BS EN 13087-5:2012

BSI Standards Publication

# Protective helmets — Test methods

## Part 5: Retention system strength

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**National foreword**

This British Standard is the UK implementation of EN 13087-5:2012. It supersedes BS EN 13087-5:2000 which is withdrawn.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.

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

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| Date | Text affected |
|---|---|

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 13087-5

February 2012

ICS 13.340.20

Supersedes EN 13087-5:2000

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 17 December 2011.

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# Foreword

This document (EN 13087-5:2012) 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of an identical text or by endorsement, at the latest by August 2012, and conflicting national standards shall be withdrawn at the latest by August 2012.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 13087-5:2000.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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

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

This European Standard consists of the following ten parts:

*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*[1]*;*

*Part 10 : Resistance to radiant heat.*

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[1] To be published.

# Introduction

This European 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 specifies 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 European Standard specifies the method of test for retention system strength.

# 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*

EN 13087-1, *Protective helmets — Test methods — Part 1: Conditions and conditioning*

# 3 Terms and definitions

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

# 4 Prerequisites

In order to implement this part of EN 13087, 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) (see 5.2.3.1) the ultimate tensile strength of the system alone is measured. In method (b) (see 5.2.3.2) 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 960:2006, 2.2, 3.1.2 and 3.2. The sizes to be used are specified in the helmet standard, but shall be selected from size designations 495, 535, 575, 605 and 625 (equivalent to codes A, E, J, M and O, respectively, EN 960:1994).

#### 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 ± 0,5) mm, with their longitudinal axes separated by (75 ± 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 ± 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 ± 3) s up to the intermediate force specified in the appropriate helmet standard. Maintain this force for (120 ± 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 ± 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 960:2006, 2.2, 3.1.2 and 3.2. The sizes to be used are specified in the helmet standard, but shall be selected from size designations 495, 515, 535, 555, 575, 585, 605 and 625 (equivalent to codes A, C, E, G, J, K, M and O, respectively, EN 960:1994). Each headform, together with the parts attached to it, shall have a total mass of (15 ± 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 ± 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 no 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 no more than 60 mm prior to impact, to within an accuracy of ± 1 %.

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

### 5.3.3 Procedure

Support the helmet from the rigid structure by means of the helmet support hook passing through a suitable hole drilled through the point of the helmet which corresponds with the central vertical axis of the headform.

Insert the headform into the helmet and locate the guide so that the falling mass is free to move only along a vertical line that passes through the point at which the helmet is supported.

Fasten the retention system in accordance with the fitting instructions.

Measure to the nearest millimetre the vertical position of the point of application of the force without the falling mass resting on the system.

Allow the mass to fall on to the anvil through the required height to give the impact energy specified in the helmet standard. Measure to the nearest millimetre the maximum dynamic displacement of the point of application of the force.

At between 115 s and 125 s after the test, measure to the nearest millimetre the residual displacement of the point of application of the force whilst the falling mass is resting on the anvil.

If specified in the helmet standard, ascertain whether the retention system can be released using only one hand whilst the falling mass is resting on the anvil.

#### 5.3.4 Test report

Report the maximum dynamic displacement and the residual displacement of the point of application of the force and, if specified in the helmet standard, whether the retention system can be released using only one hand.

### 5.4 Headform support, dynamic load method

#### 5.4.1 Principle

The helmet is supported on a headform and a sudden downward force is applied to the retention system via an artificial jaw. The maximum dynamic displacement and the residual displacement of the jaw is measured.

#### 5.4.2 Apparatus

##### 5.4.2.1 General

The apparatus shall include:

— a series of headforms;

— a rigid structure to support the headforms;

— an artificial jaw;

— a falling mass and associated guidance system;

— a means to measure impact speed;

— a means to measure the displacement of the artificial jaw.

An arrangement of a suitable apparatus is shown in Figure 4.

##### 5.4.2.2 Test headforms

The headforms shall comply with EN 960:2006, 2.2, 3.1.2 and 3.2. The sizes to be used are specified in the helmet standard, but shall be selected from size designations 495, 535, 575, 605 and 625 (equivalent to codes A, E, J, M and O, respectively, EN 960:1994).

##### 5.4.2.3 Rigid structure

The rigid structure shall be such as to support the headform so that it does not move during the test.

#### 5.4.2.4 Artificial jaw

The artificial jaw comprises two rigid cylindrical rollers of diameter (12,5 ± 0,5) mm, with their longitudinal axes separated by (75 ± 2) mm. A means to apply the test force to the jaw shall be provided.

#### 5.4.2.5 Falling mass and guidance system

A guidance system shall be provided to enable the falling mass of (4 ± 0,1) kg to be dropped in guided fall. Means shall be provided to observe the position and displacement of the artificial jaw in a vertical direction.

The mass of the guidance and loading system, excluding the falling mass, shall be (5 ± 0,5) kg.

The guidance system shall be such as to ensure that the falling mass falls with an impact speed of no less than 95 % of that which would theoretically obtain for a free fall.

#### 5.4.2.6 Means to measure impact speed

Means shall be provided to measure the speed of the falling mass at a distance of no more than 60 mm prior to impact, to within an accuracy of ± 1 %.

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

### 5.4.3 Procedure

Mount the helmet on the headform and pass the chinstrap around the artificial jaw and secure it, so that the guidance and loading system hangs freely on the retention system.

Measure to the nearest millimetre the vertical position of the point of application of the force without the falling mass resting on the system.

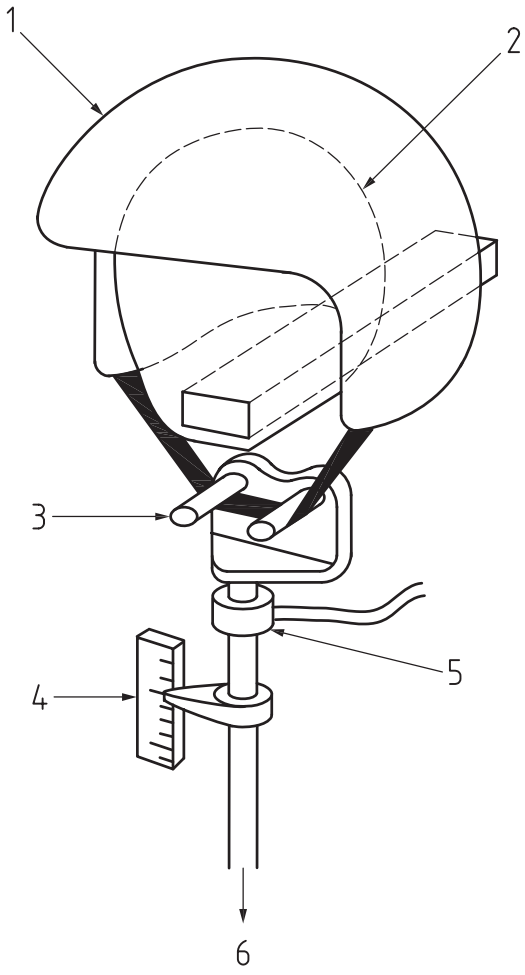
Allow the mass to fall on to the anvil through the required height to give the impact energy specified in the helmet standard. Measure to the nearest millimetre the maximum dynamic displacement of the point of application of the force.

At between 115 s and 125 s after the test, measure to the nearest millimetre the residual displacement of the point of application of the force whilst the falling mass is resting on the metal end stop.

If specified in the helmet standard, ascertain whether the retention system can be released using only one hand.

### 5.4.4 Test report

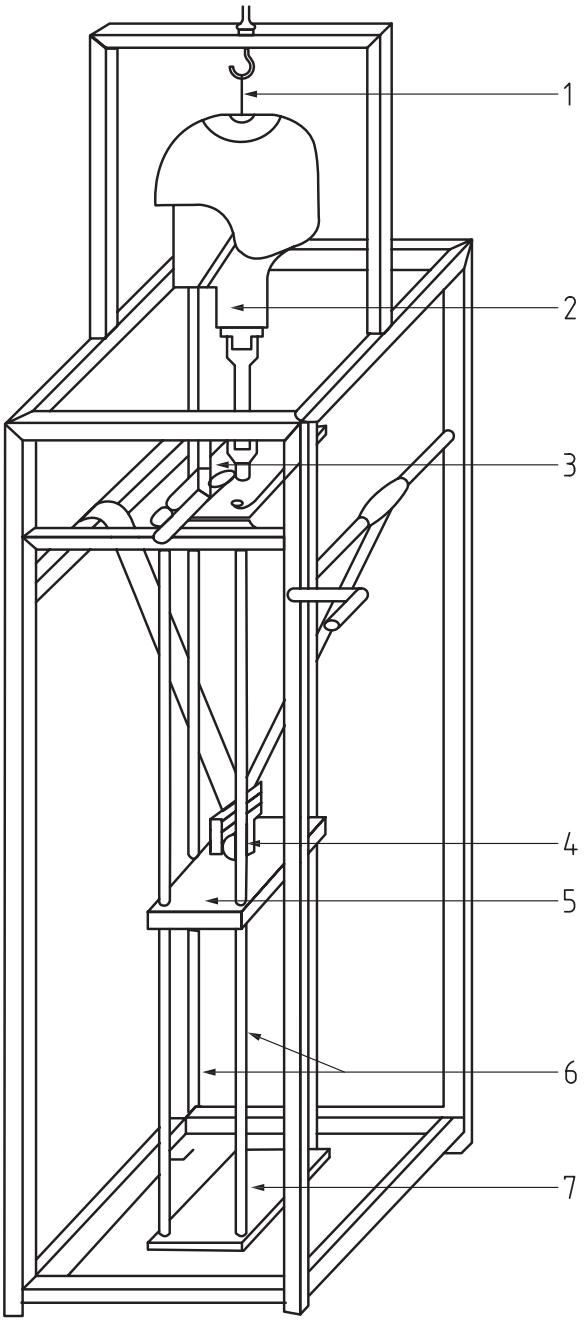
Report the maximum dynamic displacement and the residual displacement of the point of application of the force, and, if specified in the helmet standard, whether the retention system can be released using only one hand.




**Key**

1 helmet
2 headform
3 artificial jaw
4 displacement indicator
5 load cell (optional)
6 pulling strength

**Figure 1 — Determination of retention system strength by headform support, increasing load method**

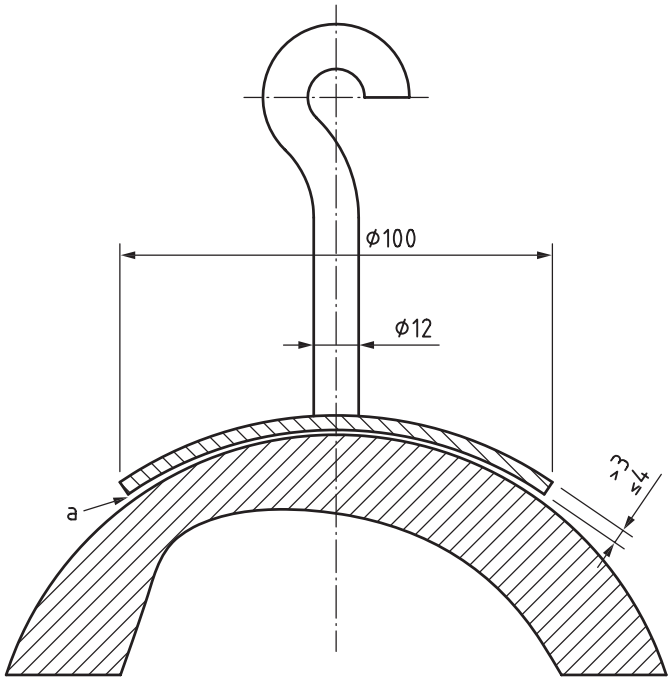



**Key**

1 helmet support hook
2 headform
3 displacement indicator
4 falling mass release
5 falling mass
6 guides
7 metal end stop

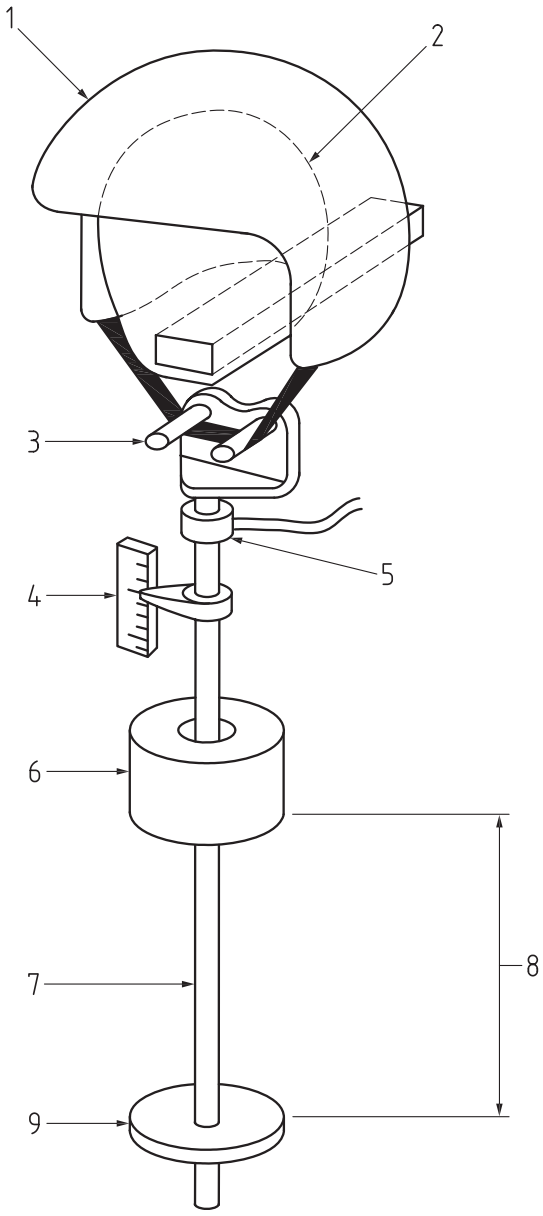
**Figure 2 — Determination of retention system strength by hook support, dynamic load method**

Dimensions in millimetres




[a] Deviation from headform profile of 2 mm maximum

**Figure 3 — Helmet support hook assembly for hook support, dynamic load method**




**Key**

1 helmet
2 headform
3 artificial jaw
4 displacement indicator
5 load cell (optional)
6 falling mass
7 guide bar
8 drop height
9 metal end stop

**Figure 4 — Determination of retention system strength by headform support, dynamic load method**

# Annex A
(normative)

# Test results – Uncertainty of measurement

For each of the required measurements performed in accordance with this European Standard, a corresponding estimate of the uncertainty of measurement shall be evaluated. This estimate of uncertainty shall be applied and stated when reporting test results, in order to enable the user of the test report to assess the reliability of the data.

# Annex B
(informative)

# Significant technical changes between this European Standard and EN 13087-5:2000

The significant changes with respect to the first edition of EN 13087-5 are as listed below.

**Table B.1 — Significant changes between this European Standard and EN 13087-5:2000**

| Clause/paragraph/table/figure | Change |
|---|---|
| Clause 2 | The normative references in Clause 2 and in the text have been updated.<br>EN 960 has been dated throughout the text. |
| 5.2.2.2 | Update of cross references.<br>Sizes have been extended to size designations and between brackets EN 960:1994 equivalent code letters. |
| 5.3.2.2 | Update of cross references.<br>Sizes have been extended to size designations and between brackets EN 960:1994 equivalent code letters. |
| 5.4.2.2 | Update of cross references.<br>Sizes have been extended to size designations and between brackets EN 960:1994 equivalent code letters. |
| Annex ZA | Has been updated. |
| 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, together with the relevant requirements given in the product standard, confers, within the limits of the scope of this standard, a presumption of conformity with the Essential Requirements 2.1 of Annex II of that Directive and associated EFTA regulations.

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