

# Helmets for alpine skiers and snowboarders

The European Standard EN 1077:2007 has the status of a British Standard

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## National foreword

This British Standard is the UK implementation of EN 1077:2007. It supersedes BS EN 1077:1996 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PH/6, Head protection.

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.

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## Helmets for alpine skiers and snowboarders

Casques pour skieurs de ski alpin et de surf nes neiges

Helme für alpine Skiläufer und für Snowboarder

This European Standard was approved by CEN on 17 February 2007.

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 Management Centre or to any CEN member.

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**Management Centre: rue de Stassart, 36 B-1050 Brussels**

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## **Foreword**

This document (EN 1077:2007) 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of an identical text or by endorsement, at the latest by February 2008, and conflicting national standards shall be withdrawn at the latest by February 2008.

This document supersedes EN 1077:1996.

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 89/686/EEC.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

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, 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 and United Kingdom.

## Introduction

The intention of helmets is to reduce the risk of injury to the skull and part of the head surrounded by the helmet.

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 should be replaced even if damage is not apparent.

To achieve the performance of which it is capable, and to ensure stability on the head, a helmet should be as closely fitting as possible consistent with comfort. In use it is essential that the helmet is securely fastened, with any chin strap under proper tension at all times.

Although the experience of the existing standard for alpine skiers is very good, it has become more and more obvious that there is a need for an alternative standard that can meet the demand from skiers and snowboarders who desire more ventilation and better hearing. This has resulted in two classes of helmets, class A and class B. Compared to class B, class A protects a larger area of the head and offers a higher degree of protection from penetration.

## 1 Scope

This European Standard is applicable to performance requirements and tests for two classes of helmets for alpine skiers, snowboarders and for similar groups, including children and participants in competitions. The standard comprises two different classes of protection, class A and class B.

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

- construction including field of vision;
- shock absorbing properties;
- resistance to penetration;
- retention system properties;
- marking and information.

## 2 Normative references

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

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

EN 13087-2:2000, *Protective helmets — Test methods — Part 2: Shock absorption*

EN 13087-3:2000, *Protective helmets — Test methods — Part 3: Resistance to penetration*

EN 13087-4:2000, *Protective helmets — Test methods — Part 4: Retention system effectiveness*

EN 13087-5:2000, *Protective helmets — Test methods — Part 5: Retention system strength*

EN 13087-6, *Protective helmets — Test methods — Part 6: Field of vision*

## 3 Terms and definitions

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

**3.1 protective helmet**  
item to be worn on the head, intended to absorb the energy of a foreseeable impact thus reducing the risk of injury to the head

**3.2 shell**  
outer layer which provides part of the whole general form of the helmet

**3.3 helmet type**  
category of helmets which does not differ in such essential respects as the materials or dimensions or construction of the helmet, or of the retention system



NOTE Helmet type may include a range of helmet sizes, provided that the thickness of the protective padding in each size in the range is at least equal to that in the helmet which, when subjected to the tests, satisfies the requirements of this standard.

### **3.4 padding**

#### **3.4.1 protective padding**

material used to absorb impact energy

#### **3.4.2 comfort padding**

liner material provided for the wearer's comfort

#### **3.4.3 sizing padding**

liner material used for adjustment of the helmet size

### **3.5 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

### **3.6 chin-strap**

part of the retention system that passes under the wearer's jaw to keep the helmet in position

### **3.7 basic plane of the human head**

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

### **3.8 basic plane of a headform**

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

### **3.9 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 Requirements**

### **4.1 Materials**

For those parts of the helmet coming into contact with the skin the material used shall not be subject to any known 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 or other adverse effects on health. For a material not in general use advice as to its suitability shall be sought before its introduction.

Examples for documents which can be presented as evidence of chemical innocuousness are given in the NOTE.

NOTE The following list of documents is given for information and as examples of documents to be examined:

## EN 1077:2007 (E)

- a) materials specifications;
- b) safety data sheets relating to the materials;
- c) information relating to the suitability of the materials for use with food, in medical devices, or other relevant applications;
- d) information relating to toxicological, allergenic, carcinogenic, toxic to reproduction or mutagenic investigations on the materials;
- e) information relating to ecotoxicological and other environmental investigations on the materials.

The examination should determine whether the claim that the materials are suitable for use in the protective helmet is justified. Particular attention needs to be paid to the presence of plasticisers, unreacted components, heavy metals, impurities and the chemical identity of pigments and dyes.

All metallic materials which could come into prolonged contact with the skin (e.g. buckles, fittings) are recommended to be tested according to EN 1811 for emission of nickel.

### 4.2 Construction

#### 4.2.1 General

The helmet shall be so designed and shaped that parts of it (for example visor, rivets, ventilators, edges, fastening device etc.) are not likely to injure the user. This can be verified in accordance with 5.2.

NOTE Helmets should:

- have low weight;
- be easy to put on and take off;
- be usable with spectacles;
- not significantly interfere with the ability of the user to hear;
- have good durability and withstand normal handling;
- permit cleaning.

#### 4.2.2 Retention system

##### 4.2.2.1 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 system or to the helmet, so it would not come off during its use. This can be verified in accordance with Clauses 5.7 and 5.8

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

The colour of any part of the retention system shall not be green.

##### 4.2.2.2 Chin straps

The chin strap shall not include a chin cup.

Any chin strap shall be not less than 15 mm wide. This can be verified in accordance with 5.2.

Chin straps may be fitted with means of enhancing comfort for the wearer.

#### 4.2.2.3 Fastening devices

Any retention system shall be fitted with a device to adjust and maintain tension in the system. The strength in the system shall be in accordance with 4.7.1.

### 4.3 Field of vision

When tested in accordance with EN 13087-6, there shall be no occultation in the field of vision bounded by angles as follows:

- horizontally 105°;
- upwards 25°;
- downwards 45°.

### 4.4 Extent of coverage

#### 4.4.1 Class A

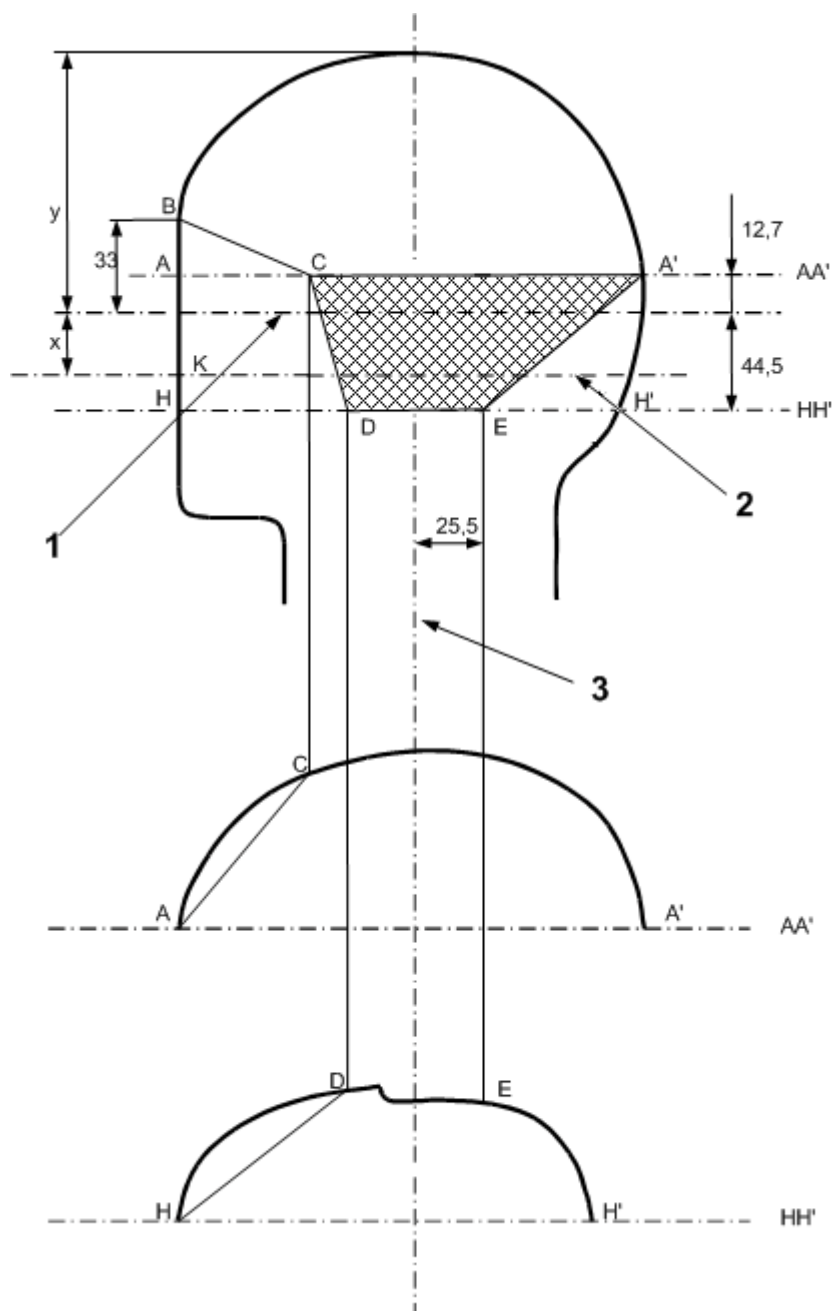
For Class A, when positioned in accordance with EN 13087-6 on a headform of appropriate size, the helmet shall cover at least the area above the line BCDEA' in Figure 1. No parts of the coverage may be detachable. Examples of different headform sizes are given in Table 1.

Those parts covering the area below the reference plane (shaded in Figure 1) shall be designed to give some protection against mechanical risks like abrasion. This can be verified in accordance with 5.2. Smaller openings for better hearing and/or ventilation are allowed.

#### 4.4.2 Class B

For Class B, when positioned in accordance with EN 13087-6 on a headform of appropriate size, the helmet shall cover at least the area above the line BCA' in Figure 1.

Parts below the AA' plane (shaded part in Figure 1) are optional and may be detachable and/or removable. Examples of different headform sizes are given in Table 1.



**Key**

- 1 reference plane
- 2 basic plane
- 3 central vertical axis

**Figure 1 — Minimum extent of coverage: Measurements for different headform sizes**

Table 1 — Examples of headforms

Dimensions in millimetres

Size designation (see EN 960)	Circumference of the headform at the reference plane	AC	HD	Y	X
495	495	84	89	89,7	23.5
535	535	88,5	92	96.0	25.5
575	575	93	95	102,4	27,5
605	605	97,5	98	107.2	29.0
625	625	100	100	110.2	30.0

NOTE The dimensions AC and HD correspond to the length of the chords measured with dividers.

#### 4.5 Shock absorbing capacity

When tested in accordance with 5.5 the peak acceleration shall not, for each impact, exceed 250 g.

#### 4.6 Resistance to penetration

When tested in accordance with 5.6 the point of the punch shall not touch the headform.

#### 4.7 Retention system performance

##### 4.7.1 Strength

When tested in accordance with 5.7, the dynamic extension shall not exceed 35 mm and the residual extension shall not exceed 25 mm. For this purpose, extension includes slippage of the fastening device. Following the test the retention system shall still permit the helmet to be released from the headform by normal operation of the release system.

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

##### 4.7.2 Effectiveness

When tested in accordance with 5.8 the helmet shall not come off the headform.

#### 4.8 Durability

After being tested the helmet shall not show damage that would cause an additional injury to the wearer's head (sharp edges, points etc.). This can be verified in accordance with 5.2.

### 5 Testing

#### 5.1 Sampling

Only new and complete helmets as offered for sale shall be tested.

The duration between the date of manufacture and the date of testing shall be not less than 6 days.

Four samples of helmets are required for each test headform within the size range of each shell/protective padding size combination. If there is no test headform applicable to the shell/protective padding size combination, the next smaller available test headform shall be used.

**Table 2 — Sequence of tests and number of tests per sample**

Performance test	Sequence of tests	Sample number			
		1	2	3	4
Retention system effectiveness (5.8)	1 <sup>st</sup>	1	-	-	-
Shock absorbing capacity (5.5)	2 <sup>nd</sup>	1	2	3	-
Resistance to penetration (5.6)	3 <sup>rd</sup>	-	-	-	4
Retention system strength (5.7)	4 <sup>th</sup>	-	-	-	4

**5.2 Inspection and determination of mass**

If no test method is specified in this European Standard the compliance with the requirements have to be checked by visual and/or tactile examination.

The width of the chin strap shall be measured prior to testing and without any tension on the strap.

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

**5.3 Conditioning**

**5.3.1 Room conditioning**

The sample shall be exposed to a temperature of + 20 °C ± 2 °C for not less than 4 h.

**5.3.2 Low temperature conditioning**

The sample shall be exposed to a temperature of - 25 °C ± 2 °C for not less than 4 h.

**5.3.3 Artificial ageing**

The sample shall be exposed successively to:

- temperature of + 70 °C ± 2 °C for not less than 48 h;
- room conditioning according to 5.3.1;
- ultraviolet irradiation by a 125 W xenon-filled quartz lamp for 48 h at a distance of 250 mm evenly over the exterior surface of the sample (e.g. by rotation);
- room conditioning according to 5.3.1.

An alternative method for artificial ageing is described in EN 13087-1:2000, Annex A. This method may be used as an alternative to the conditioning according to 5.3.3.

## 5.4 Test areas

### 5.4.1 General

Headforms shall comply with EN 960. Examples of measurements for different headform sizes are given in Table 1.

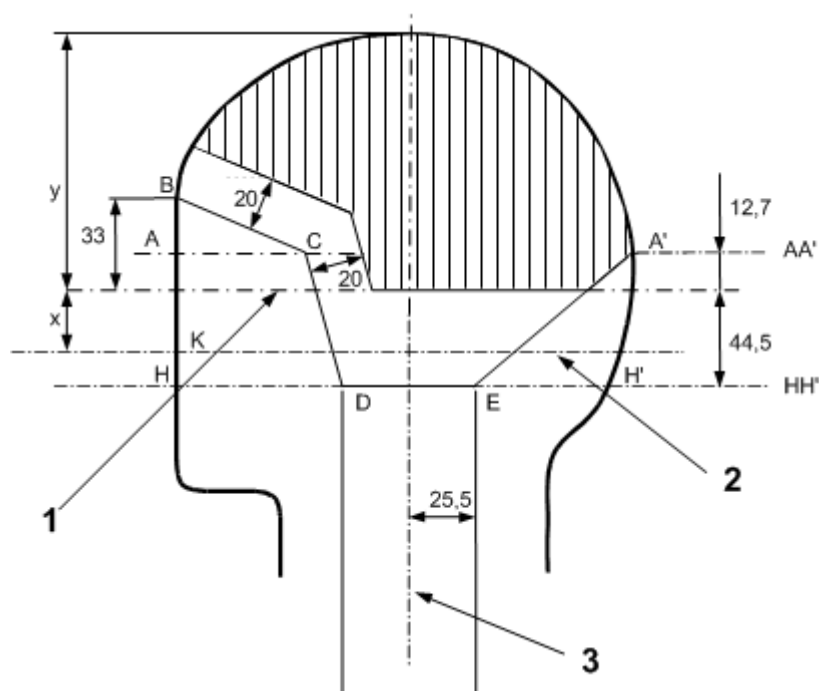
NOTE Free falling headforms are currently only commercially available in EN 960:1994 code letters A, E, J, M and O; equivalent to EN 960: 2006 sizes 495, 535, 575, 605 and 625. The 2006 edition of EN 960 should result in free falling headforms being made commercially available in the smaller sizes

Test areas for impact testing and penetration testing are given in 5.4.2 and 5.4.3.

### 5.4.2 Test area for class A

The test area for class A is given in Figure 2.

Dimensions in millimetres



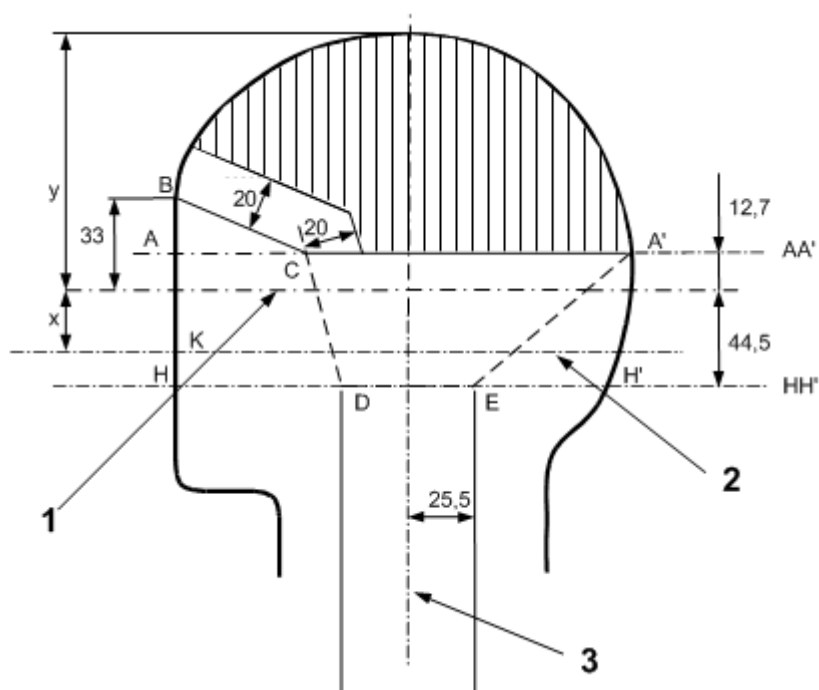
#### Key

- 1 reference plane
- 2 basic plane
- 3 central vertical axis

Figure 2 — Test area for class A

### 5.4.3 Test area for class B

The test area for class B is given in Figure 3.



### Key

- 1 reference plane
- 2 basic plane
- 3 central vertical axis

Figure 3 — Test area for class B

## 5.5 Determination of shock absorbing capacity

### 5.5.1 Apparatus

The apparatus shall be in accordance with EN 13087-2:2000, 5.3, falling headform method.

Only the flat anvil shall be used.



## 5.5.2 Procedure

### 5.5.2.1 Testing parameters

The testing shall be carried out according to Table 3.

**Table 3 — Testing parameters**

Sample	Conditioning
1	Ambient temperature
2	Low temperature
3	Artificial ageing

Within 1 min of its removal from conditioning (this time applies to temperature conditioning only), fit the helmet to the appropriate headform in the manner in which it is intended to be worn on the head, position the assembly so as to present the specified impact point over the anvil, then raise to the required drop height and release. All subsequent impacts shall be completed within 3 min from removal of the helmet from the conditioning chamber.

Impact each helmet on two sites.

The impact sites on the same sample shall be separated by a distance of minimum 100 mm measured as a chord with a divider.

The impacts shall be directed towards the centre of gravity of the headform.

The velocity of the headform shall be  $5,42 \text{ m/s}^{+0}_{-0,1}$  (this is theoretically equivalent to a drop height of 1 500 mm).

The velocity of the headform shall be measured at a distance between 60 mm and 10 mm prior to impact, to an accuracy of 1 %.

The testing shall be conducted under recorded conditions of room temperature.

Applicable conditioning shall be made according to 5.3.

### 5.5.2.2 Recording

The measured results ( $g_{\max}$ ) shall be recorded in tabular form completed with time/acceleration diagrams.

The extent of any damage as described in 4.8 shall also be recorded.

## 5.6 Determination of resistance to penetration

### 5.6.1 Apparatus

The apparatus shall be in accordance with EN 13087-3:2000, 5.3.3.

The conical striker described in EN 13087-3:2000, 5.3.3 a) shall be used. The test block described EN 13087-3:2000, 5.3.2 shall be used.

### **5.6.2 Procedure**

The procedure shall be in accordance with EN 13087-3:2000, 5.4. The helmets shall first undergo the process of conditioning according to 5.3, selected by the test laboratory, which is likely to give the least satisfactory results.

Perform the test on sample 4 (see Table 2).

The velocity of the striker shall be one of the following:

a) 3,84 m/s <sup>+0</sup> <sub>-0,1</sub> m/s (this is theoretically equivalent to a drop height of 750 mm) for class A helmets;

b) 2,71 m/s <sup>+0</sup> <sub>-0,1</sub> m/s (this is theoretically equivalent to a drop height of 375 mm) for class B helmets.

Each helmet shall be impacted three times, each time in a different site. The sites shall be at least 100 mm apart measured as chords with dividers.

## **5.7 Determination of retention system strength**

### **5.7.1 Apparatus**

The apparatus shall be in accordance with EN 13087-5:2000, 5.3.2.

### **5.7.2 Procedure**

The procedure shall be in accordance with EN 13087-5:2000, 5.3.3.

Sample 4 (see Table 2) shall be used for the test. Fit the helmet to the appropriate headform in the manner in which it is intended to be worn on the head.

Release the drop weight and allow it to drop from a height of (200 ± 5) mm.

## **5.8 Determination of retention system effectiveness**

### **5.8.1 Apparatus**

The apparatus shall be in accordance with EN 13087-4:2000, 5.3.

### **5.8.2 Procedure**

The procedure shall be in accordance with EN 13087-4:2000, 5.4.

Hook the twisted steel wire to the rear part of the helmet.

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

## **5.9 Test report**

The test report shall contain at least the following information:

- a) identification details of the helmets tested including range of sizes and masses;
- b) results of the tests according to 5.2, 5.5, 5.6, 5.7 and 5.8;
- c) date of testing;
- d) name of the test house.

## 6 Marking

Each helmet shall be permanently 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:

- number of this European Standard, i.e. EN 1077;
- name or trademark of the manufacturer;
- designation of the model;
- designation (on class A helmet only): 'helmet for alpine skiers and for snowboarders – class A';
- designation (on class B helmet only): 'helmet for alpine skiers and for snowboarders – class B';
- size or size range of the helmet, quoted as the circumference (in cm) of the head which the helmet is intended to fit;
- weight of the helmet (the average mass in grams of the helmet size in question rounded to the nearest 50 g);
- year and quarter of manufacture.

## 7 Information to be supplied by the manufacturer

With every helmet distinct information in the language(s) of the country of sale shall be furnished as follows:

- maintenance, cleaning and storage;
- suitable accessories;
- warning if the shell is made of a material that is known to be adversely affected by contact with hydrocarbons, cleaning fluids, paints, transfers or other extraneous additions;
- that the helmet shall be adjusted to fit the wearer;
- how the helmet should rest on the head to ensure the intended protection (e.g. that it should be placed so as to protect the forehead and not be pushed too far back over the back of the head);
- that a helmet subjected to violent impact shall be discarded;
- the following text:  
'Class A and class B helmets are for alpine skiers, snowboarders and similar groups. Class A helmets offer comparatively more protection. Class B helmets may offer greater ventilation and better hearing, but protect a smaller area of the head and give a lesser degree of protection from penetration.'

## Annex ZA (informative)

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

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.

Once this standard is cited in the Official Journal of the European Communities 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 — Correspondence between this European Standard and Directive 98/37/EC**

Clause(s)/subclause(s) of this EN	Essential Requirements (ERs) of Directive 89/686/EEC, Annex II	Qualifying remarks/Notes
4.4	1.1.2.2 Classes of protection appropriate to different levels of risk	
4.2.2.1, 4.2.2.2, 4.2.2.3, 4.4, 4.7.2, 4.8	1.2.1 Absence of risk of other inherent nuisance factors	
4.1	1.2.1.1 Suitable constituent materials	
4.2.1	1.2.1.2 Satisfactory surface condition of all parts of PPE in contact with the user	
4.3	1.2.1.3 Maximum permissible user impediment	
4.2.2.1, 7	1.3.1 Adaptation of PPE to user morphology	
5.3	1.3.2 Lightness and design strength	
6, 7	1.4 Information supplied by the manufacturer	
4.2.2.3, 4.7.1	2.1 PPE incorporating adjustment systems	
5.3.3, 6, 7	2.4 PPE subject to ageing	
6, 7	2.12 PPE bearing one or more identification or recognition marks directly or indirectly relating to health and safety	
4.5, 4.6	3.1.1 Impact caused by falling or projecting objects and collision of parts of the body with obstacle	

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

## Bibliography

- [1] EN 1811, *Reference test method for release of nickel from products intended to come into direct and prolonged contact with the skin*
- [2] EN 13087-1:2000, *Protective helmets — Test methods — Part 1: Conditions and conditioning*

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