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Guidance Document for drafting CEN/TC 158 Standards

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

This document (CEN/TR 16149:2011) has been prepared by Technical Committee CEN/TC 158 “Head Protection”, the secretariat of which is held by BSI.

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.

Introduction

This document has been produced by the convenors of CEN/TC158 working groups. It is intended to serve as a guide, to be consulted when drafting new EN standards for head protection and when revising or amending existing ones.

Whilst implementation of its contents is not mandatory, working groups are urged not to make deviations from this guidance document without good cause.

This is a living document – omissions will be covered in later issues.

In this document, reference is made to CEN/TR 16148, *Head and neck impact, burn and noise injury criteria — A Guide for CEN helmet standards committees*. This gives further guidance about the areas of the head which helmet standards should aim to protect, and about head and neck injuries.

The working group should assess the foreseeable risks against which the helmet should provide protection. Each of the helmet standards should provide for a helmet, which will offer optimum protection to the head against these foreseeable risks and should satisfy the Basic Health and Safety Requirements of EU Directive 89/686/EEC to the extent indicated in Annex ZA of the helmet standard.

Helmet standards should indicate, in an informative annex, how the level of performance requirements specified relates to the severity of injury to be tolerated. Working groups should refer to CEN/TR 16148 when drafting this annex.

Reference is also made to EN 13087 (all parts), *Protective helmets — Test methods*. This standard provides harmonized methods of test for many of the topics listed below. The various parts of EN 13087 are listed in the Bibliography.

1 General

Typically, a helmet standard will include a Requirements section and a Testing section.

1.1 Requirements section

The topics listed below should always be addressed, as a minimum. Other requirements, not included here, will be dependent upon the type of helmet for which the standard is being written.

The choice of performance requirements should be based upon the risk to the wearer and the ability to perform the tasks to be undertaken whilst wearing the helmet.

It is recommended that these criteria be stated in the introduction to the helmet standard (and possibly also in the Scope) so that the risks and work activities that the standard intends to cover are made clear. It may also be useful to state the injury level that is regarded as tolerable when the helmet meets its performance requirements. This needs to be phrased with care – it should not suggest that it can replace the need for the user to conduct their own risk assessment before choosing/using a helmet, nor should it exclude the helmet from carefully considered use outside its primary field of use.

The level of performance requirement should be based upon the severity of injury to be tolerated. Refer to CEN/TR 16148 for specific guidance on the relevant topic. If there is a performance requirement then there must be a corresponding test method.

1.2 Testing section

Before specifying a test for a particular requirement, check to see if there is a relevant part of EN 13087. If there is not, or if the EN 13087 method is not considered suitable by the WG, then the WG should write a test method and include it in the helmet standard.

2 Type of injuries

This topic is covered in CEN/TR 16148.

3 Areas of coverage, areas to be protected and areas to be tested

The following three areas are variously mentioned in many helmet standards. For the purpose of this document, they are defined and explained as follows.

1) ‘Area to be tested’ - the area /points on the helmet which will be subjected to a performance test (not only a visual assessment). This area may include ventilation features.

2) ‘Area to be protected’ - the area/points on a head or headform for which protection is intended/deemed to be provided by the helmet. This area should correspond to the parts of the head that are intended to be protected from injury, as described at the end of this section.

The helmet standard should specify performance and, if necessary, constructional requirements for all areas designated as areas to be protected. It is preferable for the ‘area to be protected’ to be entirely described by the area to be tested, i.e. to be defined only by performance requirements.

However, if performance testing of some parts of the ‘area to be protected’ is deemed by the working group to be too complex or difficult, then a constructional requirement may be used – e.g. specify a minimum thickness of the shell or liner or both and that the shell or liner or both shall be of the same density and material as within the test area. Such a constructional requirement should be carefully considered, and in particular the

validity of the assumption, that a similar thickness of shell or liner or both at different points on the helmet will afford similar impact performance at those different points, should be examined.

Therefore, the 'area to be protected' will include, but may extend beyond, the area to be tested by a performance test, (1) above.

3) 'Area of coverage', 'extent of coverage' - the area/points on a head or headform which are intended to be covered by the helmet; currently assessed visually in several helmet standards. These, and similar, terms should not be used within helmet standards because they are not relevant to the protective function of the helmet. They are subjective, cause confusion and lead to differences in interpretation.

For each performance requirement (e.g. shock absorption, resistance to penetration, etc), the working group should determine requirements for areas (1) and (2). These should be defined and assessed using the appropriate test headform, specified in the helmet standard.

For example, EN 1078:1997 states specifically:

"4.4 Shock absorbing capacity

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

Standards should be no less descriptive than this example and should consider the need to be more descriptive with reference to N551. For example, use of terms such as "temporal region", "parietal region" and "occipital region" should be encouraged; if the Committee believes that this gives a more precise definition for the purpose of protection. Furthermore, if one part of the head is deemed to be more vulnerable or more susceptible to injury for a given dose (for example force, acceleration) then the committee should consider this and prescribe different requirements for the different parts. For example it is known that an impact in the temporal region is likely to be more in injurious than an equivalent impact to the occipital region. The committee should be precise about the requirements for the area of protection if this is defined to be greater than the test area. It is not sufficient simply to define an area of protection without defining the requirements for that area.

As is noted in Clause 13 (and in sections W and X of Annex A), parts of the helmet (and accessories) may, or may not, have a protective function. Where part of the helmet or an accessory is not designed to protect it must not reduce the level of protection afforded by any other part of the helmet. In practice, this will often mean that the helmet should be tested with the non-protective part of the helmet or accessory fitted.

4 Field of vision

There will generally be a need to define at least a minimum requirement for the field of vision, since there is a balance between the protection from impact etc. and the risk of the field of vision being too small to be safe. The working group should specify the requirements for field of vision that are relevant for the particular type of helmet. In many types of helmet, requirements for field of vision may compromise both the area of the head to be protected and the area of the helmet to be tested for shock absorption and/or penetration.

Examples of field of vision requirements in helmet Standards include:

— Motorcycle helmets (UN ECE 22 05) – upward 7o from top of eyes, downward 45o from bottom of eyes, horizontally +/-52.5o. This reflects the need to protect the forehead and the lack of need to view very far upward to see the road, etc. The same requirement is used for snowmobile/bobsleigh helmets (EN 13781:2001) for the same reasons.

— Ice hockey helmets (EN ISO 10256:2003) - upward 35o from top of eyes, horizontally +/-45o. Here there is a greater need for upward vision, while there is no chin-guard so downward vision has not been specified.

A useful reference for general fields of vision for different tasks is EN 894-2:1997, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays.* Subclauses 4.1.1 and 4.1.2 define three zones of decreasing efficiency for visual signal detection and monitoring tasks;

— recommended zone – a cone with 30o internal angle;

— acceptable zone – between a cone with 30o and 60o internal angle; and

— not suitable zone – outside a cone with 60o internal angle.

Of course, for many helmet applications peripheral vision outside the 60o cone is still needed (e.g. the Standards above).

Requirements for field of vision should use the test method given in EN 13087-6.

5 Helmet sizes

Helmet standards should specify which requirements are to be satisfied for particular sizes, or for ranges of helmet sizes, relevant to the population of intended wearers.

If ranges of sizes is preferred, it may be useful to refer in the standard to “helmet type”, i.e. “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”.

6 Ventilation

Ventilation features should allow air movement between the inside and outside of the helmet.

Ventilation of any helmet has an important impact on comfort and wearability. However, at present, there is no recognised test method for assessing ventilation performance. In many types of helmet, requirements for ventilation may compromise both the extent of protection provided and the area of the helmet to be tested for shock absorption and/or penetration. If ventilation features are provided and are positioned within the area of the helmet to be tested for shock absorption and/or penetration, all such features should be subjected to these tests. The definition of ventilation (and non-ventilation) holes and features needs to be carefully considered and clearly worded so as to avoid ambiguities in interpretation.

7 Mass

The mass of the helmet should always be made available to the user. The working group should define how and where this is done.

8 Comfort

It should be remembered that comfort is a very subjective assessment. However, it is a well-known fact that the more comfortable a piece of personal protective equipment, the more likely the user is to wear it. Many factors are involved – mass / position of the centre of gravity / stability of the helmet on the head / ventilation / provision of a comfort band or sweatband, etc.

If provision is made for the fixing of accessories, such as ear-muffs, face-shields, etc, both the design and positioning of the fixing point can affect the comfort of the total assembly.

Comfort is generally best assessed by practical performance tests. Such tests may be combined with tests for compatibility (see Clauses 14 and 15). There are existing standards which specify requirements and test

methods for the objective and subjective evaluation of the ergonomic and thermal effects on the human body of personal protective equipment (PPE) ensembles, including gloves, footwear, clothing, helmets and respiratory protective equipment (RPE), on wearers.

For example, BS 8469:2007, *Personal protective equipment for firefighters — Assessment of ergonomic performance and compatibility — Requirements and test methods* has been developed for the PPE ensembles used in structural firefighting.

Similarly, BS 7971-2:2003, *Protective clothing and equipment for use in violent situations and in training - Part 2: Guidance on risk assessment and on the selection, use, cleaning and maintenance of protective clothing and equipment* also has some advice on user trials of PPE (Subclause 5.4).

These standards are also useful references for practical performance trials of compatibility (see Clauses 14 and 15).

9 Skin irritation

At present, there are no prescriptive requirements for skin irritation. Refer to EU Directives 67/548/EEC and 76/769/EEC. (See also Clause 10, Innocuousness of materials.)

10 Innocuousness of materials

A recommendation has been sent to all PPE Technical Committees to introduce a clause and an informative annex on innocuousness, based on a model European Standard EN 340:2003, *Protective clothing — General requirements*. Further guidance is included in part C2 of Document PPE N122, CEN PPE Forum, *Guide for the drafting or the revision of EN standards on PPE*.

11 Ignitability / Flame resistance

The underlying philosophy for requiring an ignitability test is that wearing a helmet should not increase the user's susceptibility to injury from flame. The test method is given in EN 13087-7. More severe ignitability test methods are given in EN 13274-4, *Respiratory protective devices — Methods of test — Part 4: Flame tests*.

12 Corrosion

If metal parts are used in the helmet construction, the working group should consider whether the corrosion of such parts during the lifetime of the helmet would adversely affect the protection afforded by the helmet or adversely affect its innocuousness.

13 Combined and combination PPE and accessories

Other items of PPE and accessories are often attached to, or built into, protective helmets. This practice then leads to the questions – "Does the helmet continue to satisfy the respective helmet standard, when such other items are attached or built in?"; "If the other item is PPE, normally covered by its own standard, does the item still satisfy its standard when attached to or built into the helmet?"

Following consideration of these questions within a CEN/BTS/4 ad hoc group a few years ago, the wording as given in Annex A was recommended and this should be applied by all TC158 working groups.

As noted Annex A, parts of the helmet and accessories may, or may not, have a protective function. Where part of the helmet or an accessory does not have a protective function, it must not reduce the level of

protection offered by any other part of the helmet. In practice, this will often mean that performance tests should be conducted with the non-protective part of the helmet or accessory fitted.

14 Compatibility with other headgear

The wearing of other PPE headgear (e.g. = goggles, respiratory protective device) at the same time as helmets should be considered, such that the ensemble should be wearable, and the individual items should continue to provide the same protection as when worn alone.

This item is not the same as (12) above and it is clearly difficult to give guidance on all eventualities. The working group should consider possible implications and draft requirements accordingly. Refer also to Annex A.

The compatibility of helmets with other PPE, whether this is solely headgear or covers other parts of the body, is generally best assessed by practical performance tests. Such tests may be combined with tests for comfort (see Clause 8). There are existing standards which specify requirements and test methods for the objective and subjective evaluation of the compatibility of PPE ensembles. Examples of these standards are given in Clause 8.

15 Compatibility with other PPE

The wearing of other PPE (e.g. – jacket, gloves) at the same time as helmets should be considered such that the ensemble should be wearable, and the individual items should continue to provide the same protection as when worn alone. The working group should consider possible implications and draft requirements accordingly.

The compatibility of helmets with other PPE, whether this is solely headgear or covers other parts of the body, is generally best assessed by practical performance tests. Such tests may be combined with tests for comfort (see Clause 8). There are existing standards which specify requirements and test methods for the objective and subjective evaluation of the compatibility of PPE ensembles. Examples of these standards are given in Clause 8.

16 Shock absorption

Head protection should absorb energy and spread the impact force over the head.

The working group should consider likely accidents, likely injury types, likely wearer profiles, and the desirable Abbreviated Injury Scale (AIS). The wearability of the helmet, the impact test site and impact angle, the striker shape, and the need for single or multiple impacts, should also be considered.

Harmonised test methods are specified in EN 13087-2. Helmet standards should be consistent in specifying these requirements – e.g. peak force, deceleration, HIC, GSI, etc.

17 Rotational effects

Head protection should limit the force and torque applied to the skull, brain and neck.

The working group should consider likely accidents, likely injury types, likely wearer profiles, and the desirable Abbreviated Injury Scale (AIS).

TC158/WG11 is currently developing test methods to assess rotational effects. Until these are published however, working groups should consider requirements for the geometry of the outer surface of the helmet, which might reduce these effects.

18 Penetration

Head protection should resist penetration and distribute the impact force over the head. In a penetration incident there are two potential injury mechanisms. First, contact of the penetrating object with the head and, second, shock to the head from the impact. So the penetration test method could consider both penetration and shock absorption.

In existing standards the penetration test has not directly considered or measured the shock produced during impact. This is because the impact energy used in the penetration test is lower than that used in the shock absorption test (Clause 16). So, if a helmet passes the shock absorption test, then it has been assumed that it will also “pass” for the shock produced in the penetration test.

The working group should consider whether this assumption is valid. The striker for the penetration test may concentrate the impact force on a smaller area of the helmet than the striker for the shock absorption test. If this is the case than the pressure applied to the impact area may be greater for the penetration test than for the shock absorption test. The effect of this higher pressure on forces transmitted through the helmet to the head, and the potential resulting levels of injury, will need to be considered. This transmission will be affected by the nature of the helmet e.g. the stiffness of the shell, the softness of any liner, the contact between helmet and head, etc. For standards where the shock absorption test using a falling headform and the penetration test uses a falling striker the impact forces, etc, can still be calculated for each test and then compared. The comparison is just more complicated than in the case where both shock and penetration tests use a falling mass.

In summary, it is often a reasonable assumption that, if the impact energy in a penetration test method is less than that used for a similar impact in the shock absorption test method, then there is likely to be no need to consider shock absorption as a part of the penetration test. The working group should always consider whether this assumption is valid.

The working group should consider likely accidents, likely injury types, likely wearer profiles, and the acceptable level of injury (AIS). The wearability of the helmet, the impact test site and impact angle, the striker shape and the need for single or multiple impacts should also be considered.

Harmonised test methods are specified in EN 13087-3. Helmet standards should be consistent in specifying these requirements.

19 Crush and rigidity

When the head is supported on one side and a force from a moving object is applied to the opposite side then skull fracture and brain injury can occur. Examples are: A horse rider falls to the ground and then the horse falls on the rider's head; an industrial worker or fire-fighter can fall to the ground and an object falls on their head.

A range of expert views on crush mechanisms has lead to the opinion that helmets can be designed in different ways to reduce the potential for crushing of the head-skull complex.

Two methods are:

a) to design the structure shell and liner to deform and absorb the energy of the crushing mechanism so that the force on the head does not rise above the value that can be tolerated by the human skull;

b) to design the shell to be as rigid as possible so that the crushing force is resisted with very little shell deformation; thus, the load transmitted to the head is small and does not rise above the value that can be tolerated by a human skull.

Irrespective of the way in which a helmet is designed to resist a crushing load, the most relevant and hence important criterion against which this should be assessed is the force on the skull. The lateral protection afforded to the user of a helmet can be determined by the method described in prEN 13087-9 which describes

a method of measuring force that is indicative of the force on the skull of the wearer of the helmet when he/she is involved in an accident in which the head is subject to a crushing type load. The method has considered only lateral crush but the facility for assessing fore-aft crush is described.

Accident data should be used to determine the likely worst case to define the input to the apparatus.

Working groups should refer to CEN/TR 16148 for values (output of the apparatus described in prEN 13087-9) which must not be exceeded.

Other test methods may be considered, but it is critical to the safety of the wearer that the assessment is based upon the accident mechanism and that the requirement is based upon measurements that relate to the force that causes skull fracture and, in turn, possible brain injury (see CEN/TR 16148).

20 Retention system strength

The breaking strain of the retention system should be appropriate to the likely use. The working group should consider whether helmet retention in an accident is more important than the risk of strangulation.

EN 13087-5 specifies three test methods, in 5.2, 5.3 and 5.4 respectively, only the following two of which are recommended for new and revised helmet standards.

The headform support, dynamic load method, given in 5.4, should always be specified, irrespective of helmet application.

The headform support, increasing load method (a), given in 5.2.3.1, should be specified additionally, where there is a risk of strangulation.

The above two methods should replace the other methods which may currently be present in existing standards. Other methods should not be introduced into new standards.

21 Retention system effectiveness

The working group should consider under which circumstances the retention system should retain the helmet on the head.

A retention system effectiveness test should always be performed. The working group should consider the need for these tests to be performed at the front, rear and possibly the side, of the helmet. The working group should also consider the force which is appropriate for this test.

If chinstraps are provided, their positioning, fixing and adjustment, and the materials from which they are made, should take into account the range of head shapes and sizes of the prospective wearer.

When appropriate, a chinstrap retention force should be specified.

Critical to the effectiveness of a retention system is the performance of the buckle or fastener. The headform used for the retention system tests does not have a profile or stiffness that represents a human jaw bone accurately. Test houses have reported that when tested in the conventional position, buckles and fasteners are subject to loads (stresses and strains) that are inappropriately high. Consequently, buckles break when they would not do so if the headform were more human-like. The solution is to place the buckle on the side of the headform jaw rather than underneath. Consumer groups argue that this is not appropriate. Working groups should specify clearly where the buckle should be placed for the test(s) and satisfy themselves that in this position(s) the loads applied to the buckle are representative of the likely worst case in an accident.

No current TC 158 helmet standard makes the use of chin-cups compulsory, but some do specifically exclude them. This is because they are believed to cause injury under certain conditions and that they do not enhance retention. Accordingly, their use is not recommended.

A retention system effectiveness test is specified in EN 13087-4.

Inadvertent release of the retention system is a risk and working groups should ensure that this risk is eliminated or minimised. A performance test is under consideration within WG11.

22 Radiant heat

The helmet should protect the wearer from radiant heat, and offer shock absorption and penetration protection after exposure to radiant heat. It may also be tested for its ability to withstand radiant heat.

Existing TC158 helmet standards currently specify a heat intensity of either 7 kW/m^2 or 14 kW/m^2. It is recommended that, unless there is good reason, other values be not introduced.

Where this characteristic is relevant to the type of helmet, the requirements should be drafted so as to be consistent with the test methods given EN 13087-10.

23 Electrical and electrostatic properties

23.1 General

Protection against live conductors (23.2) requires that a helmet does not conduct electricity. The general principle of electrostatic protection (23.3) is that a helmet should be able to conduct to ensure that there cannot be a build up of static electricity on the helmet which is capable of causing an explosion by a spark or discharge. The working group should consider the balance between these risks. For example, in EN 397 it has been assumed that electrocution is the major hazard.

Taking some examples of conduction requirements from standards:

— EN 397 requires that the helmet has a MINIMUM resistance of 1 x 10*6 ohms (calculated using Ohm's law). This means that the helmet does not conduct electricity.

— EN 1149-1:1995, *Protective clothing — Electrostatic properties — Part 1: Surface resistivity (Test methods and requirements)* requires that the clothing has a MAXIMUM resistance of 5 x 10*10 ohms (calculated using Ohm's law). This means that the clothing is capable of conducting some electricity.

— EN 138:1994, *Respiratory protective devices — Fresh air hose breathing apparatus for use with full face mask, half mask or mouthpiece assembly — Requirements, testing, marking* has an optional test for breathing hoses which are claimed to be antistatic which requires that the resistance is BETWEEN 1 x 10*3 and 1 x 10*8 ohms. This means that the hose is capable of conducting electricity.

23.2 Live conductors

The working group should consider if electrocution caused by accidental contact between a live conductor and the outer surface of the helmet is likely to be relevant. If so, helmets should provide such protection.

Standards for helmets intended for specialist live working are not within the scope of CEN/TC 158. Reference should be made to standards published by IEC.

Existing TC158 helmet standards currently specify performance requirements corresponding to the three test methods given EN 13087-8. It is recommended that, unless there is good reason, other values be not introduced.

23.3 Electrostatic properties

The working group should consider if electrostatic issues are likely to be relevant. It is most likely that electrostatic issues will only be relevant to helmets for industrial use or fire-fighting. All other helmets are intended for outdoor use or for use where an electrostatic hazard is unlikely.

If electrostatic protection is a requirement, the working group should consider other relevant standards.

Products in explosive atmospheres are covered by the ATEX directive - these standards are in the EN 50000 range. These standards use the capacitance of an item as a measure of its electrostatic protection.

Only a brief outline of the basic principles involved is given here.

The human body can become charged, potentially to high as 2,5 kV. At this voltage any energy capable of being stored in/on the helmet is likely to be insufficient to ignite explosive atmospheres. (Of course, the EN 50xxx standards include "safety factors" which are taken into consideration to ENSURE safe environments.)

As a general guide to potentially explosive environments:

- a hydrogen rich atmosphere requires 20 micro joules to ignite it;
- an ethylene rich atmosphere requires 80 micro joules to ignite it;
- a propane rich atmosphere requires 160 micro joules to ignite it; and
- a methane rich atmosphere requires 260 micro joules to ignite it.

Previous measurements on EN 397 industrial helmets found that the maximum capacitance (measured using EN 62013-1, which documents a test method to measure the capacitance of insulating items) was 2 picofarads which is calculated to be the equivalent of 11 micro joules of explosive energy at 2,5 kV.

From these measurements, industrial helmets would not be considered to be considered to be "incendive", i.e. they should not be capable of causing explosions in the potentially explosive environments described above.

Regulators in the UK have accepted this opinion i.e. that there is insufficient material available in EN 397, *Industrial safety helmets* for them to be considered as explosive hazards.

24 Protection against molten metal

Helmets should protect the wearer against burns and flame spread resulting from molten metal splash.

There is no harmonized test method given in EN 13087. Requirements and reference to a test method (EN 373) are found in EN 397 and EN 14052. It is recommended that, unless there is good reason, other requirements and tests be not introduced.

25 Testing scheme

A testing scheme should be included in each helmet standard. This should include sufficient details regarding:

- number of specimens to test;
- specimen numbering;
- requirements clauses to be tested;

— corresponding test clauses;

— sequence of tests.

All standards should state that if one specimen fails, the model fails.

26 Pre-conditioning

This type of conditioning has been included in some EN. It usually specifies numbers of days, rather than numbers of hours, of conditioning to be performed before the usual, specific conditioning regimes specified in EN 13087-1. Its use should be discontinued.

27 Conditioning

Working groups should specify the most appropriate requirements according to the expected application of the helmets concerned and corresponding to the harmonised values specified in EN 13087-1.

In the case of conditioned specimens that are required by the helmet standard to undergo more than one impact, the need to return the specimen to the conditioning chamber for at least 1 hour between impacts should be considered.

28 Pre-requisites for the testing

Each part of EN 13087 lists pre-requisites, which need to be specified within the helmet standard. Working groups should therefore refer to these lists and include the relevant information in their helmet standards.

The same applies if a standard contains its own specific test method or refers to a test method from another standard.

29 Sizes of headforms

Helmets should be tested on a range of headform sizes, corresponding to the range of sizes in which the helmet model is made available to the market. Care should be taken to ensure that all helmet sizes are covered.

EN 960:1994 specifies headforms, (expressed by code letters), corresponding to helmet sizes, from 50 cm to 64 cm, in 1 cm increments of circumference. This version of EN 960 will only be specified in a helmet standard by a dated reference. Undated references to EN 960 will automatically apply to the latest, published version.

EN 960:2006 has been published and supersedes the 1994 version, which is withdrawn. The 2006 version specifies headform sizes (expressed by circumference in mm) in 10 mm increments of circumference. It also extends the range of headforms to include children's sizes. Working groups should consider whether standards should be updated to accommodate these smaller sizes.

The nominal circumferences of corresponding headforms, defined in the two versions of the standard, are the same.

References made to EN 960 during revision of helmet standards, should, wherever possible, be undated, (unless there is reference to a particular clause) so that this reference will always call on the latest version of the standard.

Headforms used for shock absorption testing are either free falling or rigidly mounted.

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

Headforms used for all other tests are rigidly mounted. These are commercially available in most, if not all, of the specified sizes.

Working groups may find it useful to be aware of some of the differences, and similarities, between the 2006 and 1994 versions of EN 960.

A full explanation for the rationale behind EN 960:2006 is given in its Introduction. Some of the key points are:

- removal of dimensional errors, which evidence themselves on the headforms as spurious bumps and depressions;
- adding desirable definitions, characteristics and headform markings;
- adding tolerances associated with the specified dimensions;
- using a method of dimensioning the headforms which facilitates a straightforward method of tolerancing these dimensions;
- specifying “half headforms” and “three-quarter headforms” in addition to “full headforms”;
- specifying more adequately the centre of gravity and the geometric centre of headforms;
- specifying five new, smaller, headforms for children (below size 495).

Annex C of EN 960:2006 contains a table giving the history of headform sizes. This, together with the detailed dimension tables in the standard, can be used to compare the EN 960:1994 and EN 960:2006 size classifications. It is likely that many of the existing EN 960:1994 headforms will conform to the new EN 960:2006 shape and size requirements, but this will need to be demonstrated by measuring the headforms.

30 Application of the uncertainty of measurement

In order to determine compliance or otherwise of a measurement made in accordance with any test, when compared to the specification limits given in the helmet standard, it is necessary to consider the uncertainty associated with the measurement made.

Following consideration within a CEN/BTS/4 ad hoc group a few years ago, of this and associated questions, the wording as given in Annex B was recommended and this should be applied by all TC158 working groups in an informative annex.

31 Marking and labelling

Working groups should decide on the markings and/or labels to be attached to a helmet. They should also consider whether such markings are also needed on any parts intended by the manufacturer to be replaceable by the user.

These markings and/or labels convey information is that is essential for the user of the helmet to know.

The following are likely to be needed:

a) number and year of the Standard;

b) indication of year and quarter or month of manufacture;

c) name or identification mark of the manufacturer (or other unambiguous means of identification);

d) manufacturer's unique model designation;

e) size or size range (in centimetres); and

f) unambiguous symbol(s) or statement(s) indicating the intended use of the helmet and/or any optional requirements complied with.

Other items which may be considered necessary are:

g) mass of the helmet (in grams, to the nearest 50 g);

h) abbreviation for the material of the helmet (if made from plastics) in accordance with EN ISO 472 (e.g. ABS, PC, HDPE, PS, etc.);

i) unambiguous descriptions of other materials used in the helmet; and

j) warnings, if the helmet performance can be adversely affected by contact with certain materials.

The marking/labelling can be specified e.g. "moulded or impressed marking", "on the outer surface of the helmet" or "shall carry a durable self-adhesive label".

Any statements using subjective words such as visibility, legibility and durability should be accompanied by an objective means of interpretation (as noted in Clause 34).

The PPE Directive, Annex II, 2.12 refers to markings on the PPE and their durability/legibility.

A statement such as "Each helmet shall be marked with the following information in a manner consistent with the official language and practice of the country where the helmet is offered for sale" may be made.

Working groups may specify that some of the extra information for users (Clause 32) is "attached to the helmet". Again the meaning of such statements must be made clear.

32 Information to be supplied by the manufacturer for users

Working groups should decide on the information that will accompany a helmet. Such information is needed for the user of the helmet to know how to use and maintain the helmet, and to understand its performance limitations.

Guidance is given in Part D of Document PPE N122, CEN PPE Forum, *Guide for the drafting or the revision of EN standards on PPE*.

The PPE Directive, Annex II, 1.4 also gives requirements.

The working group should consider how the information should be provided e.g. "attached to the helmet" or "a copy of this information with each helmet". The information may be separated and provided in different ways.

Again, any statements using subjective words should be accompanied by an objective means of interpretation (as noted in Clause 34).

33 Life of helmet

The following is proposed as standard wording to be included in the information to be supplied by the manufacturer clause (Clause 33 above).

The statement: “The length of the useable life of this helmet will be affected by the type(s) of material used in its construction and the environments in which the helmet is used and stored. Recommendations on this topic should be sought from the manufacturer.”

34 Terms and definitions

It would be useful to define within helmet standards, those terms which may result in ambiguity of understanding and/or possible differing interpretations by testing laboratories.

Examples of such words are:

- securely (a subjective term, which should only be used if qualified with an objective means of interpretation);
- permanently (usually associated with attachment of something and meaning that the item would have to be damaged beyond further use during removal);
- durable / durably (a subjective term, which should only be used if qualified with an objective means of interpretation);
- legible / legibly (a subjective term, which should only be used if qualified with an objective means of interpretation);
- shell;
- brim;
- holes.

Examples of words that are recommended not to be used are:

- “Address” issues;
- coverage / area of coverage (note that, as discussed in section 3, “area of coverage” is a term that should not be used).

In line with the *CEN Internal Regulations, Part 3*, the following reference works for language are suggested and reference to them should be included within helmet standards, if appropriate:

- for English, The Shorter Oxford English Dictionary, The Concise Oxford Dictionary, The Collins Concise English Dictionary, Webster’s New World College Dictionary or Chambers Concise Dictionary;
- or French, Dictionnaire Robert, Dictionnaire Larousse and *Dictionnaire des difficultés de la langue française* (V. Thomas, Larousse);
- or German, Der Duden, das Standardwerk zur Deutschen Sprache (Bibliographisches Institut).

Abbreviated terms should be used with care, and their use should be limited to those cases where it is not likely to cause confusion.

35 Annex ZA of the PPE Directive

Under the provisions of the mandate given to CEN by the European Commission, PPE standards are required to fulfil the requirements of the Directive. It has been decided by CEN that this will be demonstrated in each PPE standard by the inclusion of an Annex ZA. This annex should cross refer the Basic Health and Safety Requirements (BHSRs) of the Directive with the corresponding clauses of the standard. It is the working group's responsibility to ensure that their helmet standard satisfies the BHSRs of the Directive. A checklist is available to assist in this process. However, the Annex itself should be drafted by the CEN/TC 158 Secretary and the CEN Consultant. Templates for Annexes ZA are available from the CEN/TC 158 secretariat.

Annex A
(informative)

Combined and combination PPE and accessories

The following text, where applicable, should be included within the relevant clauses of the helmet standard.

W Terms and definitions

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

W.a
integral additional protective function
part(s) of the helmet, intended by the helmet manufacturer not to be removed by the user, except for maintenance purposes, and which provide protection to the wearer, other than as provided for by this standard

W.b
non-integral additional protective function
additional protective device(s) which may be attached to the helmet and intended to be removable by the user, but not specifically required in order for the helmet to satisfy this standard

W.c
helmet accessory
additional device(s) which may be attached to the helmet and intended to be removable by the user, but which provide no protective function to the wearer, e.g. lamp bracket, cable clip

X Performance requirements

X.1 General

Helmets, as offered for sale, shall satisfy the requirements of this European Standard. When items, as defined in W.a, W.b and W.c, are provided by the helmet manufacturer for use with the helmet, the helmet with such items fitted to it, shall continue to satisfy the requirements of this standard.

Y Testing

Y.a Samples

Helmets shall be submitted for testing in the condition in which they are offered for sale, including any requisite holes, or other means of attachment, for any item(s) as defined in W.b or W.c.

Z Marking and information to be supplied by the manufacturer

Z.a Additional information supplied by the manufacturer

"WARNING — When fitted with another item of personal protective equipment or with an accessory, (other than as supplied by the helmet manufacturer for use with this helmet) a helmet marked as complying with this standard is unlikely still to satisfy all clauses of the helmet standard. Refer to information supplied by the helmet manufacturer."

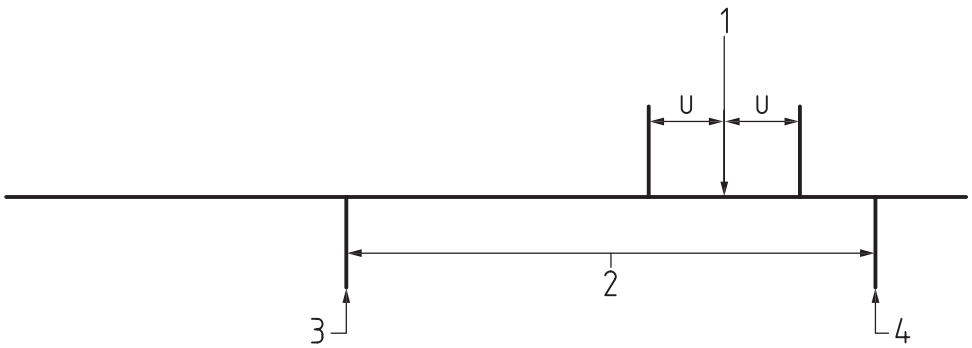
Annex B
(informative)

Application of uncertainty of measurement

B.1 Determination of compliance

In order to determine compliance or otherwise of the measurement made in accordance with this test method, when compared to the specification limits given in the helmet standard, the following protocol shall be applied.

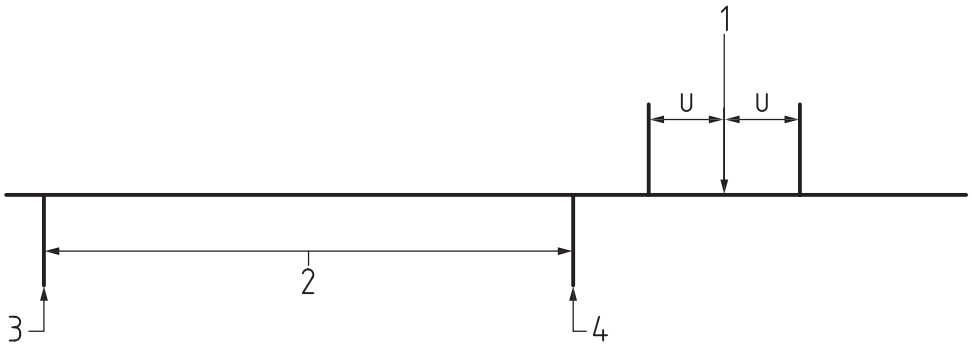
If a specification limit value (upper or lower) for the particular test given in the helmet standard, falls outside of the range of values calculated from the measured value plus/minus the uncertainty U of measurement, then the result shall be deemed to be a straightforward pass or fail (Figures B.1 and B.2).



Key

1 Measured value
2 Specification zone
3 Lower specification limit (LSL)
4 Upper specification limit (USL)

Figure B.1 — Result pass

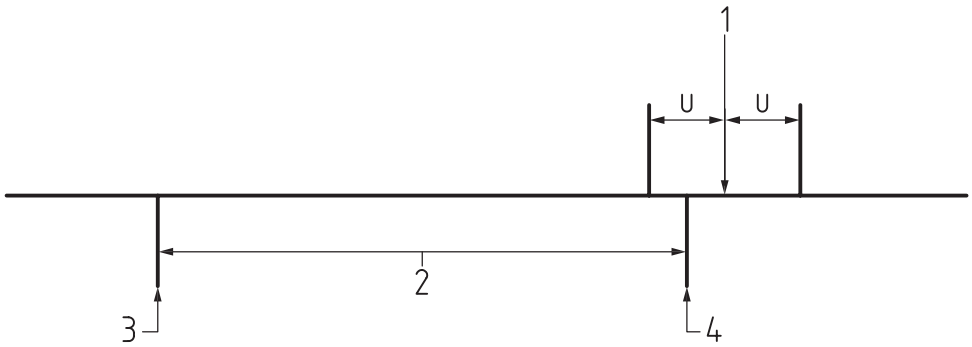


Key

1 Measured value
2 Specification zone
3 Lower specification limit (LSL)
4 Upper specification limit (USL)

Figure B.2 — Result fail

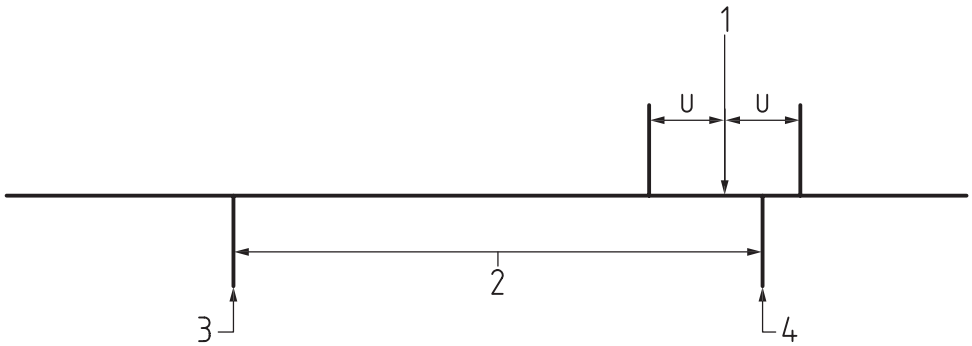
If a specification limit value (upper or lower) for the particular test given in the helmet standard, falls within the range of values calculated from the measured value plus/minus the uncertainty U of measurement, then the assessment of pass or fail shall be determined on the basis of safety for the wearer of the device; that is, the result shall be deemed to be a fail (Figures B.3 and B.4).



Key

1 Measured value
2 Specification zone
3 Lower specification limit (LSL)
4 Upper specification limit (USL)

Figure B.3 — Result fail



Key

1 Measured value
2 Specification zone
3 Lower specification limit (LSL)
4 Upper specification limit (USL)

Figure B.4 — Result fail

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