BS EN 13087-2:2012

BSI Standards Publication

Protective helmets — Test methods

Part 2: Shock absorption

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National foreword

This British Standard is the UK implementation of EN 13087-2:2012. It supersedes BS EN 13087-2:2000 which is withdrawn.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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Foreword

This document (EN 13087-2:2012) 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of an identical text or by endorsement, at the latest by August 2012, and conflicting national standards shall be withdrawn at the latest by August 2012.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 13087-2:2000.

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 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

The 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 for determination of shock absorption.

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 960:2006, *Headforms for use in the testing of protective helmets*

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

ISO 6487, *Road vehicles — Measurement techniques in impact tests — Instrumentation*

3 Terms and definitions

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

4 Prerequisites

In order to implement this part of EN 13087, at least the following parameters need to 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 or 5.3;

g) sizes of headforms;

h) type of striker or anvil;

i) fitting instructions;

j) number and location of impact points on helmets;

k) for each impact, the impact energy, including tolerance, of the falling mass for the falling mass method, or the impact speed, including tolerance, of the helmet/headform assembly for the falling headform method.

5 Test methods

5.1 General

Testing shall be performed in the ambient conditions specified in EN 13087-1. When the test method specifies that the helmet shall be fitted to a headform, this shall be done in accordance with the appropriate helmet standard. Two test methods are specified. The appropriate helmet standard will state which of these methods is applicable. Annex A refers to the uncertainty of measurement.

5.2 Falling mass method

5.2.1 Principle

A specified striker is allowed to fall with specified energy on to a helmet which is fitted to a rigidly mounted headform. The transmitted force is measured by means of a force transducer located beneath the headform.

5.2.2 Apparatus

5.2.2.1 Base

The base shall be solid, made of steel or a combination of steel and concrete and have a mass of not less than 500 kg. At least the uppermost 25 mm shall consist of steel, which shall be firmly attached to the concrete if present. No part of the base and headform mounting assembly shall have a resonant frequency liable to affect the measurements.

NOTE See 5.2.2.6.2 regarding frequency response.

5.2.2.2 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). When in the upright position, the headform shall be positioned so that its central vertical axis coincides with those of the force transducer and striker.

5.2.2.3 Striker

Two types of striker are specified - a flat one and a hemispherical one. The type of striker to be used is specified in the appropriate helmet standard.

The striker shall be made of steel and have a mass of (5 ± 0,05) kg.

The flat striker shall have a flat striking face of diameter (100 ± 2) mm, with the edge of its circumference radiused to nominally 2 mm.

The hemispherical striker shall have a hemispherical striking face of radius (50 ± 1) mm.

5.2.2.4 Guidance system

Means shall be provided for the striker to be dropped in free or guided fall.

The guidance system shall be such as to ensure that the striker:

— shall be positioned above the headform so that its central axis coincides with the central vertical axis of the force transducer; and

— falls on to the required impact point with an impact speed of not less than 95% of that which would theoretically obtain for a free fall.

5.2.2.5 Means to measure impact speed

Unless free fall is employed, means shall be provided to measure the striker speed 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 impact, but has to be sufficiently regular to comply with 5.2.2.4.

5.2.2.6 Instrumentation to record and analyse the data

5.2.2.6.1 Force transducer

The non-inertial force transducer shall be firmly attached to the base and arranged so that its sensitive axis coincides with the vertical axis passing through the centre of gravity of the headform and the centre of the striker. The transducer shall be capable of withstanding a compressive force of 40 kN without damage.

5.2.2.6.2 Signal conditioning instrumentation

The instrumentation shall provide for the complete measuring channel to have a frequency response in accordance with channel frequency class (CFC) 600 of ISO 6487. If digital sampling is employed, a sample rate of at least 6 kHz shall be used. The required low pass filter may be included within the computer software.

Means shall be provided to record the maximum force transmitted during impact, to the nearest 10 N.

5.2.3 Procedure

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 and allow the striker to fall on to the specified impact point. The impact energy shall be as specified in the appropriate helmet standard.

If the design of the helmet permits direct contact between the striker and the headform, the test shall not be performed and the result shall be declared a failure.

5.2.4 Test report

Record and report the maximum force transmitted during the impact to the nearest 10 N.

5.3 Falling headform method

5.3.1 Principle

The helmet to be tested is fitted to a headform and the assembly is allowed to fall with specified speed on to a rigidly mounted anvil. The deceleration of the headform is measured by means of a tri-axial accelerometer located within the headform.

5.3.2 Apparatus

5.3.2.1 Base

The base shall be solid, made of steel or a combination of steel and concrete and have a mass of not less than 500 kg. At least the uppermost 25 mm shall consist of steel, which shall be firmly attached to the concrete if present. No part of the base and anvil assembly shall have a resonant frequency liable to affect the measurements.

NOTE See 5.3.2.6.2 regarding frequency response.

5.3.2.2 Anvil

Two types of anvil are specified - a flat one and a kerbstone one. Both shall be made of steel. The anvil to be used is specified in the appropriate helmet standard.

The flat anvil shall have a flat impact face of diameter (130 ± 3) mm, with the edge of its circumference radiused to nominally 2 mm.

The kerbstone anvil shall have two faces, each inclined at (52,5 ± 2,5)° to the vertical and meeting along a striking edge with a radius of (15 ± 0,5) mm. The height shall be not less than 50 mm and the length not less than 125 mm.

5.3.2.3 Guidance system

Means shall be provided for the headform/helmet assembly to be dropped in free or guided fall.

The guidance system shall provide for the positioning of any impact point on the helmet vertically above the anvil, within a radius of 10 mm. It shall be such as to ensure that the headform/helmet assembly falls on to the anvil with an impact speed of not less than 95 % of that which would theoretically obtain for a free fall. Its characteristics shall not affect the measurement of acceleration of the headform/helmet assembly.

5.3.2.4 Means to measure impact speed

Unless free fall is employed, means shall be provided to measure the headform/helmet assembly speed at a distance of not more than 60 mm prior to impact, to within an accuracy of ± 1 %.

5.3.2.5 Test headforms

The headforms shall comply with EN 960:2006, 2.2, 2.12, 3.1.1, 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).

5.3.2.6 Instrumentation to record and analyse the data

5.3.2.6.1 Accelerometer

The tri-axial accelerometer shall be firmly attached to the headform near to its centre of gravity.

NOTE ISO 6487 recommends that the Z axis of the accelerometer should coincide with the vertical axis passing through the centre of gravity of the headform, whilst the X axis corresponds with the longitudinal axis and the Y axis with the transverse axis.

The mass of the accelerometer and its mounting shall not exceed 50 g.

The accelerometer shall be capable of withstanding a maximum acceleration of 2 000 g without damage.

5.3.2.6.2 Signal conditioning instrumentation

The instrumentation shall provide for each complete measuring channel to have a frequency response in accordance with channel frequency class (CFC) 1000 of ISO 6487. If digital sampling is employed, a sample rate of at least 6 kHz per channel shall be used. The required low pass filters may be included within the computer software.

Means shall be provided to record the maximum deceleration during impact versus time, to the nearest 1 g and 0,1 ms, respectively.

5.3.3 Procedure

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. The impact speed shall be as specified in the helmet standard.

If the design of the helmet permits direct contact between the headform and the anvil, the test shall not be performed and the result shall be declared a failure.

5.3.4 Test report

Record for each axis the values of deceleration during the impact versus time to the nearest 1 g and 0,1 ms, respectively.

Calculate and report the maximum deceleration as the maximum value of the resultant of the decelerations of the three axes.

$$g_{max} = \mathrm{Max}\left[\sqrt{\left(x^2 + y^2 + z^2\right)}\right]$$

Calculate and report any other result as specified in the helmet standard.

Annex A
(normative)

Test results – Uncertainty of measurement

For each of the required measurements performed in accordance with this 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 13087-2:2000

The significant changes with respect to the first edition of EN 13087-2 are as listed below.

Table B.1 — Significant changes between this European Standard and EN 13087-2:2000

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.
5.2.2.2	Update of cross references. Sizes have been extended to size designations and between brackets EN 960:1994 equivalent code letters.
5.3.2.5	Update of cross references. 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 3.1.1 of Annex II of that Directive and associated EFTA regulations.

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