SRI LANKA STANDARD 1069: 2021

UDC 614:891

SPECIFICATION FOR HEADFORMS FOR USE IN THE TESTING OF PROTECTIVE HELMETS (FIRST REVISION)

SRI LANKA STANDARDS INSTITUTION

SPECIFICATION FOR HEADFORMS FOR USE IN THE TESTING OF PROTECTIVE HELMETS

(First Revision)

SLS 1069: 2021

Gr. 14

SRI LANKA STANDARDS INSTITUTION
53, Dharmapala Mawatha,
Colombo 03,
Sri Lanka

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This Standard does not purport to include all the necessary provisions of a contract

SRI LANKA STANDARD
SPECIFICATION FOR HEADFORMS FOR USE IN THE TESTING OF PROTECTIVE HELMETS
(First REVISION)

FOREWORD

This standard was approved by the Sectoral Committee on Materials, Mechanical Systems and Manufacturing Engineering and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2021- 04 - 30.

This is formulated to complement the requirements given in SLS 517 Protective helmets for vehicle users (Second revision), in which the details of headforms are not covered. This is the 1st revision of SLS 1069 Specification for headforms for use in the testing of Protective helmets published in 1995. This revision differs from the previous standard in the following areas:

a) New materials are catered for headform in size wise in addition to wooden headform.

b) Whilst, in the past, the nominal sizes of head forms have been specified in multiples of millimeter (500,510,520 etc.), the actual circumferences are closer to five millimeters greater or less than nominal. In this revision therefore, the size designations have been specified according to the actual circumferences, in increments of ten millimeters (505,515,525 etc.).

c) In order to overcome the problems of tolerencing, it was decided to replace the existing dimensioning system with a spherical coordinate system. Namely, using point 'R' (geometric center) as the datum and then specifying the radius of points on the outer surface of the head form at various angles measured from point 'R'. Appropriate tolerances have been assigned to the radius and to the angles.

d) As a part of this process, linear regression lines through the existing data sets for head sizes A to Q were established and the spherical coordinates were specified from the equations of these regression lines. The coordinates of the new, smaller heads, sizes 445 to 485 were derived by simple scaling of the corresponding points of head size 495 in proportion to the respective circumferences.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed of calculated, expressing the result of a test or an analysis shall be rounded off in accordance with SLS 102. The number of significant places retained in the rounded off value shall be the same as that of the specified value in this standard.

The Sri Lanka Standards Institution gratefully acknowledges the use of the following publications of the International Organization for Standardization, British Standards Institutional and Japanese Standards Association in the preparation of this standard.

BS	6658 : 1985	Protective helmets for vehicle users
BS EN	960 : 2006	Headforms for use in the testing of protective Helmets
JIS T	8133 : 2015	Protective helmets for motor vehicle users

1 SCOPE

This standard specifies the materials, sizes and constructional details of headforms for use in the testing of protective helmets.

Details of heasfroms below the reference plane are included as optional requirements.

2 REFERENCES

SLS 102 Presentation of numerical values.

SLS 517 Protective helmets for vehicle users

3 DEFINITIONS

For the purpose of this standard, the definitions given in **SLS 517** shall apply.

3.1 Head form

three dimensional approximation of part, or all of human head, excluding facial features and pinnae. Three general forms are characterized as follows,

- Full Headform –extends from the crown downwards to below the chain and includes part of the neck,

-Three quarter headform – extends from the crown downwards at the sides and rear to below the level of the basic plane,

-half headform – extends from the crown downwards at the sides and rear to approximately the level of the basic plane,

3.2 Size designation

circumference of a given headform, expressed in mm, as shown in **Table 1.**

3.3 Circumference, C

for a given headform, the length of its periphery, measured at the level of the reference plane

3.4 AA1 plane

For a given headfrom, the horizontal transverse plane located at a vertical distance 12.7 mm above and parallel to the reference plane

NOTE: *This plane is deemed to correspond to the level of the lower edge of headband of a helmet. It is the basis upon which the size designation of a helmet may be specified.*

3.5 reference plane

For a given headfrom, when erect, the horizontal plane at a vertical distance ‘y’ measured down the central vertical axis from the center of the crown

NOTE: *All horizontal datum levels are quoted relative to this plane*.

3.6 central vertical axis

Vertical axis lying along the intersection of the vertical longitudinal plane and the vertical transverse plane.

3.7 crown

Area on the upper, outer surface of a haedfrom, centered on the central vertical axis

3.8 vertical longitudinal plane

For a given headform, the vertical plane of symmetry, perpendicular to the reference plane and located mid-way between the left hand and right hand extremities of the headform.

NOTE : *This corresponds to the mid-sagittal plane of the human head.*

3.9 vertical transverse plane

For a given headform, the vertical plane perpendicular to both the vertical longitudinal plane and the reference plane and located mid-way between the front and rear extremities of the headform.

NOTE : *This corresponds to the coronal plane of the human head.*

3.10 basic plane

For a given headform, horizontal plane located at a vertical distance 'x' below and parallel to the reference plane

NOTE : *This corresponds to the basic plane of the human head being the longitudinal plane which passes through the lower level of the eye orbits and the upper level of the external opening of the ear canals.*

3.11 centre of gravity of the three-quarter headform - point A

For a given headform, the point on the central vertical axis located at a vertical distance 12.7 mm above the reference plane

3.12 centre of the gravity of the full headform –point G

For a given headform, the point on the central vertical axis located at a vertical distance 'z' below the reference plane, as given in **Table 1**

3.13 geometric centre –point R

For a given headform, the point on the central vertical axis, located at its intersection with the reference plane

NOTE : *This point is the datum for all the dimensions given in* ***Annex A***

4 REQUIREMENTS

4 REQUIREMENTS

4.1 Material and other characteristics

4.1.1 Headforms for shock absorption and penetration tests, with falling headform/helmet assembly

The headforms shall be made of metal or suitable material and together with any measures for their support, shall exhibit no resonance below a frequency of 2000 Hz.

Full haedforms shall have the following characteristics

a) The center of gravity shall the located within a 10 mm radius of point G on the central vertical axis
b) A facility for attaching an accelerometer shall be incorporated such that, with the headform in any angular orientation, the respective sensitive axes of the accelerometer shall pass within 10 mm of point G
c) The appropriate mass if specified in **Table 1**

Three quarter haedforms shall have the following characteristics:

i) the center of gravity shall be located within a 10 mm radius of point A on the central vertical axis
ii) a facility for attaching an accelerometer shall be incorporated within the headform or its means of support that, with the headform in any regular orientation, the respective sensitive axes of the accelerometer shall pass within 10 mm of point A

NOTE 1 : *For this type of test ,full and three quarter headforms may be specified in the respective helmet standard*

NOTE 2 : *The geometry of the half headform does not facilitate its use for this type of test*

NOTE 3 : *Care should be taken to ensure that the total mass of the headform, when fitted with the accelerometer and its means of attachment, falls within any tolerances specified in either this standard or the respective helmet standard as appropriate*

4.1.2 Headforms for shock absorption and penetration tests, with rigidly mounted (not falling) headform/helmet assembly

The headforms shall be made of a rigid material which does not affect the measurements of shock absorption or penetration (e.g. wood). The headforms, together with their means of support, shall exhibit no resonance below a frequency of 2000 Hz.

NOTE : *For this type of test , full, three-quarter and half headforms may be specified in the respective helmet standard*

4.1.3 Headforms for geometric examination or positional marking of the helmet

The haedforms shall be made of any suitable material

4.1.4 Headforms for other tests

When a test requires the headform to be made from a specific material or to possess specific material characteristics (e.g. thermal or electrical conductivity, thermal capacity etc,), these materials and characteristics shall be specified in the relevant helmet standard.

4.2 Dimensions

The outer surface of each headform shall lie within the locus of the coordinates given in **Annex A.** Between coordinate points, the outer surface of the headform shall be curved and smooth

NOTE : *The exact geometry of the surface between the specified coordinates may be determined, for example , by a* 5^{th} *order spline function*

Table 1 – Dimensions for Figure 1 and headform masses

Size designation	h (mm)	x (mm)	y(mm)	z(mm)	Mass (g)
445	108.5	21.0	81.7	9.9	
455	110.6	21.5	83.3	10.1	1970±75
465	112.7	22.0	84.8	10.4	
475	114.8	22.5	86.4	10.6	
485	116.9	23.0	88.0	10.8	
495	119.0	23.5	89.7	11.1	3100±100
505	121.1	24.0	91.2	11.3	
515	123.2	24.5	92.7	11.5	
525	125.3	25.0	94.5	11.7	
535	127.4	25.5	96.0	11.9	4100±120
545	129.5	26.0	97.5	12.1	
555	131.6	26.5	99.1	12.3	
565	133.7	27.0	100.8	12.5	
575	135.8	27.5	102.4	12.7	4700±140
585	137.9	28.0	103.9	12.9	
595	140.0	28.5	105.4	13.1	
605	142.1	29.0	107.2	13.3	5600±160
615	144.2	29.5	108.7	13.5	
625	146.3	30.0	110.2	13.7	6100±180
635	148.4	30.5	111.8	13.9	
645	150.5	31.0	113.5	14.1	

4.3 Marking

4.3.1 Headforms for geometric examination or positional marking of the helmet shall be marked with,

a) Size designation of the headform

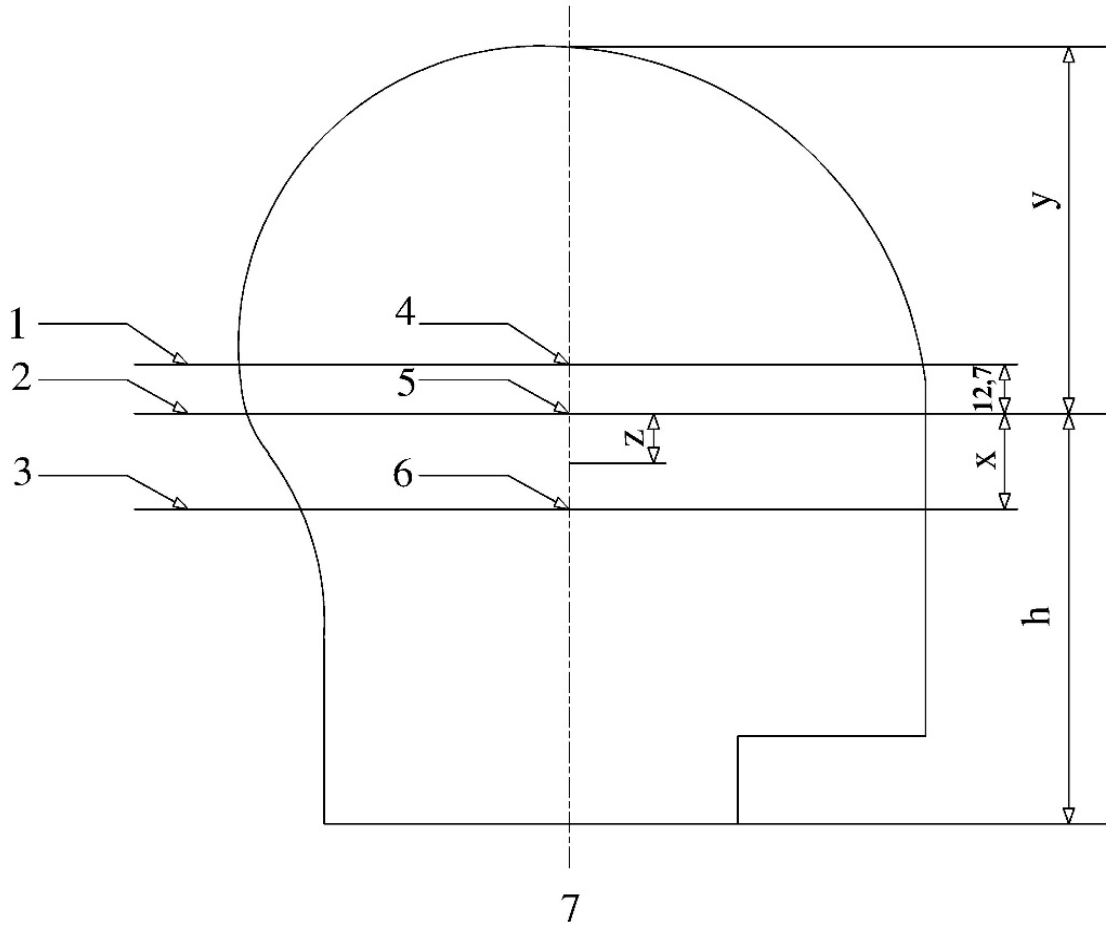
b) reference plane

c) basis plane

d) vertical longitudinal plane

e) vertical transverse plane

4.3.2 All other headforms shall be marked at least with the size designation of the headform



Section on vertical longitudinal plane

Key

1	AA' Plane
2	Reference plane
3	Basic plane
4	Point A
5	Point R
6	Point G
7	Central vertical axis.

FIGURE 1 – Principal planes and reference points of a headform

Annex A

(normative)

Spherical coordinates

The spherical coordinates are given in **Table A.1** to **A.21**.

Table A.1 – Spherical coordinates for full headform size 445

1-445		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3	80.3
	80	79.3	79.1	79.1	79.2	79.4	79.8	79.8	80.1	80.8	81.0	81.6	81.7	81.6
	70	78.9	78.8	78.8	78.8	78.6	78.6	78.7	79.5	80.7	81.9	82.8	83.1	83.0
	60	79.6	79.6	79.6	78.7	77.5	76.7	76.9	78.1	79.8	82.1	83.6	83.8	83.8
	50	80.8	80.7	80.8	78.4	75.7	74.2	74.2	75.9	78.2	81.3	83.7	83.8	83.7
	40	81.3	81.1	81.0	77.1	73.2	71.0	70.9	72.9	75.9	79.7	83.0	83.1	83.1
	30	80.7	80.5	79.8	74.7	69.9	67.4	67.1	69.4	73.1	77.4	81.4	82.0	82.2
	20	79.4	79.0	77.5	71.6	66.3	63.6	63.4	66.0	69.8	74.6	79.3	80.8	81.2
	10	78.5	77.5	75.3	68.8	63.5	60.6	60.5	63.2	66.7	71.7	76.9	79.6	80.1
Reference plane	0	79.0	77.4	74.4	67.6	62.4	59.7	59.5	62.0	65.7	70.5	75.3	78.4	79.0
Angle V Below	10	80.2	79.3	75.4	67.7	62.0	59.9	59.9	61.8	64.8	69.2	72.8	75.3	75.7
	20	84.0	85.1	77.3	69.2	62.8	59.8	57.5	59.6	62.2	66.1	69.6	71.8	72.3
	30	91.2	92.5	80.7	71.4	65.9	63.3	57.7	59.1	61.9	65.6	68.8	70.4	69.9
	40	103.1	104.5	88.6	77.8	70.9	65.1	61.7	62.3	64.5	67.3	69.5	70.4	69.6
	46	113.7	115.2	93.9	83.4	76.2	68.8	66.3	66.8	68.4	70.4	71.8	72.6	72.3
	50	110.1	111.2	97.4	87.0	81.2	73.6	70.8	71.5	72.5	74.3	75.2	76.1	76.3
	52	107.2	108.3	97.5	88.6	84.2	76.4	73.5	74.4	75.3	76.9	77.8	78.7	79.2
	55	103.3	104.3	96.2	89.0	84.2	80.2	78.6	79.7	80.5	82.0	82.8	84.0	84.7
	60	97.6	98.4	94.4	88.2	89.5	89.6	90.1	91.5	92.6	94.1	95.0	96.6	97.6
	65	101.7	103.5	100.6	101.9	105.5	105.6	106.8	108.4	109.7	111.6	112.7	114.4	115.3

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding $\pm 0.2^0$ Radii in mm, with a tolerance of ±0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.2 – Spherical coordinates for full headform size 455														
1-455		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	82.1	82.1	82.1	82.1	82.1	82.1	82.1	82.1	82.1	82.1	82.1	82.1	82.1
	80	81.1	80.9	80.9	81.0	81.2	81.6	81.6	81.9	82.6	82.8	83.4	83.5	83.5
	70	80.6	80.6	80.6	80.6	80.4	80.3	80.5	81.3	82.5	83.7	84.7	84.9	84.9
	60	81.4	81.4	81.4	80.5	79.2	78.4	78.6	79.9	81.6	83.9	85.5	85.7	85.6
	50	82.6	82.5	82.6	80.1	77.4	75.9	75.9	77.6	80.0	83.1	85.6	85.7	85.6
	40	83.1	83.0	82.8	78.9	74.8	72.6	72.5	74.5	77.6	81.5	84.8	85.0	85.0
	30	82.5	82.3	81.6	76.4	71.5	68.9	68.7	71.0	74.7	79.1	83.2	83.9	84.1
	20	81.2	80.7	79.3	73.3	67.8	65.1	64.9	67.5	71.4	76.2	81.0	82.6	83.0
	10	80.3	79.2	77.0	70.0	64.9	62.0	61.9	64.6	68.2	73.3	78.7	81.3	81.9
Reference plane	0	80.7	79.1	76.1	69.1	63.8	61.1	60.9	63.4	67.2	72.1	77.0	80.1	80.7
Angle V Below	10	82.0	81.1	77.1	69.2	63.4	61.2	61.3	63.2	66.2	70.7	74.4	77.0	77.4
	20	85.9	87.0	79.1	70.7	64.3	61.2	58.7	61.0	63.6	67.6	71.1	73.4	73.9
	30	93.2	94.5	82.5	73.0	67.3	64.8	59.0	60.5	63.3	67.1	70.4	72.0	71.4
	40	105.4	106.9	90.6	79.5	72.5	66.6	63.1	63.7	66.0	68.9	71.0	72.0	71.2
	46	116.2	117.8	96.0	85.3	77.9	70.4	67.8	68.3	69.9	72.0	73.5	74.3	74.0
	50	112.6	113.7	99.6	89.0	83.1	75.2	72.4	73.1	74.2	75.9	76.9	77.8	78.0
	52	109.6	110.7	99.7	90.6	86.1	78.1	75.2	76.1	77.0	78.6	79.5	80.5	80.9
	55	105.6	106.6	98.3	91.0	86.1	82.0	80.4	81.5	82.4	83.8	84.6	85.8	86.6
	60	99.8	100.6	96.5	90.2	91.5	91.7	92.1	93.5	94.7	96.2	97.2	98.8	99.8
	65	104.0	105.8	102.9	104.2	107.9	108.0	109.2	110.8	112.2	114.1	115.2	117.0	117.9

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding $\pm 0.2^0$. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.3 – Spherical coordinates for full headform size 465														
1-465		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	83.9	83.9	83.9	83.9	83.9	83.9	83.9	83.9	83.9	83.9	83.9	83.9	83.9
	80	82.9	82.6	82.6	82.8	83.0	83.3	83.4	83.7	84.4	84.6	85.3	85.4	85.3
	70	82.4	82.3	82.4	82.4	82.2	82.1	82.3	83.0	84.4	85.5	86.6	86.8	86.7
	60	83.2	83.1	83.2	82.3	81.0	80.2	80.4	81.6	83.4	85.8	87.4	87.6	87.5
	50	84.4	84.3	84.4	81.9	79.2	77.6	77.6	79.3	81.7	85.0	87.5	87.5	87.5
	40	84.9	84.8	84.6	80.6	76.5	74.2	74.1	76.2	79.3	83.3	86.7	86.8	86.9
	30	84.3	84.2	83.4	78.1	73.0	70.4	70.2	72.6	76.3	80.9	85.1	85.7	85.9
	20	83.0	82.5	81.0	74.9	69.3	66.5	66.3	69.0	72.9	77.9	82.8	84.4	84.8
	10	82.1	80.9	78.7	71.8	66.3	63.4	63.3	66.1	69.7	75.0	80.4	83.1	83.7
Reference plane	0	82.5	80.9	77.7	70.7	65.2	62.4	62.2	64.8	68.7	73.7	78.7	81.9	82.5
Angle V Below	10	83.8	82.9	78.8	70.7	64.8	62.5	62.6	64.6	67.7	72.3	76.1	78.7	79.1
	20	87.8	89.0	80.8	72.3	65.7	62.5	60.0	62.3	65.0	69.1	72.7	75.0	75.5
	30	95.3	96.6	84.3	74.6	68.8	66.2	60.3	61.8	64.7	68.5	71.9	73.5	73.0
	40	107.7	109.2	92.6	81.3	74.1	68.0	64.4	65.1	67.4	70.4	72.6	73.6	72.7
	46	118.8	120.4	98.2	87.1	79.6	71.9	69.3	69.8	71.4	73.6	75.1	75.9	75.6
	50	115.1	116.2	101.8	90.9	84.9	76.9	74.0	74.7	75.8	77.6	78.6	79.5	79.8
	52	112.0	113.1	101.9	92.6	88.0	79.8	76.9	77.7	78.7	80.4	81.2	82.3	82.7
	55	107.9	109.0	100.5	93.0	88.0	83.8	82.2	83.3	84.2	85.7	86.5	87.7	88.5
	60	102.0	102.9	98.6	92.2	93.5	93.7	94.1	95.6	96.7	98.3	99.3	100.9	102.0
	65	106.3	108.1	105.1	106.5	110.3	110.3	111.6	113.3	114.7	116.6	117.8	119.6	120.5

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.4 – Spherical coordinates for full headform size 475														
1-475		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7	85.7
	80	84.7	84.4	84.4	84.6	84.8	85.1	85.2	85.5	86.2	86.5	87.1	87.2	87.2
	70	84.2	84.1	84.1	84.1	83.9	83.9	84.1	84.8	86.2	87.4	88.4	88.6	88.6
	60	85.0	84.9	85.0	84.0	82.7	81.9	82.1	83.4	85.2	87.6	89.2	89.5	89.4
	50	86.2	86.1	86.2	83.7	80.9	79.2	79.2	81.0	83.5	86.8	89.3	89.4	89.4
	40	86.8	86.6	86.5	82.3	78.1	75.8	75.7	77.8	81.0	85.1	88.6	88.7	88.7
	30	86.2	86.0	85.2	79.8	74.6	71.9	71.7	74.1	78.0	82.6	86.9	87.6	87.8
	20	84.8	84.3	82.8	76.8	70.8	67.9	67.7	70.4	74.5	79.6	84.6	86.2	86.6
	10	83.8	82.7	80.4	73.4	67.7	64.7	64.6	67.5	71.2	76.6	82.1	84.9	85.5
Reference plane	0	84.3	82.6	79.4	72.2	66.6	63.8	63.5	66.2	70.2	75.2	80.4	83.6	84.3
Angle V Below	10	85.6	84.7	80.5	72.3	66.2	63.9	64.0	66.0	69.1	73.8	77.7	80.4	80.9
	20	89.7	90.9	82.6	73.8	67.1	63.9	61.3	63.7	66.4	70.6	74.3	76.6	77.2
	30	97.3	98.7	86.1	76.2	70.3	67.6	61.6	63.1	66.1	70.0	73.5	75.1	74.6
	40	110.1	111.5	94.5	83.0	75.7	69.5	65.8	66.5	68.9	71.9	74.1	75.2	74.3
	46	121.4	123.0	100.3	89.0	81.3	73.5	70.8	71.3	73.0	75.2	76.7	77.5	77.2
	50	117.5	118.7	104.0	92.9	86.7	78.5	75.5	76.3	77.4	79.3	80.3	81.3	81.5
	52	114.4	115.6	104.1	94.6	89.9	81.5	78.5	79.4	80.4	82.1	83.0	84.0	84.5
	55	110.2	111.3	102.6	95.0	89.9	85.6	83.9	85.0	86.0	87.5	88.3	89.6	90.4
	60	104.2	105.1	100.8	94.1	95.5	95.7	96.2	97.6	98.8	100.4	101.4	103.1	104.1
	65	108.6	110.5	107.4	108.8	112.6	112.7	114.0	115.7	117.1	119.2	120.3	122.1	123.1

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.5 – Spherical coordinates for full headform size 485														
1-485		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
	80	86.4	86.2	86.2	86.3	86.5	86.9	87.0	87.3	88.0	88.0	88.9	89.0	89.0
	70	86.0	85.9	85.9	85.9	85.7	85.6	85.8	86.6	88.0	89.2	90.3	90.5	90.5
	60	86.8	86.7	86.8	85.8	84.5	83.6	83.8	85.1	87.0	89.4	91.1	91.3	91.3
	50	88.0	87.9	88.0	85.4	82.6	80.9	80.9	82.7	85.2	88.6	91.2	91.3	91.3
	40	88.6	88.4	88.3	84.1	79.8	77.4	77.3	79.5	82.7	86.9	90.4	90.6	90.6
	30	88.0	87.8	87.0	81.5	76.2	73.4	73.2	75.7	79.6	84.3	88.7	89.4	89.6
	20	86.6	86.0	84.5	78.1	72.3	69.3	69.1	71.9	76.1	81.3	86.4	88.0	88.4
	10	85.6	84.4	82.1	74.9	69.2	66.1	66.0	68.9	72.7	78.2	83.8	86.7	87.2
Reference plane	0	86.0	84.4	81.1	73.7	68.1	65.1	64.9	67.6	71.6	76.8	82.1	85.4	86.0
Angle V Below	10	87.4	86.5	82.2	73.8	67.6	65.2	65.3	67.4	70.6	75.4	79.3	82.1	82.6
	20	91.6	92.8	84.3	75.4	68.5	65.2	62.6	65.0	67.8	72.1	75.8	78.2	78.8
	30	99.4	100.8	87.9	77.8	71.8	69.0	62.8	64.4	67.5	71.5	75.0	76.7	76.2
	40	112.4	113.9	96.5	84.8	77.3	71.0	67.2	67.9	70.3	73.4	75.7	76.8	75.9
	46	123.9	125.6	102.4	90.9	83.0	75.0	72.3	72.8	74.5	76.8	78.3	79.2	78.8
	50	120.0	121.2	106.2	94.9	88.5	80.2	77.1	77.9	79.1	81.0	82.0	83.0	83.2
	52	116.8	118.0	106.3	96.6	91.8	83.2	80.2	81.1	82.1	83.8	84.7	85.8	86.3
	55	112.5	113.7	104.8	97.0	91.8	87.4	85.7	86.8	87.8	89.4	90.2	91.5	92.3
	60	106.4	107.3	102.9	96.1	97.6	97.7	98.2	99.7	100.9	102.6	103.6	105.3	106.3
	65	110.9	112.8	109.6	111.1	115.0	115.1	116.4	118.1	119.6	121.7	122.8	124.7	125.7

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.6 – Spherical coordinates for full headform size 495														
1-495		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	89.3	89.3	89.3	89.3	89.3	89.3	89.3	89.3	89.3	89.3	89.3	89.3	89.3
	80	88.2	88.0	88.0	88.1	88.3	88.7	88.8	89.1	89.8	90.1	90.8	90.9	90.8
	70	87.7	87.7	87.7	87.7	87.5	87.4	87.6	88.4	89.8	91.1	92.1	92.4	92.3
	60	88.5	88.5	88.6	87.6	86.2	85.3	85.6	86.9	88.8	91.3	93.0	93.2	93.2
	50	89.8	89.8	89.8	87.2	84.3	82.6	82.6	84.4	87.0	90.4	93.1	93.2	93.2
	40	90.4	90.3	90.1	85.8	81.4	79.0	78.9	81.1	84.4	88.7	92.3	92.4	92.5
	30	89.8	89.6	88.8	83.1	77.8	74.9	74.7	77.2	81.3	86.1	90.5	91.3	91.5
	20	88.4	87.8	86.2	79.7	73.8	70.8	70.6	73.4	77.6	82.9	88.2	89.9	90.3
	10	87.4	86.2	83.8	76.5	70.6	67.4	67.3	70.3	74.2	79.8	85.6	88.5	89.0
Reference plane	0	87.8	86.1	82.7	75.2	69.5	66.4	66.2	69.0	73.1	78.4	83.8	87.2	87.8
Angle V Below	10	89.2	88.2	83.9	75.3	69.0	66.6	66.6	68.8	72.0	77.0	81.0	83.8	84.3
	20	98.5	94.7	86.0	77.0	69.9	66.6	63.9	66.3	69.2	73.5	77.4	79.8	80.4
	30	101.4	102.9	89.8	79.4	73.3	70.5	64.1	65.8	68.9	73.0	76.5	78.3	77.7
	40	114.7	116.2	98.5	86.5	78.9	72.4	68.6	69.3	71.8	74.9	77.3	78.4	77.4
	46	126.5	128.2	104.5	92.8	84.8	76.6	73.7	74.3	76.0	78.4	79.9	80.8	80.5
	50	122.5	123.7	108.4	96.8	90.4	81.9	78.7	79.5	80.7	82.6	83.7	84.7	84.9
	52	119.3	120.4	108.5	98.6	93.7	85.0	81.8	82.7	83.8	85.5	86.5	87.6	88.1
	55	114.9	116.0	107.0	99.0	93.7	89.2	87.5	88.6	89.6	91.2	92.1	93.4	94.2
	60	108.6	109.5	105.0	98.1	99.6	99.7	100.2	101.8	103.0	104.7	105.7	107.5	108.5
	65	113.2	115.1	111.9	113.4	117.4	117.5	118.8	120.6	122.1	124.2	125.4	127.3	128.3

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line***.**

Table A.7 – Spherical coordinates for full headform size 505														
1-505		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9
	80	89.8	89.6	89.6	89.7	90.0	90.3	90.4	90.8	91.4	91.7	92.4	92.5	92.5
	70	89.3	89.3	89.3	89.3	89.1	89.0	89.2	90.0	91.4	92.7	93.8	94.0	94.0
	60	90.1	90.1	90.1	89.2	87.8	87.0	87.2	88.5	90.4	92.9	94.6	94.9	94.8
	50	91.4	91.4	91.4	88.8	85.9	84.2	84.2	86.0	88.6	92.0	94.7	94.8	94.8
	40	92.0	91.9	91.7	87.4	83.0	80.6	80.5	82.7	86.1	90.3	93.9	94.1	94.1
	30	91.4	91.2	90.4	84.8	79.4	76.6	76.4	78.9	82.9	87.7	92.2	92.9	93.1
	20	90.0	89.4	87.9	81.3	75.5	72.4	72.2	75.0	79.3	84.6	89.8	91.5	91.9
	10	89.0	87.8	85.4	78.1	72.2	69.1	69.0	72.0	75.9	81.4	87.2	90.1	90.7
Reference plane	0	89.4	87.7	84.4	76.8	1.1	68.1	67.8	70.5	74.7	80.0	85.4	88.8	89.4
Angle V Below	10	90.9	89.9	85.4	76.7	70.2	67.8	67.9	70.0	73.3	78.3	82.4	85.3	85.8
	20	95.2	96.4	87.6	78.3	71.2	67.8	65.1	67.5	70.4	74.9	78.8	81.3	81.9
	30	103.3	104.7	91.4	80.8	74.6	71.7	65.3	67.0	70.1	74.3	77.9	79.7	79.1
	40	116.8	118.3	100.3	88.1	80.3	73.8	69.8	70.6	73.1	76.3	78.7	79.8	78.8
	46	128.8	130.5	106.4	94.4	86.3	77.9	75.1	75.7	77.4	79.8	81.3	82.3	81.9
	50	124.6	125.6	110.3	98.5	92.0	83.3	80.1	81.0	82.1	84.1	85.2	86.2	86.4
	52	121.3	122.3	110.4	100.3	95.4	86.4	83.3	84.3	85.3	87.1	88.0	89.1	89.6
	55	116.8	117.7	108.9	100.7	95.3	90.8	89.0	90.3	91.2	92.9	93.7	95.0	95.9
	60	110.4	111.1	106.9	99.8	101.3	101.5	102.0	103.6	104.8	106.5	107.6	109.4	110.5
	65	114.9	116.6	113.9	115.3	119.4	119.6	120.9	122.8	124.3	126.4	127.6	129.5	130.6

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.8 – Spherical coordinates for full headform size 515														
1-515		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	92.5	92.5	92.5	92.5	92.5	92.5	92.5	92.5	92.5	92.5	92.5	92.5	92.5
	80	91.4	91.2	91.2	91.3	91.6	92.0	92.0	92.4	93.1	93.4	94.0	94.1	94.1
	70	90.9	90.9	90.9	90.9	90.7	90.6	90.8	91.6	93.0	94.3	95.4	95.6	95.6
	60	91.7	91.7	91.7	90.8	89.5	88.6	88.8	90.1	92.0	94.5	96.3	96.5	96.4
	50	93.0	93.0	93.0	90.4	87.5	85.8	85.8	87.7	90.3	93.7	96.4	96.4	96.4
	40	93.6	93.5	93.3	89.0	84.7	82.3	82.2	84.4	87.7	91.9	95.5	95.7	95.7
	30	93.0	92.8	92.0	86.4	81.0	78.2	78.0	80.5	84.6	89.3	93.8	94.5	94.7
	20	91.6	91.0	89.5	83.0	77.1	74.1	73.9	76.7	80.9	86.2	91.4	93.1	93.5
	10	90.6	89.4	87.1	79.8	73.9	70.8	70.6	73.6	77.5	83.1	88.9	91.7	92.3
Reference plane	0	91.1	89.4	86.0	78.4	72.7	69.7	69.4	72.1	76.3	81.6	87.0	90.4	91.1
Angle V Below	10	92.5	91.5	86.9	78.0	71.4	69.0	69.1	71.2	74.6	79.7	83.9	86.8	87.3
	20	96.9	98.1	89.1	79.7	72.4	69.0	66.2	68.7	71.7	76.2	80.2	82.7	83.3
	30	105.2	106.6	93.0	82.3	75.9	73.0	66.5	68.2	71.4	75.6	79.3	81.1	80.5
	40	118.9	120.4	102.1	89.6	81.7	75.1	71.1	71.8	74.3	77.6	80.0	81.2	80.2
	46	131.1	132.8	108.2	96.1	87.8	79.3	76.4	77.1	78.7	81.2	82.8	83.7	83.3
	50	126.7	127.6	112.3	100.3	93.6	84.7	81.6	82.4	83.6	85.6	86.7	87.7	87.9
	52	123.3	124.1	112.4	102.1	97.1	87.9	84.8	85.8	86.8	88.6	89.6	90.7	91.2
	55	118.7	119.5	110.8	102.4	97.0	92.3	90.6	91.9	92.8	94.5	95.3	96.7	97.6
	60	112.2	112.7	108.7	101.5	103.0	103.2	103.8	105.5	106.7	108.4	109.4	111.3	112.4
	65	116.7	118.1	115.8	117.3	121.4	121.7	123.0	125.0	126.5	128.6	129.8	131.8	132.9

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.9 – Spherical coordinates for full headform size 525														
1-525		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2	94.2
	80	93.0	92.9	92.8	93.0	93.2	93.6	93.6	94.0	94.7	95.0	95.6	95.7	95.7
	70	92.5	92.5	92.5	92.5	92.3	92.2	92.4	93.2	94.6	95.9	97.0	97.3	97.2
	60	93.3	93.3	93.3	92.5	91.1	90.2	90.4	91.7	93.6	96.1	97.9	98.1	98.0
	50	94.6	94.6	94.6	92.1	89.1	87.4	87.5	89.3	91.9	95.3	98.0	98.1	98.0
	40	95.2	95.1	94.9	90.6	86.3	83.9	83.8	86.0	89.4	93.5	97.1	97.3	97.3
	30	94.6	94.4	93.6	88.0	82.7	79.9	79.7	82.2	86.2	91.0	95.4	96.1	96.3
	20	93.2	92.7	91.2	84.6	78.8	75.8	75.6	78.3	82.6	87.9	93.1	94.7	95.1
	10	92.2	91.1	88.8	81.4	75.5	72.4	72.3	75.2	79.2	84.7	90.5	93.3	93.9
Reference plane	0	92.7	91.0	87.6	80.1	74.3	71.3	71.0	73.7	77.9	83.2	88.6	92.0	92.7
Angle V Below	10	94.1	93.1	88.4	79.3	72.6	70.2	70.3	72.5	75.9	81.1	85.3	88.3	88.8
	20	98.6	99.8	90.7	81.1	73.7	70.2	67.4	69.9	73.0	77.5	81.6	84.2	84.8
	30	107.0	108.4	94.6	83.7	77.2	74.2	67.6	69.4	72.6	76.9	80.7	82.5	81.9
	40	121.0	122.5	103.8	91.2	83.1	76.4	72.3	73.1	75.6	79.0	81.4	82.6	81.5
	46	133.4	135.1	110.1	97.7	89.3	80.7	77.7	78.4	80.1	82.6	84.2	85.1	84.8
	50	128.8	129.5	114.2	102.0	95.2	86.2	83.0	83.9	85.0	87.1	88.2	89.2	89.4
	52	125.3	126.0	114.3	103.9	98.7	89.4	86.2	87.3	88.3	90.2	91.1	92.2	92.8
	55	120.6	121.2	112.6	104.1	98.6	93.9	92.2	93.5	94.5	96.1	97.0	98.4	99.2
	60	114.0	114.3	110.6	103.2	104.7	105.0	105.6	107.4	108.6	110.3	111.3	113.2	114.3
	65	118.4	119.6	117.8	119.3	123.5	123.8	125.2	127.2	128.7	130.8	132.0	134.1	135.2

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.10 – Spherical coordinates for full headform size 535														
1-535		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8	95.8
	80	94.6	94.5	94.5	94.6	94.8	95.2	95.2	95.6	96.3	96.6	97.3	97.3	97.4
	70	94.1	94.1	94.1	94.2	94.0	93.9	94.1	94.8	96.2	97.6	98.7	98.9	98.9
	60	94.9	94.9	94.9	94.1	92.7	91.8	92.0	93.3	95.2	97.7	99.5	99.7	99.7
	50	96.2	96.2	96.2	93.7	90.7	89.1	89.1	90.9	93.5	96.9	99.6	99.7	99.6
	40	96.8	96.7	96.5	92.3	87.9	85.5	85.4	87.6	91.0	95.1	98.8	98.9	98.9
	30	96.2	96.0	95.2	89.6	84.3	81.5	81.3	83.8	87.8	92.6	97.0	97.7	97.9
	20	94.8	94.3	92.8	86.2	80.4	77.4	77.2	80.0	84.2	89.5	94.7	96.3	96.7
	10	93.8	92.7	90.4	83.1	77.2	74.1	73.9	76.8	80.8	86.4	92.2	94.9	95.5
Reference plane	0	94.3	92.6	89.3	81.7	75.9	72.9	72.6	75.3	79.6	84.9	90.3	93.6	94.3
Angle V Below	10	95.8	94.8	89.9	80.7	73.9	71.4	71.5	73.7	77.2	82.5	86.8	89.8	90.3
	20	100.3	101.5	92.2	82.5	74.9	71.4	68.6	71.1	74.2	78.9	83.0	85.6	86.2
	30	108.9	110.2	96.2	85.1	78.5	75.5	68.8	70.6	73.9	78.3	82.1	84.0	83.3
	40	123.1	124.6	105.6	92.7	84.6	77.7	73.5	74.4	76.9	80.3	82.8	84.0	82.9
	46	135.7	137.4	112.0	99.4	90.9	82.1	79.0	79.8	81.5	84.0	85.6	86.6	86.2
	50	130.9	131.4	116.2	103.8	96.8	87.6	84.4	85.4	86.5	88.6	89.6	90.7	91.0
	52	127.3	127.8	116.2	105.7	100.4	90.9	87.7	88.8	89.8	91.7	92.6	93.8	94.3
	55	122.5	123.0	114.5	105.8	100.3	95.5	93.8	95.2	96.1	97.8	98.6	100.0	100.9
	60	115.8	116.0	112.4	104.8	106.4	106.8	107.4	109.2	110.4	112.2	113.2	115.1	116.3
	65	120.2	121.0	119.8	121.3	125.5	125.9	127.3	129.5	130.9	133.1	134.2	136.3	137.5

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.11 – Spherical coordinates for full headform size 545														
1-545		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	97.4	97.4	97.4	97.4	97.4	97.4	97.4	97.4	97.4	97.4	97.4	97.4	97.4
	80	96.2	96.1	96.1	96.2	96.5	96.8	96.9	97.2	97.9	98.2	98.9	98.9	99.0
	70	95.7	95.7	95.7	95.8	95.6	95.5	95.7	96.4	97.8	99.2	100.3	100.5	100.5
	60	96.5	96.5	96.5	95.7	94.3	93.4	93.7	94.9	96.8	99.4	101.2	101.4	101.3
	50	97.8	97.8	97.8	95.3	92.3	90.7	90.7	92.5	95.1	98.5	101.2	101.3	101.3
	40	98.4	98.3	98.1	93.9	89.5	87.2	87.1	89.2	92.6	96.8	100.4	100.5	100.6
	30	97.8	97.6	96.8	91.2	85.9	83.2	83.0	85.5	89.5	94.2	98.6	99.3	99.6
	20	96.4	95.9	94.4	87.9	82.1	79.1	78.9	81.6	85.8	91.2	96.4	97.9	98.3
	10	95.4	94.3	92.1	84.7	78.8	75.8	75.6	78.5	82.5	88.0	93.8	96.5	97.1
Reference plane	0	95.9	94.3	90.9	83.3	77.5	74.5	74.2	76.9	81.2	86.5	91.9	95.2	95.9
Angle V Below	10	97.4	96.4	91.4	82.0	75.1	72.6	72.7	74.9	78.5	83.9	88.3	91.3	91.9
	20	102.1	103.2	93.8	83.9	76.2	76.2	69.8	72.3	75.5	80.2	84.3	87.1	87.7
	30	110.8	112.1	97.8	86.5	79.8	76.7	70.0	71.8	75.1	79.6	83.5	85.4	84.7
	40	125.2	126.7	107.4	94.3	86.0	79.0	74.7	75.6	78.2	81.7	84.2	85.4	84.3
	46	138.1	139.7	113.9	101.1	92.4	83.5	80.4	81.2	82.8	85.4	87.1	88.0	87.6
	50	132.9	133.4	118.1	105.5	98.5	89.1	85.8	86.8	87.9	90.0	91.1	92.2	92.5
	52	129.3	129.7	118.2	107.5	102.1	92.4	89.2	90.4	91.3	93.2	94.2	95.4	95.9
	55	124.5	124.7	116.4	107.5	102.0	97.0	95.3	96.8	97.7	99.4	100.2	101.7	102.6
	60	117.6	117.6	114.2	106.5	108.1	108.5	109.2	111.1	112.3	114.0	115.0	117.0	118.2
	65	121.9	122.5	121.7	123.3	127.6	128.0	129.4	131.7	133.1	135.3	136.5	138.6	139.7

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.12 – Spherical coordinates for full headform size 555														
1-555		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0
	80	97.8	97.7	97.7	97.8	98.1	98.4	98.5	99.5	99.5	99.9	100.5	100.6	100.7
	70	97.3	97.3	97.3	97.4	97.2	97.1	97.3	99.4	99.4	100.8	101.9	102.1	102.1
	60	98.1	98.1	98.1	97.3	95.9	95.1	95.3	98.4	98.4	101.0	102.8	103.0	102.9
	50	99.4	99.4	99.4	96.9	94.0	92.3	92.4	96.8	96.8	100.1	102.9	103.0	102.9
	40	100.0	99.9	99.7	95.5	91.1	88.8	88.7	94.3	94.3	98.1	102.0	102.2	102.2
	30	99.4	99.2	98.4	92.8	87.6	84.8	84.7	91.1	91.1	95.9	100.3	100.9	101.2
	20	98.0	97.5	96.1	89.5	83.7	80.7	80.5	87.5	87.5	92.8	98.0	99.5	100.0
	10	97.0	95.9	93.7	86.4	80.5	77.5	77.2	84.1	84.1	89.7	95.5	98.1	98.7
Reference plane	0	97.5	95.9	92.6	84.9	79.1	76.2	75.9	82.8	82.8	88.1	93.5	96.8	97.5
Angle V Below	10	99.1	98.0	92.9	83.4	76.3	73.8	73.9	79.8	79.8	85.3	89.7	92.9	93.4
	20	103.8	104.9	95.3	85.3	77.4	73.8	70.9	76.7	76.7	81.5	85.7	88.5	89.2
	30	112.6	113.9	99.4	88.0	81.1	77.9	71.1	76.4	76.4	80.9	84.8	86.8	86.1
	40	127.3	128.7	109.2	95.8	87.4	80.4	76.0	79.4	79.4	83.0	85.6	86.8	85.7
	46	140.4	142.0	115.8	102.7	93.9	84.9	81.7	84.2	84.2	86.8	88.5	89.5	89.0
	50	135.0	135.3	120.1	107.2	100.1	90.5	87.2	89.4	89.4	91.5	92.6	93.7	94.0
	52	131.4	131.5	120.1	109.2	103.8	93.8	90.7	92.8	92.8	94.8	95.7	96.9	97.5
	55	126.4	126.4	118.3	109.2	103.6	98.6	96.9	99.3	99.3	101.0	101.8	103.3	104.3
	60	119.4	119.2	116.1	108.2	109.8	110.3	111.0	114.1	114.1	115.9	116.9	118.9	120.1
	65	123.7	124.0	123.7	125.2	129.6	130.1	131.5	135.3	135.3	137.5	138.7	140.9	142.0

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line***.**

Table A.13 – Spherical coordinates for full headform size 565														
1-565		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6	100.6
	80	99.4	99.4	99.3	99.4	99.7	100.0	100.1	100.4	101.1	101.5	102.1	102.2	102.3
	70	98.9	98.9	98.9	99.0	98.8	98.7	98.9	99.7	101.0	102.4	103.6	103.8	103.8
	60	99.7	99.7	99.7	99.0	97.6	96.7	96.9	98.1	100.1	102.6	104.4	104.6	104.5
	50	100.9	101.0	101.0	98.5	95.6	93.9	94.0	95.7	98.4	101.7	104.5	104.6	104.5
	40	101.6	101.5	101.3	97.1	92.8	90.4	90.4	92.5	95.9	100.0	103.6	103.8	103.8
	30	101.0	100.9	100.1	94.4	89.2	86.4	86.3	88.7	92.8	97.5	101.9	102.6	102.8
	20	99.7	99.1	97.7	91.1	85.4	82.4	82.2	84.9	89.1	94.5	99.6	101.1	101.6
	10	98.6	97.6	95.4	88.0	82.2	79.1	78.8	81.7	85.8	91.3	97.1	99.7	100.3
Reference plane	0	99.2	97.5	94.2	86.5	80.8	77.8	77.5	80.1	84.4	89.7	95.2	98.4	99.2
Angle V Below	10	100.7	99.6	94.4	84.7	77.5	75.0	75.1	77.4	81.0	86.6	91.2	94.4	94.9
	20	105.5	106..6	96.9	86.7	78.7	75.0	72.1	74.7	78.0	82.8	87.1	90.0	90.6
	30	114.5	115.8	101.0	89.4	82.4	79.2	72.3	74.2	77.6	82.2	86.2	88.2	87.5
	40	129.4	130.8	110.9	97.4	88.8	81.7	77.2	78.2	80.7	84.4	87.0	88.2	87.0
	46	142.7	144.3	117.6	104.4	95.5	86.3	83.0	83.9	85.5	88.2	89.9	90.9	90.5
	50	137.1	137.4	122.1	109.0	101.7	91.9	88.7	89.7	90.8	93.0	94.1	95.3	95.5
	52	133.4	133.4	122.0	111.0	105.4	95.3	92.1	93.4	94.3	96.3	97.3	98.5	99.1
	55	128.3	128.2	120.2	110.9	105.3	100.2	98.5	100.0	100.9	102.7	103.5	105.0	106.0
	60	121.2	120.8	117.9	109.9	111.5	112.1	112.8	114.9	116.0	117.8	118.8	120.8	122.1
	65	125.4	125.5	125.7	127.2	131.6	132.2	133.7	136.1	137.5	139.7	140.9	143.1	144.3

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.14– Spherical coordinates for full headform size 575														
1-575		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3	102.3
	80	101.0	101.0	100.9	101.0	101.3	101.6	101.7	102.0	102.7	103.1	103.8	103.8	104.0
	70	100.5	100.5	100.5	100.6	100.5	100.3	100.5	101.3	102.6	104.1	105.2	105.4	105.4
	60	101.3	101.3	101.3	100.6	99.2	98.3	98.5	99.7	101.7	104.2	106.1	106.3	106.2
	50	102.5	102.6	102.5	100.2	97.2	95.6	95.6	97.3	100.0	103.3	106.1	106.2	106.1
	40	103.2	103.1	102.9	98.7	94.4	92.1	92.0	94.1	97.6	101.6	105.2	105.4	105.4
	30	102.6	102.5	101.7	96.1	90.8	88.1	88.0	90.4	94.4	99.1	103.5	104.2	104.4
	20	101.3	100.7	99.3	92.8	87.0	84.1	83.9	86.6	90.8	96.1	101.3	102.7	103.2
	10	100.3	99.2	97.0	89.7	83.8	80.8	80.5	83.3	87.5	93.0	98.8	101.3	101.9
Reference plane	0	100.8	99.2	95.8	88.1	82.4	79.4	79.1	81.7	86.0	91.3	96.8	100.0	100.8
Angle V Below	10	102.3	101.3	95.9	86.1	78.8	76.2	76.3	78.6	82.3	88.0	92.6	95.9	96.4
	20	107.2	108.2	98.4	88.1	79.9	76.2	73.3	75.9	79.3	84.2	88.5	91.4	92.1
	30	116.3	117.6	102.6	90.8	83.7	80.4	73.5	75.4	78.8	83.6	87.6	89.6	88.9
	40	131.5	132.9	112.7	98.9	90.3	83.0	78.4	79.4	82.0	85.7	88.4	89.6	88.4
	46	145.0	146.6	119.5	106.0	97.0	87.6	84.3	85.2	86.9	89.6	91.3	92.4	91.9
	50	139.2	139.2	124.0	110.7	103.3	93.4	90.1	91.2	92.3	94.5	95.6	96.8	97.0
	52	135.4	135.2	124.0	112.8	107.1	96.8	93.6	94.9	95.9	97.8	98.8	100.0	100.6
	55	130.2	129.9	122.1	112.6	106.9	101.8	100.1	101.7	102.6	104.3	105.1	106.7	107.6
	60	123.0	122.4	119.8	111.6	113.2	113.8	114.6	116.7	117.9	119.6	120.7	122.7	124.0
	65	127.2	126.9	127.6	129.2	133.7	134.3	135.8	138.3	139.7	141.9	143.1	145.4	146.6

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.15 – Spherical coordinates for full headform size 585														
1-585		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	103.9	103.9	103.9	103.9	103.9	103.9	103.9	103.9	103.9	103.9	103.9	103.9	103.9
	80	102.6	102.6	102.5	102.6	103.0	103.3	103.3	103.6	104.4	104.8	105.4	105.4	105.6
	70	102.1	102.0	102.1	102.3	102.1	102.0	102.1	102.9	104.2	105.7	106.8	107.0	107.1
	60	102.9	102.9	102.9	102.2	100.8	99.9	100.1	101.4	103.3	105.8	107.7	107.9	107.8
	50	104.1	104.2	104.1	101.8	98.8	97.2	97.2	99.0	101.6	104.9	107.7	107.9	107.7
	40	104.8	104.8	104.5	100.3	96.0	93.7	93.7	95.8	99.2	103.2	106.8	107.0	107.1
	30	104.2	104.1	103.3	97.7	92.5	89.7	89.6	92.0	96.0	100.8	105.1	105.8	106.1
	20	102.9	102.3	101.0	94.4	88.7	85.7	85.5	88.2	92.4	97.7	102.9	104.3	104.8
	10	101.9	100.8	98.7	91.4	85.5	83.5	82.1	85.0	89.1	94.6	100.4	102.9	103.5
Reference plane	0	102.4	100.8	97.5	89.8	84.0	80.0	80.7	83.3	87.6	92.9	98.4	101.6	102.4
Angle V Below	10	104.0	102.9	97.4	87.4	80.0	77.3	77.5	79.9	83.6	89.4	94.1	97.4	98.0
	20	108.9	109.9	99.9	89.4	81.1	77.4	74.4	77.1	80.5	85.5	89.9	92.8	93.5
	30	118.2	119.5	104.2	92.2	85.0	81.7	74.6	76.6	80.1	84.9	89.0	91.0	90.2
	40	133.6	135.0	114.5	100.5	91.7	84.3	79.6	80.7	83.3	87.1	89.8	91.0	89.8
	46	147.3	148.9	121.4	107.7	98.5	89.0	85.6	86.6	88.2	91.1	92.8	93.8	93.3
	50	141.3	141.1	126.0	112.5	104.9	94.8	91.5	92.7	93.7	96.0	97.1	98.3	98.5
	52	137.4	137.1	125.9	114.6	108.8	98.3	95.1	96.4	97.4	99.4	100.3	101.6	102.2
	55	132.1	131.6	124.0	114.3	108.6	103.3	101.6	103.3	104.2	105.9	109.7	108.3	109.3
	60	124.8	124.0	121.6	113.3	115.0	115.6	116.4	118.6	119.7	121.5	122.5	124.6	126.0
	65	128.9	128.4	129.6	131.2	135.7	136.4	137.9	140.5	141.9	144.2	145.3	147.6	148.9

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.16 – Spherical coordinates for full headform size 595														
1-595		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	105.5	105.5	105.5	105.5	105.5	105.5	105.5	105.5	105.5	105.5	105.5	105.5	105.5
	80	104.2	104.2	104.2	104.2	104.9	104.9	104.9	105.3	106.0	106.4	107.0	107.0	107.3
	70	103.7	103.6	103.7	103.9	103.6	103.6	103.8	104.5	105.8	107.3	108.5	108.6	108.7
	60	104.4	104.5	104.5	103.8	101.5	101.5	101.8	103.0	104.9	107.4	109.3	109.5	109.4
	50	105.7	105.8	105.7	103.4	98.8	98.8	98.9	100.6	103.3	106.6	109.4	109.5	109.4
	40	106.4	106.4	106.1	101.9	95.3	95.3	95.3	97.4	100.8	104.9	108.5	108.7	108.7
	30	105.8	105.7	104.9	99.3	91.4	91.4	91.3	93.7	97.7	102.4	106.7	107.4	107.7
	20	104.5	103.9	102.6	96.0	87.4	87.4	87.2	89.8	94.1	99.4	104.5	105.9	106.4
	10	103.5	102.5	100.3	93.0	84.1	84.1	83.8	86.6	90.8	96.2	102.1	104.5	105.2
Reference plane	0	104.0	102.4	99.1	91.4	82.6	82.6	82.3	84.9	89.2	94.5	100.1	103.2	104.0
Angle V Below	10	105.6	104.5	98.9	88.8	78.5	78.5	78.7	81.1	84.9	90.8	95.6	98.9	99.5
	20	110.6	111.6	101.5	90.8	78.6	78.6	75.6	78.3	81.8	86.8	91.3	94.3	95.0
	30	120.1	121.3	105.9	93.6	82.9	82.9	75.8	77.8	81.3	86.2	90.4	92.4	91.6
	40	135.7	137.1	116.3	102.0	85.6	85.6	80.9	82.0	84.5	88.4	91.2	92.4	91.1
	46	149.7	151.1	123.3	109.4	90.4	90.4	87.0	88.0	89.6	92.5	94.2	95.3	94.8
	50	143.4	143.0	127.9	114.2	96.3	96.3	92.9	94.1	95.2	97.5	98.6	99.8	100.0
	52	139.4	138.9	127.8	116.4	99.8	99.8	96.6	98.0	98.9	100.9	101.9	103.2	103.8
	55	134.0	133.4	125.9	116.0	104.9	104.9	103.2	104.9	105.8	107.6	108.4	110.0	111.0
	60	126.6	125.7	123.5	115.0	117.4	117.4	118.2	120.5	121.6	123.4	124.4	126.5	127.9
	65	130.7	129.9	131.6	133.1	138.5	138.5	140.0	142.8	144.1	146.4	147.6	149.9	151.2

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.17 – Spherical coordinates for full headform size 605														
1-605		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1
	80	105.8	105.9	105.8	105.9	106.2	106.5	106.5	106.9	107.6	108.0	108.6	108.6	108.9
	70	105.3	105.2	105.3	105.5	105.4	105.2	105.4	106.1	107.4	108.9	110.1	110.3	110.3
	60	106.0	106.0	106.1	105.5	104.1	103.2	103.4	104.6	106.5	109.1	111.0	111.2	111.0
	50	107.3	107.4	107.3	105.0	102.1	100.4	100.5	102.2	104.9	108.2	111.0	111.1	111.0
	40	108.0	108.0	107.7	103.6	99.3	97.0	97.0	99.0	102.5	106.5	110.1	110.3	110.3
	30	107.4	107.3	106.5	100.9	95.7	93.0	93.0	95.3	99.3	104.0	108.4	109.0	109.3
	20	106.1	105.6	104.3	97.7	92.0	89.1	88.9	91.5	95.7	101.0	106.2	107.5	108.0
	10	105.1	104.1	102.0	94.7	88.8	85.8	85.4	88.2	92.4	97.9	103.7	106.1	106.8
Reference plane	0	105.6	104.1	100.7	93.0	87.2	84.3	83.9	86.5	90.8	96.1	101.7	104.8	105.6
Angle V Below	10	107.2	106.2	100.4	90.1	82.5	79.7	79.9	82.4	86.2	92.2	97.0	100.4	101.0
	20	112.4	113.3	103.0	92.2	83.6	79.9	76.8	79.5	83.0	88.2	92.7	95.7	96.5
	30	121.9	123.2	107.5	95.1	87.7	84.2	76.9	79.0	82.6	87.5	91.8	93.9	93.0
	40	137.8	139.1	118.0	103.5	94.5	87.0	82.1	83.2	85.8	89.8	92.6	93.8	92.5
	46	152.0	153.4	125.2	111.0	101.6	91.8	88.3	89.3	91.0	93.9	95.6	96.7	96.2
	50	145.5	145.0	129.9	115.9	108.2	97.7	94.3	95.6	96.6	99.0	100.1	101.3	101.5
	52	141.4	140.7	129.8	118.1	112.1	101.2	98.0	99.5	100.4	102.4	103.4	104.7	105.3
	55	136.0	135.1	127.8	117.7	111.9	106.5	104.8	106.6	107.4	109.2	110.0	111.7	112.7
	60	128.4	127.3	125.3	116.6	118.4	119.1	120.0	122.4	123.5	125.3	126.3	128.4	129.8
	65	132.5	131.4	133.5	135.1	139.8	140.6	142.2	145.0	146.3	148.6	149.8	152.2	153.5

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE The surface corresponding to the shown in italics lies below the jaw line**.**

Table A.18 – Spherical coordinates for full headform size 615														
1-615		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	108.8	108.8	108.8	108.8	108.8	108.8	108.8	108.8	108.8	108.8	108.8	108.8	108.8
	80	107.7	107.6	107.6	107.4	107.6	107.8	108.1	108.5	109.3	109.3	108.5	109.2	109.2
	70	106.9	106.8	106.9	107.1	107.0	106.9	107.0	107.7	110.5	110.5	111.3	111.6	111.6
	60	107.6	107.6	107.7	107.1	105.8	104.8	104.9	106.1	110.7	110.7	112.8	112.9	112.8
	50	108.9	109.0	108.9	106.6	103.6	102.0	102.1	103.7	109.8	109.8	112.6	112.7	112.7
	40	109.6	109.6	109.3	105.1	100.8	98.5	98.6	100.6	108.1	108.1	111.5	111.8	111.8
	30	109.0	108.9	108.2	102.6	97.3	94.7	94.7	97.1	105.7	105.7	110.0	110.6	110.9
	20	107.7	107.2	105.9	99.3	93.7	90.8	90.6	93.2	102.7	102.7	108.0	109.3	109.7
	10	106.7	105.7	103.6	96.3	90.4	87.4	86.9	89.7	99.5	99.5	105.2	107.7	108.4
Reference plane	0	107.3	105.7	102.4	94.6	88.8	85.9	85.5	88.2	92.4	97.8	103.5	106.4	107.3
Angle V Below	10	108.9	107.8	101.9	91.5	83.7	80.9	81.1	83.6	87.5	93.6	98.5	101.9	102.5
	20	114.1	115.0	104.6	93.6	84.9	81.1	77.9	80.7	84.3	89.5	94.1	97.2	97.9
	30	123.8	125.0	109.1	96.5	89.0	85.4	78.1	80.2	83.8	88.9	93.2	95.3	94.4
	40	139.9	141.2	119.8	105.1	95.9	88.3	83.3	84.5	87.1	91.1	93.9	95.3	93.9
	46	154.3	155.7	127.0	112.7	103.1	93.2	89.6	90.7	92.3	95.3	97.1	98.2	97.6
	50	147.6	146.9	131.8	117.7	109.8	99.1	95.7	97.1	98.1	100.4	101.6	102.8	103.1
	52	143.4	142.6	131.7	119.9	113.8	102.7	99.5	101.0	101.9	104.0	104.9	106.3	106.9
	55	137.9	136.9	129.7	119.4	113.5	108.0	106.4	108.2	109.0	110.8	111.6	113.3	114.4
	60	130.2	128.9	127.2	118.3	120.1	120.9	121.8	124.2	125.3	127.1	128.1	130.3	131.8
	65	134.2	132.8	135.5	137.1	141.8	142.7	144.3	147.2	148.5	150.8	152.0	154.4	155.8

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.19 – Spherical coordinates for full headform size 625														
1-625		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	110.4	110.4	110.4	110.4	110.4	110.4	110.4	110.4	110.4	110.4	110.4	110.4	110.4
	80	109.0	109.1	109.0	109.1	109.5	109.7	109.8	110.1	110.8	111.3	111.9	111.9	112.2
	70	108.5	108.4	108.5	108.8	108.6	108.4	108.6	109.3	110.5	112.2	113.4	113.5	113.6
	60	109.2	109.2	109.3	108.7	107.3	106.4	106.6	107.8	109.7	112.3	114.2	114.4	114.3
	50	110.5	110.6	110.5	108.3	105.3	103.7	103.8	105.4	108.2	111.4	114.2	114.4	114.2
	40	111.1	111.2	110.9	106.8	102.5	100.2	100.2	102.3	105.8	109.7	113.3	113.5	113.5
	30	110.7	110.5	109.8	104.1	99.0	96.3	96.3	98.6	102.6	107.3	111.6	112.2	112.5
	20	109.3	108.8	107.5	100.9	95.3	92.4	92.2	94.8	99.0	104.3	109.4	110.7	111.3
	10	108.3	107.4	105.3	98.0	92.1	89.1	88.7	91.5	95.7	101.2	107.0	109.3	110.0
Reference plane	0	108.9	107.3	104.0	96.2	90.4	87.5	87.1	89.7	94.0	99.4	104.9	108.0	108.9
Angle V Below	10	110.5	109.4	103.5	92.8	84.9	82.1	82.3	84.8	88.8	94.9	99.9	103.4	104.1
	20	115.8	116.7	106.1	95.0	86.1	82.3	79.1	81.9	85.6	90.8	95.5	98.6	99.4
	30	125.6	126.9	110.7	97.9	90.3	86.7	79.3	91.4	85.1	90.2	94.5	96.7	95.8
	40	142.0	143.3	121.6	106.6	97.4	89.6	84.5	85.5	88.4	92.5	95.3	96.7	95.3
	46	156.6	158.0	128.9	114.3	104.6	94.6	90.9	92.1	93.7	96.7	98.5	99.6	99.0
	50	149.7	148.8	133.8	119.4	111.4	100.6	97.2	98.5	99.5	101.9	103.1	104.3	104.6
	52	145.5	144.4	133.7	121.7	115.5	104.2	101.0	102.5	103.4	105.5	106.5	107.9	108.5
	55	139.8	138.6	131.6	121.1	115.2	109.6	108.0	109.8	110.7	112.5	113.3	115.0	116.0
	60	132.0	130.5	129.0	120.0	121.8	122.7	123.6	126.1	127.2	129.0	130.0	132.2	133.7
	65	136.0	134.3	137.5	139.1	143.9	144.8	146.4	149.4	150.7	153.0	154.2	156.7	158.1

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Table A.20 – Spherical coordinates for full headform size 635														
1-635		**0^0**	**15^0**	**30^0**	**45^0**	**60^0**	**75^0**	**90^0**	**105^0**	**120^0**	**135^0**	**150^0**	**165^0**	**180^0**
Angle V above	90	112.0	112.0	112.0	112.0	112.0	112.0	112.0	112.0	112.0	112.0	112.0	112.0	112.0
	80	110.6	110.7	110.6	110.7	111.3	111.3	111.4	111.7	112.4	112.9	113.5	113.5	113.8
	70	110.1	110.0	110.1	110.4	110.0	110.0	110..2	110.9	112.1	113.8	115.0	115.1	115.2
	60	110.8	110.8	110.8	110.3	108.9	108.0	108.2	109.4	111.3	113.9	115.9	116.1	115.9
	50	112.1	112.2	112.1	109.9	106.9	105.3	105.4	107.0	109.8	113.0	115.9	116.0	115.8
	40	112.7	112.8	112.5	108.4	104.1	101.9	101.9	103.9	107.4	111.3	114.9	115.1	115.2
	30	112.3	112.1	111.4	105.7	100.6	98.0	97.9	100.2	104.2	108.9	113.2	113.8	114.2
	20	110.9	110.4	109.2	102.6	96.9	94.1	93.9	96.4	100.6	106.0	111.1	112.3	112.9
	10	109.9	109.0	106.9	99.6	93.7	90.8	90.3	93.1	97.4	102.8	108.7	110.9	111.6
Reference plane	0	110.5	109.0	105.6	97.8	92.1	89.1	88.7	91.3	95.6	101.0	106.6	109.6	110.5
Angle V Below	10	112.2	111.0	105.0	94.1	86.1	83.3	83.5	86.1	90.1	96.3	101.4	104.9	105.6
	20	117.5	118.4	107.7	96.4	87.4	83.5	80.3	83.1	86.8	92.1	96.9	100.1	100.8
	30	127.5	128.7	112.3	99.3	91.4	87.9	80.4	82.6	86.3	91.5	95.9	998.1	97.2
	40	144.1	145.4	123.4	108.2	98.8	90.9	85.8	87.0	89.6	93.9	96.7	98.1	96.6
	46	158.9	160.3	130.8	116.0	106.2	95.9	92.3	93.4	95.0	98.1	99.9	101.1	100.5
	50	151.8	150.8	135.7	121.1	113.1	102.0	98.6	100.0	101.0	103.4	104.5	105.8	106.1
	52	147.5	146.3	135.6	123.5	117.2	105.7	102.5	104.0	104.9	107.1	108.0	109.4	110.0
	55	141.7	140.3	133.5	122.8	116.8	111.2	109.5	111.5	112.3	114.4	114.9	116.6	1107.7
	60	133.8	132.1	130.9	121.7	123.5	124.4	125.4	128.0	129.0	130.9	131.9	134.1	135.6
	65	137.7	135.8	139.4	141.1	145.9	146.9	148.5	151.6	152.9	155.3	156.4	158.9	160.4

V = Vertical angle above or below the reference plane

H = Angle of vertical slice, measured in horizontal plane, from front of mid-sagittal plane

Angles in degrees, to be measured with an uncertainty of measurement not exceeding ± 0.2^0. Radii in mm, with a tolerance of ± 0.5% and measured with an uncertainty of measurement not exceeding 0.1 mm.

The jaw line shall be radiused along its length with a nominal 5 mm radius. The base of the neck shall be squared off perpendicular to the central vertical axis.

NOTE *The surface corresponding to the shown in italics lies below the jaw line.*

Annex B

(informative)

Equations defining the radii of the spherical coordinate system for sizes 495 to 645

Table B.1 – At and above the reference plane

Angle V	Angle H	Equation to define radius, R	Angle H	Equation to define radius, R	Angle H	Equation to define radius, R
90	**0**	0.1618 x C + 9 247 6	**15**	0.1621 x C + 9 080 4	**30**	0.1619 x C + 9 165 7
80		0.1601 x C + 8 973 7		0.1625 x C + 7 543 2		0.1618 x C + 7 888 6
70		0.1596 x C + 8 724 6		0.1599 x C + 8 507 5		0.1604 x C + 8 273 5
60		0.159 x C + 9 842		0.1594 x C + 9 607 3		0.1592 x C + 9 752 5
50		0.1588 x C + 11 224		0.1605 x C + 10 314		0.159 x C + 11 123
40		0.1594 x C + 11 516		0.1611 x C + 10 517		0.159 8 x C + 11 007
30		0.1605 x C + 10 344		0.161 x C + 9 885 5		0.161 5 x C + 8 812 6
20		0.1612 x C + 8 576 4		0.1612 x C + 8 026 9		0.1638 x C + 5 160 1
10		0.1611 x C + 7 628		0.1631 x C + 5 423 1		0.1654 x C + 1 920 3
0		0.1617 x C + 7 798		0.1635 x C + 5 157 3		0.1634 x C + 1 863 1
90	**45**	0,1623 x C + 8 945 8	**60**	0,1618 x C + 9 247 6	**75**	0,1622 x C + 9 005 3
80		0,1613 x C + 8 270 7		0,1601 x C + 8 973 7		0,1626 x C + 7 845 8
70		0,1622 x C + 7 381 4		0,1596 x C + 8 724 6		0,1627 x C + 6 924 1
60		0,1626 x C + 7 086 7		0,159 x C + 9 842		0,1622 x C + 5 927 3
50		0,1621 x C + 6 953 7		0,1588 x C + 11 224		0,1618 x C + 4 167 3
40		0,1613 x C + 5 966 5		0,1594 x C + 11 516		0,1622 x C + 1.12
30		0,1614 x C + 3 251 1		0,1605 x C + 10 344		0,1635 x C – 3 177 6
20		0,1633 x C – 1 134 8		0,1612 x C + 8 576 4		0,165 x C – 7 873
10		0,1653 x C – 5 346 5		0,1611 x C + 7 628		0,1652 x C – 11 186
0		0,1617 x C – 4831 6		0,1617 x C + 7 798		0,1614 x C – 10 437
90	**90**	0,162 x C + 9 125 8	**105**	0,1621 x C + 9 093 3	**120**	0,1622 x C + 9 004 6
80		0,1614 x C + 8 89		0,1611 x C + 9 399 1		0,1614 x C + 9 931 8
70		0,1616 x C + 7 599 3		0,1607 x C + 8 861 3		0,1596 x C + 10 799
60		0,162 x C + 5 360 8		0,1607 x C + 7 341 2		0,1606 x C + 9 314 2
50		0,1629 x C + 1 948 4		0,1614 x C + 4 534 1		0,1627 x C + 6 468 4
40		0,1645 x C – 2 566		0,1628 x C + 0 516 8		0,1639 x C + 3 316 5
30		0,1661 x C – 7 525 9		0,1642 x C – 4 037 2		0,1641 x C + 0 046 2
20		0,1633 x C – 11 749		0,1644 x C – 7 974		0,1644 x C – 3 755 4
10		0,1642 x C – 13 931		0,1625 x C – 10 108		0,1651 x C – 7 481 2
0		0,1608 x C – 13 392		0,1595 x C – 10 002		0,1609 x C – 6 53
90	**135**	0,1622 x C + 9 006 2	**150**	0,1622 x C + 8 984 6	**165**	0,1622 x C + 9 025 5
80		0,1629 x C + 9 457 9		0,1625 x C + 10 332		0,1615 x C + 10 924
70		0,1623 x C + 10 728		0,1634 x C + 11 251		0,1625 x C + 11 945
60		0,1616 x C + 11 292		0,1634 x C + 12 112		0,1632 x C + 12 437
50		0,1613 x C + 10 589		0,1626 x C + 12 622		0,163 x C + 12 498
40		0,1619 x C + 8 529 1		0,1618 x C + 12 194		0,1622 x C + 12 145
30		0,1632 x C + 5 299 3		0,162 x C + 10 352		0,1613 x C + 11 42
20		0,1646 x C + 1 456 1		0,1636 x C + 7 188 2		0,1605 x C + 10 417
10		0,1646 x C – 1 688 5		0,1651 x C + 3 848 5		0,1601 x C + 9 242 8
0		0,1612 x C – 1 391		0,163 x C + 3 067 3		0,1601 x C + 7 912 5
90	**180**	0,162 x C + 9 082 1				
80		0,1643 x C + 9 491 6				
70		0,1634 x C + 11 462				
60		0,1624 x C + 12 789				
50		0,1621 x C + 12 914				
40		0,1622 x C + 12 172				
30		0,1622 x C + 11 166				
20		0,1616 x C + 10 277				
10		0,1611 x C + 9 304 2				
0		0,1626 x C + 7 230 4				

Table B.2 – Below the reference plane

Angle V	Angle H	Equation to define radius, R	Angle H	Equation to define radius, R	Angle H	Equation to define radius, R
90	**0**	0.1637 x C + 8 204 4	**15**	0.1621 x C + 9 080 4	**30**	0.1619 x C + 9 165 7
80		0.1715 x C + 8 597 3		0.1625 x C + 7 543 2		0.1618 x C + 7 888 6
70		0.1861 x C + 9 328 1		0.1599 x C + 8 507 5		0.1604 x C + 8 273 5
60		0.2104 x C + 10 544		0.1594 x C + 9 607 3		0.1592 x C + 9 752 5
50		0.232 x C + 11 629		0.1605 x C + 10 314		0.159 x C + 11 123
40		0.2094 x C + 18 822		0.1611 x C + 10 517		0.159 8 x C + 11 007
30		0.2016 x C + 19 465		0.161 x C + 9 885 5		0.161 5 x C + 8 812 6
20		0.1918 x C + 19 923		0.1612 x C + 8 026 9		0.1638 x C + 5 160 1
10		0.1799 x C + 19 532		0.1631 x C + 5 423 1		0.1654 x C + 1 920 3
0		0.1754 x C + 26 334		0.1635 x C + 5 157 3		0.1634 x C + 1 863 1
90	**45**	0.1345 x C + 8 733 7	**60**	0.1226 x C + 8 277 2	**75**	0.1196 x C + 7 381 5
80		0.1388 x C + 8 251 1		0.1249 x C + 8 082 9		0.1209 x C + 6 710 9
70		0.1422 x C + 9 036 8		0.1309 x C + 8 458 2		0.1246 x C + 8 789 5
60		0.1546 x C + 10 016		0.1423 x C + 8 435 2		0.1321 x C + 7 042 1
50		0.1659 x C + 10 65		0.153 x C + 9 0181		0.1384 x C + 8 055 4
40		0.1738 x C + 10 78		0.1621 x C + 10 12		0.1441 x C + 10 522
30		0.178 x C + 10 447		0.1675 x C + 10 799		0.1481 x C + 11 641
20		0.1702 x C + 14 751		0.1653 x C + 11 864		0.1571 x C + 11 423
10		0.1685 x C + 14 694		0.1709 x C + 14 974		0.1765 x C + 12 349
0		0.1978 x C + 15 457		0.2039 x C + 16 436		0.2102 x C + 13 41
90	**90**	0.1207 x C + 6 902 2	**105**	0.1235 x C + 7 635 5	**120**	0.1288 x C + 8 271 8
80		0.1169 x C + 6 043		0.1197 x C + 7 085 7		0.1261 x C + 6 754 3
70		0.1164 x C + 6 526 7		0.1203 x C + 6 225 7		0.1245 x C + 7 259 1
60		0.1226 x C + 7 913 5		0.1266 x C + 6 626 6		0.1275 x C + 8 666 9
50		0.1323 x C + 8 252 5		0.1362 x C + 6 930 3		0.1357 x C + 8 860 4
40		0.1418 x C + 8 534 4		0.1461 x C + 7 200 3		0.145 x C + 8 915 4
30		0.1475 x C + 8 800 7		0.1522 x C + 7 401 3		0.151 x C + 9 025 2
20		0.1576 x C + 9 453 3		0.1632 x C + 7 838 1		0.162 x C + 9 401 3
10		0.1796 x C + 11 317		0.1873 x C + 9 042 5		0.1862 x C + 10 804
0		0.2125 x C + 13 609		0.2218 x C + 10 794		0.2203 x C + 13 024
90	**135**	0.1384 x C + 8 449 9	**150**	0.1458 x C + 8 803 4	**165**	0.151 x C + 9 054 6
80		0.1328 x C + 7 806		0.1393 x C + 8 430 1		0.1446 x C + 8 252
70		0.1325 x C + 7 377 6		0.1384 x C + 8 037 1		0.1415 x C + 8 247 5
60		0.1353 x C + 7 93 76		0.139 x C + 8 460 1		0.1408 x C + 8 658 6
50		0.1411 x C + 8 516 4		0.1429 x C + 9 181 6		0.1447 x C + 9 179 2
40		0.1485 x C + 9 111 8		0.149 x C + 9 932 8		0.1512 x C + 9 83
30		0.1536 x C + 9 514 2		0.1537 x C + 10 41		0.1561 x C + 10 288
20		0.1635 x C + 10 286		0.1632 x C + 11 271		0.1661 x C + 11 164
10		0.1871 x C + 12 058		0.187 x C + 13 127		0.1906 x C + 13 106
0		0.2221 x C + 14 23		0.222 x C + 15 467		0.2262 x C + 15 31
90	**180**	0.1523 x C + 8 866 7				
80		0.146 x C + 8 137 6				
70		0.1391 x C + 8 870 4				
60		0.1372 x C + 9 511 5				
50		0.1429 x C + 9 733 1				
40		0.1512 x C + 10 064				
30		0.157 x C + 10 35				
20		0.1681 x C + 10 984				
10		0.1937 x C + 12 646				
0		0.2292 x C + 14 831				

Annex C
(informative)

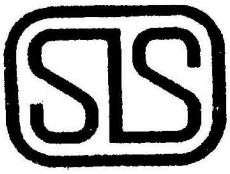
Tabular history of headform H, 565 mm and dimension Y

Size ins	Circ ins	Circ mm	Rounded	Y ins	Circ mm	Circ ins	Code	Circ mm	Code	Circ mm	Code	Y mm	Y ins	Code	Y mm
TRRL	**TRRL**	**TRRL**	**TRRL**	**TRRL**	**BS 1869**	**BS 1869**	**BS 1869**	**R 1511**	**DIS6220**	**DIS6220**	**EN 960**	**EN 960**	**EN 960**	**EN 960**	**EN 960**
(1950s)	**(1950s)**	**(1950s)**	**(1950s)**	**(1950s)**	**(1960)**	**(1960)**	**(1960)**	**(1970)**	**(1983)**	**(1983)**	**(1994)**	**(1994)**	**(1944)**	**(2006)**	**(2006)**
						and	and		and	and					
														445	81.7
						R 1511	**R 1511**		**EN 960**	**EN 960**				445	83.3
						(1970)	(1970)		(1994)	(1994)				465	84.8
														475	86.4
6 1/8	19 2/8	489	490	3.53										485	88.0
6 2/8	19 5/8	499	500	3.59	498	19 5/8	A	500	A	500	A	89.7	3.53	495	89.7
6 3/8	20	509	510	3.65	508	20	B	510	B	510	B	91.2	3.59	505	91.2
6 4/8	20 3/8	519	520	3.72	518	20 3/8	C	520	C	520	C	93.0	3.66	515	92.7
6 5/8	20 7/8	529	530	3.78	527	20 6/8	D	530	D	530	D	94.5	3.72	525	94.5
6 6/8	21 2/8	539	540	3.84	537	21 1/8	E	540	E	540	E	96.0	3.78	535	96.0
6 7/8	21 5/8	549	550	3.90	546	21 4/8	F	550	F	550	F	97.5	3.84	545	97.5
7	22	559	560	3.97	556	21 7/8	G	560	G	560	G	99.0	3.90	555	99.1
					565	22 2/8	H	565						565	100.8
7 1/8	22 3/8	569	570	4.03	575	22 5/8	J	570	J	570	J	102.5	4.04	575	102.4
7 2/8	22 6/8	579	580	4.09	584	23	K	580	K	580	K	104.0	4.09	585	103.9
7 3/8	23 1/8	588	590	4.15	594	23 3/8	L	590	L	590	L	105.4	4.15	595	105.4
7 4/8	23 4/8	598	600	4.22	603	23 6/8	M	600	M	600	M	107.0	4.21	605	107.2
7 5/8	24	608	610	4.28	613	24 1/8	N	610	N	610	N	108.7	44.28	615	108.7
7 6/8	24 3/8	618	620	4.34	622	24 4/8	O	620	O	620	O	110.0	4.33	625	110.2
7 7/8	24 6/8	628	630	4.40	632	24 7/8	P	630	P	630	P	111.8	4.40	635	111.8
8	25 1/8	638	640	4.47	641	25 2/8	Q	640	Q	640	Q	113.5	4.47	645	113.5

SLS CERTIFICATION MARK

The Sri Lanka Standards Institution is the owner of the registered certification mark shown below. Beneath the mark, the number of the Sri Lanka Standard relevant to the product is indicated. This mark may be used only by those who have obtained permits under the SLS certification marks scheme. The presence of this mark on or in relation to a product conveys the assurance that they have been produced to comply with the requirements of the relevant Sri Lanka Standard under a well designed system of quality control inspection and testing operated by the manufacturer and supervised by the SLSI *which includes surveillance inspection of the factory, testing of both factory and market samples.*

Further particulars of the terms and conditions of the permit may be obtained from the Sri *Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.*



Printed at SLSI (Printing Unit)

SRI LANKA STANDARDS INSTITUTION

The Sri Lanka Standards Institution (SLSI) is the National Standards Organization of Sri Lanka established under the Sri Lanka Standards Institution Act No. 6 of 1984 which repealed and replaced the Bureau of Ceylon Standards Act No. 38 of 1964. The Institution functions under the Ministry of Science & Technology.

The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

The Institution is financed by Government grants, and by the income from the sale of its publications and other services offered for Industry and Business Sector. Financial and administrative control is vested in a Council appointed in accordance with the provisions of the Act.

The development and formulation of National Standards is carried out by Technical Experts and representatives of other interest groups, assisted by the permanent officers of the Institution. These Technical Committees are appointed under the purview of the Sectoral Committees which in turn are appointed by the Council. The Sectoral Committees give the final Technical approval for the Draft National Standards prior to the approval by the Council of the SLSI.

All members of the Technical and Sectoral Committees render their services in an honorary capacity. In this process the Institution endeavours to ensure adequate representation of all view points.

In the International field the Institution represents Sri Lanka in the International Organization for Standardization (ISO), and participates in such fields of standardization as are of special interest to Sri Lanka.

Printed at the Sri Lanka Standards Institution, 17, Victoria Place, Elvitigala Mawatha, Colombo 08.