

Australian/New Zealand Standard™

Methods of testing protective helmets

Part 1: Definitions and headforms



AS/NZS 2512.1:2009

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Helmet Testing Interests, New Zealand
IEA National Panel—Biomechanics of Injury
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Methods of testing protective helmets

Part 1: Definitions and headforms

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CS-097, Testing of Helmets and Visors, to supersede AS/NZS 2512.1:1998, *Methods of testing protective helmets, Method 1: Definitions and headforms*.

The objective of this (Standard) is to specify materials and sizing of headforms and provide definitions to be used with other parts of the AS/NZS 2512 series.

The objective of the revision process was to review the headform sizes available. As a result a note has been added to Clause 5 on tolerancing. The headform size tables have not been changed.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Methods of testing protective helmets

Part 1: Definitions and headforms

1 SCOPE

This Standard sets out general information relating to the methods of testing protective helmets and defines commonly used terms. It also specifies materials and sizing of headforms for use in the testing of protective helmets. Details of headform dimensions below line *HH'* are included, to be used if a complete headform is required.

2 REFERENCED DOCUMENT

The document below is referred to in this Standard:

AS

1100 Technical drawing

1100.101 Part 101: General principles

3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

3.1 Approved

Approved by the appropriate regulatory authority.

3.2 Basic (basal) plane

A plane through the centre of the right and left ear openings and lower edge of the eye sockets (see Figure 1) and represented on a reference headform (see Figures 2 and 3) or test headform.

3.3 Bitracion coronal arc

The arc between the right tracion and left tracion as measured over the top of the head in a plane perpendicular to the mid-sagittal plane (see Figure 4).

3.4 Bitracion inion arc

The arc between the right tracion and left tracion as measured over the inion (see Figure 5).

3.5 Brim

Where fitted, a rim surrounding the shell that may form a gutter.

3.6 Chinstrap

An adjustment device, being a part of the retention system, fitting under the chin to secure the helmet to the head.

3.7 Comfort padding

A non-energy-absorbing material that may define the internal form of a helmet and may be used for helmet size adjustment.

3.8 Coronal plane

The plane, perpendicular to the basal and mid-sagittal planes, that passes through the centres of the external ear openings.

3.9 Crown

The portion of the helmet that covers the head above the reference plane.

3.10 Ear covers

An accessory of the helmet that, when fitted, provides cover for the ears. May be combined with neck cover.

3.11 Energy attenuating

Material contributing to the attenuation of kinetic energy during an impact.

3.12 Faceshield

A part of the helmet that provides limited protection for all or part of the face and may supplement primary eye protection.

3.13 Harness

The assembly by means of which the helmet is maintained in position on the head and which may provide a means of absorbing kinetic energy. It may consist of the following:

- (a) *Cradle* The fixed or adjustable assembly of the parts of the harness in contact with the head, excluding the headband and nape strap.
- (b) *Cushioning* Material to improve wearer comfort but which is not intended to perform the function of protective padding.
- (c) *Headband* Part of the harness that surrounds the head in the area of the base of the skull, including the sweatband.
- (d) *Nape strap* A strap that, when in use, is located completely below the basal plane and aids helmet retention; it may be an integral part of the headband.
- (e) *Sweatband* An accessory to cover at least the inner front surface of the headband to improve wearer comfort.

3.14 Helmet positioning index

The distance between the forward brim of the helmet at its intersection with the mid-sagittal plane and the basic plane of the reference or test headform, when the helmet is firmly and properly positioned on the reference headform as specified by the manufacturer. This index shall reflect the placement of the helmet and its orientation on the wearer's head as intended by the manufacturer.

NOTES:

- 1 Where the manufacturer has not provided the 'positioning index', this index should be determined by the test laboratory.
- 2 Research has found that head impact is to the front and sides of the head of the cyclist. It is intended that helmets protect these areas.

3.15 Horizontal centre plane

Any plane passing through the helmet that intersects with the helmet surface equidistant from the top of the helmet at all points.

3.16 Liner

The protective component(s) of a helmet, which may provide either the general inner or outer form of the helmet, or both.

3.17 Mid-sagittal plane

A longitudinal plane through the apex of a reference headform or test headform, perpendicular to the basic plane and geometrically bisecting the headform. (See Figure 6.)

3.18 Neck cover

An accessory of the helmet that, when fitted, provides cover for the neck. May be combined with ear covers.

3.19 Peak

A permanent or detachable extension of the helmet above the eyes. A peak may be an integral part of the shell, or a separate device that is fixed or detachable. (See Figure 7.)

3.20 Permanently attached

Not removable except by using a tool or causing damage to the helmet.

3.21 Projection

Any fixed part that extends abruptly beyond the internal or external surface of the helmet.

3.22 Protective helmet (helmet)

A device worn on the head, designed to mitigate the adverse effects of a blow to the head within a specified area. It includes retention and protective components, such as a shell, liner and harness.

3.23 Protective padding

Material that is intended to contribute to the ability of a helmet to attenuate the energy of a blow to the head.

3.24 Reference headform

A measuring device contoured to specific dimensions with surface markings indicating headform identification, the locations of the basic, mid-sagittal and reference planes, and the centres of the external ear openings.

3.25 Reference plane

A plane above and parallel to the basic plane on a reference or test headform. (See Figure 8.)

3.26 Retaining strap

A strap that passes under the wearer's lower jaw to retain the helmet in position. It may be attached either to the shell or the headband.

3.27 Retention system

The complete assembly by means of which the helmet is retained in position on the head during use. It may include a harness.

3.28 Shell

The component of a helmet that provides the general outer form of the helmet.

3.29 Test headform

A test device contoured to specific dimensions for all surface areas that contact the helmet, with surface markings indicating the locations of the basic, mid-sagittal and reference planes.

3.30 Test line

A line denoting the extent of protection of a helmet coinciding with the dimensions given in Table 1, as shown in Figures 2 and 3.

NOTES:

- 1 The test line is not necessarily the extent of coverage.
- 2 Helmets may have parts below the test line which, because of the shape of the helmet, may be contacted during testing, even though the test site is located above the test line. Such contact does not invalidate a test.

3.31 Ventilation gap

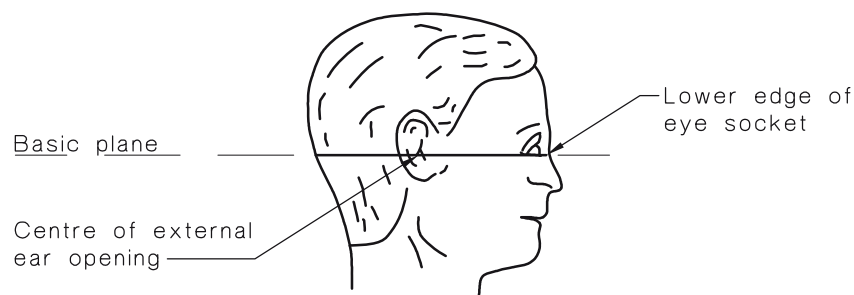
The open space between the headband and the shell.

3.32 Vertical clearance

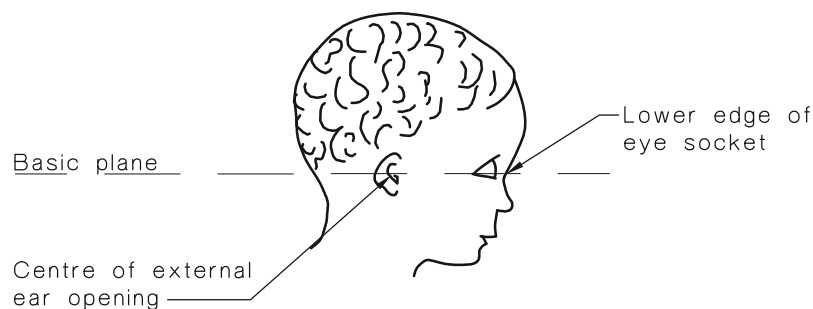
The minimum vertical distance between the top of the head or headform and the inside of the helmet shell.

3.33 Wearing height

The vertical distance from the lower edge of the headband to the highest point of the head or headform.



(a) A-Q headforms



(b) AA headforms

FIGURE 1 LOCATION OF BASIC PLANE

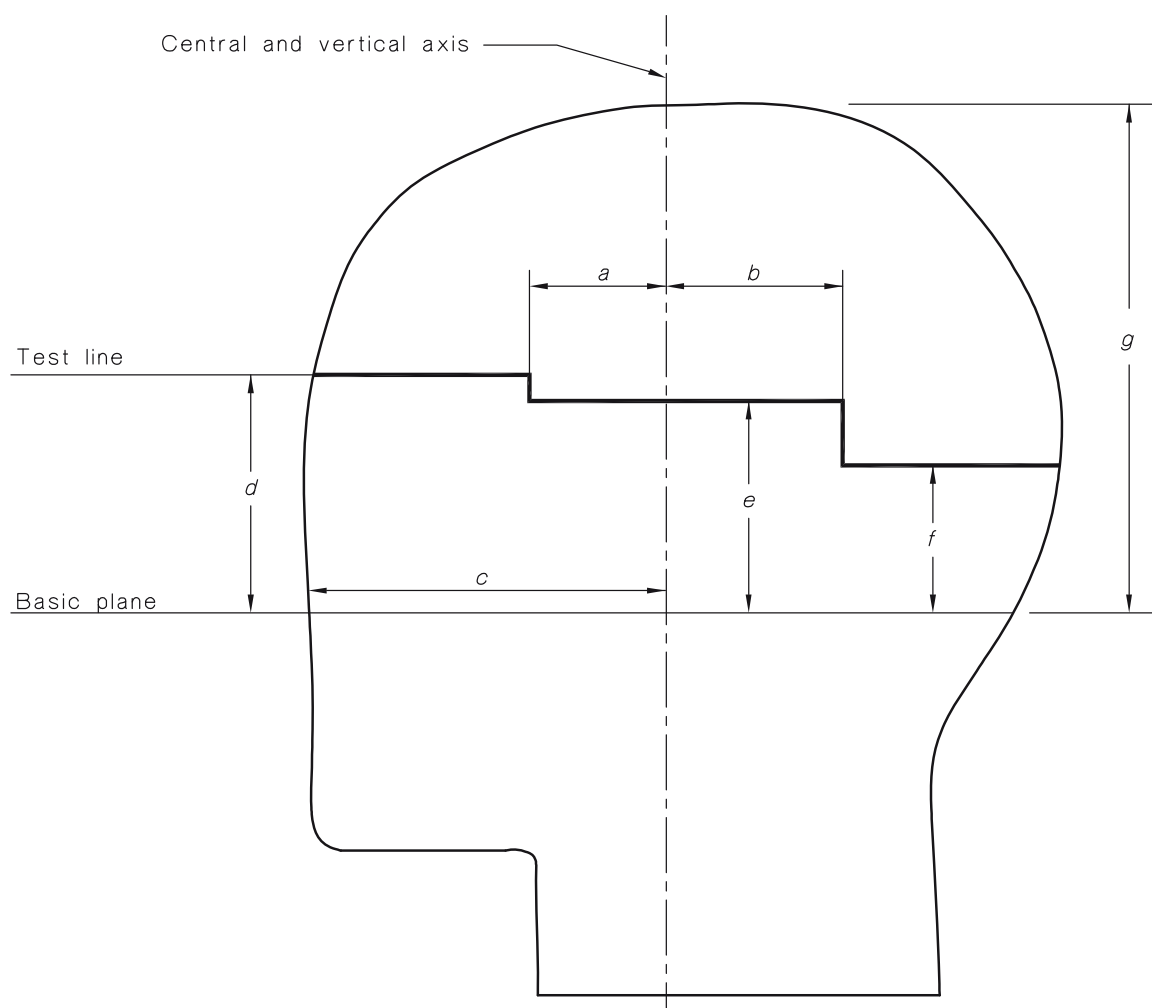


FIGURE 2 EXTENT OF PROTECTION AND TEST LINE FOR HELMETS
INTENDED FOR PERSONS OVER FOUR YEARS OF AGE

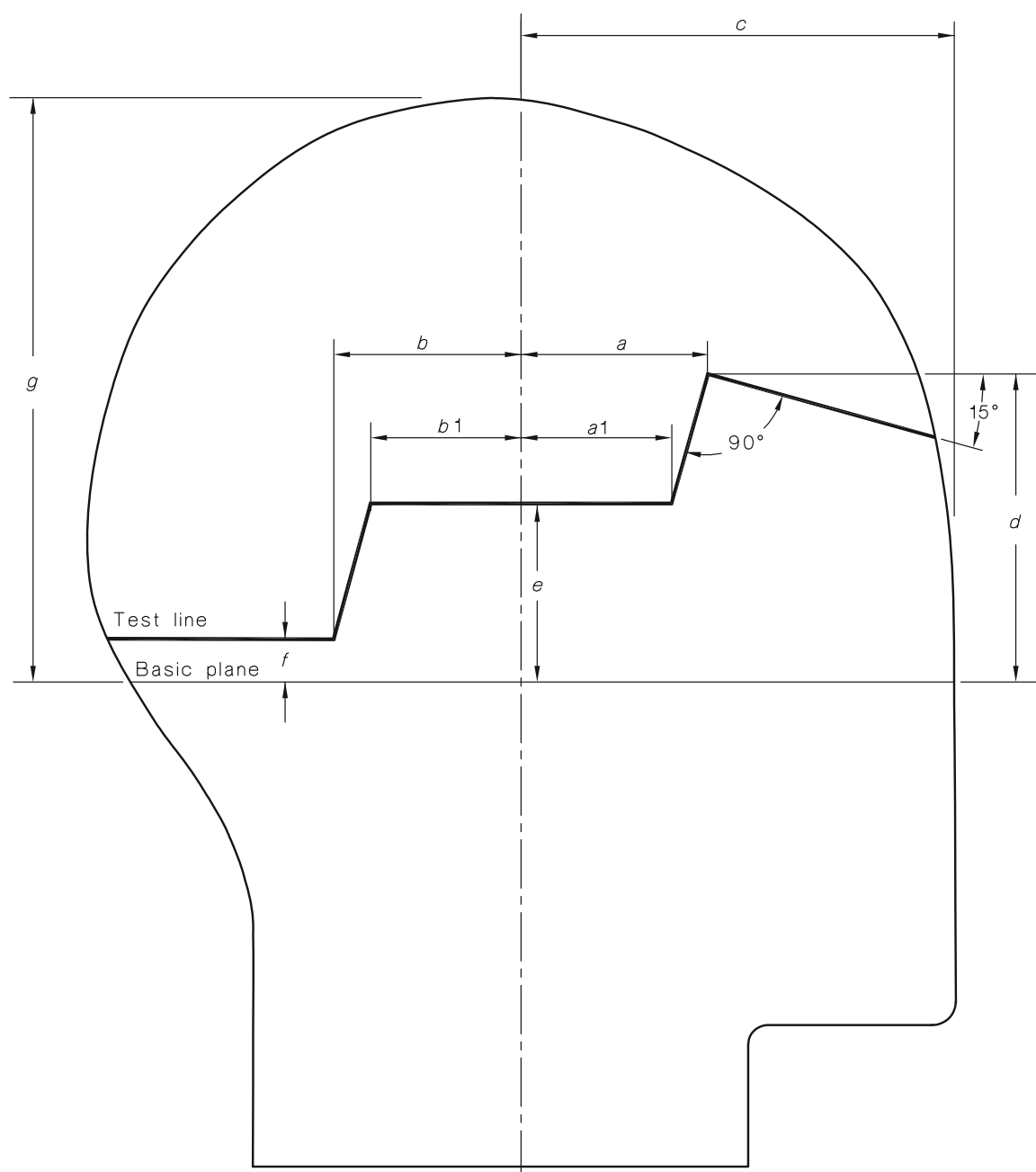


FIGURE 3 EXTENT OF PROTECTION AND TEST LINE FOR HELMETS
INTENDED FOR PERSONS FOUR YEARS OF AGE AND UNDER



FIGURE 4 BITRAGION-CORONAL ARC

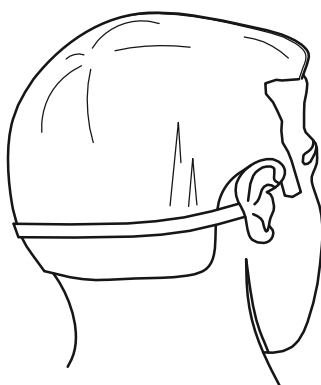
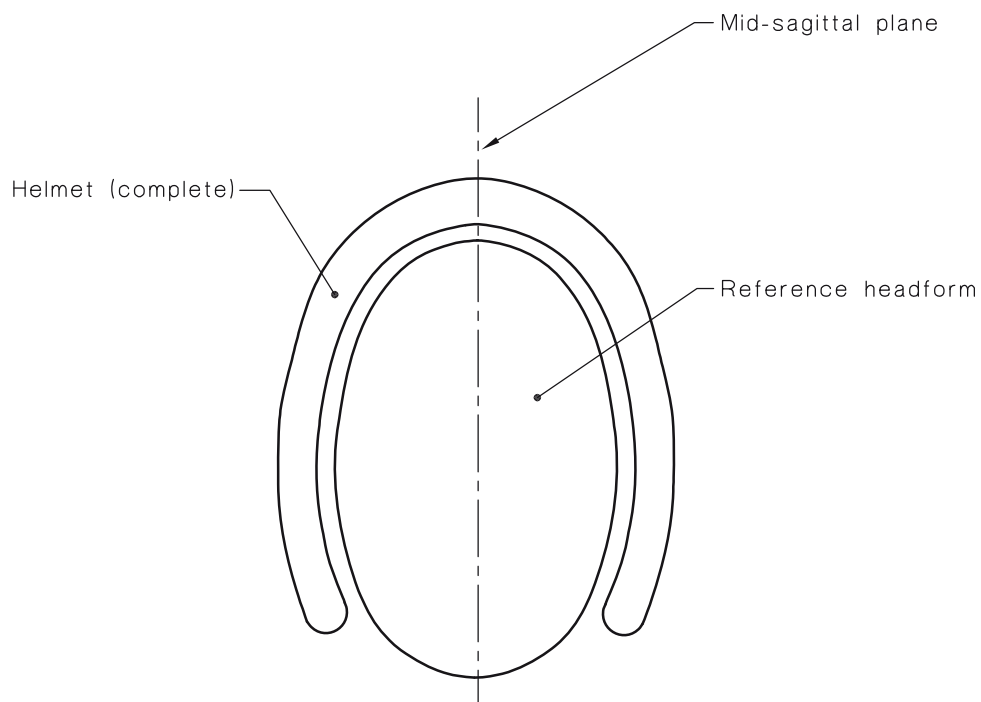


FIGURE 5 BITRAGION-INION ARC



SECTION ON BASIC PLANE

FIGURE 6 MID-SAGITTAL PLANE

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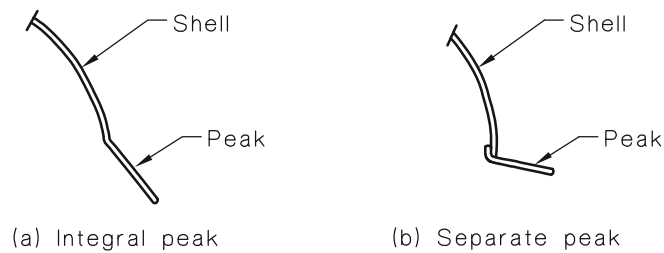


FIGURE 7 PEAKS

TABLE 1
TEST LINE DIMENSIONS FOR COMMONLY USED HEADFORMS

Headform size	Dimensions (see Figures 2 & 3)								
	<i>a</i>	<i>aI</i>	<i>b</i>	<i>bI</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
AA	34	28	36	30	86	54	31	8	112
A	23	—	65	—	88	59	34.5	26.5	113.5
E	29.5	—	65	—	94.5	64	39	33	122
J	36	—	65	—	101	66	41	36	130
M	41	—	65	—	106	67	41.5	37	136
O	43.5	—	65	—	108.5	68	42	38	140

NOTE: *c* and *g* are dimensions to determine the basic plane of the headform.

4 HEADFORMS

4.1 Materials

The test headforms shall be made of hardwood or metal or other suitable material. Where a test method requires a specific material to be used, it is stated in the appropriate Standard.

4.2 Sizing

4.2.1 A–Q headforms

The reference and test headforms shall conform to the following dimensions and contours:

- The size codes for the A–Q headforms, related to the inside circumference of helmets and other measurements, are listed in Table 2. The circumference values refer to the internal circumference of the helmet measured at the headband level (*AA'*) as illustrated in Figure 8.
- The data for the A–Q headforms are given in Figures 9 and 10. Each datum level is quoted relative to the reference plane.
- A–Q headforms shall extend down at least to line *HH'* (see Figure 8). If a complete headform is required it shall extend to cover the full distance below the reference plane. The dimensions in relation to the reference planes shall be as follows:
 - Above the reference plane* The headforms shall comply with the appropriate dimensions given in Tables 3(a) to 3(o). The polar coordinates of the horizontal half-sections at each datum level referred to in these Tables are illustrated in Figure 11(a).