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## Protective helmets – Test methods – Part 5: Retention system strength

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## Skyddshjälm – Provnings- metoder – Del 5: Hakbandets håll- fasthet

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English version

## Protective helmets - Test methods - Part 5: Retention system strength

Casques de protection - Méthodes d'essai - Partie 5:  
Résistance du système de rétention

Schutzhelme - Prüfverfahren - Teil 5: Festigkeit des  
Haltesystems

This European Standard was approved by CEN on 18 June 2000.

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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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## 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of an identical text or by endorsement, at the latest by February 2001, and conflicting national standards shall be withdrawn at the latest by February 2001.

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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

It consists of ten Parts as follows:

- Part 1 : Conditions and conditioning
- Part 2 : Shock absorption
- Part 3 : Resistance to penetration
- Part 4 : Retention system effectiveness
- Part 5 : Retention system strength
- Part 6 : Field of vision
- Part 7 : Flame resistance
- Part 8 : Electrical properties
- Part 9 : Mechanical rigidity
- Part 10 : Resistance to radiant heat

## Introduction

This standard is intended as a supplement to the specific product standards for protective helmets (helmet standards). This method or other test methods may be applicable to specified for complete helmets or parts thereof, and may be referenced in the appropriate helmet standards.

Performance requirements are given in the appropriate helmet standard, as are such prerequisites as the number of samples, preconditioning, preparation of samples for the tests, sequence and duration of testing and assessment of test results. If deviations from the test method given in this standard are necessary, these deviations will be specified in the appropriate helmet standard.

## 1 Scope

This European Standard describes methods of test for protective helmets. The purpose of these tests is to enable assessment of the performance of the helmet as specified in the appropriate helmet standard.

This standard specifies the method of test for retention system strength.

## 2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 960:1994 Headforms for use in the testing of protective helmets.

EN 13087-1 Protective helmets – Test methods - Part 1: Conditions and conditioning

## 3 Terms and definitions

For the purposes of this European Standard, terms and definitions given in this standard may be found in the appropriate helmet standard.

## 4 Prerequisites

In order to implement this standard, at least the following parameters shall be specified in the appropriate helmet standard:

- a) performance requirements
- b) number of samples
- c) preparation of samples
- d) sequence of conditioning
- e) sequence of tests
- f) method of test - 5.2. (including 5.2.3.1. or 5.2.3.2) , 5.3 or 5.4, and the initial and intermediate forces.
- g) sizes of the headforms
- h) impact energy, including tolerance, of the falling mass - methods 5.3 and 5.4.
- i) fitting instructions

## 5 Methods

### 5.1 General

Testing shall be performed in ambient conditions specified in EN 13087-1.  
Three test methods are specified. The method to be used is specified in the helmet standard.

### 5.2 Headform support, increasing load method

#### 5.2.1 Principle

The helmet is supported on a headform and a specified, varying force is applied to the retention system via an artificial jaw. In method (a) the ultimate tensile strength of the system alone is measured. In method (b) the elongation of the system is measured as well.

#### 5.2.2 Apparatus

##### 5.2.2.1 General

The apparatus shall include:-

- a series of headforms
- a rigid structure to support the headforms
- an artificial jaw
- a means of applying a variable tensile force to the artificial jaw
- a means to measure the displacement of the artificial jaw

An arrangement of a suitable apparatus is shown in Figure 1.

##### 5.2.2.2 Test headforms

Headforms, conforming to EN 960:1994, 2.2, 4.1, 4.2, 4.3.1. The sizes to be used are specified in the helmet standard, but shall be selected from sizes A, E, J, M and O.

##### 5.2.2.3 Rigid structure

Rigid structure, capable of supporting the headform so that it does not move during the test.

##### 5.2.2.4 Artificial jaw

Artificial jaw, comprising two rigid cylindrical rollers of diameter  $(12,5 \pm 0,5)$  mm, with their longitudinal axes separated by  $(75 \pm 2)$  mm.

##### 5.2.2.5 Means of applying a known variable force to the artificial jaw

Any suitable means may be used.

##### 5.2.2.6 Means to measure the displacement of the artificial jaw

Any suitable means may be used.

### 5.2.3 Procedure

#### 5.2.3.1 Method (a)

Mount the helmet on the appropriate headform, pass the chinstrap through and secure it around the artificial jaw.

Apply the initial tensile force as specified in the appropriate helmet standard to the artificial jaw. Increase the force at a rate of  $(20 \pm 2)$  N/min until the artificial jaw is released due to failure of the retention system.

Record the maximum force measured during the test and the mode of failure of the retention system.

#### 5.2.3.2 Method (b)

Mount the helmet on the appropriate headform, pass the chinstrap through and secure it around the artificial jaw.

Apply the initial tensile force as specified in the appropriate helmet standard in order to ensure that the fastening device is correctly tightened. Note the position,  $P_0$ , of the load bearing spindle to the nearest millimetre.

Increase the force over a period of  $(30 \pm 3)$  s up to the intermediate force specified in the appropriate helmet standard. Maintain this force for  $(120 \pm 3)$  s, then note the position,  $P_1$ , of the load bearing spindle to the nearest millimetre, and, if required by the appropriate helmet standard, re-measure the width of the chinstrap.

Increase the force at a rate of  $(500 \pm 50)$  N/min until the artificial jaw is released due to failure of the retention system. Record the maximum force measured during the test and the mode of failure of the retention system.

### 5.2.4 Test report

#### *Method (a)*

Report the maximum force measured during the test and the mode of failure of the retention system.

#### *Method (b)*

Calculate and report the elongation of the retention system as the difference between positions  $P_0$  and  $P_1$ .

Report the maximum force measured during the test and the mode of failure of the retention system, and, if required, the width of the chinstrap.

### 5.3 Hook support, dynamic load method

#### 5.3.1 Principle

The helmet, including retention system, is fitted to a headform which is then subjected to a sudden downward force. The maximum and residual displacements of the headform are measured.

#### 5.3.2 Apparatus

##### 5.3.2.1 General

The apparatus shall include:-

- a series of headforms
- a helmet support hook assembly
- a rigid structure to support the helmet and loading system
- a falling mass and associated guidance system
- a means to measure impact speed
- a means to measure the position and displacement of the headform in a vertical direction

An arrangement of a suitable apparatus is shown in Figure 2.

##### 5.3.2.2 Test headforms

The headforms shall comply with EN 960:1994, 2.2 and clause 4. The sizes to be used are specified in the helmet standard, but shall be selected from sizes A, C, E, G, J, K, M and O. Each headform, together with the parts attached to it, shall have a total mass of  $(15 \pm 0,5)$  kg.

##### 5.3.2.3 Helmet support hook assembly

The helmet support hook assembly shall be made from steel and is shown in Figure 3.

##### 5.3.2.4 Rigid structure

The rigid structure shall adequately support the helmet and loading system during the test.

##### 5.3.2.5 Falling mass and guidance system

A guidance system shall be provided to enable the falling mass of  $(10 \pm 0,1)$  kg to be dropped in guided fall on to the metal end stop.

The guidance system shall be such as to ensure that the falling mass falls with an impact speed of not less than 95% of that which would theoretically obtain for a free fall.

##### 5.3.2.6 Means to measure impact speed

Means shall be provided to measure the speed of the falling mass at a distance of not more than 60 mm prior to impact, to within an accuracy of  $\pm 1\%$ .

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

##### 5.3.2.7 Means to observe the position and displacement of the headform in a vertical direction.

Any suitable means may be used.