

Helmets for fire fighting in buildings and other structures

ICS 13.940.20

National foreword

This British Standard is the UK implementation of EN 443:2008. It supersedes BS EN 443:1997 which is withdrawn.

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

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Helmets for fire fighting in buildings and other structures

Casques pour la lutte contre les incendies dans les
bâtiments et autres structures

Feuerwehrliebe für die Brandbekämpfung in Gebäuden
und anderen baulichen Anlagen

This European Standard was approved by CEN on 28 December 2007.

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Foreword

This document (EN 443:2008) 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of an identical text or by endorsement, at the latest by August 2008, and conflicting national standards shall be withdrawn at the latest by August 2008.

This document supersedes EN 443:1997.

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.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

Minimum requirements for helmets protecting the lower face and the neck are included in this European Standard. Requirements for other products protecting the lower face and neck are also covered in other European Standards. This European Standard allows options to take account of particular additional requirements.

This European Standard deals with two types of helmets: type A and type B. Selection of the type of helmet and any optional equipment should be made following a comprehensive risk assessment.

Annex A gives an informative list of hazards.

Firefighters should be trained in the use, care and maintenance of helmets covered by this European Standard, including an understanding of any limitations.

1 Scope

This European Standard specifies minimum requirements for firefighters' helmets protecting the upper head mainly against the effects of impact, penetration and heat and flame, whilst firefighting in buildings and other structures.

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 136:1998, *Respiratory protective devices — Full face masks — Requirements, testing, marking*

EN 137:2006, *Respiratory protective devices — Self-contained open circuit compressed air breathing apparatus with full face mask — Requirements, testing, marking*

EN 166:2001, *Personal eye-protection — Specifications*

EN 168:2001, *Personal eye-protection — Non-optical test methods*

EN 469:2005, *Protective clothing for firefighters — Performance requirements for protective clothing for firefighting*

EN 531:1995, *Protective clothing for industrial workers exposed to heat (excluding firefighters' and welders' clothing)*

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

EN 13087-1:2000, *Protective helmets — Test methods — Part 1: Conditions and conditioning*

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

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

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

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

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

EN 13087-8:2000, *Protective helmets — Test methods — Part 8: Electrical properties*

EN 13087-10, *Protective helmets — Test methods — Part 10: Resistance to radiant heat*

EN 13911, *Protective clothing for firefighters — Requirements and test methods for fire hoods for firefighters*

EN 14458:2004, *Personal eye-equipment — Face shields and visors for use with firefighters' and high performance industrial safety helmets used by firefighters, ambulance and emergency services*

EN ISO 9185:2007, *Protective clothing — Assessment of resistance of materials to molten metal splash (ISO 9185:2007)*

ISO 1817:2005, *Rubber, vulcanized — Determination of the effect of liquids*

ISO 17493, *Clothing and equipment for protection against heat — Test method for convective heat resistance using a hot air circulating oven*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 960:2006 and the following apply.

3.1

helmet for firefighting in buildings and other structures (hereafter referred to as 'helmet')

headwear, for the protection of the wearer's head against hazards which might occur during operations of firefighting in buildings and other structures

3.2

area of protection

specific area on a headform for which protection is intended to be provided by the helmet

NOTE This European Standard envisages five areas as defined in 3.3 to 3.7.

3.3

area 1a

area situated above plane 'AA' as defined in Figure 1

3.4

area 1b

area situated between plane 'AA' and points CDEF as defined in Figure 1

3.5

area 2

at least the area defined for an eye-guard in EN 14458

3.6

area 3a

area on the neck-guard from the lower edge of the shell to the lower edge of the neck-guard and rearward from the vertical transverse plane, or part thereof

3.7

area 3b

at least the area CDHG defined in Figure 2

3.8

type A helmet

helmet protecting at least area 1a

3.9

type B helmet

helmet protecting at least areas 1a and 1b

3.10

headform

shape replacing the head which is used for testing certain helmet characteristics

3.11

sagittal plane of the helmet

plane corresponding with the longitudinal vertical median plane of the headform when the helmet is correctly adjusted on it according to manufacturer's instructions of use

3.12

vertical axis of the helmet

axis corresponding with the central vertical axis of the headform when the helmet is correctly adjusted on it according to manufacturer's instructions of use

3.13

basic shape

outer shape which the helmet would have if it had neither comb nor brim nor any of the fairings or radiusing associated with these

3.14

helmet shell

component in hard material with a smooth finish, which gives the helmet its general shape

3.15

comb

raised part of the shell that runs along the mid-sagittal plane

3.16

brim

ridge protruding outwards from the basic shape of the shell forming the lower edge of the shell and including its associated fairings and radiusing

3.17

accessory

additional device(s) approved by the manufacturer which may be attached to the helmet and intended to be removable by the user, but which provide no protective function to the wearer

NOTE Examples of accessories are lamp brackets, cable clips, badges and trims.

3.18

integral additional protective function

part(s) of the helmet, intended by the helmet manufacturer not to be removed by the user, except for maintenance and fitting purposes, and which provide protection to the wearer

NOTE The protection afforded to the wearer by the integral additional protective function is not within the scope of this European Standard.

3.19

non-integral additional protective function

additional protective device(s) which may be attached to the helmet and intended to be removable by the user

NOTE Non-integral additional protective functions are optional and are not specifically required for conformity to this European Standard.

3.20

energy absorption system

material and/or suspension system which serves to dampen impact energy

3.21

comfort system

material and/or system which serves to improve comfort for the wearer

3.22

retention system

those parts which are responsible for securing the helmet in position on the head, including items which enable adjustment or improved comfort

3.23

chinstrap

part of a retention system, including a strap which passes under or on the wearer's chin and which helps to ensure that the helmet is correctly maintained in place

3.24

neck-guard

part which protects the neck (area 3a) from liquids, hot materials, radiant heat and flames

3.25

face protector

part that protects at least the part of the face that is defined by area 2

3.26

ear covers

part of the helmet which protects at least the ears of the wearer

3.27

dripping

softening with material movement and consequent detachment

3.28

badge

material attached to the helmet for purposes of identification

3.29

trim

retro reflective and/or fluorescent material attached to the outermost surface of the helmet shell e.g. for visibility enhancement

4 Requirements

4.1 General

4.1.1 Surface finish

When tested in accordance with 5.2 there shall be no sharp edges, roughness or projection on any part of the helmet that may cause discomfort or injury to the wearer during fitting, wearing or maintenance.

4.1.2 Innocuousness of materials

When tested in accordance with 5.2 materials that may come into contact with the wearer's skin shall not be known to be likely to cause irritation or any other adverse effect to health.

4.1.3 Visual defects

All materials shall be visibly unimpaired after cleaning and disinfection by the agents and procedures specified by the manufacturer in the information supplied.

Such agents shall not be known to be likely to cause irritation or any other adverse effect to the health of the wearer.

4.1.4 Additional devices and accessories

When items as defined in 3.17, 3.18 and 3.19 are stated as being for use with the helmet by the helmet manufacturer, the helmet with such items fitted to it shall continue to satisfy the requirements of this European Standard.

4.1.5 Face protectors

Face protectors intended for use and supplied with helmets conforming to this European Standard shall conform to the requirements of EN 14458.

When protection of Area 2 is provided or recommended by the helmet manufacturer for use with a helmet complying with this European Standard, it shall be by a face protector conforming to EN 14458.

4.1.6 Neck guards

When neck-guards are provided or recommended by the helmet manufacturer for use with a helmet complying with this European Standard, the neck-guards shall conform to the requirements for area 3a as appropriate.

4.1.7 Protection of area 3b

When protection of area 3b is provided or recommended by the helmet manufacturer for use with a helmet complying with this European Standard, this protection shall conform to the requirements for area 3b as appropriate.

4.1.8 Wearing the helmet

The constraints imposed by the wearing of the helmet shall be minimized, so as to enable the wearer to perform structural firefighting.

NOTE Annex C gives guidance to verify this requirement.

4.2 Shock absorption

4.2.1 Area 1a

When the helmet is tested in accordance with 5.4.1, the force transmitted to the headform shall not exceed 15 kN.

4.2.2 Areas 1a and 1b

When tested in accordance with 5.4.2:

- a) projectile shall be prevented from passing completely through the helmet;
- b) there shall be no release of material from the inner surface of the helmet;
- c) where protection is provided by non-rigid material, there shall be no additional contact with the headform such that a mark appears on the white paper on the opposite side to that struck by the ball.

4.3 Resistance to penetration

When the helmet is tested in accordance with 5.5, there shall be no contact between the striker and the test block.

4.4 Lateral crushing

When the helmet is tested in accordance with 5.6, the maximum transverse and longitudinal deformations of the helmet shall not exceed 40 mm. The residual deformations shall not exceed 15 mm.

4.5 Retention system effectiveness

When the helmet is tested in accordance with 5.7 it shall not come off the headform.

4.6 Retention system strength

This clause applies to helmets for which a chin strap is recommended or provided by the helmet manufacturer for use with the helmet.

When the helmet is tested in accordance with 5.8:

- a) maximum elongation of the whole system shall not exceed 20 mm for a load of 250 N;
- b) minimum width of the chin strap shall be 15 mm for a load of 250 N;
- c) release point of the retention system shall be between 500 N and 1 000 N.

4.7 Radiant heat

4.7.1 Areas 1a and 1b

When the helmet is tested in accordance with 5.9.1:

- a) temperature measured at the surface of the artificial head shall not rise more than 25 °C above the standard laboratory temperature, (20 ± 2) °C;
- b) no part of the helmet providing protection to areas 1a and 1b shall ignite or melt to such a degree as to cause softening or dripping of material such that there is contact of the material with the headform;
- c) the helmet shall continue to conform with the shock absorption (area 1a and 1b as appropriate, see 4.2) and resistance to penetration (area 1a only, see 4.3) requirements following radiant heat exposure.

4.7.2 Areas 3a and 3b

When tested in accordance with 5.9.2 the components protecting areas 3a and 3b shall achieve at least performance level 1 according to 6.3 of EN 469:2005. In the case where area 3b protection is provided by way of a face protector complying with EN 14458, testing of area 3b is exempt from this requirement.

4.8 Protection against hot solids

When the helmet is tested in accordance with 5.10 it shall conform to the requirements of EN 166:2001, 7.2.3 f).

4.9 Protection against molten metals

4.9.1 Areas 1a and 1b

When tested in accordance with 5.11.1, the helmet shall not:

- a) be penetrated by the molten metal;
- b) show any deformation, measured at right angles to the base plane of the helmet, greater than 10 mm;
- c) burn with the emission of flame after a period of 5 s has elapsed after the pouring of molten metal has ceased.

4.9.2 Areas 3a and 3b

When the test is performed in accordance with 5.11.2 it shall conform to the requirements of EN 531:1995, 6.5.

In the case where area 3b protection is provided by way of a face protector complying with EN 14458, testing of area 3b is exempt from this requirement.

4.10 Heat resistance

4.10.1 Area 1a, area 1b and area 2

When the helmet and the face protector in their in-use position are tested in accordance with 5.12.1 they shall conform to the following requirements:

- a) no part of the helmet that is not in contact with the headform before this test shall come into contact with the headform as a result of this test. Testing by visual inspection (see Clause 5);
- b) there shall be no separation, melting, or dripping of any part of the helmet;
- c) any moveable elements of the helmet, e.g. chin strap closure and release device(s) shall remain functional;
- d) there shall be no ignition of any part of the helmet;
- e) there shall be no ignition, melting or loss of legibility of the product labels;
- f) no part of the face protector that was not below the brim line prior to the test shall be below the brim line after the test;
- g) no part of the face protector shall ignite or come into contact with the test headform.

4.10.2 Area 3a

When tested in accordance with 5.12.2 the material used in the neck guard assembly shall not ignite or melt and shall not shrink more than 5 % in two perpendicular directions.

4.11 Flame resistance

When the helmet is tested in accordance with 5.13, the material shall not show:

- a) any drip during the whole test;
- b) any visible flame or glow after 5 s following removal of the flame.

4.12 Electrical properties

4.12.1 Conductive headform

When the helmet is tested in accordance with 5.14.1, no evidence of breakdown shall be visible and the leakage current shall not exceed 1,2 mA.

4.12.2 Wet helmet insulation

When the helmet is, in addition, optionally tested in accordance with 5.14.2, no evidence of breakdown shall be visible and the leakage current shall not exceed 1,2 mA.

4.12.3 Surface insulation

When the helmet is, in addition, optionally tested in accordance with 5.14.3, no evidence of breakdown shall be visible and the leakage current shall not exceed 1,2 mA.

NOTE 1 These requirements are intended to provide protection to the wearer against short term accidental contact with live electrical conductors at voltages up to 440 V ac.

NOTE 2 The test in 5.14.1 is intended to simulate closely the situation in use - that is the leakage current to the wearer via a live conductor touching the shell.

NOTE 3 The test in 5.14.2 is dependent only upon the transverse resistance of the shell (thickness). This effectively precludes the use of a metal shell and of holes or metal fasteners passing through the shell.

NOTE 4 The test in 5.14.3 is also dependent upon the surface resistance of the shell and effectively precludes the use of shells which have a conductive surface (metal electro-plating). This test is intended to obviate the danger to the wearer should they try to remove a helmet the shell of which is in contact with a live conductor.

4.13 Contact with liquid chemicals (optional)

4.13.1 Areas 1a, 1b

The helmet may be tested in accordance with 5.15.1. If tested, there shall be no visible damage to the shell and the fitting devices.

4.13.2 Areas 3a, 3b

The helmet may be tested in accordance with 5.15.2. If tested, the components protecting area 3a and/or 3b shall conform to the requirements of EN 469:2005, 6.10. Where area 3b protection is provided by a face protector complying with EN 14458, testing of this area is not required.

4.14 Field of vision

When the helmet is tested in accordance with 5.16 the wearer's field of vision shall correspond to the following angles:

- a) horizontal field of vision of not less than 105°;
- b) vertical field of vision in the upwards direction of not less than 7°;
- c) vertical field of vision in the downwards direction of not less than 45°.

The specified field of vision shall be achieved with a face protector in its in-use and out-of-use positions. The periphery of the face protector may fall within the specified field of vision.

NOTE The face protector should not restrict the users' awareness of the surroundings.

4.15 Extent of protection

4.15.1 Area 1a and area 1b

When the helmet is tested in accordance with 5.17:

- a) type A helmets shall protect at least area 1a;
- b) type B helmets shall protect at least area 1a and area 1b;
- c) protection shall be provided by the helmet assembled without any non-integral components, accessories or optional parts.

In the case of an integral face protector being fitted, a contribution to protection may be provided by the face protector, so long as the face protector is in its out-of-use position.

4.15.2 Area 3b (optional)

Helmets may provide protection for the optional area 3b.

If this protection is provided it shall:

- a) protect at least the area CDHG of the medium headform, defined in Figure 2, when assessed in accordance with EN 168:2001,10.2;

NOTE Helmets fitted with a face guard conforming to EN 14458 are considered to satisfy this requirement.

- b) be provided by the helmet assembled without any non-integral components, accessories or optional parts, apart from those optional parts specified in the information supplied by the manufacturer as being necessary to provide the claimed protection. If the size range of the helmet does not permit the helmet to fit the test headform, then a claim of protection of area 3b cannot be made for that size of helmet.

5 Test procedures

5.1 Sampling and helmet adjustment

5.1.1 Sampling

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 3.17, 3.18 or 3.19.

If several sizes of helmet are available then the size representing the most unfavourable helmet in relation to the headform size shall be used.

5.1.2 Helmet adjustment

Before any testing on a headform, the helmet shall be adjusted in accordance with the manufacturer's instructions.

The headforms for use in this European Standard shall be sizes 495, 535, 575, 605 and 625 complying with EN 960:2006 or the medium size complying with EN 168:2001, as appropriate to the test performed.

If the wearing adjustment covers several sizes of headform then the size of headform representing the most unfavourable case shall be used.

5.2 Visual inspection

A visual inspection shall be performed prior to laboratory tests.

NOTE This may entail a certain amount of dismantling in accordance with the manufacturer's instructions for maintenance.

The visual inspection shall include the assessment of the device marking and information supplied by the manufacturer and any safety data sheets or declarations relevant to the materials used in its construction.

5.3 Conditioning

5.3.1 General

Before any testing is performed the helmet shall be conditioned in accordance with the conditioning sequences given in Annex B and the relevant specifications defined in 5.3.2 to 5.3.7.

5.3.2 Ultra-violet (UV) ageing

The helmet shall be preconditioned in accordance with 4.7 of EN 13087-1:2000.

5.3.3 Thermal shock

The helmet shall be exposed successively to the following conditions:

- a) 1 h at one of the following, as identified in the marking at 6 g):
 - i) $(-10 \pm 2) ^\circ\text{C}$;
 - ii) $(-20 \pm 2) ^\circ\text{C}$;
 - iii) $(-30 \pm 2) ^\circ\text{C}$;
 - iv) $(-40 \pm 2) ^\circ\text{C}$;
- b) 1 h at $(+60 \pm 2) ^\circ\text{C}$;
- c) 15 min totally immersed in distilled water at a temperature of $(+10 \pm 2) ^\circ\text{C}$;
- d) 1 h at $(+60 \pm 2) ^\circ\text{C}$;
- e) 20 h to 24 h at standard temperature $(+20 \pm 2) ^\circ\text{C}$ and standard relative humidity $(65 \pm 5) \%$.

The time interval between sequences a) to b), b) to c) and c) to d) shall be within 5 s.

During sequences d) and e), the helmet shall be placed in a position that allows it to drain.

5.3.4 Solvent conditioning

Take a cotton cloth at least 150 mm \times 150 mm and at least 25 ml of a solvent consisting of test liquid B in accordance with ISO 1817:2005, Table A.1. Using the cloth soaked in the solvent, apply the solvent to all those regions of the outside surface of the helmet shell within 50 mm of the retention system fixing, and keep these regions wet with the solvent for $(7,5 \pm 2,5)$ s. Repeat the procedure on the remainder of the external surface, keeping these regions wet for $(12,5 \pm 2,5)$ s.

Do not carry out further conditioning or testing during the following 30 min.

5.3.5 "Thermal plus" conditioning

The helmet shall be preconditioned in accordance with EN 13087-1:2000, 4.4. The temperature shall be $+50 ^\circ\text{C} \pm 2 ^\circ\text{C}$.

5.3.6 "Thermal minus" conditioning

The helmet shall be preconditioned in accordance with EN 13087-1:2000, 4.5.

The temperature selected in 5.3.3 a) shall be used for the "thermal minus" conditioning.

5.3.7 Wet conditioning

The helmet shall be preconditioned in accordance with EN 13087-1:2000, 4.6 Method 1.

5.4 Shock absorption

5.4.1 Area 1a

The helmet shall be tested in accordance with EN 13087-2 with the following modifications:

- a) perform the impacts in accordance with EN 13087-2:2000, 5.2, falling mass method, using the hemispherical striker. The mass of this striker shall be $(5,0 \pm 0,05)$ kg, rather than that stated in EN 13087-2;
- b) impact energy shall be (123 ± 3) J;
- c) headform shall be rotated so that the impact point lies along the axis through the striker and transducer. Allow the striker to fall on to each of the 5 impact points shown in Figure 3;
- d) where samples have been initially conditioned in accordance with 5.3.5, 5.3.6, or 5.3.7, the first impact shall be performed within one minute of removal from conditioning and subsequent impacts within five minutes. If further impacts are required, samples shall be returned immediately to the conditioning chamber for at least 1 h before further impacts.

5.4.2 Areas 1a and 1b

The helmet shall be tested in accordance with EN 166:2001, 7.2.2, with the following modifications:

- a) test in EN 166:2001, 7.1.4.2.2 is not performed;
- b) steel ball is projected at a speed of 120_{-0}^{+3} m/s;
- c) for Type A helmets, impacts shall be directed within the zone described above the line AA (see Figure 1);
- d) for Type B helmets, impacts shall be directed within the zone described above the line ACDEF (see Figure 1);
- e) impact point of the ball shall be at any point of the helmet at least 5 mm inside the edge of this zone;
- f) sheet of carbon paper, on top of a sheet of white paper, is attached to the headform at the impact points;
- g) impact tests shall be conducted on both areas 1a and 1b (as appropriate to the type of helmet) and additionally at any areas of different construction, as assessed by a visual inspection;
- h) number of impacts shall be determined as appropriate to the type of helmet (A or B) and any areas of different construction, as assessed by a visual inspection;
- i) multiple impacts may be performed on the same sample, but there shall be a minimum separation of 15 mm between impact sites. In the case of samples initially conditioned in accordance with 5.3.5, 5.3.6, or 5.3.7, the first impact shall be performed within one minute of removal from conditioning and subsequent impacts within five minutes. If further impacts are required, samples shall be returned immediately to the conditioning chamber for at least 1h before further impacts;
- j) during testing, the headform shall only be rotated about the vertical axis.

5.5 Resistance to penetration

The helmet shall be tested in accordance with EN 13087-3 using the flat blade striker and with the following modifications:

- a) mass of the flat blade striker shall be $(1\,000 \pm 15)$ g;
- b) three impacts per helmet, one helmet per condition;
- c) on each helmet, one impact on the crown plus two impacts off-crown. Allow the striker to fall with the vertical axis perpendicular to the surface of the helmet, on to each of 3 sites separated by at least 40 mm, measured with a chord and within the area defined by a circle of 100 mm diameter centred on the vertical axis of the helmet;
- d) impact energy shall be $(24,5 \pm 1)$ J for crown impact;
- e) impact energy shall be $(19,5 \pm 1)$ J for off-crown impact;
- f) impact site for off-crown impacts shall be at a different point of each of the helmets tested under the conditioning required (see 5.3). For example: front, left, side, rear and right side;
- g) in the case of samples initially conditioned in accordance with 5.3.5, 5.3.6, or 5.3.7, the first impact shall be performed within one minute of removal from conditioning and subsequent impacts within five minutes. If further impacts are required, samples shall be returned immediately to the conditioning chamber for at least 1 h before further impacts.

5.6 Lateral crushing

5.6.1 Principle

The helmet is subjected to transverse compressive force, then to longitudinal compressive force.

The maximum and the residual deformations are measured.

5.6.2 Procedure

- a) Condition the helmet as specified in 5.3;
- b) place the helmet between two guided rigid parallel plates of nominal size 300 mm \times 250 mm, having their lower 300 mm long inner edges radiused to $(10 \pm 0,5)$ mm;
- c) position the lower edges of the plates at the level of the 'AA' plane;
- d) apply an initial force of 30 N perpendicular to the plates, so that the helmet is subjected to a compressive force. After 30 s measure the distance between the plates;
- e) increase the forces by 100 N/min up to 630 N and hold for 30 s. Measure the distance between the plates and calculate the maximum deformation;
- f) decrease the force to 25 N and then immediately increase to 30 N, and hold for 30 s. Measure the distance between the plates and calculate the residual deformation;
- g) make measurements to the nearest millimetre, and note the extent of damage, if any.

5.7 Retention system effectiveness

The helmet shall be tested in accordance with EN 13087-4.

The drop height of the falling mass shall be (175 ± 5) mm.

5.8 Retention system strength

The helmet shall be tested in accordance with EN 13087-5:2000, 5.2, Method b).

The helmet shell shall be fixed relative to the headform.

The initial tensile force shall be 30 N and the intermediate force shall be 250 N.

The chinstrap width shall be measured one minute after initial application of the intermediate force.

5.9 Radiant heat

5.9.1 Areas 1a and 1b

5.9.1.1 General

The helmet, with any face protector in the 'in-use' position, shall be tested in accordance with EN 13087-10, except that the exposure time shall be (480 ± 5) s. The heat flux intensity shall be 14 kW/m^2 .

Two helmets shall be tested, one for the shock (areas 1a and 1b, if appropriate) and one for the penetration (area 1a only).

5.9.1.2 Shock

The sample shall be tested according to 5.4.1, except that only a single impact shall be performed, at the centre of the irradiated area, and the conditioning of 5.4.1 shall not be performed. This impact shall be performed within 60 s after the end of the exposure.

For type B helmets, the sample shall then be impacted according to 5.4.2 within area 1b only and the conditioning of 5.4.2 shall not be performed.

5.9.1.3 Penetration

The sample shall be impacted according to 5.5, except that the impact shall be performed at the centre of the irradiated area and the conditioning of 5.5 shall not be performed. This impact shall be performed within 60 s after the end of the exposure.

5.9.2 Areas 3a and 3b

The helmet shall be tested in accordance with EN 469:2005, 6.3.

5.10 Protection against hot solids

Areas 1a and 1b of the helmet shall be tested in accordance with EN 168:2001, Clause 11; the socket shall be placed on the area that has to be tested.

One test shall be performed within area 1a and one test shall be performed within area 1b. Tests may be performed at any location within the specified test area.

NOTE One helmet may be used for both tests.

5.11 Protection against molten metals

5.11.1 Area 1a and 1b

Areas 1a and 1b of the helmet shall be tested in accordance with EN ISO 9185, modified by the introduction of an appropriate headform and by substituting the helmet under test for the PVC skin simulant.

The metal shall be iron, as specified in EN ISO 9185:2007, Annex A, with a mass of (150 ± 10) g.

Place the helmet on the headform in such a way that the point of impact of the liquid metal is within a circle of radius 50 mm centred on the crown.

5.11.2 Area 3a and area 3b

The test shall be performed in accordance with EN ISO 9185, using a projection of molten aluminium as specified in EN ISO 9185:2007, Annex A.

5.12 Heat resistance

5.12.1 Areas 1a and 1b

The helmet shall be tested in accordance with ISO 17493 with a temperature of (90 ± 5) °C for 20 min. Any face protector shall be fitted in the 'in-use' position.

5.12.2 Area 3a

The test on the neck-guard material shall be in accordance with ISO 17493 with a temperature of (180 ± 5) °C for 5 min.

5.13 Flame resistance

The complete helmet shall be tested in accordance with the flame engulfment test described in EN 137:2006, 7.4.1.3, but with the following modifications:

- a) test manikin shall be fitted with the helmet to be tested, together with a firefighters' jacket according to EN 469, a fire hood according to EN 13911 and a full facemask according to EN 136:1998, Class 3. The jacket, hood and face mask shall be selected with the agreement of the manufacturer of the helmet and the models used shall be reported by the test house. Any helmet accessories, or non-integral additional protective function components, fitted during the test shall also be reported. It is not necessary to fit breathing apparatus according to EN 137;
- b) one helmet shall be tested;
- c) breathing machine shall not be used for testing, and the measurement of breathing resistance is not required;
- d) burner strips shall not be set as given in Figure 3 of EN 137:2006, but instead shall be raised so that the highest burner strip is positioned on the level of point L1 (Figure 3 of this European Standard) of the helmet on the test manikin's head;
- e) drop test shall not be performed.

5.14 Electrical properties

5.14.1 Conductive headform test

The helmet shall be tested in accordance with EN 13087-8:2000, 5.2.

5.14.2 Wet helmet insulation test

The helmet shall be tested in accordance with EN 13087-8:2000, 5.3 and shall be carried out on the complete helmet with the fitting devices for optional equipment and/or accessories if they are supplied.

5.14.3 Surface insulation test

The helmet shall be tested in accordance with EN 13087-8:2000, 5.4.

5.15 Contact with liquid chemicals (optional)

5.15.1 Areas 1a and 1b

Where required:

- a) shell and the fitting devices shall be tested in accordance with EN 14458:2004, 6.10, except that the chemical is poured on to the crown;
- b) shell and the fitting devices shall be tested against at least the chemicals listed in EN 14458:2004, Table 2.

5.15.2 Areas 3a and 3b

The test shall be performed in accordance with EN 469:2005, 6.10.

5.16 Field of vision

The helmet shall be tested in accordance with EN 13087-6.

5.17 Extent of protection, area 1a and 1b

5.17.1 Equipment

- a) Headforms of sizes 495, 535, 575, 605 and 625 complying with EN 960:2006, marked with the test areas specified by Figure 1 of this European Standard;
- b) ballast mass of $(5,0 \pm 0,5)$ kg.

5.17.2 Samples

One sample shall be tested for each size combination of shell and retention system.

5.17.3 Test method

From the size range stated by the manufacturer for the given combination of shell and retention system, select the largest headform appropriate to that range.

Fit the helmet to the test headform in accordance with the information supplied by the manufacturer and ensure that the longitudinal vertical median plane of the helmet coincides with the longitudinal vertical median plane of the headform.

Centre the ballast mass on the crown of the helmet and stabilise it in position.

Determine whether the helmet provides protection to the appropriate areas for its type.

6 Marking

Every helmet conforming to this European Standard shall carry visible, legible and unambiguous, permanent and durable marking giving the following information:

- a) number and year of this European Standard, i.e. EN 443:2008;

- b) name or identification mark of the manufacturer;
- c) year of manufacture;
- d) type of helmet:
 - i) A or B;
 - ii) A3b or B3b (where compliance is claimed);
- e) model of helmet (manufacturer's designation);
- f) size or size range (in cm);
- g) low temperature classification:
 - i) * for products satisfying the relevant requirements for -10 °C;
 - ii) ** for products satisfying the relevant requirements for -20 °C;
 - iii) *** for products satisfying the relevant requirements for -30 °C;
 - iv) **** for products satisfying the relevant requirements for -40 °C;

Sub-assemblies and components with considerable bearing on safety shall be marked so that they can be identified. If sub-assemblies with considerable bearing on safety are too small to be marked, the information shall be given in the information supplied by the manufacturer.

Every helmet claimed to conform to the optional requirements of this European Standard shall carry visible, legible and unambiguous, permanent and durable marking on the shell or shall carry durable self-adhesive label, stating the optional requirements complied with, as follows:

- h) electrical properties classification (where compliance is claimed):
 - i) E2 for products conforming with the requirements of 4.12.2;
 - ii) E3 for products conforming with the requirements of 4.12.3;
- i) resistance to liquid chemicals (where compliance is claimed) shall be indicated by a capital letter "C".

Marking of compliance with requirement g) and the optional requirements h) and i) shall be adjacent to each other, e.g. E2C***.

Marking shall be easily visible to the user without requiring disassembly of the helmet or removal of accessories.

7 Information to be supplied by the manufacturer

All accessories and their respective replacement shall be described in the information supplied by the manufacturer.

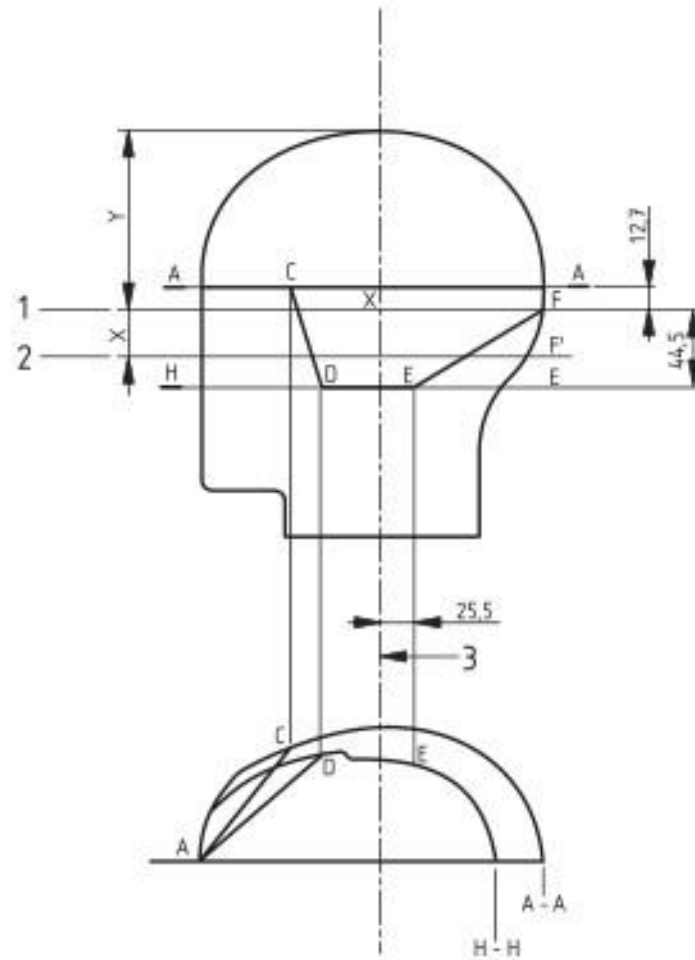
The following information shall be clearly and fully provided with each helmet in one of the official languages of the country of intended use:

- a) name and address and trademark* of the manufacturer or his authorised representative. (*Only if appropriate to aid identification);
- b) telephone and/or facsimile numbers and/or email address of the manufacturer or his authorised representative;

- c) manufacturers type number, identification number or model number;
- d) helmet size ranges;
- e) number and year of this European Standard, i.e. EN 443:2008;
- f) significance of the information given by the markings or label in accordance with 6 g) and 6 i);
- g) instructions or recommendations regarding:
 - i) size selection;
 - ii) mass;
 - iii) fitting and adjustment;
 - iv) use;
 - v) cleaning and disinfection;
 - vi) maintenance and servicing;
 - vii) storage and transportation;
 - viii) Obsolescence (life expectancy).
- h) 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.";
- i) details of additional devices (defined in 3.17 and 3.19) approved by the manufacturer and appropriate spare parts, including reference to sizes and/or materials where necessary;
- j) warning that the safety intended to be provided by the helmet can only be ensured when it is properly assembled and correctly fitted, and that removable parts shall not be worn separately;
- k) statement: "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 EN 443 might no longer satisfy all clauses of the standard. Refer to information supplied by the helmet manufacturer.";
- l) list of chemicals against which the helmet has been tested (if any such tests have been carried out);
- m) statement: "This helmet complies with the retention requirements of this standard when the chin strap supplied by the helmet manufacturer is worn and adjusted in accordance with these instructions.";
- n) statement: "Helmet absorbs the energy of a blow by partial destruction of, or damage to, the helmet. Even though such damage may not be readily apparent, any helmet subjected to a severe impact should be replaced."

NOTE The information should be easily understood and where appropriate, the use of illustrations and part numbers and descriptions is encouraged. Appropriate warnings or answers to frequently asked questions should be provided to assist the user to use the helmet correctly.

Dimensions in millimetres



Key

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

Figure 1 — Protected areas 1a and 1b

Table 1 — Dimensions for Figure 1

Headform (see EN 960)	AC	HD
495	80,0	88,0
535	84,0	92,0
575	87,0	95,0
605	90,0	98,0
625	92,0	100,0

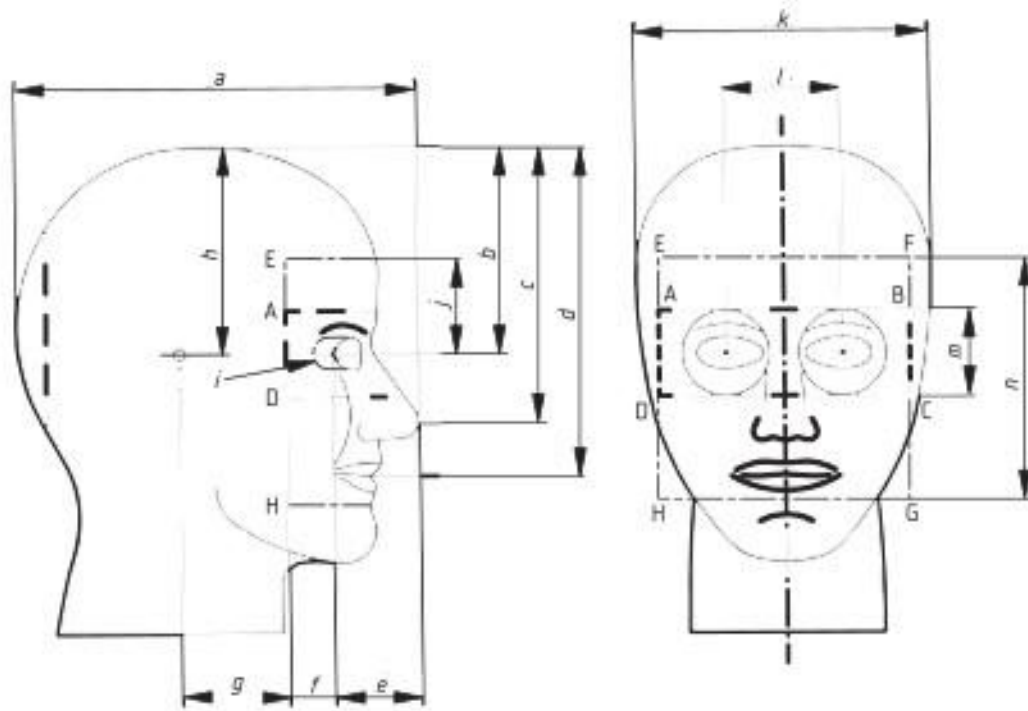
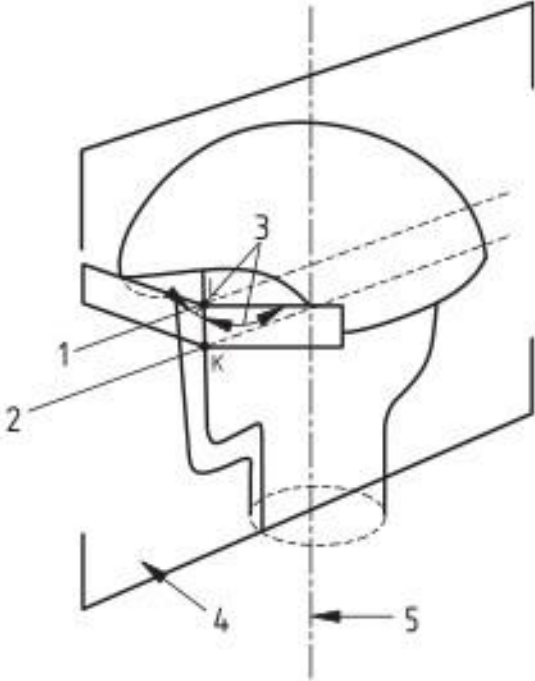


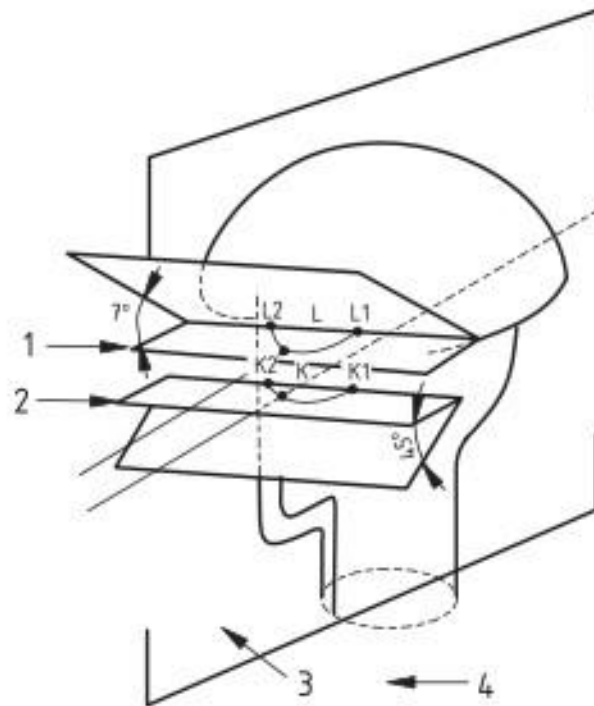
Figure 2 — Protected areas 2 and 3b
(all information about this headform can be found in EN 168:2001)



Key

- 1 reference plane
- 2 basic plane
- 3 angle of 105°
- 4 longitudinal vertical median plane
- 5 central vertical axis

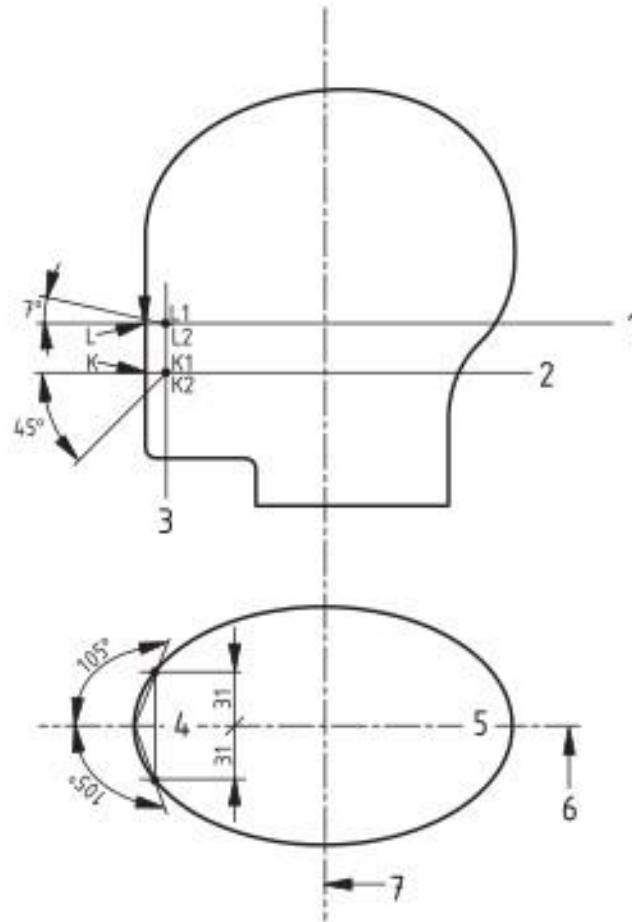
Figure 4 — Lateral field of vision



Key

- 1 reference plane
- 2 basic plane
- 3 longitudinal vertical median plane
- 4 central vertical axis

Figure 5 — Vertical field of vision



Key

- 1 reference plane
- 2 basic plane
- 3 front plane
- 4 front
- 5 back
- 6 longitudinal vertical median plane
- 7 central transverse vertical plane

Figure 6 — Section of headform at longitudinal vertical medial and reference plane

Annex A (informative)

List of hazards

The most significant hazards of structural firefighting that are taken into account in this European Standard are listed in Table A.1.

Table A.1 — Significant hazards of structural firefighting

Hazard reference	Protection area ^a	Conditions and objectives	References to the requirements in this European Standard	Test method
Mechanical hazards				
Shock	Areas 1a and 1b	Fall of a blunt object in the principal positions of the head	4.2.1	5.4.1
		Collision with a fixed or moving object (including in the vehicle in case of a road accident)	4.2.2	5.4.2
	Areas 1a and 1b	Projection of solid, liquid or gaseous materials	4.2.2	5.4.2
	Area 2	Projection of solid, liquid or gaseous materials	4.1.6	EN 14458
Penetration	Area 1a	Fall of a sharp object	4.3	5.5
Crushing	Areas 1a and 1b	Falling in or untimely displacement of a part of the structure in which the intervention takes place	4.4	5.6
		Road accident in which the vehicle transporting the personnel wearing a helmet, is involved		

Table A.1 (continued)

Hazard reference	Protection area ^a	Conditions and objectives	References to the requirements in this European Standard	Test method
Pulling off	Areas 1a, 1b and 2	Effect of violent blow, caused for instance by an explosion or a backdraft	4.5	5.7
Tearing off	Retention system	Catching a part of the helmet on a fixed element, which can lead to a form of strangulation by the chin strap	4.6	5.8
Thermal hazards				
Radiant heat	Areas 1a and 1b	Fierce and very fierce combustion, incandescence	4.7.1	5.9.1
	Area 2	Fierce and very fierce combustion, incandescence	4.7.2	EN 14458
	Areas 3a and 3b	Fierce and very fierce combustion, incandescence	4.7.2	5.9.2
Splashes of hot substances	Areas 1a and 1b	Contact with hot substances	4.8/4.9	5.10/5.11
	Area 2	Contact with hot substances	4.8	EN 14458
	Areas 3a and 3b	Contact with hot substances	4.9.2	5.11.2
Heat resistance	Areas 1a, 1b, 2,	Exposure to hot atmosphere	4.10.1	5.12.1
	Area 3a		4.10.2	5.12.2
Flames	Complete helmet	Fierce and very fierce combustion, flashover	4.11	5.13
Electrical hazards				
Low voltage	Areas 1a and 1b	Contact with electricity	4.12	5.14

Table A.1 (concluded)

Hazard reference	Protection area ^a	Conditions and objectives	References to the requirements in this European Standard	Test method
Chemical hazards				
Liquid chemicals	Areas 1a and 1b	Splash of liquid chemicals	4.13	5.15
Liquid chemicals	Areas 3a and 3b	Splash of liquid chemicals	4.13	5.15
Field of vision				
	Area 1a	Physical characteristics of the shell or accessories that prevent the wearer from seeing, without moving his head, within a certain field of vision	4.14	5.16
	Area 2	Deterioration of the face protector - by flame or heat, by a mechanical agent, by a chemical agent, by condensation.	4.14	EN 14458
<p>^a The protection of area 1b is only required and controlled according to this European Standard for type B helmets and for type A helmets that are provided with a protective element for that area.</p> <p>NOTE These hazards are taken from the document TC162/JWG1/FFPPE/N52 "Risk assessment guidelines for choosing the PPE for firefighters".</p>				

Annex B
(normative)

Conditioning – Testing schedule

Table B.1 — Conditioning testing schedule

Sequence	1	2	3	4	5	6	7	8
Types A and B Sample no.	UV ageing 5.3.2	Thermal shock 5.3.3	Solvent 5.3.4	Thermal plus 5.3.5	Thermal minus 5.3.6	Wet 5.3.7	Test 1	Test 2
1	x	x	x	x			Shock - 1a (5.4.1)	n/a
2	x	x	x		x			n/a
3	x	x	x			x		n/a
4 ^a	x	x	x	x				n/a
5 ^a	x	x	x		x		Shock - 1a and 1b (5.4.2)	n/a
6 ^a	x	x	x			x		n/a
7	x	x	x	x			Penetration (5.5)	n/a
8	x	x	x		x			n/a
9	x	x					Lateral Crushing (5.6)	n/a
10	x	x					Retention effectiveness (5.7)	n/a
11	x	x					Retention strength (5.8)	n/a
12	x	x					Radiant heat - 1a and 1b (5.9.1)	Shock
13	x	x						Penetration
14 ^c	x	x					Radiant heat - 3a and 3b (5.9.2)	n/a
15	x	x					Hot solids - 1a and 1b (5.10)	n/a
16	x	x					Molten metal - 1a and 1b (5.11.1)	n/a
17 ^c	x	x					Molten metal - 3a and 3b (5.11.2)	n/a
18	x	x						n/a

Table B.1 (concluded)

19	x	x	x						Heat resistance (5.12)	n/a
20	x	x	x							n/a
21	x	x	x	x					Flame - all areas (5.13)	n/a
22	x	x	x						Electrical properties - E1 (5.14)	n/a
23 (optional) ^b	x	x	x						Electrical properties - E2 (5.14)	n/a
24 (optional) ^b	x	x	x						Electrical properties - E3 (5.14)	n/a
25 (optional) ^c	x	x	x						Contact with liquid chemicals (5.15) - chemical 1	n/a
26 (optional) ^c	x	x	x						Contact with liquid chemicals - chemical 2	n/a
27 (optional) ^c	x	x	x						Contact with liquid chemicals - chemical 3	n/a
28 (optional) ^c	x	x	x						Contact with liquid chemicals - chemical 4	n/a
29 ^d									Field of vision (5.16) and Extent of protection (5.17)	n/a

^a At the discretion of the manufacturer, in the case of Type B helmets, samples used for testing area 1a can then be used for the testing of area 1b.

^b At the discretion of the manufacturer, the same sample can be used for all electrical properties testing. If so, the order of testing shall be E3, E1 and then E2.

^c At the discretion of the manufacturer, the sample of the protective device of area 3a and/or 3b can be taken from other sample.

^d Samples used for these testing may be also used for other testing.

Annex C **(informative)**

Checking compatibility of PPE

As firefighters wear a combination of PPE to enable them to achieve their objectives a potential exists for negative interference between the different items of PPE.

The helmets in this European Standard can be used for other activities subject to an appropriate risk assessment.

To ensure that negative interference between firefighters' helmets according to this European Standard and other items of PPE is minimized, the guidelines for the design of PPE given in EN 340:2003, 4.3 and the guidelines for selection and use of PPE given in CEN/TR 14560:2003, Clauses 3 and 4 should be closely followed.

It is recommended that before procurement, wearer trials of potentially suitable helmets according to this European Standard are conducted according to CEN/TR 14560:2003, 3.5 in conjunction with the other items of PPE normally worn by firefighting personnel of that particular brigade.

Participants should be chosen according to CEN/TR 14560:2003, 3.5 with their helmets properly fitted, correctly positioned and fastened according to the manufacturer's instructions.

The wearer trials should include the following:

Details of the ambient temperature and humidity of the test environment.

Subjective assessment of the helmet during the trials by the wearer and an observer. A record of the observer's and the wearer's comments and the following details should be made after the trial:

- a) comfort of the combination (weight, balance, thermal);
- b) security of fastenings and retention system;
- c) clarity and field of vision (including any tendency to fogging);
- d) any contact between the face protector and the face or corrective frames;
- e) inadvertent operation of the raising / lowering mechanism;
- f) ability to operate the raising / lowering mechanism (with and without gloves, if worn);
- g) any incompatibilities with other items of equipment;
- h) ease with which the different tasks could be carried out;
- i) ease of communication (speaking and listening);
- j) any other comment volunteered by the wearer on request.

The following activities should be performed within a period of 30 min. The sequence of activities will be at the discretion of the organiser of the trials. One sequence of tests should be performed with the face protector in the in-use position; the sequence should then be repeated with the face protector in the out-of-use position. If designated corrective frames are available, a further test sequence should be carried out with the frames in position and the face protector in the in-use position:

- 1) thirty strokes on a work machine, each stroke being vertical from 1,8 m towards the ground on a mass of 25 kg, giving a total work load of 13 500 Nm;
- 2) walking on the level with full headroom for a total distance of 125 m;
- 3) walking on the level with headroom of (1,3 + 0,2) m (total distance 200 m);
- 4) crawling on the level with headroom of (0,70 + 0,05) m (total distance of 100 m);
- 5) climbing up and down a ladder, passing once in each direction through a 460 mm square opening (total vertical distance 20 m);
- 6) crawling through a narrow section (4 m long) without removing or adjusting the position of the face protector / helmet;
- 7) laying out a fire hose of at least 15 m in length, and recoiling it;
- 8) reading four lines of newsprint aloud, and repeating two lines of newsprint read by the observer;
- 9) reading a typical analogue pressure gauge from a breathing apparatus set, and the time from a typical LCD digital watch;
- 10) moving the head from side to side, and up and down, while standing.

Each test sequence should be continuous, without removal of the equipment. Between test sequences (face protector in the different positions, and with corrective frames), equipment may be removed and refitted.

The following are obvious reasons for concluding that a helmet is unacceptable:

- i) it does not stay secured, or will not stay in place;
- ii) it compromises a vital function such as vision;
- iii) simple tasks to be performed while wearing it are impossible;
- iv) the subject refuses, or is unable, to continue this assessment due to pain or discomfort;
- v) it prevents the wearing of other essential equipment.

To ensure that each individual clearly understands how to correctly wear a helmet according to this European Standard, it is further recommended that the above tests are also carried out during mandatory basic training of firefighting.

When individual parts of PPE - including but not restricted to the helmet - are replaced, tests should be carried out to ensure that the required level of protection is maintained.

Some basic ergonomic features can also be checked following EN 469:2005, Annex D.

Annex D (informative)

Test results, uncertainty of measurement

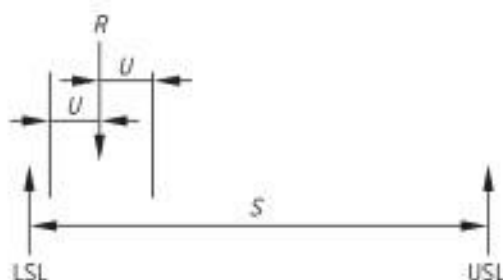
D.1 Uncertainty of measurement

For each of the measurements performed in accordance with this European Standard, a corresponding estimate of the uncertainty of measurement U should be calculated. This estimate of uncertainty should be applied in accordance with D.2 and stated when reporting test results, in order to enable the user of the test report to assess the reliability of the data.

D.2 Interpretation of results

The following protocol with regard to uncertainty of measurement should be applied to test results:

If the mean value of the result from the test data plus/minus the uncertainty of measurement U falls between the upper and lower limiting values for the particular parameter specified in the product performance guidelines then the result should be deemed to be a straightforward pass (see Figure D.1).

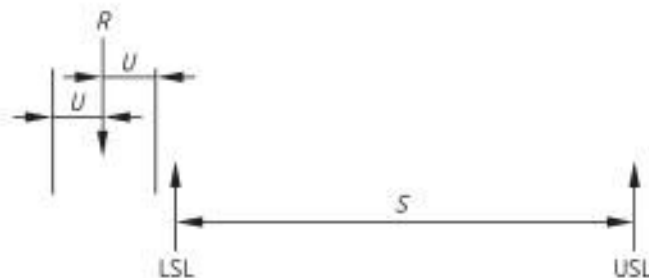


Key

R result of a measurement
S specified performance guidelines
U uncertainty of measurement
LSL Lower specified limit
USL Upper specified limit

Figure D.1 — Result pass

If the mean value of the results from the test data plus/minus the uncertainty of measurement U falls outside of the upper or lower limiting values for the particular parameter specified in the product performance guidelines, then the result should be deemed to be a straightforward fail (see Figure D.2).

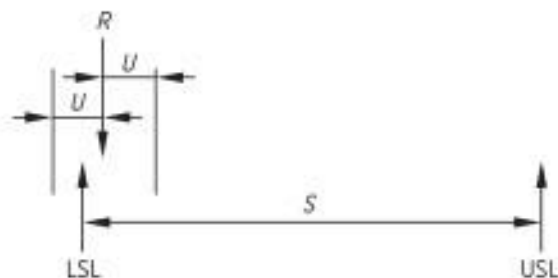


Key

- R result of a measurement
- LSL Lower specified limit
- S specified performance guidelines
- USL Upper specified limit
- U uncertainty of measurement

Figure D.2 — Result fail

If the mean value of the results from the test data falls within the specified limits for the particular parameter given in the product performance guidelines, but the uncertainty of measurement U falls outside of the upper or lower limiting values, then the result should be deemed a fail (see Figure D.3).



Key

- R result of a measurement
- LSL Lower specified limit
- S specified performance guidelines
- USL Upper specified limit
- U uncertainty of measurement

Figure D.3 — Result fail

D.3 Calculation of uncertainty of measurement

The uncertainty of measurement should be calculated. The two following approaches can be used:

- a) statistical method, for example that given in ISO 5725-2;
- b) mathematical method, for example that given in ENV 13005 (GUM).

Annex ZA
(informative)

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

This European Standard has been prepared under a mandate given to CEN by the European Commission to provide a means of conforming to Essential Requirements of the New Approach Directive EU Directives 89/686/EEC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and EU Directive 89/686/EEC

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of Directive 89/686/EEC	Qualifying remarks/Notes
	1.1.1 Ergonomics	Considered but not verified (see 4.1.8)
4.14	1.1.2.1 Highest level of protection possible	Considered but not verified (see 4.1.8)
4.6; 4.8; 4.10; 4.12	1.2.1 Absence of risk and other nuisance factors	
4.1.2	1.2.1.1 Suitable constituent materials	
4.1.1	1.2.1.2 Satisfactory surface condition	
4.14	1.2.1.3 Maximum permissible user impediment	Partially covered
4.5	1.3.1 Adaptation of PPE to user morphology	
5.3	1.3.2 Lightness and design strength	
4.1.4; 4.1.5; 4.1.6	1.3.3 Compatibility of different PPE designed for simultaneous use	
4.1.3; 6; 7	1.4 Information supplied by manufacturer	

Table ZA.1 (concluded)

6	2.4 PPE subject to ageing	
7	2.8 PPE for use in very dangerous situations	
6	2.12 PPE bearing identification marks related to health and safety	
4.2.1; 4.2.2; 4.3	3.1.1 Impact caused by falling or projecting objects and collision of parts of the body with an obstacle	
4.4	3.2 Protection against (static) compression of part of the body	
4.7; 4.9; 4.11	3.6.1 Protection against heat and fire (materials)	
4.7; 4.13	3.6.2 Protection against heat and fire (complete PPE)	

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

Bibliography

- [1] EN 340:2003, *Protective clothing — General requirements*
- [2] ENV 13005, *Guide to the expression of uncertainty in measurement*
- [3] CEN/TR 14560, *Guidelines for selection, use, care and maintenance of protective clothing against heat and flame*
- [4] ISO 5725-1:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

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