The shell may be pierced by holes that allow ventilation or the draining of water.

5.4 Projections

Rivet heads shall be rounded and shall not project more than 2 mm beyond the outer surface of the shell. All edges of the shell shall be smooth and rounded to a radius of not less than 1 mm. Any rigid internal projection shall be covered with protective padding.

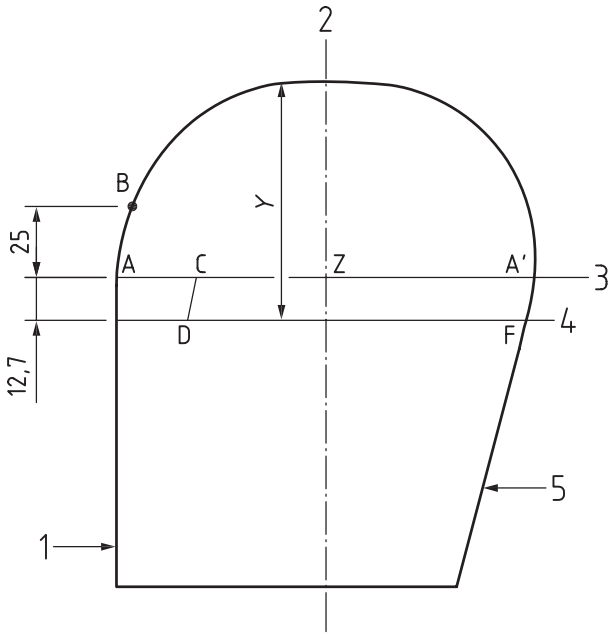
5.5 Retention system

The width of any chin strap shall be not less than 15 mm. The chin strap shall be fitted with a device to adjust and maintain tension in the strap, and shall not include a chin cup.

5.6 Face guards and visors

If the helmet is fitted with means for attaching a face guard or visor then the means of attachment shall not reduce the degree of protection of the helmet.

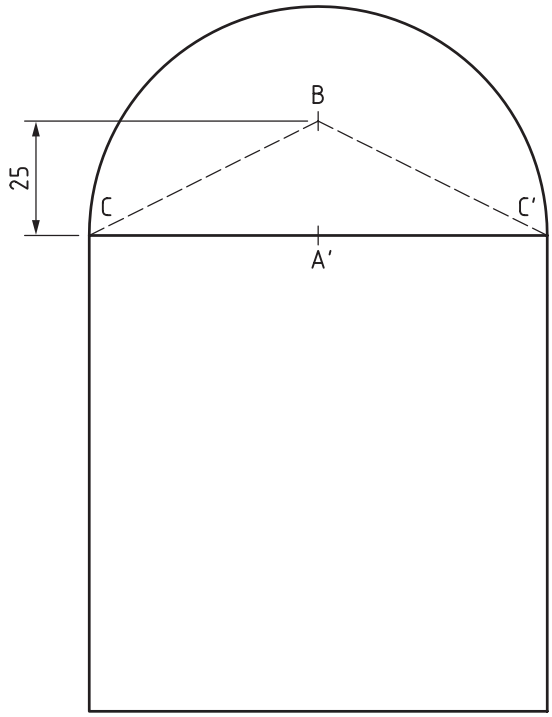
Dimensions in millimetres



Key

1 front
2 central vertical axis
3 AA^{I} plane
4 reference plane
5 rear

a) Section of headform showing positions of planes, lines and points



b) Figure 1 a) through 90°

Figure 1 — Sections of headform

6 Performance requirements

6.1 Impact protection

Helmets shall be capable of withstanding an impact of not less than 15 J.

The deceleration of the headform shall not exceed 250 gn where gn is an acceleration of 9,81 m/s^2.

Testing shall be in accordance with 7.6. The helmet shall be capable of conforming to these requirements regardless of which conditioning procedure in 7.5 has been chosen. A helmet that has been subjected to the procedure in 7.6 shall not be subjected to it a second time.

NOTE This implies that in order to use all four conditioning procedures, a set of at least four helmets is needed.

6.2 Retention system strength

When the retention system is tested by the method described in 7.7 the maximum dynamic extension shall not exceed 25 mm.

6.3 Retention system effectiveness

When the helmet is tested by the method in 7.8, the front edge of the helmet shall not move upwards by more than 80 mm.

6.4 Buoyancy

After conditioning for water immersion in accordance with 7.5.3, the helmet shall float to the surface.

7 Testing

7.1 General

Helmets that are adjustable in size shall be tested at the extremes of the size range. For non-adjustable helmets, the next smallest headform size (Table 1) shall be used. The liner or cradle (including the adjustment system) shall remain intact and fully attached to the shell throughout each of the performance tests.

Any helmet that has been tested shall not be offered for sale and shall not be used for protection.

7.2 Headforms

The headforms used shall be full headforms conforming to EN 960:2006. The sizes given in Table 1 are to be used.

7.3 Number of samples and sequence of tests

7.3.1 Number of samples

Five helmets for each headform size shall be submitted for testing.

7.3.2 Sequence of tests

The sequence of testing shall be in accordance with Tables 2 and 3.

Table 2 — Sequence of testing

Performance test	Sequence test	Sample number			
Impact protection (7.6)	1st	1	2	3	4
Retention system effectiveness (7.8)	2nd	1			
Retention system strength (7.7)	3rd		2	3	
Buoyancy (6.4)	4th				4

NOTE The fifth sample is for reference and can be used to re-assess failure of any of the performance requirements.

Table 3 — Test parameters

Sample number	Conditioning
1	High temperature (7.5.1) No re-conditioning
2	Low temperature (7.5.2) No re-conditioning
3	Artificial ageing (7.5.4) No re-conditioning
4	Water immersion (7.5.3) No re-conditioning

7.4 Test area

Determine the test area of the helmet as follows. Place the helmet on a headform of appropriate size (see Table 1). Apply a vertical load of 50 N on the crown of the helmet in order to stabilize the helmet on the headform. Position the front edge of the helmet as instructed by the manufacturer, and draw a horizontal line on the helmet at the level of the AA' plane of the headform (see Figure 1 a)). Draw a point B, which is 25 mm above the AA' plane at the front of the helmet.

The test area is defined as above the line BCA'C' as shown in Figures 1 a) and 1 b).

7.5 Conditioning

7.5.1 High temperature conditioning

Place the helmet in an air-circulating chamber at a temperature of (35 ± 2) °C for not less than 4 h.

7.5.2 Low temperature conditioning

Place the helmet in an air-circulating chamber at a temperature of (0 ± 2) °C for not less than 4 h.

7.5.3 Water immersion

Totally immerse the helmet in water at a temperature of (15 ± 5) °C for not less than 4 h.

7.5.4 Artificial ageing

Expose the outer surface of the helmet successively to:

a) ultraviolet radiation by a 125 W xenon-filled quartz lamp for 48 h at a range of 250 mm;

b) spraying for 4 h to 6 h with water at ambient temperature at a rate of one litre per min.

NOTE A method for artificial ageing is described in Annex A and this may be used as an alternative.

7.6 Impact protection resistance

7.6.1 Apparatus

7.6.1.1 General

The apparatus is shown in Figure 2 and shall comprise:

a) an anvil rigidly fixed to a base;

b) a free fall guidance system;

c) a mobile system supporting the helmeted head form;

d) a metal headform fitted with a tridirectional accelerometer;

e) an accelerometer output recording and conditioning system;

f) a system by which the point of impact can be brought into correspondence with the centre of the anvil.

7.6.1.2 Base

The base shall be monolithic and made of steel or concrete or a combination of these materials and have a mass of at least 500 kg.

No part of the base or anvil shall have a resonance frequency liable to affect the measurements.

7.6.1.3 Anvil

A flat steel anvil having a circular impact face of (130 ± 3) mm diameter.

7.6.1.4 Mobile system and guides

The mobile system supporting the headform shall be such that its characteristics do not affect the measurement of acceleration at the centre of gravity of the headform. It shall also be such that any point in the test area can be positioned vertically above the centre of the anvil.

7.6.1.5 Accelerometer and measuring assembly

The tridirectional accelerometer shall be capable of measuring and recording accelerations up to 2 000 g and its maximum mass shall be 50 g.

The measuring system, including the drop assembly, shall have a frequency response in accordance with channel frequency class (CFC) 1000 of ISO 6487.

The measuring system shall include equipment to record the velocity of the headform.

7.6.1.6 Headforms

Headforms shall be in accordance with EN 960:2006, 3.1.1. See Table 1.

7.6.2 Procedure

Condition each helmet by one of the procedures given in 7.5. Fit the helmet to the headform and apply the first impact within (40 ± 10) s of removal from conditioning. In each series of tests, conduct impacts on each perceived weak area, such as ventilation features, retention anchorages or webbing supports, which fall within the test area.

Without reconditioning, impact each helmet three times in all, with the impact sites separated by a minimum distance of 150 mm.

Wait at least 15 min, to return the helmet to ambient temperature, and then carry out one further impact at one of the previously tested impact sites.

Measure the velocity of the headform at a distance not exceeding 60 mm, prior to impact, to an accuracy of ± 1 %. Use a drop height such that the impact velocity is given by Table 4.

Measure the velocity of the impacting mass and record the deceleration against time.

Table 4 — Impact velocity for impact protection test

Size designation (EN 960:1994 equivalent)	**Impact velocity** m/s
495 (A)	3,11
535 (E)	2,71
575 (J)	2,53
605 (M)	2,31
625 (O)	2,22

7.7 Test for strength of retention system

7.7.1 Apparatus

7.7.1.1 General

The apparatus is shown in Figure 3 and shall comprise:

a) means to hold the helmet with headform and loads;

b) a headform equipped with a loading device comprising a guide, an arrest device and a drop weight;

c) a retention system extension measuring system.

7.7.1.2 Headform

Headforms shall be in accordance with EN 960:2006, 3.1.1. See Table 1.

7.7.1.3 Loadbearing devices

The loadbearing device shall consist of a chin strap stirrup with a round or square guide bar having a dimension of between 12 mm and 15 mm. The bar shall have a steel end stop.

The chin strap stirrup shall consist of two metal rollers each with a diameter of (12,5 ± 0,5) mm that have a distance of (75 ± 2) mm.

The guide bar shall be provided with a cylindrical weight having a mass of (4 ± 0,1) kg and allow for a drop of the weight of (150 ± 5) mm. The mass of the entire loading apparatus excluding the 4 kg weight shall be (7 ± 0,5) kg.

7.7.1.4 Measuring device

A device to measure the vertical displacement of the chin strap fixture shall be included.

7.7.2 Procedure

Select a helmet which has already passed the shock absorption test. Place the helmet on the headform. Fasten the chin strap under the stirrup bars to that the entire test apparatus hangs freely on the retention system. Place a pre-load ballast of (0,5 ± 0,05) kg on the helmet. Then raise the drop weight and allow it to fall and impact the end stop.

During the test measure the dynamic displacement of the chin strap stirrup, and after 2 min, determine whether the retention system can be released by normal operation.

7.8 Retention system effectiveness

7.8.1 Apparatus

The apparatus is shown in Figure 4 and shall comprise:

a) a static load with a mass of (4,0 ± 0,1) kg;

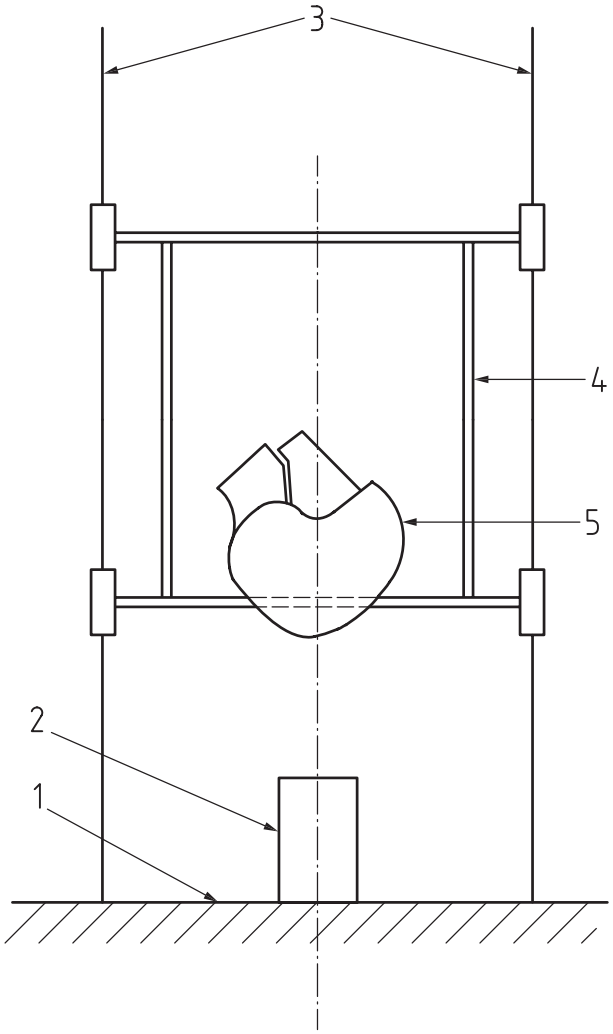
b) a flexible strap and a hook attached to the guiding system, running over a pulley with a diameter of 100 mm. The extension of the strap shall be less than 18 mm/m under a load of 1 000 N;

c) headforms in accordance with EN 960:2006 (see Table 1);

d) a base to hold the headforms.

7.8.2 Procedure

Select a helmet which has previously passed the shock absorption test. Fit the helmet to the headform in accordance with the manufacturer's instructions. Adjust the retention system to be as tight as possible. Hook the strap to the front of the helmet. Apply the static load and measure the distance by which the hook moves.



Key

1 steel base

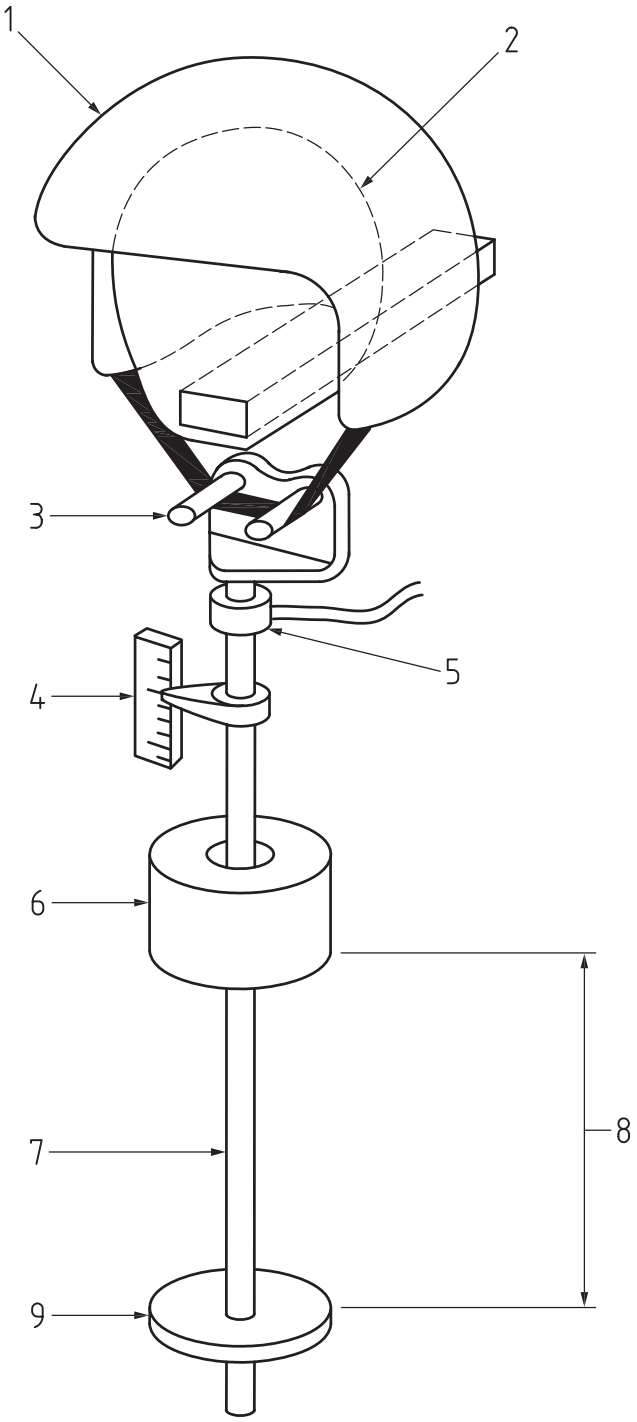
2 anvil

3 guides

4 support dolly

5 headform with helmet

Figure 2 — Typical apparatus for testing impact protection

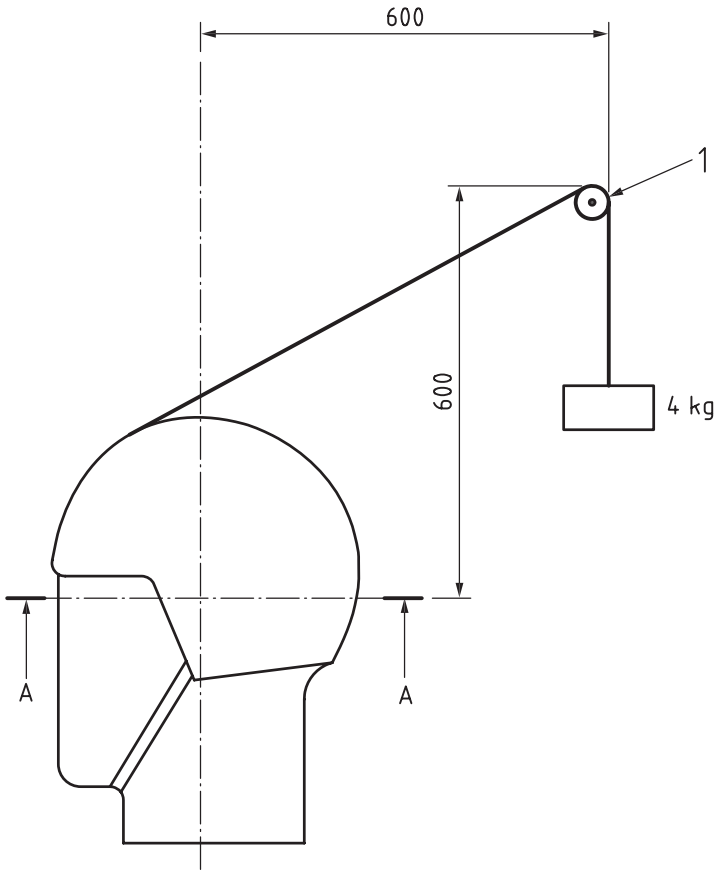


Key

1 helmet
2 headform
3 chin strap stirrup
4 extension measuring device
5 load cell (optional)
6 drop weight 4 kg ± 0,1 kg
7 guide bar
8 drop height 150 mm ± 5 mm
9 stop anvil

Figure 3 — Typical apparatus for testing the strength of the retention system

Dimensions in millimetres



Key

1 pulley Ø 100 mm

Figure 4 — Typical apparatus for testing the effectiveness of the retention system

8 Marking

8.1 Each helmet shall be marked in such a way that the following information is easily legible by the user, and is likely to remain legible throughout the life of the helmet:

a) the number of this European Standard;

b) the name or identification mark of the manufacturer;

c) the year and quarter of manufacture;

d) the designation “Helmet for canoeing and white water sports”;

e) the size or size range, in cm.

8.2 A label shall be attached to each helmet giving the following instructions, in the language of the country of sale:

a) for adequate protection this helmet has to fit or be adjusted to the size of the user's head;

b) the helmet is made to absorb the energy of a blow by partial destruction or damage to the shell and the harness, and even though such damage may not be readily apparent, any helmet subjected to severe impact should be replaced;

c) the attention of users is also drawn to the damage of modifying or removing any of the original component parts of the helmet, other than as recommended by the helmet manufacturer. Helmets should not be adapted for the purpose of fitting attachments in any way not recommended by the helmet manufacturer;

d) do not apply paint, solvents, adhesives or self-adhesive labels, except in accordance with instructions from the helmet manufacturer;

e) for cleaning, maintenance or disinfection, use only substances that have no adverse effect on the helmet and are not known to be likely to have any adverse effect upon the wearer, when applied in accordance with the manufacturer's instructions and information;

f) this helmet is not intended for use in white water classes 5 and 6 as given by the International Canoe Federation;

g) this helmet is designed to help protect from bumps, scratches and concussion.

8.3 Any packaging which is intended by the manufacturer for display at the point of sale shall reproduce the statements given in 8.2 f) and g).

9 Information to be supplied by the manufacturer

The following information, provided precisely and comprehensibly in the official language(s) of the country of sale, shall accompany each helmet:

a) the name and address of the manufacturer;

b) instructions or recommendations regarding adjustment, fitting, use, cleaning, disinfection, maintenance, servicing and storage;

c) details of suitable accessories and appropriate spare parts;

d) relevant information regarding the obsolescence deadline or period or obsolescence of the helmet and component parts;

e) relevant information regarding details of the type of packaging suitable for storage and transporting to the point of sale.

Annex A
(informative)

Alternative procedure for artificial ageing

The helmet submitted to artificial ageing is exposed to the radiation of a xenon arc lamp. The radiant energy of the lamp is filtered to provide a spectral power distribution that closely approximates that of terrestrial daylight.

The helmet should be fixed on a cylindrical holder concentric to the lamp and which rotates at a speed of 1 rev/min to 5 rev/min around its axis.

Each helmet which will subsequently be tested for shock absorption should be orientated so that the area of test should be directed towards the lamp. The plane tangential to the shell at this point should be normal to a radius of the cylindrical holder.

The radiant energy incident in the plane of the test areas should be either measured or calculated from information provided by the manufacturer of the test apparatus. The exposure interval should be adjusted so that the exposed samples should receive a total energy of 1 GJ/m^2 over the wavelength range 280 nm to 800 nm.

The samples should be sprayed with distilled or demineralised water (having a conductivity below 5 mS/cm) intermittently with a cycle of 18 min of spraying. During the latter periods the measured relative humidity should be (50 ± 5) %.

The temperature within the test chamber should be measured with black standard thermometer placed at the same distance from the lamp as the exposed test areas of the helmets. The temperature should be maintained at (70 ± 3) °C.

All other test and calibration conditions for the apparatus, otherwise meeting the requirements of EN ISO 4892-1, EN ISO 4892-2 and EN ISO 4892-3.

NOTE 1 Not all available test apparatus, otherwise meeting the requirements of EN ISO 4892-1, EN ISO 4892-2 and EN ISO 4892-3, will incorporate sample holder frames of diameter sufficient to accommodate complete helmets.

NOTE 2 The position of the water sprays may require adjustment in order to avoid interference with the test samples.

NOTE 3 The energy output of the xenon arcs should be capable of being reduced below normal operational levels so as to maintain acceptable intensities in the sample surface plane required by this procedure.

Annex B
(informative)

Significant technical changes between this European Standard and EN 1385:1997

The significant changes with respect to the first edition of EN 1385 are as listed below.

Table B.1 — Significant changes between this European Standard and EN 1385:1997

Clause/paragraph/table/figure	Change
Clause 2	The normative references in Clause 2 and in the text have been updated. EN 960 has been dated throughout the text.
Table 1	The circumference of headform column has been changed to a size designation (circumference of headform at reference plane) column with updated sizes. The equivalent EN 960:1994 code letters are given as a reference column. An explanatory note has been added before the table.
7.6.1.6	Update of cross reference.
Table 4, 1st column	Code letters have been extended to size designations and between brackets EN 960:1994 equivalent code letters.
7.7.1.2	Update of cross reference.
Annex ZA	Has been updated.
Bibliography	Has been added according to references in Annex A.
NOTE The technical changes referred include the significant technical changes from the EN revised but is not an exhaustive list of all modifications from the previous version.	

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 89/686/EEC Personal Protective Equipment

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 89/686/EEC Personal Protective Equipment.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and the EU Directives

EU Directive 89/686/ECC, Annex II	Clauses of this European Standard	Qualifying remarks/notes
1.2.1 Absence of risks and other inherent nuisance factors	5.5, 6.3	
1.3.2 Lightness and design strength	6.1	
1.4 Information supplied by the manufacturer	8, 9	
2.1 PPE incorporating adjustment systems	6.2	
2.4 PPE subject to ageing	9 d)	
2.12 PPE bearing one or more identification or recognition marks directly or indirectly relating to health and safety	8	
3.1.1 Impact caused by falling or projecting objects and collision of parts of the body with an obstacle	6.1	

Bibliography

[1] EN ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance (ISO 4892-1)*

[2] EN ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps (ISO 4892-2)*

[3] EN ISO 4892-3, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps (ISO 4892-3)*

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