PAS 015:2011

BSI Standards Publication

Helmets for equestrian use

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Contents

Summary of pages
This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 24, an inside back cover and a back cover.

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Foreword

This Publicly Available Specification (PAS 015) has been developed by the British Standards Institution (BSI). It supersedes PAS 015:1998, which is withdrawn.

This PAS has been developed in consultation with a large number of manufacturers, users, medical experts and professional bodies and associations.

Acknowledgement is given to the following organizations that were involved in the Steering Group:

- Design Headwear;
- Charles Owen;
- Champion Hats;
- BHS;
- BETA;
- Bryan Chinn, Consultant;
- Inspec International;
- Queen Elizabeth Hospital.

Acknowledgement is also given to those who reviewed the draft PAS 015 and submitted comments for consideration.

PAS 015 incorporates clauses from British and European and other national standards relevant to head protection. It is not a British Standard and will be withdrawn on publication of its content in or as a British Standard.

The PAS process enables a specification to be rapidly developed in order to fulfil an immediate need in industry. A PAS may be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

Use of this document

As a specification, this PAS takes the form of requirements.

Any service provider claiming compliance with this PAS is expected to be able to justify any course of action that deviates from its requirements.

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Contractual and legal considerations

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

Compliance with a PAS cannot confer immunity from legal obligations.

Introduction

This Publicly Available Specification (PAS) specifies the requirements for protective headwear for use in equestrian activities.

Performance levels and test methods are based upon proven national and international methods of test and technical criteria and enhanced by data from expert sources in the field of head protection. Sources of test methods and technical criteria includes BS 4472 (now withdrawn), BS 6473 (now withdrawn), BS EN 443, BS EN 960:1994 (now superseded), BS EN 1384, ASTM F1163 95 and AS 2063 for various type of protective headwear.

NOTE It was decided by the steering group that the 1994 edition of BS EN 960 is more appropriate for this PAS than the revised 2006 edition.

Specific areas that have been developed to give improved protection to the user are:

a) shock absorption including the addition of hazard impacts and extension to the area of protection;

b) penetration resistance;

c) test area and extent of protection;

d) retention system strength effectiveness;

e) stability;

f) lateral deformation.

A proportion of the energy of an impact is absorbed by the helmet, thereby reducing the force of the blow sustained by the head. The structure of the helmet may therefore be damaged in absorbing this energy and any helmet that sustains a severe blow should be replaced, even if damage is not apparent.

Wearers should be made aware that the protection given by a helmet depends on the circumstances of an accident, and wearing a helmet cannot always prevent death, injury or long-term disability.

1 Scope

This Test Method specifies the performance requirements for protective headwear for use in equestrian activities. It includes shock absorption, penetration resistance, strength and effectiveness of the retention system, durability of quick release mechanisms and deflection of the peak (where applicable).

2 Normative references

The following normative documents contain provisions, which, through reference in this text, constitute provisions of this part of this Test Method. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS EN 960:1994, *Headforms for use in the testing of protective helmets*

BS EN ISO 6508-2:2005, *Metallic materials – Rockwell hardness test. Verification and calibration of testing machines (scales A, B, C, D, E, F, G, H, K, N, T)*

ISO 6487:2002+A1:2008, *Road vehicles – Measurement techniques in impact tests. Instrumentation*

3 Terms and definitions

For the purposes of this Test Method the following definitions apply.

3.1 helmet model
one of a range of helmets that differ essentially only in size

3.2 shell
materials that provide the normally hard outer form of the helmet including any edge trim, ventilator and/or other similar features, but excluding any peak

3.3 protective padding (liner)
material provided to absorb impact energy

3.4 comfort and size padding
padding material provided to ensure comfortable and correct fit

3.5 cradle
headband or other head fitting and those internal parts of the helmet other than the padding, which are in contact with the head

3.6 retention system
complete assembly by means of which the helmet is maintained in position on the head, including any devices for adjustment of the system or to enhance the wearer's comfort

3.7 chin strap
part of the retention system consisting of a strap of material that passes under the wearer's chin

3.8 quick release mechanism
a system attached to, or incorporated in, the helmet that allows the retention system to be fastened and unfastened quickly

3.9 area of protection
area above the line AP1F'P2A (see Figure A.1)

3.10 test line
Test line DQ1F'Q2D (see Figure A.1)

3.11 user adjustable draw lace
lace enabling the wearer to adjust the vertical position of the helmet on the head

3.12 fixed draw lace
non adjustable lace fitted by the manufacturer to position the helmet vertically on the head

3.13 peak
extension from the basic form of the helmet above the eyes

3.14 chin cup
cup mounted on the retention system to locate the strap on the point of the wearer's chin

4 Materials

The helmets shall be constructed from materials that are known not to deteriorate under the following conditions:

— ageing;

— exposure to sun;

— extremes of temperature;

— exposure to extremes of rain.

For those parts of the helmet coming into contact with the skin, materials known not to undergo alteration arising from the effects of sweat and toiletries shall be used. Materials known to cause skin allergies shall not be used.

5 Construction

5.1 General

The helmet shall be fitted with a retention system. Where an open hook is used as a primary means of fastening the retention system, a secondary device shall be incorporated to prevent inadvertent release.

NOTE 1 The helmet may comprise a shell with any necessary protective padding secured within it

NOTE 2 A replaceable sweatband may be fitted.

5.2 Finish

All edges shall be smooth and rounded. There shall be no rigid projections on the inside of the helmet. Any external projection shall not exceed 5 mm or shall be smoothly faired to the adjacent surface, except for a button on the top of the helmet and a peak.

5.3 Retention system

With the exception of helmets designed for use by jockeys, a retention system shall be permanently fixed to the helmet.

NOTE 1 Helmets designed for use by jockeys may be so designed that, either the portion that passes under the jaw, or the entire chin strap, is replaceable.

A retention system shall incorporate a chin strap not less than 15 mm in width. Fastening and adjustment devices shall be permanently fitted to adjust and maintain tension in the system. The fastening and adjustment devices shall have no sharp edges.

Fastening and adjustment systems may be combined. The chin strap shall not have a chin cup, but a chin cup may be fitted to a secondary strap if a separate primary strap is provided.

NOTE 2 It is permissible for the system to include padding or other means of enhancing comfort to the wearer.

5.4 Area of protection

The extent of area of protection shall include all areas above the test line as defined in Annex A.

5.5 Draw laces

The helmet shall be tested with user adjustable draw laces completely slackened.

NOTE Fixed draw laces may be fitted.

6 Performance requirements

6.1 General

For all testing the helmet shall be positioned such that the lowest lateral mid point at the front of the liner is aligned equidistantly (midpoint) between the AA' plane and the reference plane, (see Figure A.1) or as low as the design will permit, (if this lies above midpoint).

Sampling and sequence of tests shall be carried out in accordance with clause **7**.

6.2 Shock absorption flat and hazard anvils

When tested in accordance with Annex B the maximum deceleration for any one test onto the flat anvil shall not exceed 250 g, and the average shall not exceed 225 g over 3 tests on the same helmet, and the total time during which it exceeds 150 g shall not be greater than 5 ms. The deceleration shall not exceed 200 g for tests onto the hazard anvil.

6.3 Penetration

When tested in accordance with Annex C the point of the striker shall not leave a visible indentation on the test block.

6.4 Retention system strength

When tested in accordance with Annex D the dynamic extension of the chin strap (including slippage of the buckle), as measured by displacement of the headform, shall not exceed 35 mm and the residual extension, with the weight at rest on the anvil, shall not exceed 25 mm.

Following the test, manual release of the unloaded buckle shall be possible.

6.5 Retention system effectiveness

When the helmet of a size appropriate to the headform used is tested in accordance with Annex E the helmet shall not come off the headform.

6.6 Durability of quick-release mechanisms

Where the retention system incorporates a quick-release mechanism this shall still be capable of normal operation after being tested in accordance with Annex F, and shall conform to **6.4**.

6.7 Stability of helmet

When tested in accordance with Annex G the vertical movement at the mid-point of the front edge of the liner shall not exceed 15 mm.

6.8 Lateral deformation

When tested in accordance with Annex H, the maximum lateral deformation of the helmet shall not exceed 30 mm, and the residual lateral deformation shall not exceed 10 mm.

6.9 Peak deflection

Where a helmet has a peak it shall be tested in accordance with Annex I and the deflection measured shall be greater than 6.0 mm.

6.10 Durability of marking

The label shall still be attached to each helmet and be legible after the helmet has been conditioned in accordance with Annex J.

7 Sampling and test sequence

7.1 Sampling

Helmets shall be tested as offered for sale, (inclusive of any accessories, marking and labelling).

For each model a minimum of 16 samples including at least one sample for each consumer size shall be tested.

No helmet, which has been subjected to any test, shall be offered for sale or used under any circumstances.

7.2 Test sequence

NOTE 1 Appropriate headforms are listed in Annex K.

NOTE 2 See Table 1 for summary of test sequence.

Subclause **6.6**, Durability of quick-release mechanisms, shall be conducted anytime prior to conditioning and shall not include those samples selected for retention effectiveness and stability. Six samples shall be tested.

Subclause **6.9**, Peak deflection, shall be conducted on each consumer size. Tests may be conducted at any point in the test sequence before conditioning or after retention strength assessment.

After assessment of the extent of the area of protection of the helmet in accordance with Annex A, two samples representing the largest and smallest consumer sizes submitted shall be assessed for stability and effectiveness of retention system in accordance with Annexes E and G respectively.

Each sample shall then be conditioned by one of the procedures described in Annex J, and shall be subjected, with a delay of no more than 90 s before the first impact for (+50 °C and -20 °C samples) to the shock absorption test, followed at ambient conditioning by the penetration test and then the test for retention system strength.

If the timescales are not met the samples shall be reconditioned.

For samples subjected to the water spray conditioning the first impact shall be conducted within 10 min of the end of the spray conditioning.

For lateral deformation assessment, a minimum of two helmets shall be tested with at least one taken from the largest consumer size for both the largest and smallest shell sizes within the range. In the case of a high or marginal assessment the test laboratory may request additional samples from the size range for further testing.

NOTE The test sequence should be arranged so that the number of helmets subjected to each of the four conditioning procedures is as nearly equal as possible.

Table 1 **Summary of test sequence**

Clause	Assessment	Samples required for testing
Clause **8** and **9**	Marking and information to users	All samples
Clause **5**	Construction	One of each consumer size
Subclause **6.7**	Stability	Largest and smallest consumer size
Subclause **6.5**	Retention effectiveness	Largest and smallest consumer size
Subclause **6.8**	Lateral deformation	Largest consumer size from largest and smallest shell sizes
Annex J	Conditioning	All samples
Subclause **6.10**	Durability of marking	All samples
Subclause **6.2**	Shock absorption and hazard impact	All samples
Subclause **6.3**	Penetration	All samples
Subclause **6.4**	Retention system strength	All samples

8 Marking

Each helmet shall be permanently marked in such a way that the following information is permanently legible by the user:

a) the number and date of this PAS i.e. PAS 015:2011;

b) the name, trademark or other means of identification of the manufacturer;

c) the helmet model designation, which shall be unique within the manufacturer's range of models;

d) the size or size range of the helmet, (quoted in centimetres) and a statement indicating the intended use of the helmet;

e) the month or quarter and year of manufacture.

9 Information to users

9.1 Every helmet offered for sale shall have attached to it, a label giving instructions for use, maintenance, fitting and adjustments in the language of the country of sale.

9.2 Every helmet offered for sale shall have attached to it, a warning label carrying the following information.

a) For maximum protection this helmet must fit closely and the harness must always be correctly adjusted and used according to the appropriate instructions supplied by the manufacturer. The buckle should be positioned flat on the side of the face or under the chin and the retention system securely adjusted to be both

comfortable and firm. For maximum protection this helmet shall cover as much of the forehead as possible without cutting down the field of vision. When fitted correctly it should not be possible to rotate or move the helmet on the head in a way that reduces the level of protection and/or field of vision.

Fitting is of prime importance and time should be taken to select the most suitable model and size.

b) The helmet should be replaced after a few years of careful use, if it does not fit anymore, or can no longer be fitted correctly.

c) This helmet is designed to absorb some of the energy of a blow by partial destruction of the shell or protective padding material, or both. This damage may not be visible and therefore any helmet that suffers an impact should be discarded and replaced by a new one.

d) This helmet must not be dry cleaned or exposed to solvents as these may affect the performance of the helmet.

e) Spacing between the retention system and the side of the user's head may vary substantially from one individual to another. It is essential when choosing a helmet to ensure that when correctly fitted and adjusted, any gaps between the user's head and the retention system are minimal to reduce the risk of obstacles becoming entangled.

f) It should be recognized by wearers that the protection given by a helmet depends on the circumstances of an accident, and wearing a helmet cannot always prevent death, injury or long-term disability.

g) Make no modifications to the helmet.

h) Do not subject the helmet to temperatures above 50 °C or below -20 °C. Do not store the helmet in direct sunlight.

Annex A (normative) Marking of the test line and assessment of the extent of area of protection

A.1 Principle

The extent of protection provided by the helmet is assessed by placing the test sample on the appropriate size reference headform and determining whether or not the protective padding cover the area above the test line on the headform, (see Figure A.1).

A.2 Marking of test line

Place the helmet on a headform of appropriate size chosen in accordance with Annex K, apply a vertical load of 50 N to the crown of the helmet. The helmet shall be tested with user adjustable draw laces completely slackened. Position the helmet such that the lowest lateral mid point at the front of the helmet is aligned equidistantly between the AA′ plane and the reference plane of the headform, or as low as the design will permit if this lies above the mid point between the AA′ plane and the reference plane of the headform.

Mark the helmet as follows.

a) A horizontal line at the level of the AA′ plane of the headform.

b) A horizontal line DD′ 25 mm above the reference plane of the headform.

c) A rear point F′ on the projected longitudinal vertical plane of the head form and 12.7 mm below the line marked in a) above. Point F′ is the horizontal projection of the headform point F.

d) The helmet is then tilted down at the front until the line drawn in stage a) is angled at 10° relative to its horizontal position and a line R-F′ is drawn around the helmet starting from point F′ marked on the rear of the helmet and extending to meet the AA′ line at the intersections P1 and P2 and the DD′ line at the intersections of Q1 and Q2.

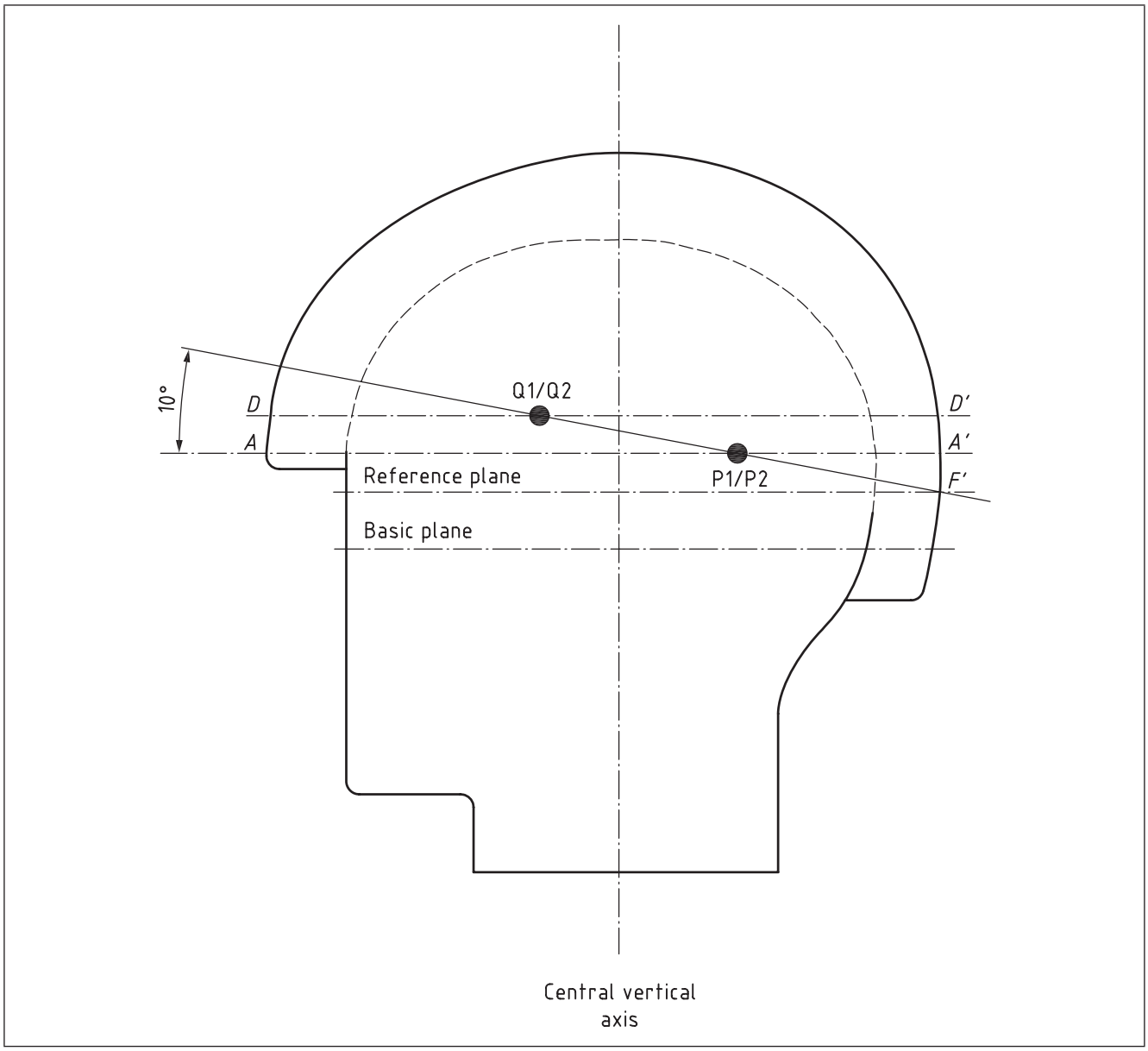
The test line is defined by DQ1F′ Q2D.

A.3 Assessment of area of protection

Assess whether the liner covers the required extent of area of protection.

The extent of the area of protection is defined as the area above the line AP1F′ P2A.

Figure A.1 **Test line and area of protection**



Annex B (normative) Shock absorption and hazard impact test

B.1 Principle

Impact absorption capacity is determined by recording the deceleration imparted to a headform fitted with the helmet against time, when dropped in guided free fall at a specific impact velocity upon a fixed steel anvil.

B.2 Marking of impact sites

Before conditioning mark the impact sites within the test area defined in Figure A.1.

B.3 Positioning of the helmet

After conditioning position, the helmet on a headform of appropriate size selected from among those listed in Annex K. Adjust the retention system to secure the helmet to the headform.

Position the helmet headform assembly such that the designated impact site on the helmet lies within a circle of radius of 32.5 mm from the vertical centreline of the anvil. The vertical centreline of the anvil shall at all times be maintained within the test area. The plane tangential to the general outer form of the helmet at the point of impact shall be horizontal.

B.4 Test

Carry out the first impact within 90 s of removal from the temperature conditioning and within 10 min of completion of water spray conditioning. All subsequent impacts shall be completed not more than 4 min after the removal from conditioning.

a) For the flat anvil impact sites on or above the line DQ1F'Q2D, (see Figure A.1). the drop height shall be such that the helmet/headform assembly falls to the test anvil at a velocity which immediately before impact, is equal to:

   5.9+0.15 -0 m/s

   NOTE This equates approximately to a freefall height of 1.8 m.

b) For the hazard anvil the drop height shall be such that the helmet/headform assembly falls to the test anvil at a velocity which immediately before impact is equal to:

   5.05+0.15 -0 m/s for all impact sites.

   NOTE This equates approximately to a freefall height of 1.3 m.

B.5 Measurements

Measure the velocity of the moving mass within 60 mm before impact to an accuracy of ±1 %. Measure and record the deceleration against time at the centre of gravity of the headform to the nearest 1 g and 0.1 ms.

B.6 Apparatus

B.6.1 Suitable apparatus, consisting of the following:

— a steel anvil rigidly fixed to a base;

— a free fall guidance system;

— a mobile system supporting the helmeted headform;

— a metal headform fitted with a tri-directional accelerometer and a measuring system;

— a system by which the point of impact can be brought into alignment with the centre of the anvil.

A typical example is shown in Figure B.1.

B.6.2 Base, made of steel or concrete or a combination of these materials and with a mass of at least 500 kg.

It shall be constructed so that there is no significant deformation of the surface under the test load.

No part of the base or anvil shall have a resonant frequency liable to affect the measurements.

B.6.3 Headforms, as defined in Annex K.

B.6.4 Anvils, consisting of the following.

a) Flat anvil – the anvil shall have a flat circular impact face of (130 ± 3) mm diameter.

b) Hazard anvil – as detailed in Figure B.2.

B.6.5 Mobile system and guides, such that its characteristics do not affect the measurement of deceleration at the centre of gravity of the headform. It shall also be such that any point in the area above the test line can be positioned vertically above the centre of the anvil.

In the case of a guided fall, the velocity of the falling body, measured at a distance of not more than 60 mm before impact, shall be not less than 95 % of the theoretical free fall velocity.

B.6.6 Accelerometer and measuring assembly, capable of withstanding a deceleration of at least 2000 g without damage and of a maximum mass of 50 g.

The measuring system, including the drop assembly, shall have a frequency response in accordance with channel frequency class (CFC) 1 000 of ISO 6487:1987.

B.7 Test procedure

Peaks and, where fitted, fixed draw laces, shall not be removed when performing impact tests.

Where the hazard anvil is used the anvil shall be orientated such that the impacting edge does not extend below the test line.

Where a sweatband is provided it shall be fitted for testing.

Where user adjustable draw laces are fitted, they shall be completely slackened.

Test each helmet by impacting it four times, commencing with impacts at, or adjacent to, the test line. The centres of the impact sites shall be separated on the helmet, by a distance not less than one-fifth of the maximum circumference of the helmet. One of the impacts on each sample shall be conducted using the hazard anvil.

All of the impacts shall be centred on or above the DQ1F'Q2D/ line.

In any sequence of tests, impacts shall be conducted on the following specific sites:

a) over a ventilation feature;

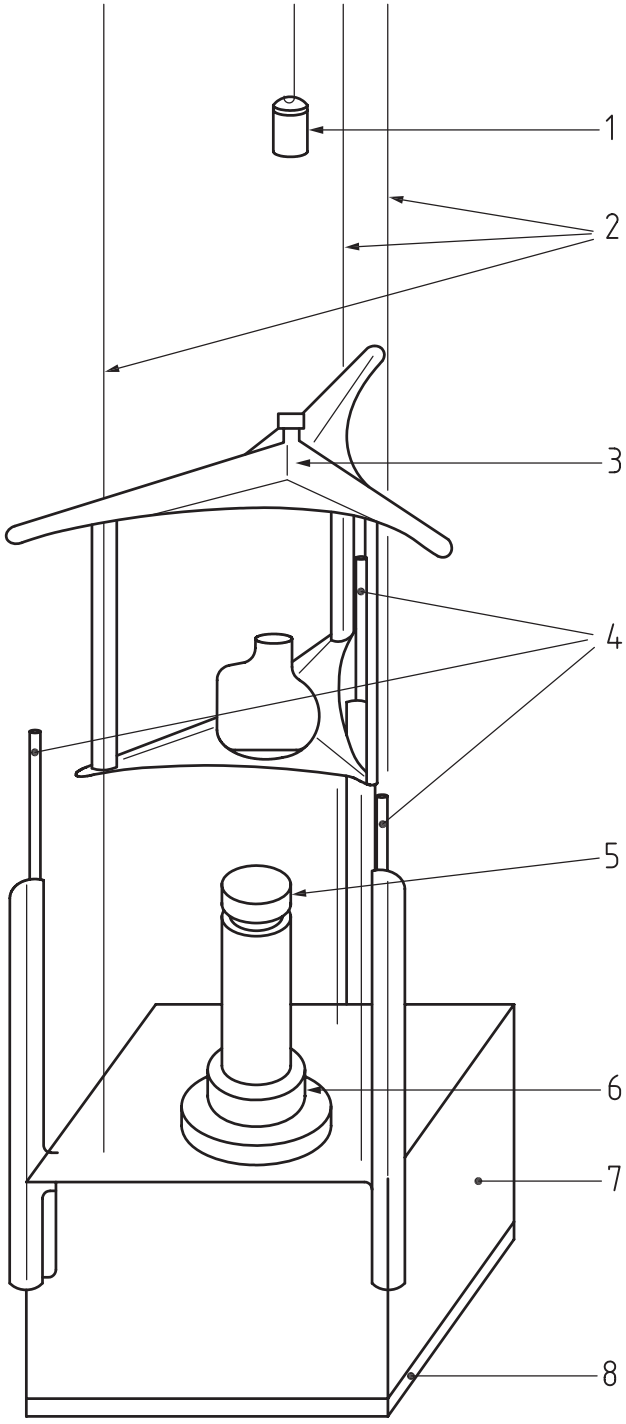
b) over a retention fixing point when this is within the test area or at a point on the test line vertically above the retention fixing point when the fixing point is outside the test area;

c) on a site, representing the temple area, midway between the front of the helmet and a point directly lateral to the central vertical axis;

d) (where a peak is fitted) on the front test line using both hazard and flat anvils. Different samples shall be used for each anvil.

NOTE *With the system adjusted for testing as specified, primary contact with features protruding below the test line (i.e. peaks) is considered to be an essential part of the overall assessment.*

Figure B.1 **Typical apparatus for testing shock absorbing capacity**

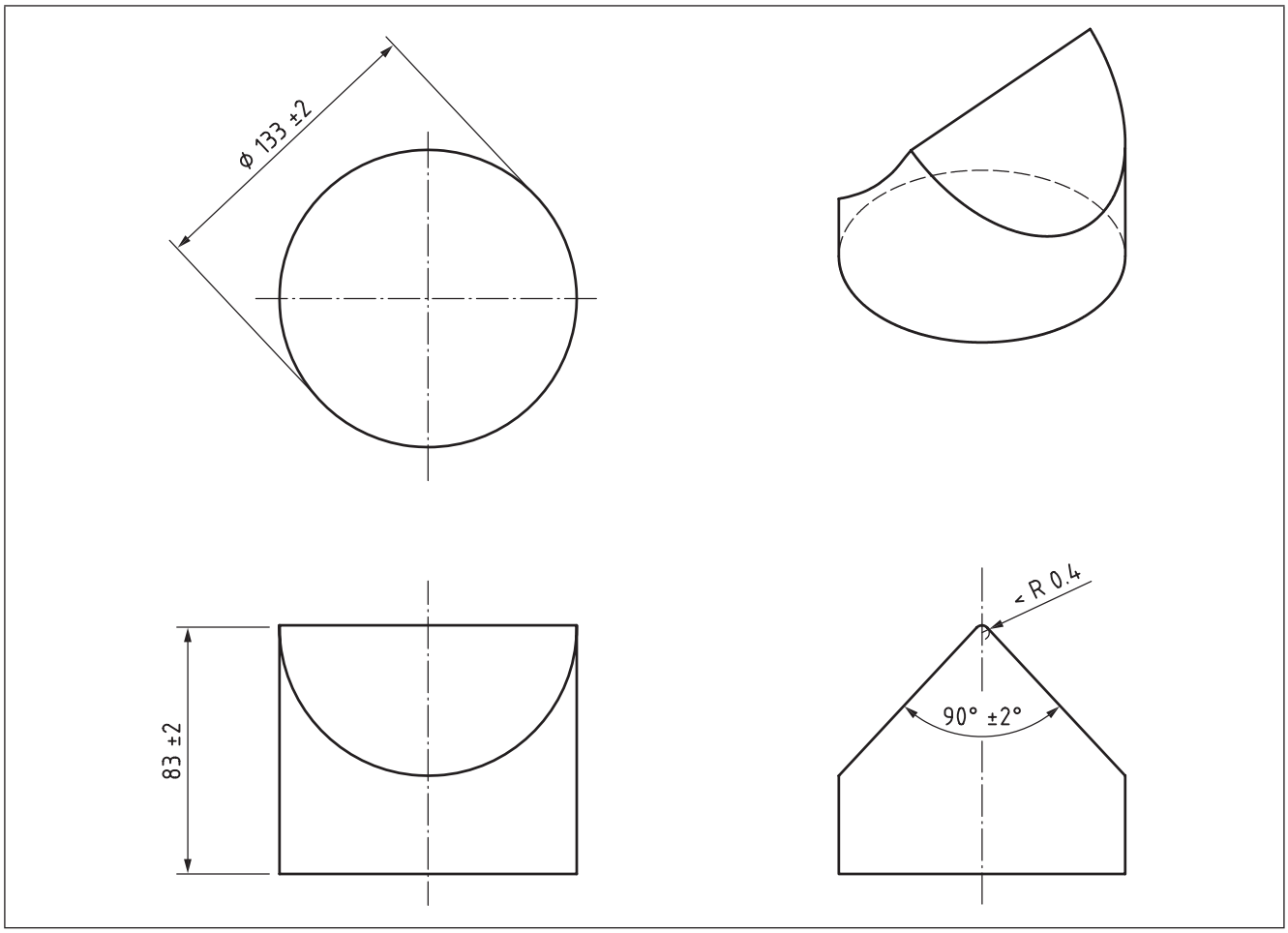


NOTE:
The headform is not constrained by the carriage/guidance cables at/after impact

Key

1	Electromagnetic dropper	5	Anvil
2	Guide cables	6	Plate magnet
3	Headform support dolly	7	Steel magnet
4	Dolly dampers	8	Rubber slab

Figure B.2 **Hazard anvil**



Annex C (normative) Penetration test

C.1 Principle

The helmet is mounted on a test block and receives a blow from a pointed striker. Note is taken whether the striker succeeds in penetrating the helmet sufficiently to reach the test block. Where ventilation features are present these shall be assessed for penetration if they fall within the test area.

The impact site shall be not less than 75 mm from the centre of a previously impacted site and shall not include areas damaged by previous impacts.

C.2 Apparatus

C.2.1 Test apparatus, as shown in Figure C.1, and consisting of the following.

a) A hemispherical test block of hardwood with a soft insert at the top of its vertical axis mounted on a rigid base.

b) A system to secure the helmet to the test block without the use of its retention system.

c) A pointed striker, positioned point downwards so that it can be dropped in substantially frictionless guided free fall onto the centre of the soft metal insert. The striker shall have the following characteristics.

Mass: (3 000 +45 0) g

Angle of point: (60.0 ± 0.5)°

Radius of point: (0.5 ± 0.1) mm

Minimum height of cone: 40 mm

Minimum hardness of tip: 50-45 HRC1 [1)]

C.3 Procedure

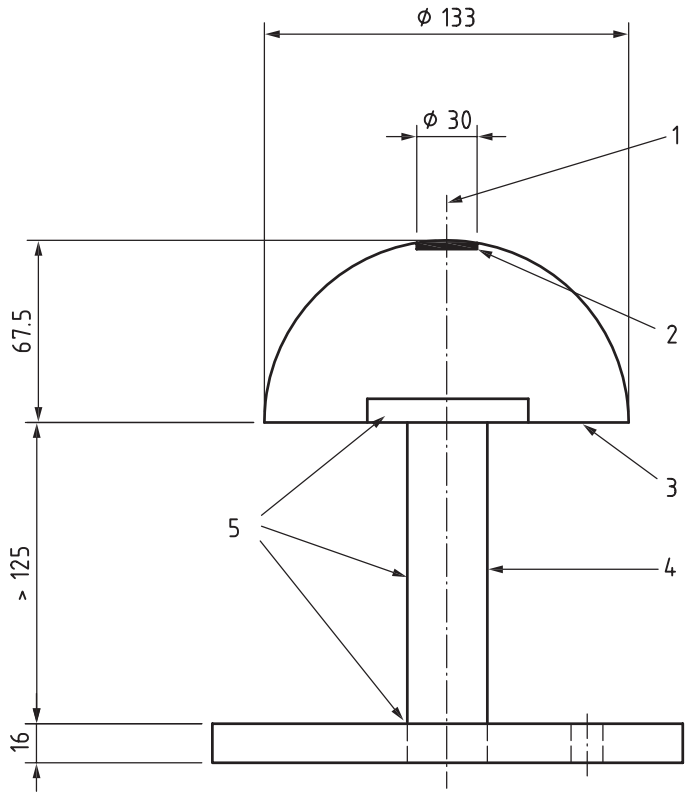
Before commencing a test, check the surface of the soft metal insert for damage and restore the insert as necessary.

Secure the helmet to the test block.

Choose three impact sites within the area defined and drop the striker through (750 ± 5) mm to contact the helmet.

Record if physical contact is made between the striker and the soft metal of the test block.

Figure C.1 **Apparatus for testing penetration**



Key

1 Striker axis
2 Replaceable insert (flat)
3 Recessed metal boss
4 Post to be moveable/adjustable to accommodate all impact positions
5 Metal framework

[1)] The symbol HRC signifies a unit of Hardness (Rockwell C) in accordance with BS EN ISO 6508-2:2005.

Annex D (normative) Retention system strength test

D.1 Principle

A dynamic load is applied to the retention system and the resulting dynamic and residual extensions are measured.

D.2 Apparatus

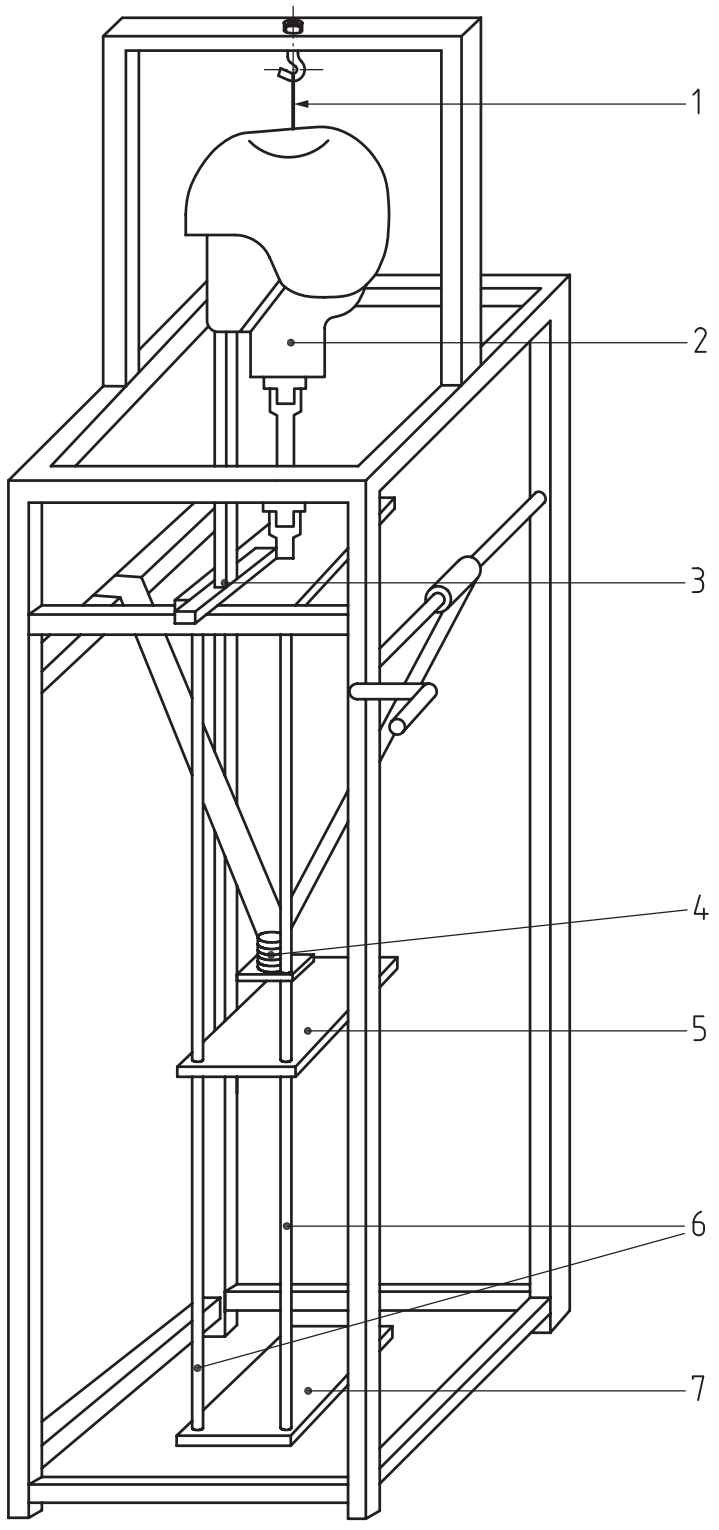
D.2.1 A headform, conforming to Annex K and having a simulated chin, is mounted at the top of a vertical guide, down which a weight can move in guided free fall on to an anvil attached to the lower end of the guide. Means shall be provided for observing the position and displacement of the head form in a vertical direction. The headform and parts attached to it shall have a mass of (15 $\pm$ 0,5) kg and the fall weight shall have a mass of(10 + 0,1) kg.

A suitable apparatus is shown in Figure D.1.

D.3 Procedure

Fix the helmet rigidly in an upright position by means of a hole drilled into its highest point. Insert the headform into the helmet and locate the guide so that the weight is free to move only along a vertical line that passes through the point at which the shell is held. Fasten the retention system in accordance with any instructions from the manufacturer. The buckle shall be adjusted such that it lies flat under the chin or along the side of the face. The nape strap shall then be adjusted and tensioned accordingly for the revised set-up. Measure the vertical position of the headform without the falling weight resting on the system. Allow the weight to fall on to the anvil through a height of (300 $\pm$ 5) mm. During the test measure the maximum dynamic displacement of the point of application of the force. After 2 min measure the residual displacement of the point of application of the force whilst the drop weight is resting on the anvil.

Figure D.1 **Apparatus for testing retention system strength**



Key

1 Fixed helmet support
2 Headform
3 Displacement recorder
4 Drop release
5 Drop weight mass 10 kg
6 Guides
7 Anvil

Annex E (normative) Test for effectiveness of retention system

E.1 Principle

The helmet, mounted firmly on an appropriate headform by means of its normal retention system, is subjected to a tangential shock load at the crown of the helmet in a forward direction, which simulates the inertial tendency of the helmet to lift and roll forward over the wearer's face when the wearer stops suddenly.

NOTE It is planned to include other tests in a rearward direction at the next revision.

E.2 Apparatus

E.2.1 Suitable apparatus, as shown in Figure E.1. The helmet shall be fitted according to the manufacturer's instructions to the appropriate headform which shall be the smallest and the largest for that helmet type.

E.2.2 A device, [the total mass being (3.0 kg $\pm$ 0.1) kg] to release a falling weight is hooked onto the rear part of the shell in the longitudinal vertical plane of the helmet, as shown in Figure E.1.

The falling weight, the mass of which shall be (10 $\pm$ 0.1) kg, is then released and drops in a guided free fall. The guiding devices shall be such as to ensure that the impact speed is not less than 95 % of the theoretical free fall speed.

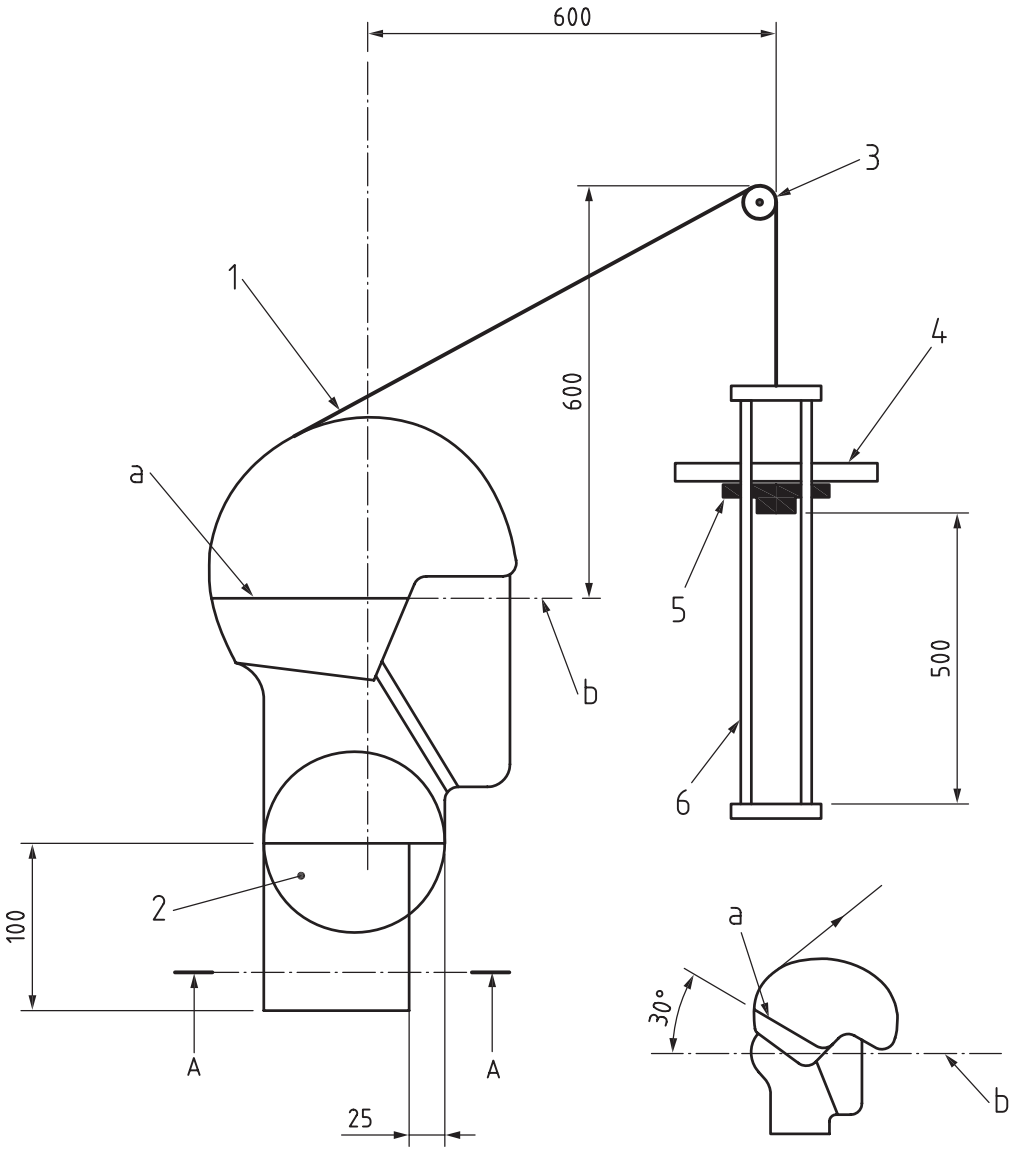
E.2.3 Procedure

Condition the helmet to ambient temperature and humidity. Mount it on the headform and fasten the retention system in the way in which it is intended to be worn. Engage the hook in the rear of the shell and raise the weight. Release the drop weight so that it falls through (500 +20 0) mm.

NOTE If possible, those factors in the design or behaviour of the helmet that have contributed to success or failure in the test should be noted for information purposes.

Figure E.1 **Apparatus for testing retention system effectiveness**

All dimensions in millimetres



Key

1	Flexible connection	5	Drop weight, mass 10 kg
2	Base	6	Guiding system, mass 3 kg
3	Pulley	a	Reference line on helmet
4	Frame	b	Reference plane

Annex F (normative) Test for durability of quick-release mechanism

F.1 Principle

The mechanism is repeatedly fastened and unfastened under load both before and after the corrosion procedure described in **F.2b)** where applicable. A dynamic strength test is then applied.

F.2 Procedure

Subject the quick-release mechanism to the following processes in the order given.

a) Use apparatus appropriate to the particular design of mechanism. Close and lock the mechanism. Apply a loading force of (23 ± 2) N in the direction in which the mechanism is designed to bear load, then unlock and disengage the mechanism under load. Complete this cycle in not less than 2 s. Repeat for a total of 2 500 cycles.

b) If the quick-release mechanism incorporates metal components, carry out the following process.

   Place the complete mechanism in a closed cabinet so that the mechanism can be continuously wetted by a spray while still allowing free access of air to all parts of the mechanism. Subject the mechanism to a spray of a solution consisting of 4 % (m / m) to 6 % (m / m) of reagent grade sodium chloride in distilled or deionized water for a period of (48 ± 1) h at a temperature of (35 ± 5) °C. Rinse the mechanism thoroughly in clean running water to remove salt deposits and allow to dry for (24 ± 1) h.

c) Repeat the process described in a).

Annex G (normative) Test for stability of helmet on headform

G.1 Principle

An assessment of the forward and rearward stability of the helmet under static load is made.

G.2 Apparatus

A suitable apparatus is shown in Figure G.1.

G.3 Test procedure

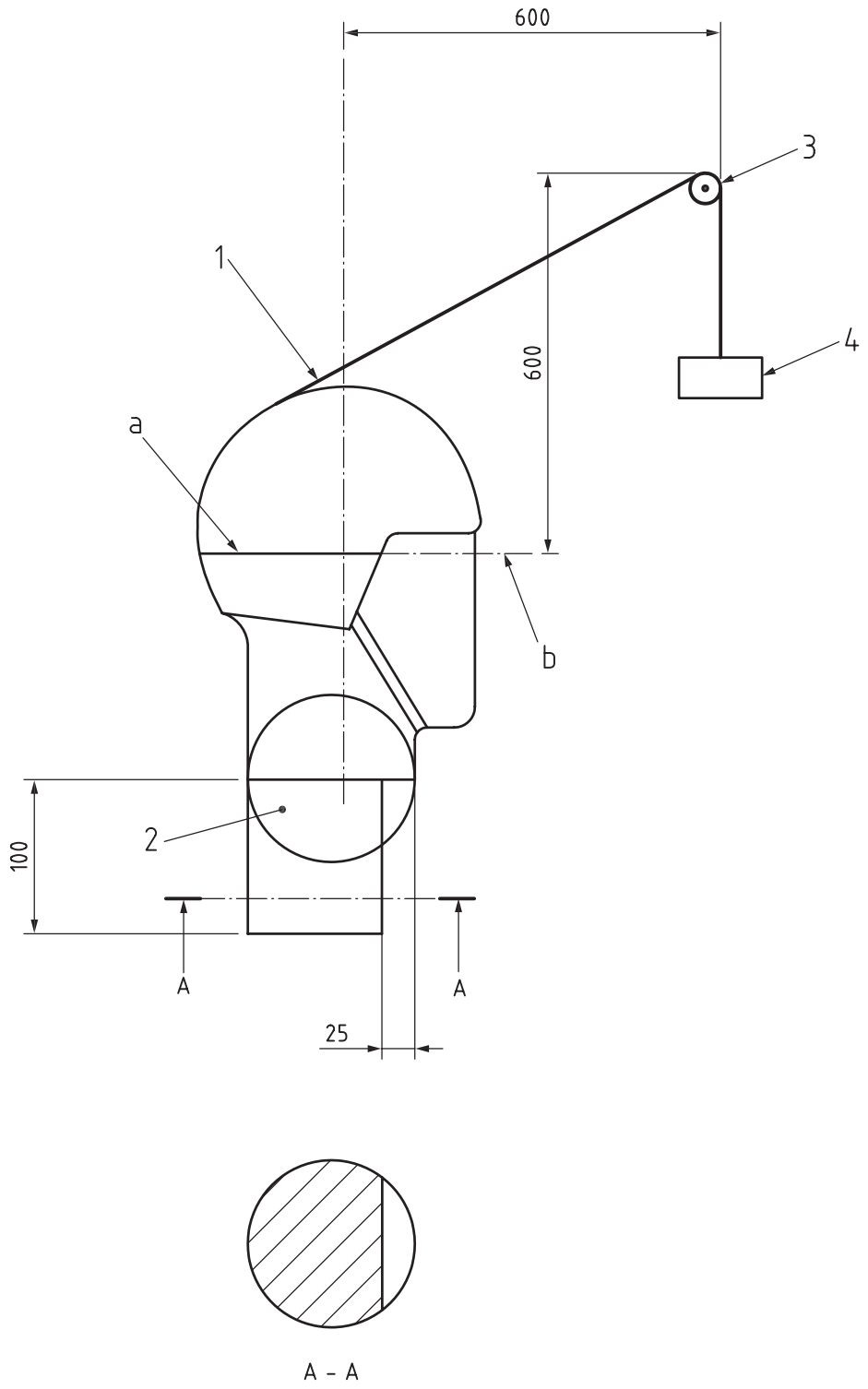
The helmet shall be fitted according to the manufacturer's instructions and positioned such that the lowest lateral mid point at the front of the liner is aligned equidistantly (midpoint) between the AA' plane and the reference plane (see Figure A.1) or as low as the design will permit, (if this lies above midpoint). Testing shall be conducted in the smallest, largest and one other size appropriate to the helmet type.

A mass of (5.0 ± 0.1) kg is hooked in turn onto the rear and front part of the shell in the longitudinal vertical plane of the helmet as shown in Figure G.1. The load is applied statically and the vertical movement

of the helmet at the lowest lateral mid point at the front of the liner is measured. The measurement shall be taken after 30 and before 60 seconds after the mass is applied.

Figure G.1 **Apparatus for testing stability**

All dimensions in millimetres



Key

1	Flexible connection	3	Pulley	a)	Reference line on helmet
2	Base	4	Static load	b)	Reference plane

Annex H (normative) Lateral deformation

H.1 Principle

The helmet is subjected to transverse compressive forces and the deformations measured.

H.2 Procedure

The helmet shall be placed transversely between two guided rigid flat parallel plates of nominal size (300 x 250) mm, with its AA' plane aligned with the major centreline of the plates.

An initial force of 30 N shall be applied perpendicular to the plates, so that the helmet is subjected to lateral force. After 30 s the distance between the plates shall be measured (dimension x).

The force shall be increased by 100 N per minute, up to 800 N, and shall be held for 30 s, after which the distance between the plates shall again be measured (dimension y).

The force shall be decreased to 25 N and then immediately increased to 30 N, and shall be held for 30 s, after which the distance between the plates shall again be measured (dimension z).

Measurements shall be made to the nearest millimetre, and the extent of damage, if any, shall be noted.

The maximum lateral deformation is the difference between dimensions x and y.

The residual lateral deformation is the difference between dimensions x and z.

Annex I (normative) Peak deflection test

I.1 Principle

The ability of the peak to deflect is assessed by applying a known load to it and measuring the resultant deflection.

I.2 Apparatus

I.2.1 Apparatus, consists of a rigid base onto which a headform is fitted and includes a system to apply the load and measure the resulting deflection.

I.2.2 Test procedure

Place the helmet on a headform of the appropriate size and secure it in place. Freely suspend a mass of 2 kg $\pm$ 10 g from the edge of the peak at a point within 12.5 mm of the centre of the front edge. Measure the deflection under load (in millimetres) at the front edge of the peak after the load has been applied for 2 min $\pm$ 10 s.

Annex J (normative) Conditioning

J.1 High temperature

Expose the helmet to a temperature of (50 ± 2) °C for not less than 2 h and not more than 24 h.

J.2 Low temperature

Expose the helmet to a temperature of (-20 ± 2) °C for not less than 2 h and not more than 24 h.

J.3 UV and water spray

Place the helmet crown uppermost under a nozzle spraying water at (15 ± 5) °C to flow over the whole of the outer surface of the helmet for a period of not less than 2 h and not more than 24 h with a flow rate of (80 ± 15) l/h.

Expose the outer surface of the helmet to ultra violet radiation using a 125 watt Xenon filled quartz lamp at a range of 250 mm for a period of (48 ± 2) h.

J.4 Ambient

Expose the helmet to a temperature of (23 ± 8) °C for not less than 2 h.

Annex K (normative) Headforms

Headforms shall conform to the following requirements of BS EN 960.

Extent of protection, retention system,	Sizes A, C, E, G, J, K, M, O.
effectiveness, strength and stability:	Shape and dimensions above and below the reference plane.
Impact headforms:	Sizes A, E, J, M and O.

Shape and dimensions above and below the reference plane.

The headforms shall not have a resonant frequency below 3 000 Hz.

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