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Specification for protective helmets for motor cycle users

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Foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Tourism, Trade and Industry established under Cap 327, of the Laws of Uganda. UNBS is mandated to co-ordinate the elaboration of standards and is

(a) a member of International Organisation for Standardisation (ISO) and

(b) a contact point for the WHO/FAO Codex Alimentarius Commission on Food Standards, and

(c) the National Enquiry Point on TBT/SPS Agreements of the World Trade Organisation (WTO).

The work of preparing Uganda Standards is carried out through Technical Committees. A Technical Committee is established to deliberate on standards in a given field or area and consists of representatives of consumers, traders, academicians, manufacturers, government and other stakeholders.

Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

Committee membership

The following organisations were represented on the Technical Committee for Transport and Communication standards, UNBS/TC 8, in the development of this standard:

- Arrive Alive Uganda
- Chevron Uganda Ltd
- Kyambogo University
- Makerere University
- Ministry of Finance , planning and Economic Development
- Ministry of Works and Transport
- Shell Uganda Ltd
- Total Uganda Ltd
- Uganda National Bureau of Standards (UNBS)

Introduction

Road traffic injuries are a major problem and a leading cause of death and injury around the world. Each year nearly 1.2 million people die as a result of road crashes, and millions more are injured or disabled. In many low-income and middle-income countries, where motorcycles and bicycles are an increasingly common means of transport, users of two-wheelers make up a large proportion of those injured or killed on the roads. Motor cycle and bicycle riders are at an increased risk of being involved in a crash. This is because they often share the traffic space with fast-moving cars, buses and trucks, and also because they are less visible. In addition, their lack of physical protection makes them particularly vulnerable to being injured if they are involved in a collision. Injuries to the head and neck are the main cause of death, severe injury and disability among users of motorcycles and bicycles.

Globally, there is an upward trend in the number and use of motor cycles and bicycles, both for transport and recreational purposes. Indeed, most of the growth in the number of vehicles on the world's roads comes from an increasing use of motorized two-wheelers.

Specification for protective helmets for motor cycle users

1 Scope

This Uganda Standard specifies types, sizes and tolerances, components, materials and construction, requirements, marking and labelling, sampling and criteria for conformity and testing for protective helmets for motor cycle users (riders and passengers).

This standard is applicable only to protective helmets for users of general motor bicycles and certain motor cars, which shall be referred to hereinafter as "helmets"; it does not cover helmets for vehicle users in competitive events.

2 Terms and definitions

For the purpose of this standard, the following terms and definitions shall apply.

2.1
protective helmet
helmet primarily intended to protect the upper part of the wearer's head against a blow. Some helmets may include additional protection features.

2.2
half type protective helmet
helmet having a shell to protect the upper part of the wearer's head

2.3
headform
three dimensional approximation of part, or all, of the human head, excluding facial features and pinnae

2.4
jet type protective helmet
helmet having a shell to protect the upper part of the wearer's head, the occipital and jaws areas of the wearer

2.5
full-face type protective helmet
helmet having a shell to protect the upper part of the head, the occipital and chin areas of the wearer

2.6
shell
hard material that provides the outer form of the helmet, covering the shock absorbing liner and other components

2.7
shock-absorbing liner
lining material provided inside the helmet to mitigate the effects of a blow on the head

2.8
chinstrap
strap which passes under or round the wearer's chin to retain the helmet in a position that can be adjusted to tighten or loosen as appropriate

2.9
cushioning
lining material provided to improve wearing comfort

2.10
ear flap
part of the helmet designed to cover the wearer's ear

2.11
rim
part covering the edge of the helmet

2.12
peak
permanent or detachable extension of the shell above the eyes

2.13
windshield
part protecting eyes against wind

2.14
ventilation holes
holes made in the shell to permit circulation of air inside the helmet

2.15
hearing holes
holes designed to permit hearing

2.16
goggles strap holder
device on the shell for holding the goggles strap

2.17
visor
transparent protective screen extending over the eyes and covering all or part of the face

2.18
labelling
marking of the helmet with the largest and smallest appropriate head circumferences in centimetres

3 Types

Protective helmets shall be divided into 3 types:

a) half type protective helmet (see Figure 1)

b) jet type protective helmet (see Figure 2)

c) full-face type protective helmet (see Figure 3)

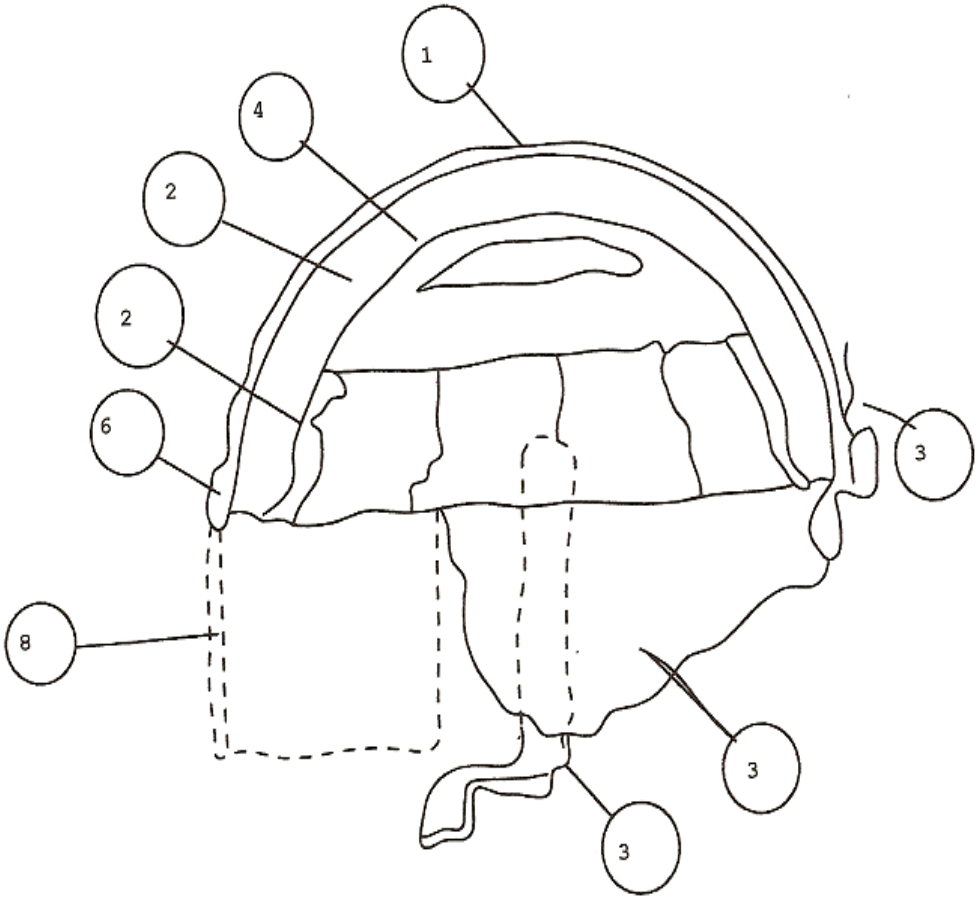

Figure 1 — Half type protective helmet

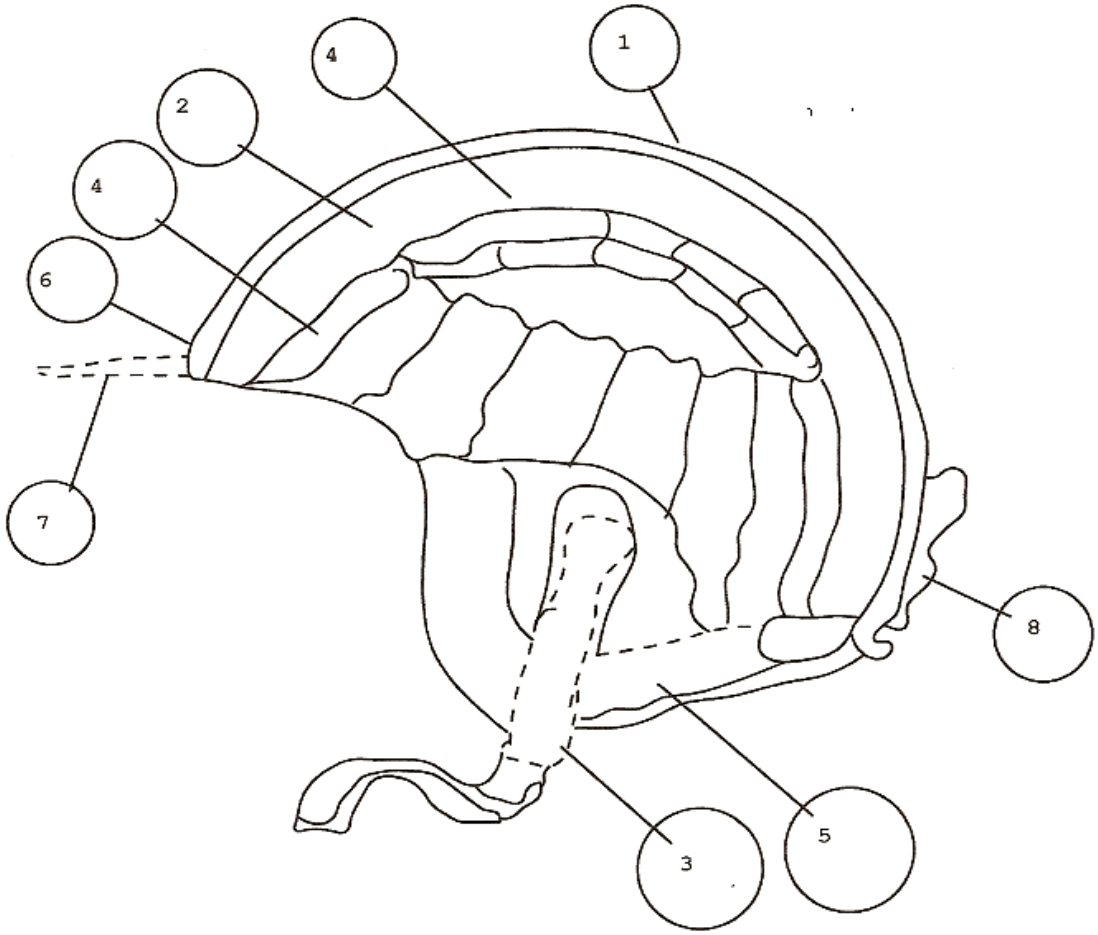

Figure 2 — Jet type protective helmet

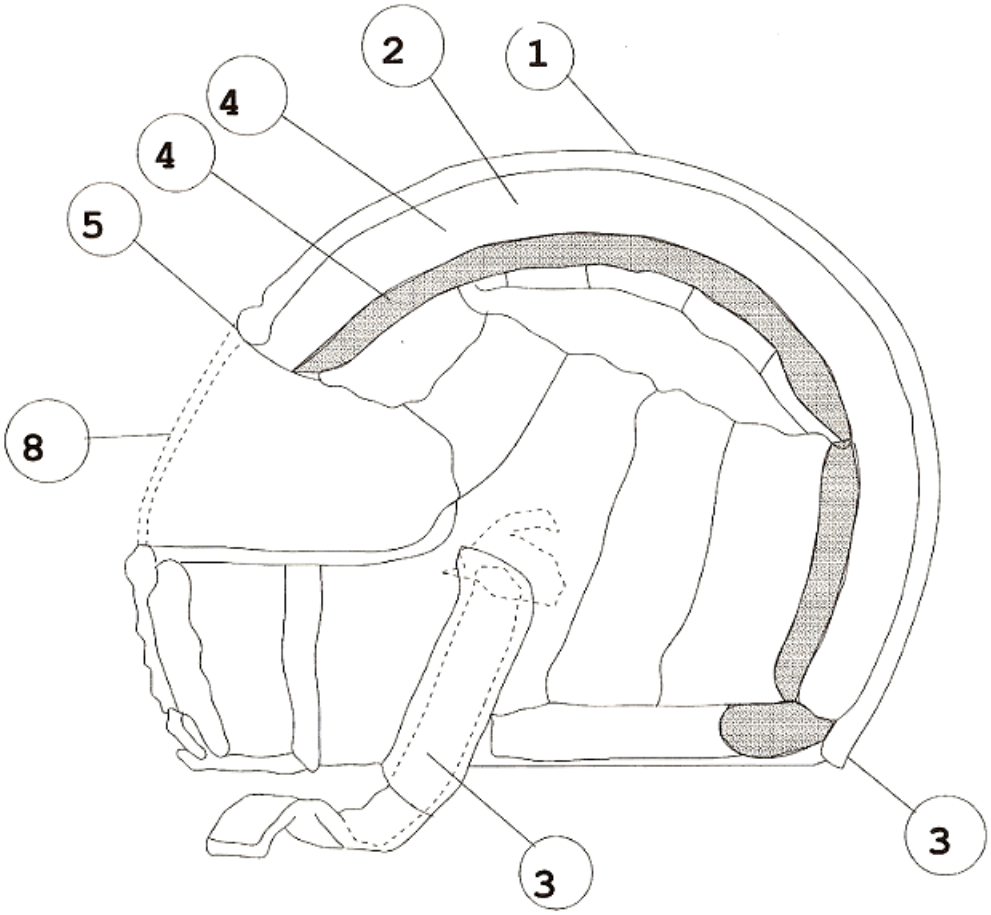

Figure 3 — Full face type protective helmet

Key

1. Shell
2. Shock-absorbing liner
3. Chinstrap
4. Cushioning
5. Ear flaps
6. Rim (if any)
7. Peak (if any)
8. Windshield (if any)
9. Goggles strap holder (if any)

4 Sizes and tolerances

Helmets are of generally of 8 sizes,

- Extra Extra Small (XXS),
- Extra Small (XS),
- Small (S),
- Medium (M),
- Large (L)
- Extra Large (XL),
- Extra Extra Large (XXL) and
- Extra Extra Extra large (XXXL).

The suggested specification for these sizes is as shown Table 1 below. They shall ensure a close fit when mounted to head forms of the same code letter.

Table 1 — Sizes of helmets

Description	Sizes	Head circumference, mm
Extra Extra Small	XXS	510 - 520
Extra Small	XS	530 - 540
Small	S	550 - 560
Medium	M	570 - 580
Large	L	590 - 600
Extra Large	XL	610 - 620
Extra Extra Large	XXL	630 - 640
Extra Extra Extra Large	XXXL	650 - 660

Dimensions of head forms shall comply with Table 2 and Annex A.

Compliance is checked by visual inspection and measurement.

Table 2 — Sizes of headforms

Symbols	Size, mm	Drop Mass, kg
A	500	3.1 ± 0.10
C	520	3.6 ± 0.11
E	540	4.1 ± 0.12
J	570	4.7 ± 0.14
M	600	5.6 ± 0.16
O	620	6.1± 0.18

5 Components, materials and construction

5.1 Components

5.1.1 General

General components of helmets shall comply with Figures 1 - 3. Any devices fitted to the helmet, in particular the metallic part of rigid materials, protruding from the inside surface of the shell, shall be such that it is unlikely to cause any injury to the wearer in the event of an accident.

5.1.2 Chinstrap/retention system

The chinstrap fitted to the helmet shall not be less than 20 mm wide. Fabric chinstrap, if used shall not be secured to the shell by bolt or by rivet. Quick release buckles, if used, shall not be able to be released accidentally.

The chinstrap and fastening devices shall be securely fixed to the shell.

Compliance is checked by visual inspection and measurement.

5.1.3 Shell

The shell shall be of uniform strength and shall not be specially reinforced at any particular point.

5.1.4 Shock-absorbing liner

The shock-absorbing liner shall closely fit the inner curvature of the shell and be capable of absorbing impact energy.

Compliance is checked by visual inspection and test using 9.2.

5.2 Materials

The materials used in the manufacture of helmets shall be of durable quality, that is, their characteristics shall not undergo appreciable alteration under influence of ageing or of the circumstances of use to which the

helmet is normally subjected, i.e. exposure to sun, rain, cold, dust, vibrations, skin, sweat or cosmetics for skin or hair.

Chinstrap and fastening devices shall not be made of materials that would be hazardous to the skin.

Compliance is checked by visual inspection.

5.3 Construction

5.3.1 The assembled helmet shall have a smooth external and internal surface without reinforcing ridges. There shall be no external projections or concavity greater than 3 mm from the outer surface of the shell except a fastening device for peak or windshield which shall not project more than 7 mm.

The above requirement does not apply to the concavity of the hearing hole and ventilation hole.

Measurement of protrusion of the fastening device for peak or windshield that is easily detachable shall be made with the peak or windshield removed.

Measurement of protrusion of the fastening device for peak or windshield that is not easily detachable shall be made without removing the peak or windshield.

5.3.2 The fastening device fitted to the shell shall be protected to prevent abrasion with the wearer's head.

5.3.3 Rivet heads shall not project more than 2 mm above the outer surface of the helmet and shall be free from sharp edges, offering no laceration or puncture hazard.

5.3.4 An assembled helmet shall have a mass not exceeding 2 kg.

5.3.5 The jet type helmet and the full-face type helmet shall provide for ventilation by holes permitting air to flow over the head top.

5.3.6 An assembled helmet with ear-covering feature shall be provided with hearing holes. Compliance is checked by visual inspection.

5.3.7 Face shield, if any, shall be made of transparent and colourless material and shall resist penetration by small particles..

5.3.8 Metallic screws and sharp metallic rivets shall not be used. Compliance is checked by visual inspection and measurement.

5.3.9 The helmet shall provide peripheral visual clearance as measured using a reference headform appropriate to the size of the helmet. This peripheral vision includes a horizontal clearance of at least 210°, an upward clearance of at least 7° and a downward clearance of at least 30°. However, this downward clearance makes specific allowance for breath deflectors. These clearances are described in terms of planes fixed in the reference headforms.

Compliance is checked by visual inspection and measurement.

6 Requirements

6.1 Shock absorption

When the helmets are submitted to the low and high temperature and moist conditions as described in clause 9.2.3 and tested as prescribed either in clause 9.2.3.2 or clause 9.2.3.3 the following requirements shall be adhered to:

a) the force transmitted shall not exceed 20 kN; or

b) the maximum acceleration of the head form shall not exceed

$$\frac{2\,000\,g}{m} \quad m/s^2$$

where

m is the mass, in kilograms, of the head form plus helmet; and

g is acceleration of gravity expressed in m/s^2.

The shell of the helmet shall not show any penetration cracks.

6.2 Penetration resistance

When tested in accordance with 9.3, the distance between the point of the spike and the headform shall at no time be less than 5 mm.

6.3 Rigidity

When tested in accordance with 9.4 at an initial load of 30 N which shall be increased to 630 N, the difference of the distance between two metal plates measured at both load applications shall not exceed 40 mm. After decreasing the load to 30 N, the difference of the distance between the two plates in relation to the initial load shall not exceed 15 mm.

6.4 Strength of chinstrap and fastening device

6.4.1 Resistance to deformation

When tested in accordance with 9.5.3, the extension under specified load of chinstrap and fastening device shall not exceed 25 mm.

6.4.2 Resistance of chinstrap and fastening device to detachment from shell

When tested in accordance with 9.5.2 the chinstrap, the fastening device and its attachment shall not break or tear away.

6.5 Flexibility of peak

If a peak is provided, when tested in accordance with 9.8 the deflection of the peak shall be not less than 6 mm and not more than 32 mm.

7 Marking and labelling

7.1 Each helmet shall be legibly and permanently marked on the inside in such a way that the following information is accessible to the user:

a) type and code letter of the helmet;

b) mass in grams or kilograms, to the nearest 50 g;

c) size of the helmet in millimetres;

d) month and year of manufacture or lot identification;

e) name of manufacturer or factory or registered trade-mark; and

f) country of origin.

In case foreign language is used, the meaning shall correspond to that in English specified above.

7.2 Any person who manufactures products complying with this standard may use the Quality Mark in connection with his products only after having received a license from UNBS.

8 Sampling and criteria for conformity

8.1 Lot

A lot comprises helmets of the same type and code letter made from the same materials under the same process which are manufactured or delivered or purchased at the same period of time.

8.2 Sampling

8.2.1 General

Sampling and acceptance shall comply with the sampling plan or other technically equivalent plan.

8.2.2 Sampling and acceptance for tests on sizes, components, materials and construction

8.2.2.1 Samples shall be drawn at random from the same lot as given in Table 3.

8.2.2.2 Provided the number of the samples failing to comply with each of the requirements of clauses 4 and 5 does not exceed the acceptance number given in Table 3, that lot shall be deemed to comply with the requirements.

8.2.3 Sampling and acceptance for test on requirements

8.2.3.1 Samples shall be drawn at random from those which conformed to the requirements on sizes, components, materials and construction in accordance with Table 3, and divided into portions as follows:

a) 1/6 of the sample size shall be tested for penetration resistance, then subjected to the tests on strength of chinstrap and fastening device and flexibility of peak respectively;

b) 1/2 of the sample size shall be tested for shock absorption; and

c) 1/3 of the sample size shall be tested for rigidity (number of tests along the longitudinal and those along transverse axes being equal.)

8.2.3.2 Provided all the samples meet all requirements of Clause 6, that lot shall be deemed to comply with the requirements.

Table 3 — Sampling plan for tests on sizes, components, materials and construction and other requirements (8.2.1 and 8.2.2.1)

Lot size units	Tests on sizes, components, materials and construction		Test on other requirements
	Sample size units	Acceptance number	Sample size units
Up to 500	20	2	7
501 up to 1200	32	3	12
1201 up to 3200	50	5	18
3201 up to 10000	80	7	24

8.3 Criteria for conformity

Provided the samples meet all the requirements of 8.2.2.2 and 8.2.3.2, that lot of helmets shall be deemed to comply with the standard.

9 Testing

9.1 Conditioning for testing

9.1.1 Pre-conditioning

All helmets shall be pre-conditioned for at least six hours at a temperature of 25 °C ± 5 °C and a relative humidity of 65 % ± 5% before applying the following individual conditioning treatment and testing.

9.1.2 Low temperature conditioning

The helmet shall be placed in a refrigerator at a temperature of -10 °C ± 2 °C for not less than 4 h and not more than 24 h.

9.1.3 High temperature conditioning

The helmet shall be placed in an oven at a temperature of 50 °C ± 2 °C for not less than 4 h and not more than 24 h.

Refrigerator and oven shall be sufficiently large to ensure that the helmets do not touch one another or the sides. In any event the total volume shall be not less than 0.13 m^3. The oven shall be fitted with a fan to provide effective air circulation. The relative humidity of the air in the oven shall be controlled at approximately 65 % ± 5 % by means of a saturated solution of sodium dichromate or by other equivalent method.

9.1.4 Wet conditioning

After removal of any protective covering from the outside of the shell, the helmet shall be sprayed externally with water at 25 °C ± 5 °C at the rate of 1 dm^3 /min for not less than 4 h and not more than 24h.

9.2 Impact management test

9.2.1 Apparatus

9.2.1.1 The smallest of the headforms appropriate for the helmet sample, which shall be of rigid, low resonance metal such as magnesium alloy and shall conform to the 'A', 'E', 'J', 'M' or 'O' geometries

9.2.1.2 Ball-arm/collar assembly which is fitted to a socket machined into the base of the headform. The ball/socket configuration shall be such that the geometrical centre of the ball is located on the central vertical axis of the head form 12.7 mm above the reference plane. The ball-arm/collar assembly shall also include a unixial accelerometer fixed firmly into the ball.

9.2.1.3 Headform support assembly rigidly attached to the ball-arm. This support assembly shall be such that it and consequently the headform may be guided in a vertical drop. The weight of the support assembly shall not exceed 25% of the combined weights of the headform, ballarm, collar and accelerometer. The total mass of the headform/support assembly shall be 5.0 kg ±.1 kg.

9.2.1.4 Guidance system such that the headform/support assembly is guided in a vertical drop onto a test anvil. This guidance system may consist of two or more wires or one or more rails. The headform/support - guidance system - test anvil alignment shall be such that:

a) the drop trajectory shall be a straight line within 3° of vertical and within 5° of the sensitive axis of the uniaxial accelerometer.

b) the line parallel to the drop trajectory and passing through the centre of the headform ball-socket shall pass within 5 mm of the centre of the test anvil, within 10 mm of the centre of gravity of the headform/support assembly, and within 5 mm of the sensitive element of the uniaxial accelerometer.

9.2.1.5 Rigid anvil mount consisting of a solid mass of at least 135 kg. The upper surface of the anvil mount shall consist of a steel plate with a minimum thickness of 12 mm and a minimum surface area of 0.10 m^2.

9.2.1.6 Three test anvils: flat, hemispherical and edge

9.2.1.6.1 The flat anvil shall have a minimum surface area of 0.0127 m^2,for example 127 mm diameter face. When fixed in position on the anvil mount, the surface shall be perpendicular to the headform trajectory.

9.2.1.6.2 The hemispherical anvil shall have a 48 mm ± 0.5 mm radius.

9.2.1.6.3 The edge anvil shall have a striking face 6.3 mm wide by at least 180 mm long with a depth of at least 35 mm. When in position, the striking face shall be perpendicular to the headform trajectory.

9.2.1.7 Uniaxial accelerometer. The acceleration data channel shall comply with SAE recommended practice J 211 requirements for channel class 1000 with the exception that the frequency response need not include the range from dc to 10 hz which may not be obtainable using certain types of transducers.

9.2.1.8 Velocity measurement device which will yield the velocity of the headform/support assembly within the last 40 mm of travel before impact. The velocity measurements shall be accurate to within ±1%.

9.2.2 Test definitions

9.2.2.1 The impact site refers to the portion of the helmet struck during an impact test. It is defined as the point where a line passing through the centre of the headform ball and the centre of the anvil intersects the outer surface of the helmet at the instant the helmet first touches the anvil.

9.2.2.2 The impact energy is the kinetic energy of the headform/support assembly at the instant of impact. It is defined as the mass of the headform/support assembly times the square of the velocity measurement times one half. The mass of the helmet is ignored in this calculation.

9.2.2.3 There are two levels of test. The first is the standard level used to identify those helmets which definitely meet this standard and which are applied to samples submitted for certification testing and to those acquired for the random sample test (RST) program. The second is the deviation level which is applied to samples acquired for second round RST procedures, that is: testing of samples of currently certified models for which previous samples have obtained failing results in RST testing.

9.2.3 Test impacts

9.2.3.1 Test impact sites shall be on or above the test line. Rivets, vents and any other helmet feature within this region shall be valid test sites. Each impact site will be subjected to a group of one or two impacts according to the anvil selected for that site. The impact site for the first impact within a group is the target for the successive impacts in the same group. However, if an impact group is sited closer than 120 mm to any previous impact group, that later impact shall be declared invalid. There is no restriction regarding test anvil selection. The impact energies for each test impact are in 9.2.3.2 to 9.2. 3.4

9.2.3.2 There shall be two impacts at each site tested against the flat anvil. For the first impact, the impact energy shall be 150 J for all standard level testing and 140 J for all deviation level testing. For the second impact, the impact energy shall be 110 J for all standard level testing and 105 J for all deviation level testing. Given an ideal frictionless mechanical test facility, the standard impact energies represent 3.0+ meter drops of a 5 kg headform and supporting assembly.

9.2.3.3 There shall be two impacts at each site tested against the hemispherical anvil. For the first impact, the impact energy shall be 150 J for all standard level testing and 140 J for all deviation level testing. For the second impact, the impact energy shall be 110 J for all standard level testing and 105 J for all deviation level testing. Given an ideal frictionless mechanical test facility, the standard impact energies represent 3.0+ meter drops of a 5 kg headform and supporting assembly.

9.2.3.4 There shall be one impact at each site tested against the edge anvil. For each impact against the edge anvil, the impact energy shall be 150 J for all standard level testing and 140 J for all deviation level testing. Given an ideal frictionless mechanical test facility, this standard impact energy represents a 3.0 + metre drop of a 5 kg headform and supporting assembly.

9.2.3.5 If the impact energy for any test impact exceeds the energy specified by more than 3 %, that impact shall be declared invalid.

NOTE The impacts described above are based on specific energies and not prescribed drop heights. To attain the proper energy for an impact, it is likely that the drop height will need to be adjusted to compensate for frictions inherent in most mechanical helmet testing systems. Height adjustments for these frictions should not account for more than 10 % of the total drop height. Also, the 3 % margin allowed for impact energy reflects the uncertainties expected even for well maintained drop equipment. It is expected that drop heights will always be selected to produce, as closely as possible, the precise impact energy called out in the standards.

9.2.4 Impact test interpretation

The peak acceleration of the headform shall not exceed 290 G's for any valid certification impact nor 300 G's for any other valid test impact. The helmet's protective structures shall not break apart throughout the testing. If the UNBS technical personnel conclude that fracture of the helmet shell, impact liner, retention system or other components could reasonably imply an undue laceration hazard either from the impact surface or from the helmet itself, the sample shall be considered to have failed. A flip-up configuration tested with the chin bar closure locked at the outset of a valid impact and which releases inadvertently as a result of the impact will also be deemed to have failed. If, in certification testing, a sample is found to meet all the test criteria but any two of the impacts were at less than 97% of the impact energy specified, the testing for that sample shall be declared inconclusive and shall be repeated. Similarly, if there are two instances where an impact falls beyond 10 mm from the first impacts in its group, the testing for the sample shall be declared inconclusive and must be repeated.

Finally, if an invalid impact produces a peak acceleration exceeding the test criterion, the testing for the sample shall be declared inconclusive and must be repeated. The impact test procedures leave considerable latitude to the helmet tester regarding site and anvil selection. It is expected that the tester will orchestrate

each standard test series in order to investigate potential weaknesses and to exercise each likely failure mode and will conduct deviation level testing to exercise the failure modes identified previously.

9.3 Penetration test

9.3.1 Apparatus and principle

A conical spike shall be placed on the shell at the point to be tested. The weight shall fall on to the top of the spike, and the depth of penetration of the spike shall be measured by a suitable non-inertial device such as a photo-electric cell.

The penetration test striker shall have a mass of 3 kg ± 50 g. The striker shall fall through a height of 3 000 mm ± 15 mm. The point of the striker shall be a cone with an included angle of 60° ± 0,5° and an altitude of 38 mm ± 0,38 mm. The striking tip shall have a hardness of 60 Rockwell (scale C ± 3 points) and a radius of 0.5 mm ± 0.01 mm. The test striker may be directed at any site on or above the test line but the penetration test site shall be at least 75 mm removed from the centre of any impact test site or any other penetration test site. At the test technician's discretions, samples may be tested at more than one site on the shell.

For all penetration tests performed, the test striker shall not penetrate to achieve even momentary contact with the test headform.

Any helmet with ventilation ducts on the shell shall be exempt from penetration test.

9.3.2 Procedure

9.3.2.1 The helmet is conditioned in the manner that gave the worst result in the shock absorption test as in 9.2.3 and then tested in accordance with clause 9.3.2.2 within 1 min of the time of removal from the conditioning atmosphere, the helmet being placed firmly on the appropriate headform in accordance with Annex A as in actual use.

9.3.2.2 The spike is placed on the shell at the test point which should be above line AA (see Figure 11). The striker is allowed to fall on to the top of the spike through a distance of 1 metre measured from the top of the spike to the underside of the striker.

9.3.2.3 The minimum distance remaining between the point of the spike and the headform shall be measured.

9.4 Rigidity test

9.4.1 Apparatus

Two metal plates for loading

9.4.2 Procedure

9.4.2.1 Samples are subjected to pre-conditioning as in 9.1.1 with number of tests along the longitudinal and those along transverse axes being equal.

Each helmet is placed between two parallel plates.

9.4.2.2 Apply an initial load of 30 N to the shell. After 2 min the distance between the plates is measured.

9.4.2.3 Increase the load to 630 N by increments of 100 N every 2 min. Maintain the load of 630 N for 2 minutes, then measure the distance between the plates.

9.4.2.4 The load is then reduced to 30 N and maintained for 5 min and the distance between the plates is re-measured.

9.5 Test for strength of retention systems with chin straps

9.5.1 General

A downward shock load is applied twice to the chin straps on a helmet. Dynamic and static extensions and slippage of the strap are observed.

9.5.2 Apparatus

A suitable apparatus is shown in Figure 4.

A support is provided for base of the brim of the helmet under test and additional support is provided for a headform.

NOTE For this test the headform is used only for positioning purposes and is not required to withstand any substantial loading. It may, therefore be made of material other than metal or wood.

Below the approximate chin strap position a guide bar is mounted in guides which maintain it in position while permitting substantially frictionless vertical movement. The upper end of the bar carries two parallel horizontal rollers capable of free rotation, each 12.5 mm ± 0.5 mm in diameter and at 76.0 ± 0.5 mm centres separation. This arrangement is considered to approximate to the bone structure of a human lower jaw.

Means are provided for measuring both the maximum dynamic vertical extension and the static residual vertical extension of any chain strap looped under the roller. This may be achieved by attaching to the guide bar a displacement transducer and a pointer indicating against a fixed vertical scale.

Any anvil having a horizontal upper surface cushioned by a pad of foam 10 ± 2 mm thick is rigidly mounted on the guide bar.

NOTE Polyethylene foam with a bulk density of 40 kg/m^3 has been found suitable.

A drop weight of mass $10^{+0.25}_{-0}$ kg can be slid up the bar and dropped onto the anvil in substantially frictionless fall through a distance of at least 750 mm.

The total mass of the guide bar and all its attachments excluding the drop weight is $7.0^{+0}_{-0.25}$ kg.

9.5.3 Procedure for resistance to deformation

Place the helmet with its base resting on the helmet support and adjust the headform to steady the helmet in such a position that when the fastened chin strap is pulled vertically downwards it lies in the same vertical plane as the guide bar. With the drop weight in its raised position, the chin strap is fastened under the rollers so that the chin strap supports the weight of the guide bar and anvil, and the buckle is not in contact with the roller. It is recommended that the rollers should be approximately 130 mm below the headform reference line.

Read or set to zero the static extension measuring device and mark the position of the buckle on the chin strap. Allow the drop weight to fall on to the anvil through a height of 750 mm ± 5 mm, including the thickness of the foam pad. Read the peak dynamic extension and while the drop weight rests on the anvil re-read, or read and set to zero, the static extension measuring device.

NOTE Extension includes any slippage of the buckle.

Without disturbing the helmet or chin strap, raise the drop weight and repeat the impact. Read the peak dynamic extension and, while the drop weight rests on the anvil, note the static extension. Re-mark the position of the buckle on the chin strap.

Record the peak dynamic extension and static extension for each impact separately and the total slippage of the buckle.

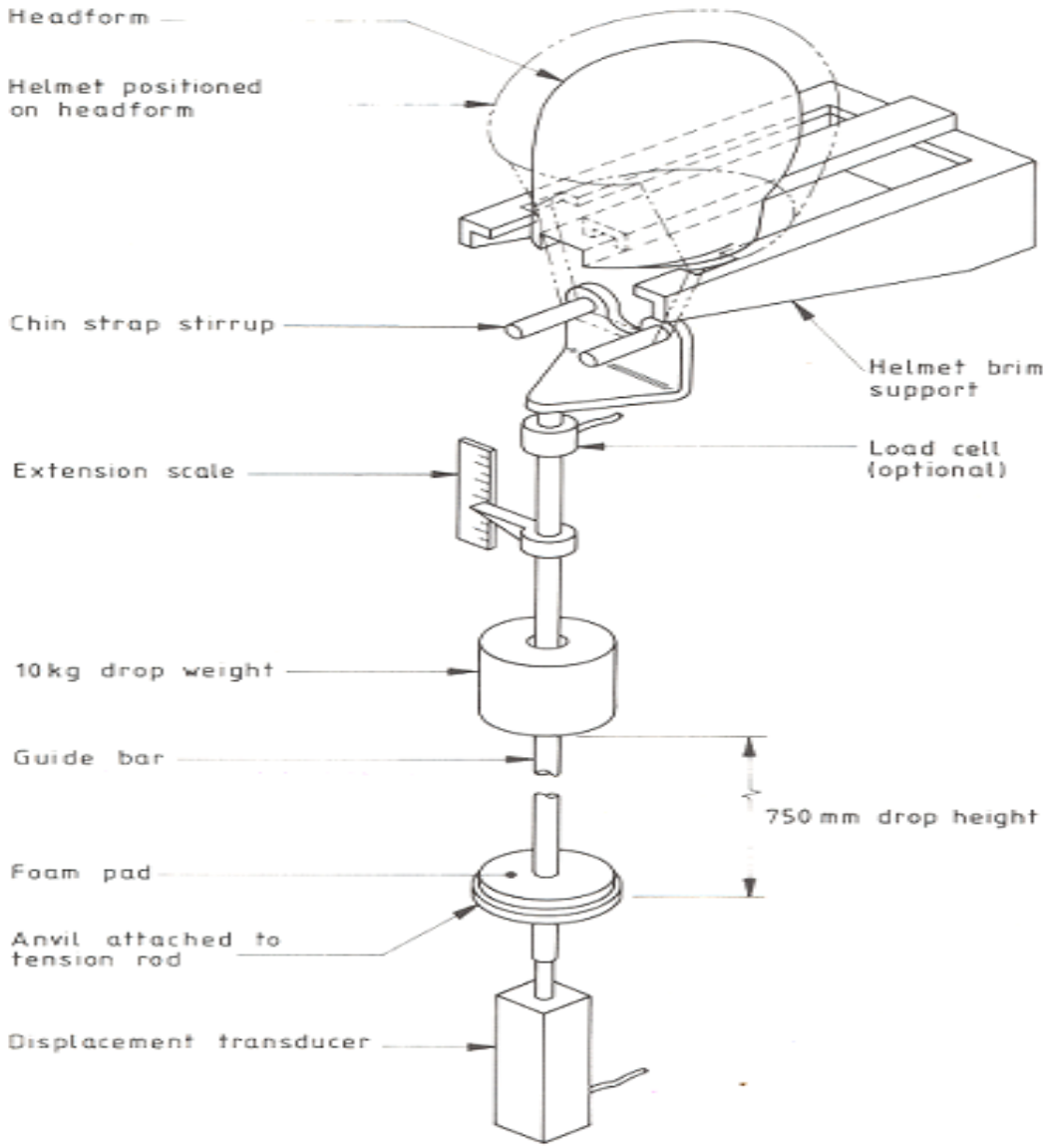

Figure 4 — Apparatus for testing retention system strength

9.6 Face shield penetration test

If a face shield is provided with a full face helmet, this face shield shall be tested for penetration resistance in the following manner:

The face shield shall be tested on the appropriate helmet, correctly deployed across the facial opening and under laboratory ambient conditions. A soft lead pellet weighing 1 g ± 0.1 g with a diameter of 5.5 mm ± 0.1 mm and travelling at a velocity of 500 km ± 20 km per hour shall strike the face shield normal to the surface. The face shield shall be tested in at least three different locations: the centre line and 80 ± 5 mm to either side of the centre line. The pellet shall not penetrate to the interior of the helmet.

9.7 Peripheral vision test

The clearance for peripheral vision will be checked by placing the helmet on each appropriate ISO headform, positioning it according to the opposite helmet positioning index and holding it in place with a force of 50 N. The clearance shall include the following solid angles to the front of the headform:

a) the upward visual clearance;

b) the lateral visual clearance; and

c) the downward visual clearance except for the breath deflector allowance.

The upward visual clearance is the solid angle bounded by the reference plane of the headform and a second plane tilted 7° up from the reference plane. This second plane intersects the reference plane at two points on the front surface of the headform that are 31 mm to the right and left of the longitudinal plane as shown in Figure 5.

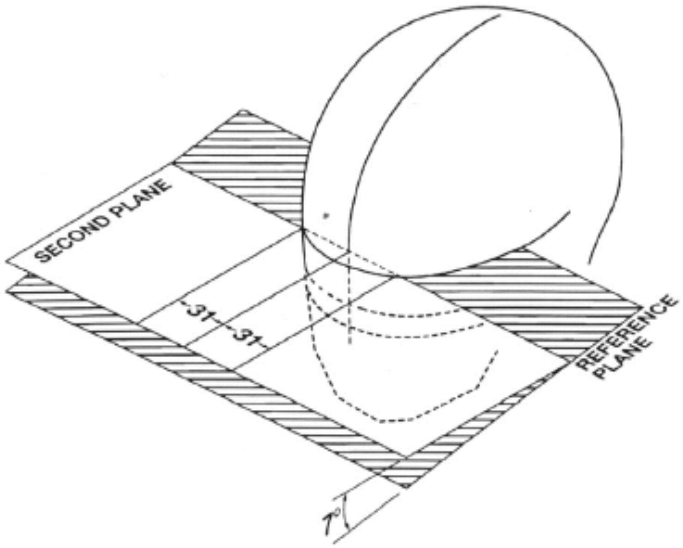

Figure 5 — Upward visual clearance

The lateral visual clearance, as shown in Figure 6, is the solid angle bounded by the reference plane, the S_4 plane and two more planes that are perpendicular to the reference plane and that contain the reference point on the front of the headform. One of these two planes forms an angle of 105° with the longitudinal plane and lies to the left of the headform.

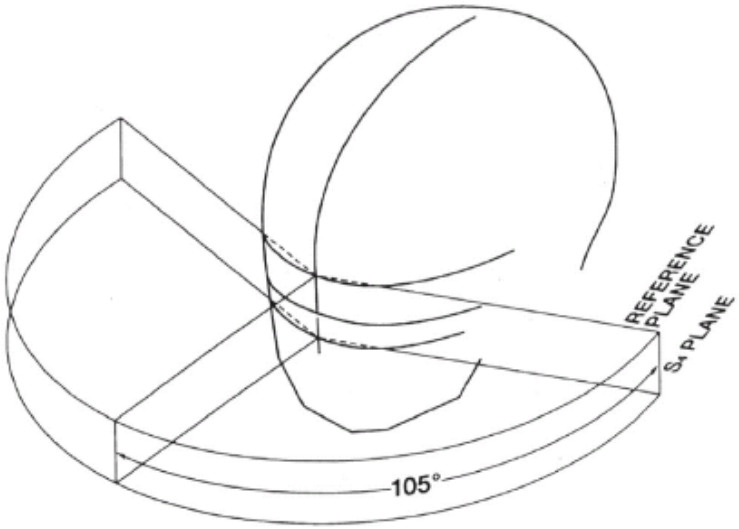

Figure 6 — Lateral vision clearance

The other forms the same angle to the right of the headform. The downward visual clearance is the solid angle bounded by the basic plane of the headform and a second plane tilted 30° down from the basic plane that intersects it at two points on the front surface of the headform that are 31 mm to the right and left of the longitudinal plane as shown in Figure 7. However, intrusions into this downward clearance are permitted so long as the intrusions are within the breath deflector allowance.

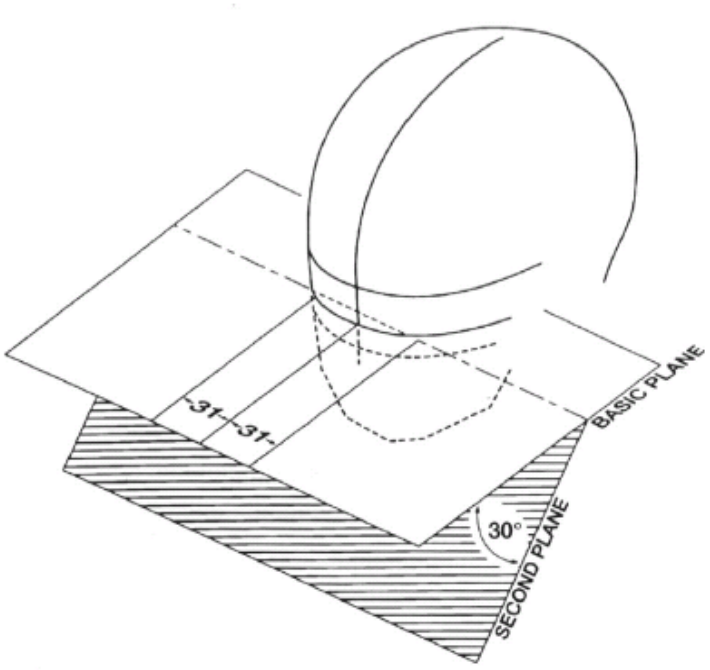

Figure 7 — Downward visual clearance

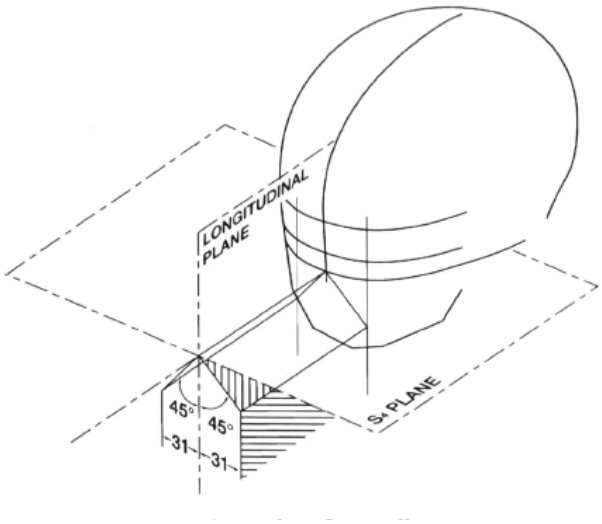

Figure 8 — Breath deflective allowance

The breath deflector allowance is shown in Figure 8. It includes the region that is within 31 mm to the right and left of the longitudinal plane and that lies below the two planes that form 45° angles with the longitudinal plane and that intersect it at the level of the S_4 plane.

9.8 Test of flexibility of peak

The sample which passed the test for the fastening device and chinstrap strength shall be mounted on an appropriate headform (Annex A) with a mass of 12 kg applied to the top of the helmet to hold it firmly in place. A mass of 1 kg shall be then freely suspended for 2 minutes from a point within 12.5 mm of the centre of the front edge of the peak. The deflection of the peak shall be measured.

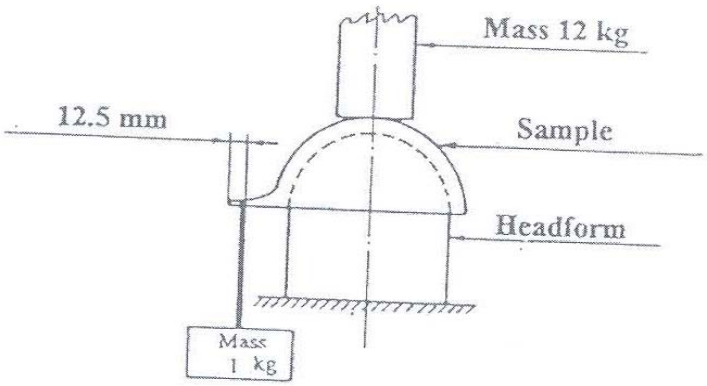

Figure 9 — Test for flexibility of peak

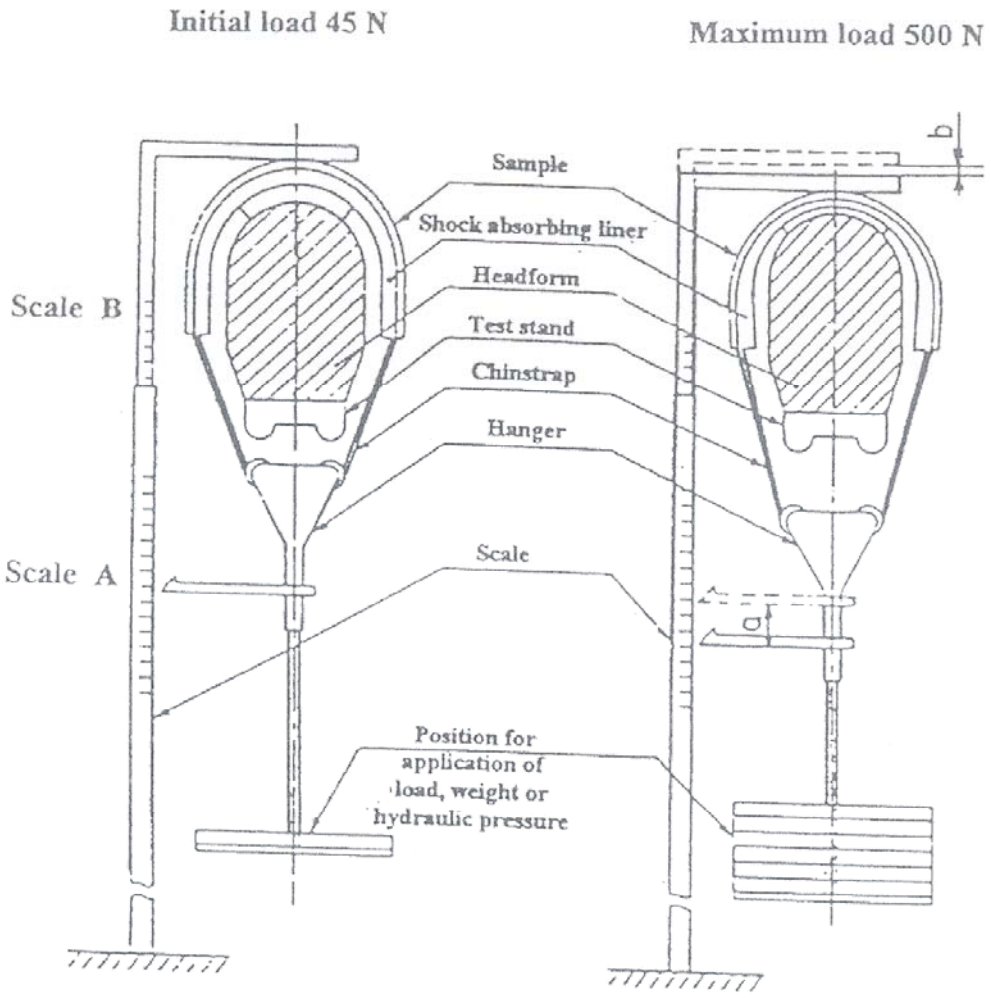

Figure 10 — Test for resistance to deformation

Annex A
(normative)

Headforms

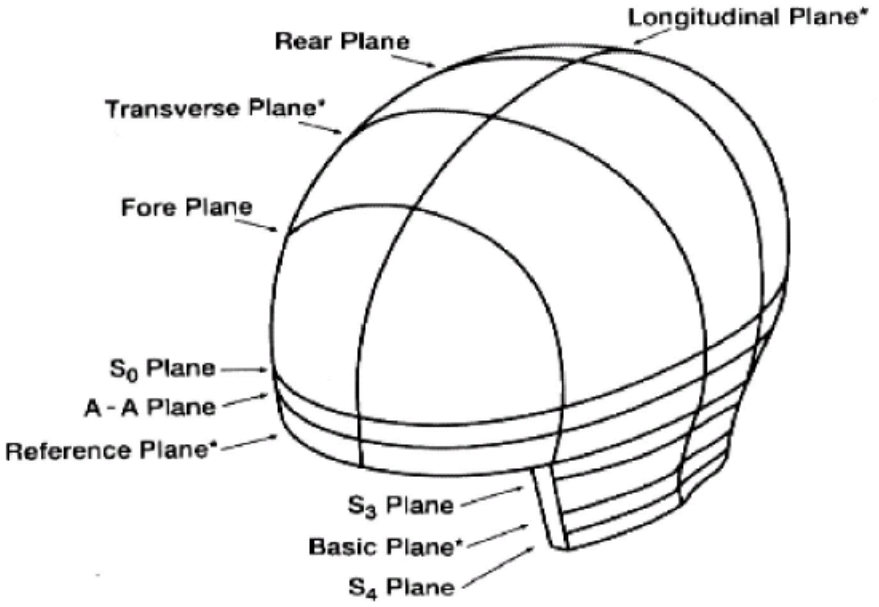

Figure 9 — Headform

The extent of protection corresponds to that region of the head for which protection is sought. This region is defined according to the geometry of five reference headforms: ‘A’, ‘E’, ‘J’, ‘M’ and ‘O’.

There are a number of planes fixed in the geometry of these headforms as shown in Figure 11. This description of the extent of protection uses the definitions of the basic plane, the longitudinal plane, the transverse plane and the reference plane. The longitudinal plane is perpendicular to the basic plane and is the plane of symmetry dividing the right half of the headform from the left. The transverse or coronal plane is perpendicular to both the longitudinal and basic planes. It corresponds to the anatomical plane that contains the two auditory measures and divides the front from the rear portions of the head. The reference plane is parallel to the basic plane and lies above it at a distance determined by the size of the headform: 24 mm, 26 mm, 27.5 mm, 29 mm and 30 mm for the ‘A’ through ‘O’ headforms respectively.

These four planes are all well known entities. The remaining planes, however, have been defined purely for the purposes of this standard. The S_0 plane is parallel to the basic plane and lies above it at a distance determined by the size of the headform, 46,8 mm, 50,0 mm, 53,0 mm, 55,2 mm and 57,2 mm for the ‘A’ through ‘O’ headforms respectively.

The S_3 plane is parallel to the S0 plane and the basic plane and lies between them at a distance of 26.1 mm, 28.2 mm, 30 mm, 31.5 mm and 32.2 mm below the S_0 plane for the ‘A’ through ‘O’ headforms respectively. The S_4 plane is also parallel to the S_0 plane and lies below it at a distance of 52,2 mm, 56,4 mm, 60,0 mm, 63,0 mm and 64,5 mm for the ‘A’ through ‘O’ headforms respectively. The rear plane divides the rear third of the head from the front two thirds. It is parallel to the transverse plane and lies at a given distance behind the point where the reference plane and longitudinal planes intersect with the front surface of the headform. The

distance from this point, hereafter called the reference point, is determined by the size of the headform: 128.6 mm, 139.0 mm, 148.4 mm, 155.8 mm and 161.5 mm for the 'A' through 'O' headforms respectively.

The fore plane is also parallel to the transverse plane. It lies behind the reference point at a distance determined by the size of the headform, 39.0 mm, 42.2 mm, 45.2 mm, 47.4 mm and 49.2 mm for the 'A' through 'O' headforms respectively. The extent of protection provided by the helmet shall include the entire region above the S_0 plane and forward of the fore plane, the entire region above the S_3 plane and between the fore and rear planes and the entire region above the S_4 plane and behind the rear plane (see Figure 12 and Table 4).

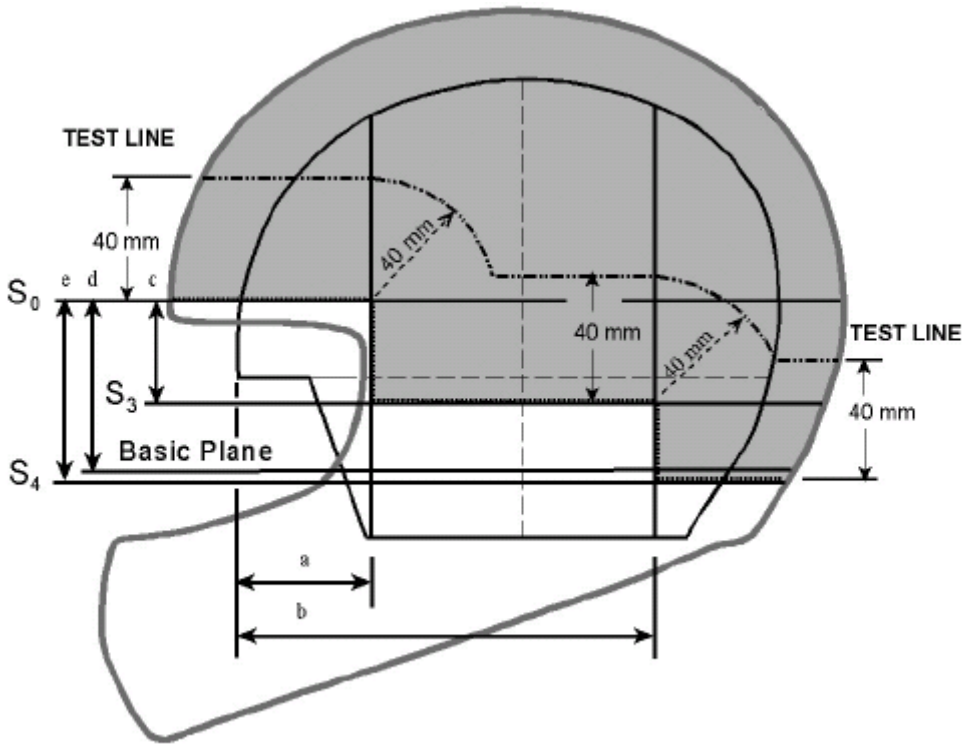

Figure 12 — Extent of protection

Table 4 — Extent of protection

Dimensions in millimetres

Head form	a	b	c	d	e
A	39,0	128,6	26,1	46,8	52,2
E	42,2	139,0	28,2	50,0	56,4
J	45,2	148,4	30,0	53,0	60,0
M	47,4	155,8	31,5	55,2	63,0
O	49,2	161,5	32,2	57,2	64,5

Annex B
(normative)

Reference headforms (shape, dimensions above reference plane)

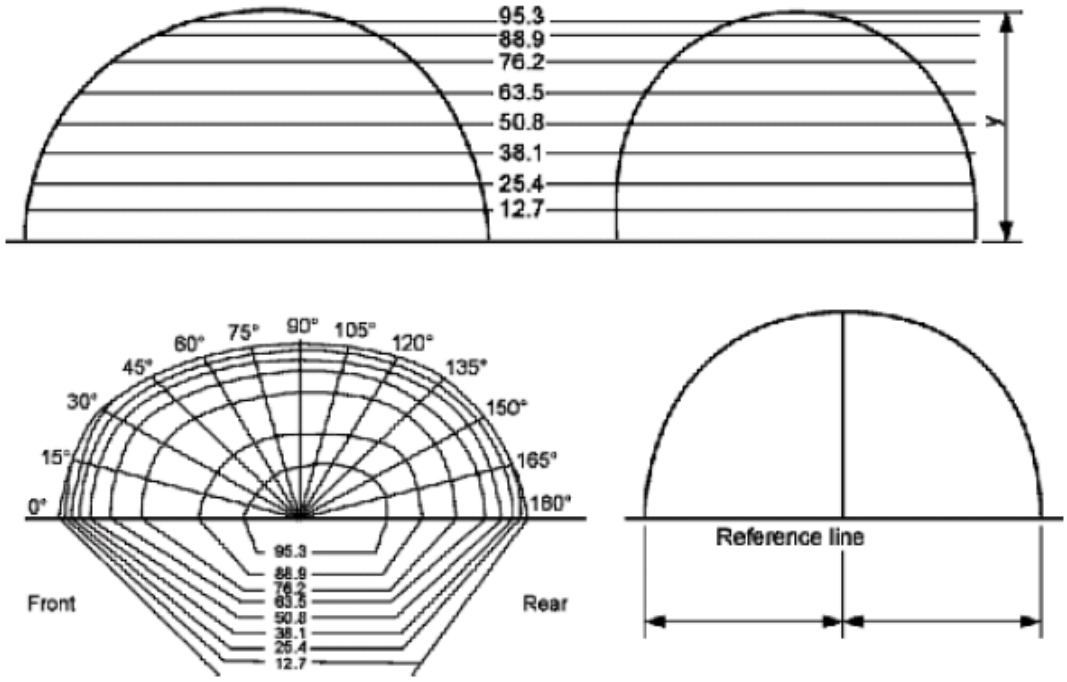

Figure 13 — Headform

Dimensions of upper part of headforms (to be used in conjunction with Figure 12 and Table 4)

Table B.1 — Headform A

Dimensions in millimetres

Height above reference line	Front 0º	15º	30º	45º	60º	75º	90º	105º	120º	135º	150º	165º	Rear 180º
0	88.1	86.4	83.1	75.4	69.9	66.8	66.5	69.3	73.4	78.8	84.1	87.6	88.1
12.7	86.9	85.3	83.1	75.4	69.9	66.8	66.5	69.3	73.4	78.8	84.1	86.1	86.1
25.4	84.6	83.6	82.3	75.4	69.9	66.8	66.5	69.3	73.4	78.8	84.1	86.1	86.1
38.1	80.8	80.3	79.5	72.9	67.6	65.3	65.0	67.6	71.6	76.5	81.3	82.8	82.8
50.8	74.7	74.4	74.0	68.1	63.2	61.0	60.7	63.2	66.8	71.6	73.7	76.7	76.7
63.5	64.8	64.8	64.8	59.9	55.6	53.3	53.1	55.4	59.2	63.5	67.7	67.7	67.7
76.2	45.7	45.7	45.5	43.4	41.4	40.4	40.4	42.4	46.2	50.5	54.6	54.6	54.6
82.6	31.0	31.2	31.2	31.0	30.0	29.7	30.2	32.5	36.1	40.4	43.9	44.5	44.5
Dimension Y: 89.7 mm – Head circumference: 500 mm													

Table B.2 — Headform C

Dimensions in millimetres

Height above reference line	Front 0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	Rear 180°
0	91.2	89.7	86.1	78.7	72.6	69.9	69.6	72.4	76.7	82.0	87.4	90.4	91.2
12.7	89.9	88.6	86.1	78.7	72.6	69.9	69.6	72.4	76.7	82.0	87.4	90.4	91.2
25.4	87.6	87.1	85.3	78.7	72.6	69.9	69.6	72.4	76.7	82.0	87.4	89.2	89.9
38.1	84.6	83.8	82.3	76.5	70.6	68.1	68.1	70.6	74.7	79.8	84.3	85..6	86.4
50.8	78.5	78.2	77.5	72.4	66.5	64.3	64.3	66.5	70.4	75.4	79.5	80.3	80.8
63.5	69.3	69.1	69.1	64.5	59.4	57.2	57.4	59.7	63.5	68.3	71.9	71.9	71.9
76.2	52.3	52.3	52.3	49.3	46.2	45.2	45.7	48.0	51.6	56.1	59.4	59.7	59.9
82.6	39.9	39.9	39.9	38.1	37.1	36.6	36.8	38.6	41.9	46.2	50.5	51.1	51.3
88.9	20..6	20.6	20.6	21.3	22.1	22.9	23.9	25.4	28.2	31.8	34.3	34.5	34.5
Dimension Y: 92.7 mm – Head circumference: 540 mm													

Table B.3 —- ISO Headform E

Dimensions in millimetres

Height above reference line	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Rear
0	94.5	93.0	89.7	82.0	76.2	73.2	72.9	75.7	79.8	84.8	90.7	93.7	94.5
12.7	93.2	91.9	89.7	82.0	76.2	73.2	72.9	75.7	79.8	84.8	90.7	93.7	94.5
25.4	91.2	90.7	88.9	82.0	76.2	73.2	72.9	75.7	79.8	84.8	90.7	92.7	93.0
38.1	87.6	87.9	85.9	80.0	74.7	71.6	71.4	74.2	77.7	82.6	88.6	89.2	89.2
50.8	82.0	82.3	81.0	75.4	70.4	67.8	67.6	70.4	73.9	79.0	83.8	84.3	84.3
63.5	73.4	73.7	73.4	68.6	64.0	61.5	61.2	63.5	67.1	71.9	76.5	76.5	76.5
76.2	57.7	57.9	58.2	55.9	52.6	50.5	50.3	52.1	55.1	59.7	64.5	64.8	64.8
82.6	46.5	46.5	46.5	45.2	43.2	42.4	42.9	44.5	47.5	52.3	56.4	56.6	56.6
88.9	30.5	30.5	30.7	31.0	31.2	31.2	31.8	33.8	36.8	40.4	43.9	44.2	44.2
Dimension: Y: 96 mm – Head Circumference: 540 mm													

Table B.4 — Headform G

Dimensions in millimetres

Height above reference line	Front												Rear
	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°
0	97.5	95.8	93.0	85.1	79.5	76.2	75.9	78.5	83.1	88.4	94.0	97.0	97.5
12.7	96.3	95.3	92.7	85.1	79.5	76.2	75.9	78.5	83.1	88.4	94.0	97.0	97.5
25.4	93.7	92.7	91.4	85.1	79.5	76.2	75.9	78.5	83.1	88.4	94.0	95.8	96.3
38.1	90.4	89.7	88.9	83.3	77.7	75.2	74.9	77.0	81.3	86.6	91.7	92.7	93.0
50.8	86.1	85.6	84.6	79.0	73.7	71.1	70.9	73.2	78.0	82.8	87.1	87.9	88.1
63.5	77.5	77.2	76.5	72.1	67.3	64.5	64.3	66.5	70.9	75.9	79.0	79.8	80.0
76.2	63.8	63.8	64.0	61.2	57.4	53.3	54.9	56.9	61.5	66.5	68.8	69.1	69.1
88.9	39.6	39.6	39.6	39.1	38.4	37.8	38.4	40.4	44.2	49.8	52.8	53.8	53.8
95.3	20.6	20.6	20.6	21.3	22.4	23.4	23.9	25.4	28.7	33.5	37.8	39.1	39.1
Dimension: Y: 96 mm – Head Circumference: 560 mm													

Table B.5 —ISO Headform J

Dimensions in millimetres

Height above reference line	0° Front	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Rear
0	100.8	98.8	96.5	88.1	82.0	79.5	79.2	82.0	85.9	91.7	96.8	100.1	100.8
12.7	99.6	98.0	95.8	88.1	82.0	79.5	79.2	82.0	85.9	91.7	96.8	100.1	100.8
25.4	96.8	95.8	94.5	88.1	82.0	79.5	79.2	82.0	85.9	91.7	96.8	98.3	98.8
38.1	93.7	92.7	91.9	86.1	80.0	77.2	77.7	80.0	83.8	89.4	94.5	95.8	96.0
50.8	89.2	88.6	87.9	82.0	76.2	73.9	74.4	77.0	80.5	85.9	90.4	90.9	90.9
63.5	81.5	80.8	81.0	75.9	70.6	68.1	68.3	71.1	74.4	79.5	83..8	84.1	84.1
76.2	69.3	69.1	69.3	65.3	61.2	58.9	59.2	61.7	65.0	69.3	73.2	73.4	73.4
88.9	47.2	47.5	48.0	46.2	44.5	43.7	44.2	46.2	50.0	54.1	58.2	58.4	58.4
95.3	32.8	32.8	33.3	32.5	32.0	32.3	33.0	35.1	38.1	42.2	46.5	47.3	47.2
Dimension: Y: 102.4 mm – Head Circumference: 570 mm													

Table B.6 — Headform K

Dimensions in millimetres

Height above reference line	Front												Rear
	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°
0	102.4	101.1	97.0	89.7	84.1	81.3	80.8	83.3	87.9	92.7	98.3	101.6	102.4
12.7	101.1	100.1	97.0	89.7	84.1	81.3	80.8	83.3	87.9	92. 7	98.3	101.6	102.4
25.4	98.8	98.3	96.3	89.7	84.1	81.3	80.8	83.3	87.9	92.7	98.3	99.8	100.6
38.1	95.5	95.3	93.7	87.4	82.0	79.5	79.5	81.5	85.9	90.4	95.5	97.0	97.7
50.8	90.9	90.4	89.7	83.6	78.5	76.2	76.2	78.5	83.1	87.4	91.9	92.5	93.2
63.5	83.1	82.8	82.0	77.2	72.1	69.9	70.4	72.4	76.7	80.8	84.6	85.1	85.6
76.2	71.1	71.1	71.4	68.1	63.8	61.2	61.2	63.0	67.1	71.6	74.9	75.2	75.2
88.9	51.8	51.0	51.8	50.8	48.5	46.7	47.2	49.3	52.1	56.9	60.7	60.7	60.7
95.3	37.6	37.3	37.3	37.3	36.8	36.6	37.1	38.9	42.2	47.0	51.1	51.8	51.3
101.6	18.3	17.8	17.8	18.0	18.5	19.3	20.1	21.8	24.9	29.0	33.8	36.1	36.6
Dimension: Y: 102.4 mm – Head Circumference: 580 mm													

Table B.7 — ISO Headform M

Dimensions in millimetres

Height above reference line	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Rear
0	105.7	103.9	100.6	92.7	86.9	84.1	83.8	86.4	90.7	96.0	102.1	105.7	105.7
12.7	104.4	103.4	100.3	92.7	86.9	84.1	83.8	86.4	90.7	96.0	102.1	105.7	105.7
25.4	102.1	101.6	99.8	92.7	86.9	84.1	83.8	86.4	90.7	96.0	102.1	104.4	104.4
38.1	99.3	98.8	97.8	90.9	85.3	82.6	82.3	84.6	88.9	94.0	99.8	100.8	101.1
50.8	95.0	94.7	93.5	86.9	81.3	79.0	78.7	81.0	85.3	90.4	96.0	96.5	96.3
63.5	87.1	86.9	86.9	80.8	75.4	73.2	73.2	75.4	79.5	84.8	89.4	89.7	89.4
76.2	75.9	76.2	76.2	71.6	67.1	64.8	64.8	66.5	70.6	75.4	80.0	80.0	79.8
88.9	58.2	58.2	58.2	56.6	54.6	52.3	52.3	53.8	56.9	61.7	66.8	67.1	66.8
95.3	45.5	45.7	46.0	46.0	44.5	43.4	43.2	44.5	47.2	52.1	57.7	58.2	57.9
101.6	26.4	26.2	26.7	27.7	28.7	29.5	30.0	31.2	34.0	38.6	42.7	43.2	42.7
Dimension: Y: 107.2 mm – Head Circumference: 600 mm													

Table B.8 —ISO Headform O

Dimensions in millimetres

Height above reference line	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180° Rear
0	108.7	107.4	103.4	95.8	90.4	87.6	87.1	90.2	94.2	99.8	105.4	107.4	108.7
12.7	107.7	106.4	103.4	95.8	90.4	87.6	87.1	90.2	94.2	99.8	105.4	107.4	108.7
25.4	105.2	104.4	102.9	95.8	90.4	87.6	87.1	90.2	94.2	99.8	105.4	106.7	106.9
38.1	102.4	102.1	101.1	94.2	88.9	86.1	85.9	88.9	93.0	98.6	103.4	104.1	104.1
50.8	97.8	97.5	96.5	90.2	58.1	82.3	82.6	85.3	89.9	94.7	99.6	100.3	100.3
63.5	91.2	91.2	90.4	84..3	97.2	76.7	77.0	79.8	83.8	88.4	93.0	93.2	93.2
76.2	81.0	81.3	80.8	76.2	71.6	69.3	69.6	71.9	75.7	80.5	84.6	84.6	84.6
88.9	64.5	64.5	64.5	61.5	58.4	57.2	57.7	60.2	63.5	68.1	71.9	71.4	71.9
95.3	54.1	53.8	54.1	52.6	50.3	49.0	49.5	51.6	55.4	60.5	64.3	64.0	64..0
101.6	37.6	37.6	38.1	38.4	38.1	37.8	38.4	40.4	43.4	48.0	51.3	51.3	51.1
Dimension: Y: 110.2 mm – Head Circumference: 620 mm													

Annex C
(normative)

Helmet size testing with respect to headforms

The table below shows the heads considered appropriate to head size ranges (in centimetres). If a helmet's specified size range falls into one of the light gray cells along the table's principal diagonal, only a single head form is deemed appropriate and only five samples fitted to the largest intended size are necessary, or else the manufacturer or marketer must provide two additional samples fitted to the smallest intended head size.

Table 13 — Test Head forms

Test Head Forms as Determined by size (Head Circumference in mm)							
		Largest Size Specified					
Smallest Size Specified		500 -	520 - 530	540 - 560	570 - 590	600 - 610	≥ 620
	<520	A	A - C	A - E	A - J	A - M	A - O
	520 - 530		C	C- E	C - J	C - M	C - O
	540 - 560			E	E - J	E - M	E - O
	570 - 590				J	J - M	J - O
	600 - 610					M	M - O
	≥ 620						O

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