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EN 1078

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Descriptors: Sports, cycling, accident prevention, helmets, specifications, equipment specifications, field of visibility, shock resistance, fastenings, dimensions, tests, marking, information

English version

Helmets for pedal cyclists and for users of skateboards and roller skates

Casques pour cyclistes et pour utilisateurs de planches à roulettes et de patins à roulettes

Helme für Radfahrer und für Benutzer von Skateboards und Rollschuhen

This European Standard was approved by CEN on 1997-01-09. 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 Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard 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of an identical text or by endorsement, at the latest by August 1997, and conflicting national standards shall be withdrawn at the latest by August 1997.

This European Standard 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 standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland 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.

The technical committee which has prepared this standard realizes that it is of importance for the wearer's comfort and psychrometric performance that a helmet is ventilated. At the time the standard was prepared no method for measuring the ventilating capacity of a helmet was recognized. For that reason no requirements concerning ventilation or heat transmission have been introduced. Manufacturers of helmets are urged to design their helmets to encourage a flow of air over the wearer's head.

Pedal cyclists' helmets and helmets for users of skateboards and roller skates are fitted with a retention system to retain the helmet on the head. However, there may be a foreseeable risk that helmets of young children could become trapped and thereby cause a risk of strangulation of the child. In such cases an impact protection helmet for young children (see EN 1080) should be used.

Contents

1 Scope

This European Standard specifies requirements and test methods for helmets worn by users of pedal cycles, skateboards and roller skates.

Requirements and the corresponding methods of test are given for the following:

- construction, including field of vision;
- shock absorbing properties;
- retention system properties, including chin strap and fastening devices;
- marking and information.

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.

EN 960	*Headforms for use in the testing of protective helmets*
ISO 6487 : 1987	*Road vehicles — Measurement techniques in impact tests — Instrumentation*

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 protective helmet

An item to be worn on the head and intended to absorb the energy of an impact, thus reducing the risk of injury to the head.

3.2 helmet type

Category of helmets which does not differ in such essential respects as the materials or dimensions or construction of the helmet, of the retention system or of the protective padding.

3.3 padding

3.3.1 protective padding

A material used to absorb impact energy;

3.3.2 comfort padding

A lining material provided for the wearer's comfort;

3.3.3 sizing padding

A lining material used for adjustment of the helmet size.

3.4 retention system

The 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.

3.5 chin-strap

Part of the retention system consisting of a strap that passes under the wearer's jaw to keep the helmet in position.

3.6 basic plane of the human head

A plane at the level of the external ear opening (external auditory meatus) and the lower edge of the eye sockets (orbits).

3.7 basic plane of a headform

The plane relative to the headform that corresponds to the basic plane of the human head.

3.8 reference plane

A 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.

3.9 test area

The area of the helmet in which impact tests may be conducted which corresponds to the minimum protected area of the human head.

4 Requirements

4.1 Materials

For those parts of the helmet coming into contact with the skin, the material used should be known not to undergo appreciable alteration from contact with sweat or with substances likely to be found in toiletries. Materials shall not be used which are known to cause skin disorders.

4.2 Construction

The helmet normally consists of a means of absorbing impact energy and means of retaining the helmet on the head in an accident.

The helmet should be durable and withstand handling.

The helmet shall be so designed and shaped that parts of it (visor, rivets, ventilators, edges, fastening device and the like) are not likely to injure the user in normal use.

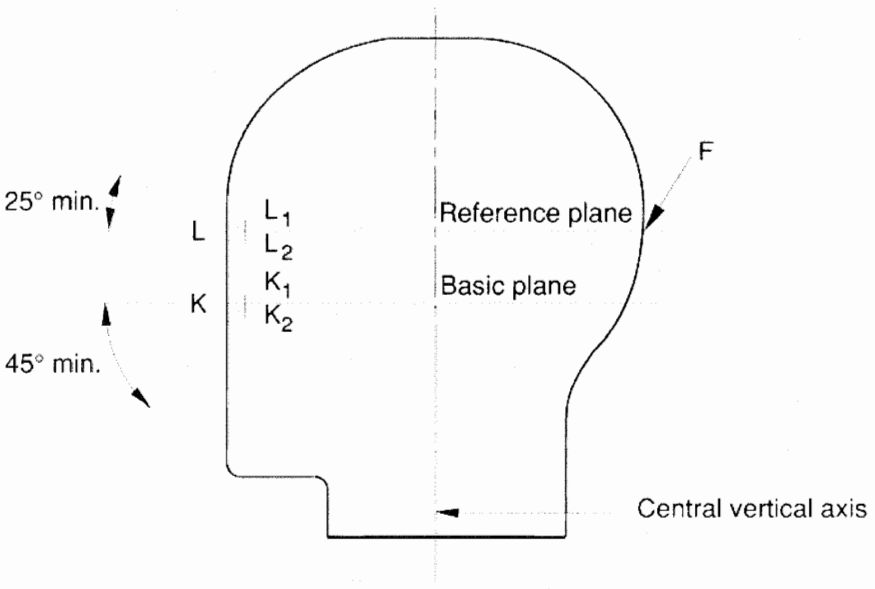
NOTE. Helmets should:

- have low weight;
- be ventilating;
- be easy to put on and take off;
- be usable with spectacles;
- not significantly interfere with the ability of the user to hear traffic noise.

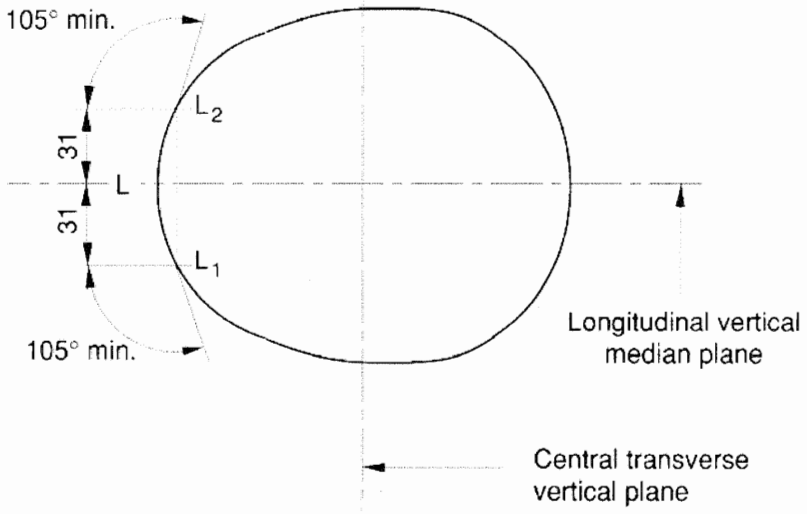
4.3 Field of vision

When tested in accordance with **5.7** there shall be no occultation in the field of vision bounded by angles as follows (see figure 1):

– horizontally:	min 105° from the longitudinal vertical median plane to the left and right hand sides;
– upwards:	min 25° from the reference plane;
– downwards:	min 45° from the basic plane.



Section of headform in longitudinal vertical plane



Section of headform in reference plane

Figure 1. Field of vision

4.4 Shock absorbing capacity

The helmet shall give protection to the forehead, rear, sides, temples and crown of the head.

When tested in accordance with **5.3** and **5.4** the peak acceleration shall not, for each impact, exceed 250 g for the velocity of $5{,}42^{+0,1}_{0}$ m/s on the flat anvil, and $4{,}57^{+0,1}_{0}$ m/s on the kerbstone anvil.

NOTE. These are theoretically equivalent to 1497 mm and 1064 mm drop heights respectively.

4.5 Durability

After being tested the helmet shall not exhibit damage that could cause significant injury to the wearer (sharp edges, points).

4.6 Retention system

4.6.1 *General*

Means shall be provided for retaining the helmet on the wearer's head. All parts of the retention system shall be securely attached to the helmet.

4.6.2 *Chin strap*

The chin strap shall not include a chin cup. Any chin strap shall be not less than 15 mm wide. Chin straps may be fitted with means of enhancing comfort for the wearer.

4.6.3 *Fastening device*

Any retention system shall be fitted with a device to adjust and maintain tension in the system. The device shall be capable of adjustment so that the buckle does not sit on the jaw bone.

4.6.4 *Colour*

No part of the retention system shall be coloured green.

NOTE. It is recommended that the opening mechanism be marked with red or orange colour.

4.6.5 *Strength*

When tested in accordance with **5.5**, the dynamic extension of the retention system shall not exceed 35 mm and the residual extension shall not exceed 25 mm. For this purpose, extension includes slippage of the fastening device.

Damage to the retention system shall be accepted provided that the above requirements are met.

NOTE. In this test, slippage of the fastening device can be measured and recorded separately from other contributions to the extension but this is for information only and is not subject to a separate requirement.

4.6.6 *Effectiveness*

When tested in accordance with **5.6** the helmet shall not come off the headform.

4.6.7 *Ease of release*

Following the strength test in accordance with **5.5** and with the load still applied, it shall be possible to open the release system with one hand.

5 Testing

5.1 Headforms

The headforms used shall comply with EN 960. The sizes in table 1 shall be used, except for determination of shock absorbing capacity, for which only sizes A, E, J, M and O are available.

For determination of retention system strength and ease of release, the headforms used shall comply with EN 960 at least down from the basic plane.

Table 1. Sizes of headforms

Code letter	Inside circumference of helmet mm
A	500
C	520
E	540
G	560
J	570
K	580
M	600
O	620

5.2 Inspection and determination of mass

Inspect the helmet to ascertain whether it is suitable for its intended purpose and fulfils the general requirements in **4.2**.

Determine the mass of the helmets of the same size submitted for testing. Calculate and record the mean value in g rounded off to the nearest 10 g, stating the size of the helmet.

5.3 Number of samples and sequence of tests

For each helmet type, four helmets for each headform size that fits within the manufacturers' claimed head size range shall be submitted for testing.

The sequence of tests performed on each helmet size and the tests performed on the same sample are given in table 2.

Table 2. Sequence of test and tests per sample

Performance test	Sequence of test	Sample number		
Retention system effectiveness (**5.6**)	1st	1	—	—
Shock absorbing capacity (**5.4**)	2nd	1	2	3
Retention system strength (**5.5**)	3rd	—	2	3

The fourth sample is reserved as a reference sample, which can be used by the test laboratory in case of doubt about any of the performance requirements.

5.4 Determination of shock absorbing capacity

5.4.1 *Test area*

a) Take a headform of appropriate size and mark a point B, midway between point A′ defined in EN 960 and point F (see figures 1 and 2).

b) Place the helmet on the headform. 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 to meet the upwards field of vision specified in **4.3** or to the manufacturer's normal wearing position, if this is detailed by the manufacturer and results in greater than the specified upwards vision.

c) Draw the AA′′ line (in the AA′ plane) on the helmet.

d) Draw a line on the helmet, parallel to and approximately 20 mm above the AA′′ line (for use as an angular measurement datum line).

e) Mark the helmet at points B_1 and B_2. These points are the sideways horizontal projection of point B on to the outer surface of the helmet.

f) Draw a line RR′ on the helmet passing through B_1 and B_2, the line being angled 10° upwards toward the front of the helmet relative to the datum line drawn in d).

The area above the line drawn in f) is the test area for impacts on to the flat anvil. The area above the line RWA′′ is the test area for impacts on to the kerbstone anvil, point W being the intersection of the lines marked in accordance with c) and f) above.

5.4.2 *Conditioning*

5.4.2.1 *High temperature conditioning*

The helmet shall be exposed to a temperature of $(+ 50 \pm 2)$ °C for not less than 4 h and not more than 6 h.

5.4.2.2 *Low temperature conditioning*

The helmet shall be exposed to a temperature of $(- 20 \pm 2)$ °C for not less than 4 h and not more than 6 h.

5.4.2.3 *Artificial ageing*

The outer surface of the protective helmet shall be exposed successively to:

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

– spraying for 4 h to 6 h with water at ambient temperature at the rate of 1 l/min.

NOTE. A method for artificial ageing is described in annex A. This method may be used as an alternative to the conditioning according to **5.4.2.3**.

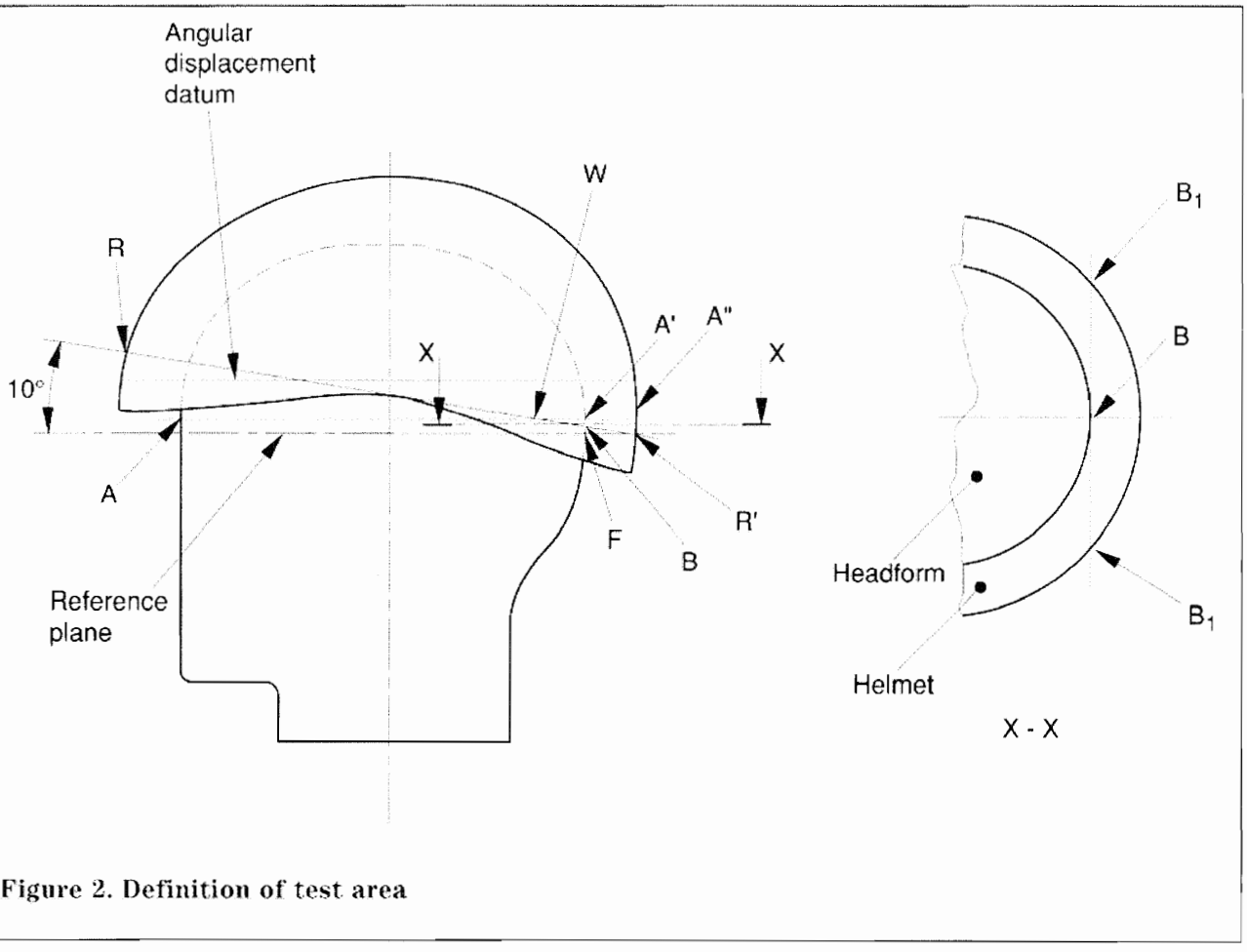


Figure 2. Definition of test area

5.4.3 *Apparatus*

5.4.3.1 *Description*

The test apparatus shall comprise:

– an anvil rigidly fixed to a base;

– a free fall guidance system;

– a mobile system supporting the helmeted headform;

– a metal headform fitted with a tridirectional accelerometer;

– an accelerometer output recording and conditioning system;

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

The principle is shown in figure 3.

5.4.3.2 *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 resonant frequency liable to affect the measurements.

5.4.3.3 *Anvils*

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

A steel anvil simulating a kerbstone and having two faces each inclined at $(52{,}5 \pm 2{,}5)°$ to the vertical and meeting along a striking edge with a radius of $(15 \pm 0{,}5)$ mm. The height shall be not less than 50 mm and the length not less than 125 mm.

5.4.3.4 *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.

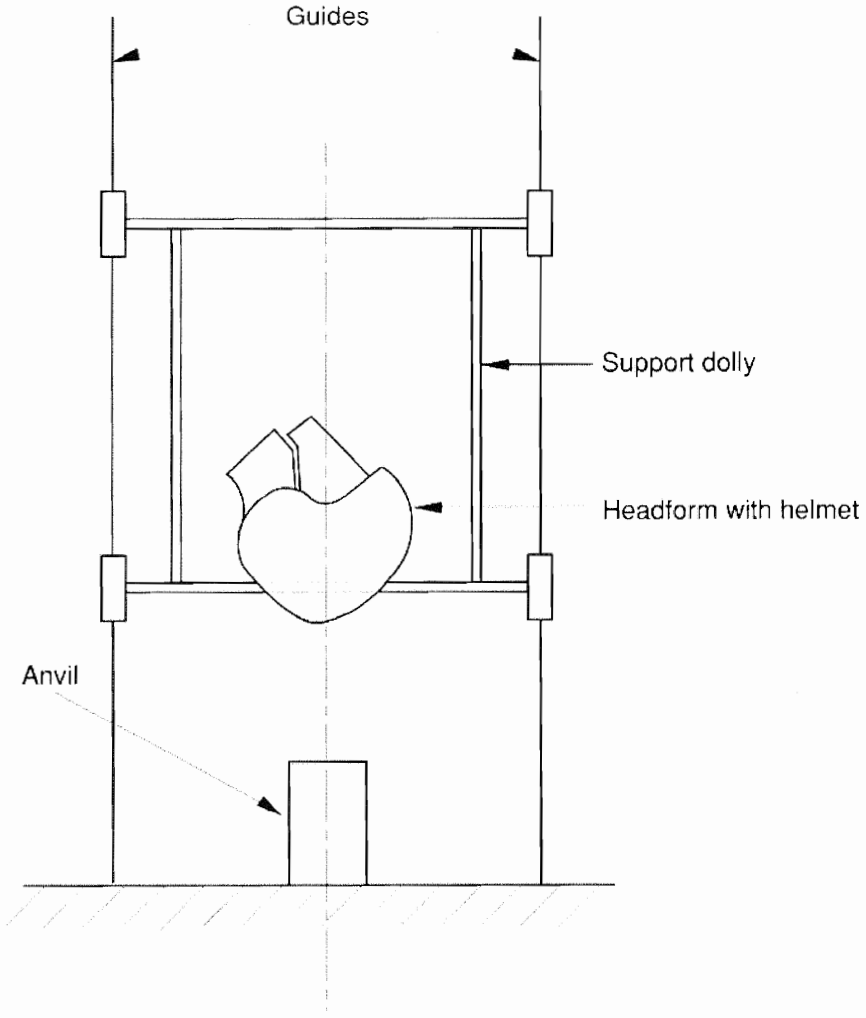


Figure 3. Principle of appratus for determination of shock absorbing capacity

5.4.3.5 *Accelerometer and measuring assembly*

The tridirectional accelerometer shall be capable of measuring and recording accelerations up to 2000 *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 : 1987.

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

5.4.3.6 *Headforms*

The headforms to be used shall comply with EN 960 (see **5.1**).

5.4.4 ***Procedure***

The testing shall be carried out in accordance with table 3.

Table 3. Test parameters

Sample number	Conditioning	Anvil
1	High temperature	Kerbstone
	No reconditioning	Flat
2	Low temperature	Flat
	No reconditioning	Kerbstone
3	Artificial ageing	Kerbstone
	No reconditioning	Flat

Make the first impact within 1 min and all further impacts within 3 min from removal of the helmet from the conditioning chamber.

Impact the helmets on sites selected by the test laboratory to present worst case conditions. Use the kerbstone anvil without any restriction on its orientation. In each series of tests on a model, conduct impacts on each perceived weak area (i.e. ventilation features, retention anchorages or webbing supports) which fall within the test area. The impact sites on each sample shall be separated by a minimum distance of 150 mm along the chord. The impact site shall be centred over the centre of the anvil.

The headform shall never be turned so that the vertical axis comes below the horizontal plane even if the test area allows. (See figure 3).

In the event of there being no helmet material at the impact site, then the adjacent material shall manage the energy of such an impact. In the case where anvil/headform contact can be made at the setting up stage for an impact, the result shall be deemed a failure, without conducting the test.

Measure the velocity of the helmeted headform at a distance not exceeding 60 mm prior to impact to an accuracy of 1 %.

5.5 Determination of retention system strength and ease of release

5.5.1 ***Apparatus***

5.5.1.1 *Description*

The test apparatus shall comprise:

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

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

– a retention system extension measuring system.

A suitable apparatus is shown in figure 4.

5.5.1.2 *Headform*

The headform to be used shall comply, at least down to the basic plane, with EN 960 (see **5.1**).

5.5.1.3 *Loadbearing device*

The loadbearing device shall consist of a chin strap stirrup with a round or square guide bar. The bar shall have a steel end stop.

The chin strap stirrup shall consist of two metal bars each with a diameter of (12,5 ± 0,5) mm that have a centre distance of (76 ± 1) mm.

The guide bar shall be provided with a cylindrical weight having a mass of (4 ± 0,2) kg and allow for a drop of the weight of (600 ± 5) mm. The mass of the entire loading apparatus excluding the 4 kg weight shall be (5 ± 0,5) kg.

5.5.1.4 *Measuring device*

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

5.5.2 ***Procedure***

Place the helmet on the headform. Fasten the chin strap under the stirrup bars so that the entire test apparatus hangs freely on the retention system. Place a preload ballast of (5 ± 0,5) 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.

After 2 min, measure the residual displacement with the drop weight still on the end stop.

Ascertain whether or not the system can be released by one hand.

5.6 Determination of retention system effectiveness

5.6.1 ***Apparatus***

The apparatus shall comprise:

– a drop weight with a mass of (10,0 ± 0,1) kg;

– a guiding system with a total mass of (3,0 ± 0,1) kg allowing the drop weight to drop in a guided free fall;

– 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 1000 N;

– headforms according to EN 960 (see **5.1**);

– a base to hold the headforms.

Figure 5 shows the principle of the apparatus.

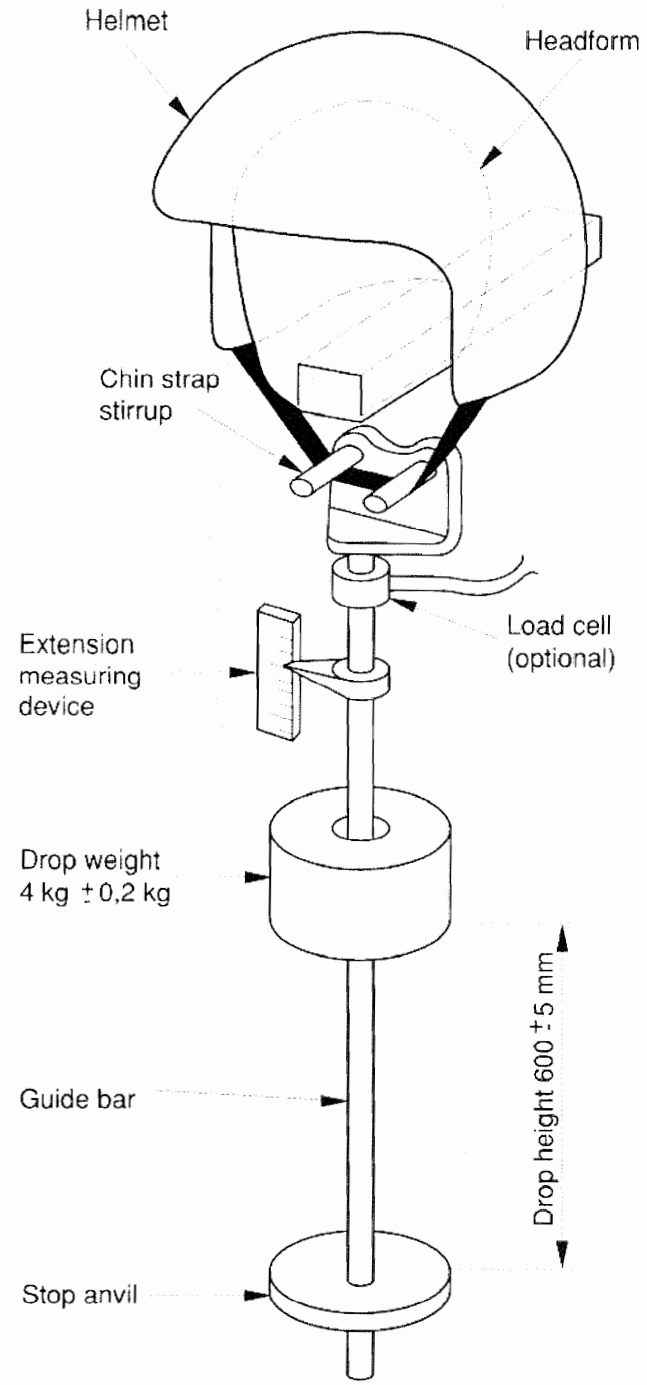
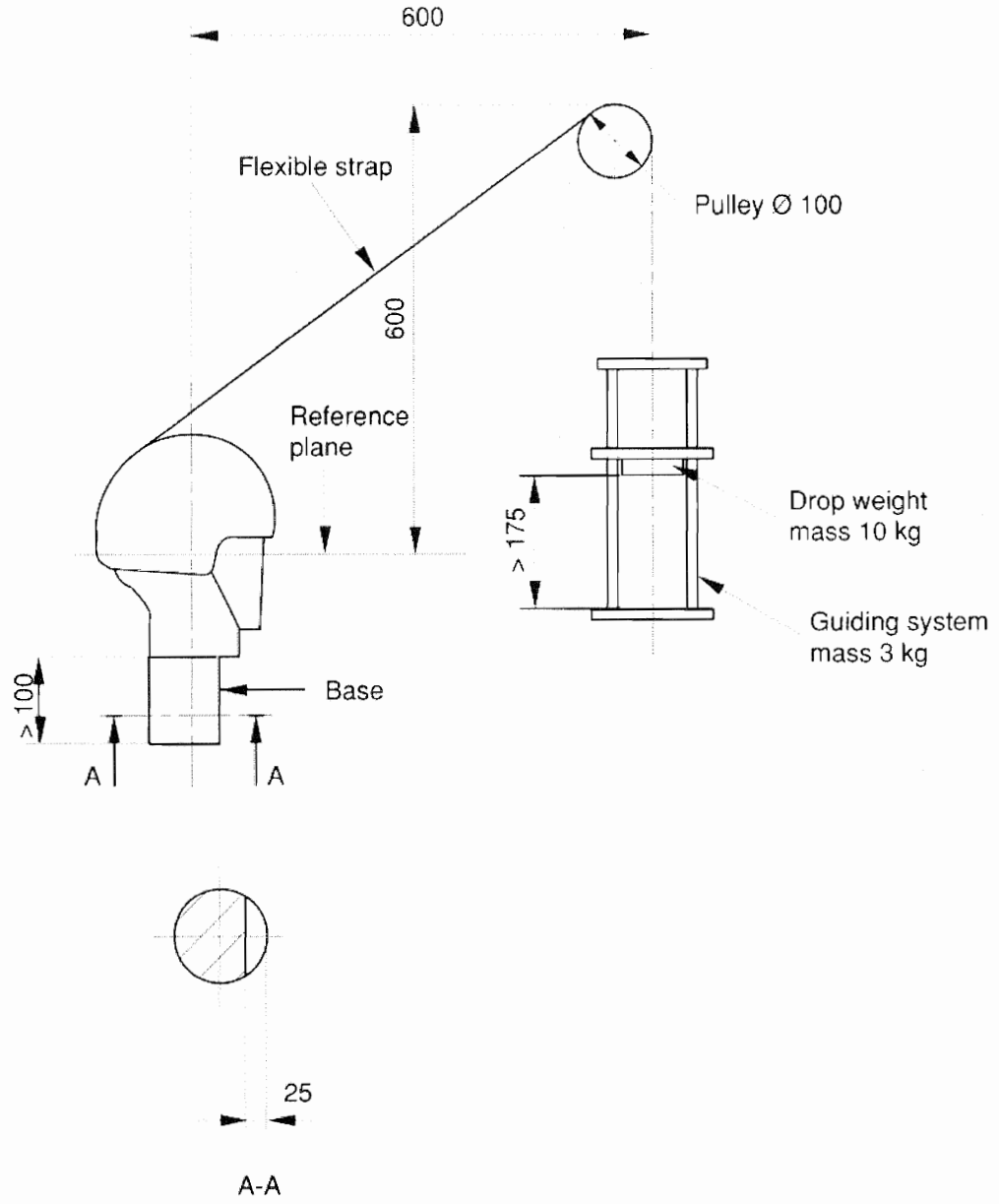


Figure 4. Example of an apparatus for testing of retention system strength



Dimensions in millimetres

Figure 5. Apparatus for testing of the retention system effectiveness

5.6.2 ***Procedure***

Fit the helmet according to the manufacturer's instructions to the appropriate headform which shall be the smallest and the largest and intermediate sizes measured for the helmet type.

Adjust the retention system to be as tight as possible.

Hook the strap to the rear of the helmet.

Release the drop weight and allow it to fall through a distance of (175 ± 5) mm.

Observe whether or not the helmet comes off.

5.7 Determination of field of vision

To carry out the test, the test laboratory shall select the size it considers likely to yield the least favourable result for the helmet type.

Place the helmet on a headform of appropriate size. Apply a load of 50 N on the crown of the helmet in order to stabilize the helmet on the headform. Ascertain that the vertical median plane of the helmet coincides with the vertical median plane of the headform.

Adjust the helmet on the headform according to the manufacturer's instructions, if supplied. In that position, determine if the helmet complies with the requirements for field of vision in **4.3**.

5.8 Test report

The test report shall contain at least the following information:

a) identification details of the helmets including range of sizes;

b) results of the test in accordance with **5.2** to **5.7**;

c) date of testing;

d) name of the test laboratory.

6 Marking

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 trademark of the manufacturer;

c) the designation of the model;

d) the designation, which shall be one or more of the following: Helmet for pedal cyclists, skateboarders or roller skaters;

e) the size or size range of the helmet, quoted as the circumference (in centimetres) of the head which the helmet is intended to fit;

f) the weight of the helmet (the average mass in g determined according to **5.2**);

g) year and quarter of manufacture;

h) a label carrying the instructions: 'This helmet should not be used by children while climbing or doing other activities when there is a risk of hanging if the child gets trapped with the helmet'.

In addition, if the helmet has components made of material which are known to be adversely affected by contact with hydrocarbons, cleaning fluids, paints, transfers or other extraneous additions, the helmet shall carry an appropriate warning.

7 Information supplied by the manufacturer

With every helmet clear information in the language of the country of sale shall be given as follows:

a) that the helmet can only protect if it fits well and that the buyer should try different sizes and choose the size which feels secure and comfortable on the head;

b) that the helmet should be adjusted to fit the user, e.g. the straps positioned so that they do not cover the ears, the buckle positioned away from the jawbone and the straps and buckle adjusted to be both comfortable and firm;

c) how the helmet should be positioned on the head to ensure the intended protection is provided (e.g. that it should be placed so as to protect the forehead and not be pushed too far over the back of the head);

d) that a helmet cannot always protect against injury;

e) that a helmet subjected to a severe impact should be discarded and destroyed;

f) a statement of the danger of modifying or removing any of the original component parts of the helmet other than as recommended by the manufacturer, and that helmets should not be adapted for the purpose of fitting accessories in a way not recommended by the manufacturer.

Annex A (informative)

Alternative procedure for artificial ageing

The helmet submitted to artificial ageing should be exposed to the radiation of a xenon arc lamp. The radiant energy of the lamp should be 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 to 5 min^{-1} 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 demineralized water (having a conductivity below 5 μS/cm) intermittently with a cycle of 18 min spraying and 102 min without spraying. During the latter periods the measured relative humidity should be (50 ± 5) %.

The temperature within the test chamber should be measured with a 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 should be in accordance with Method A of ISO 4892-1 and ISO 4892-2.

NOTE 1. Not all available test apparatus, otherwise meeting the requirements of ISO 4892, 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 arc 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 ZA (informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

This European Standard 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 Directives 89/686/EEC.

WARNING. Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

The following clauses of this standard are likely to support requirements of Directive 89/686/EEC, annex II:

EU – Directives 89/686/EEC, annex II	Clauses of this standard
1.1 Design principles	**4.1** to **4.6**
1.2 Innocuousness of PPE	**4.1, 4.5**
1.3 Comfort and efficiency	**4.1, 4.2, 4.3**
1.4 Information supplied by the manufacturer	**7**
2.1 PPE incorporating adjustment systems	**4.6**
2.4 PPE subject to ageing	**5.4.2.3**
2.5 PPE which may be caught up during use	**4.6**
2.9 PPE incorporating components which can be adjusted or removed by the user	**4.6**
2.12 PPE bearing one or more identification or recognition marks directly or indirectly relating to health and safety	**7**
3.1 Protection against mechanical impact	**4.4, 4.5**

Compliance with the clauses of this standard provides one means of conforming with the specific essential requirements of the Directives concerned and associated EFTA regulations.