



## Standard Specification for Eye and Face Protective Equipment for Hockey Players<sup>1</sup>

This standard is issued under the fixed designation F513; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification covers performance requirements and test methods for face protectors marketed, sold, and intended for ice hockey.

1.2 The intent of this specification is to reduce the risk of injury to the face without compromising the form or appeal of the game. To do so, the face protector shall be used:

1.2.1 As intended within the rules of the game and

1.2.2 In accordance with the manufacturer's instructions.

1.3 Ice hockey is a sport with intrinsic hazards associated with the normal conduct of the game. Participation in ice hockey implies the acceptance of some risk of injury. Use of a face protector certified to this specification will not prevent all injuries.

1.4 This specification has been prepared after careful consideration of the frequency and mechanisms associated with facial and eye injuries that can potentially occur within the rules of the game of ice hockey.

1.5 Requirements and the corresponding test methods, where appropriate, are given for the following:

1.5.1 Construction,

1.5.2 Puck impact resistance,

1.5.3 Penetration,

1.5.4 Field of vision, and

1.5.5 Marking and information.

1.6 Face protection is intended for use by players, goalkeepers, and certain functionaries (for example, referees and coaches). Types of protectors considered under this specification are:

1.6.1 *Type B1*—A full-face protector intended for use by persons older than ten years of age, other than goaltenders;

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F08 on Sports Equipment, Playing Surfaces, and Facilities and is the direct responsibility of Subcommittee F08.15 on Ice Hockey.

Current edition approved April 1, 2018; June 15, 2022. Published May 2018; July 2022. Originally approved in 1977. Last previous edition approved in 2012 as F513—12; F513 – 12 (2018). DOI: 10.1520/F0513-12R18; 10.1520/F0513-22.

1.6.2 *Type B2*—A full-face protector intended for use by persons ten years of age or younger, other than goaltenders; and

1.6.3 *Type C (Visor)*—A visor intended for use by person in the junior age category and older, other than goaltenders.

1.7 *Units*—The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.8 Use of the singular does not exclude the plural (and vice versa) when the sense allows.

1.9 Although the intended primary application of this specification is stated in this scope, note that it remains the responsibility of the users of this specification to judge its suitability for their particular purpose.

1.10 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.11 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[D1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics](#)

[D2240 Test Method for Rubber Property—Durometer Hardness](#)

2.2 *CSA Standard:*

[CSA ~~Z262.6-02~~Z262.6-14 Specifications for Facially Featured Headforms](#)<sup>3</sup>

## 3. Terminology

3.1 For the purposes of this specification, the following definitions apply.

3.2 *Definitions:*

3.1.1 For the purposes of this specification, the following definitions apply.

3.2.1 *chip, n*—readily visible particle missing from the protector with an area bigger than 9 mm<sup>2</sup>.

3.2.2 *collimated light source (source of illumination), n*—quartz halogen lamp (17 lx or 1.58 footcandles) producing a 100-mm beam at 6-m distance that is centered on the pupils of the eyes of the headform or the midpoint between the pupils of the eyes of the headform; this centering is maintained at all times during the optical quality test.

3.2.3 *combination, n*—combined unit of a full-face protector or visor placed on a hockey helmet with which it is designed to be used.

3.2.4 *computer interface, n*—linkage between the computer, the goniometer, and the sensors that enables a fully automated measurement process via a menu-driven operation during the optical quality test.

3.2.5 *dioptr, n*—measure of the power of a lens or a prism equal to the reciprocal of its focal length expressed in metres.

3.2.6 *field of vision, n*—projection outward of all retinal points (the nervous layer of the eye) at which visual sensations can be initiated (see Fig. 1).

3.2.6.1 *inferior (downward), adv*—refers to an angle in the vertical plane measured downwards from the horizontal.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from the Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario L4W 5N6 Canada.

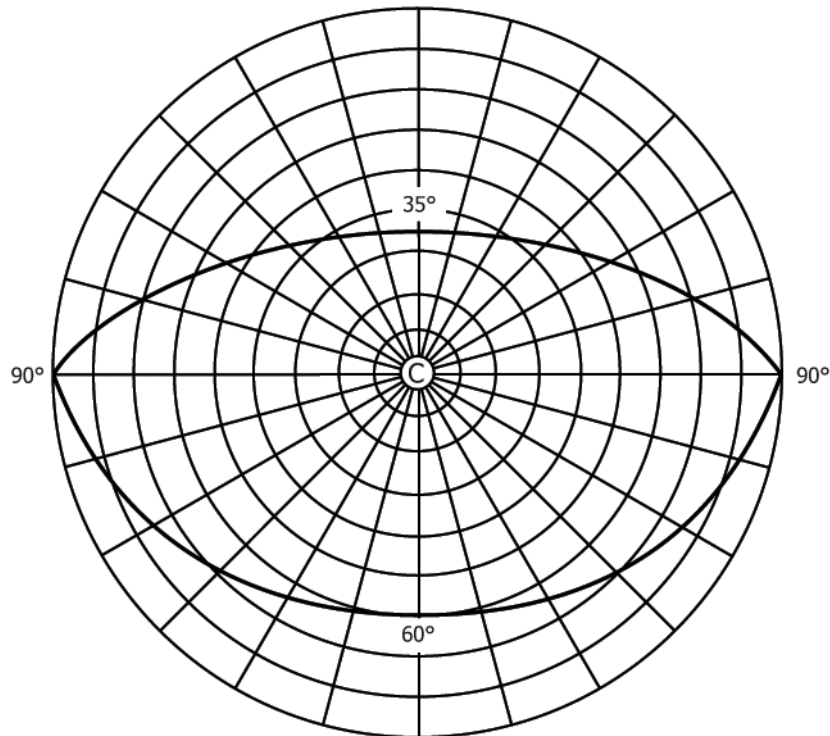


FIG. 1 Peripheral Field of Vision

3.2.6.2 *nasally, adv*—refers to an angle in the horizontal plane measured from the primary position of gaze to the left for the right eye and from the primary position of gaze to the right for the left eye.

3.2.6.3 *superior (upward), adv*—refers to an angle in the vertical plane measured upwards from the horizontal.

3.2.6.4 *temporally, adv*—refers to an angle in the horizontal plane measured from the primary position of gaze to the right for the right eye and from the primary position of gaze to the left for the left eye.

3.2.7 *glabella, n*—most prominent midline point between the eyebrows identical to the bony glabella of the frontal bone.

3.2.8 *goniometer, n*—positioning device that moves the headform such that the angular rotation and movement in both the horizontal and vertical directions enables a spherical scan to be made of the fields of vision as seen through a face protector or visor.

3.2.9 *haze, n*—percentage of transmitted light that, in passing through the specimen, deviates from the incident beam by forward scattering.

3.2.10 *helmet positioning index, HPI, n*—vertical distance measured at the median plane, from the front edge of the helmet to the basic plane, when the helmet is placed on the reference headform.

3.2.11 *impact sites for testing face protectors:—*

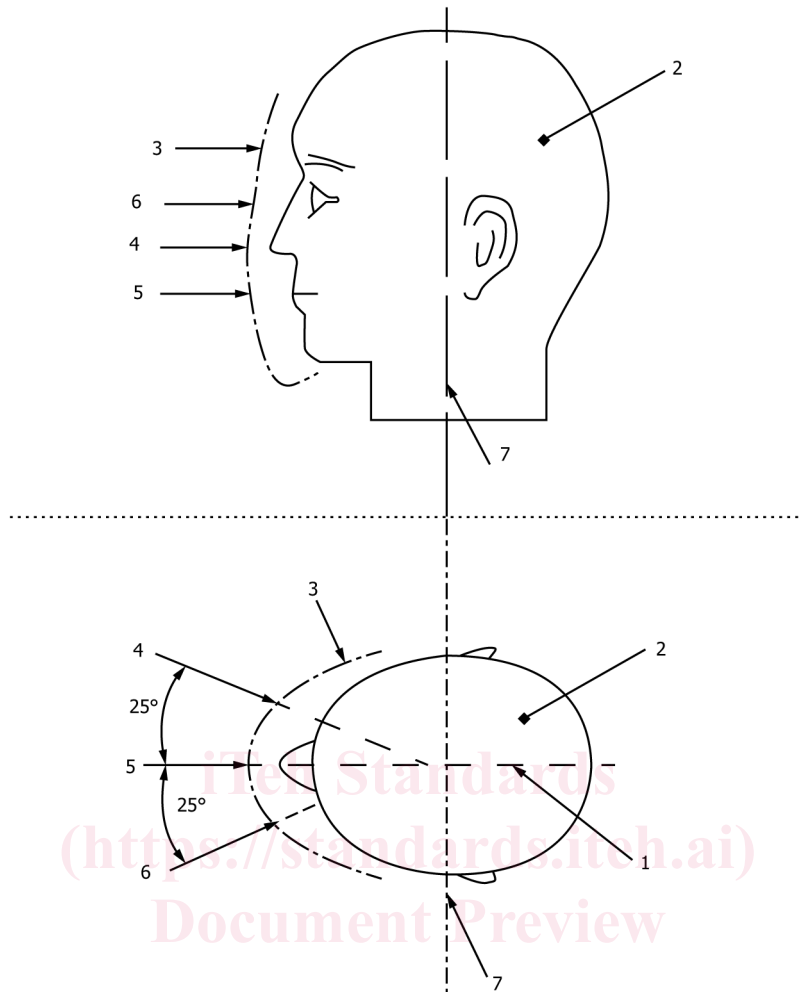
3.2.11.1 *eye impact, n*—point in the horizontal plane 25° to the median plane and in the direction of the eye (see Fig. 2).

3.2.11.2 *mouth impact, n*—point in the intersection between the horizontal plane and the median plane in the direction of the center of the mouth.

3.2.11.3 *side impact, n*—point halfway between the mouth level and the eye level in the horizontal plane, 25° to the median plane, and in the direction of the axis formed by the intersection of the median plane and the frontal plane (see Fig. 2).

3.2.12 *interpupillary distance, PD, n*—distance in millimetres between the centers of the pupils of both eyes on the facially featured headform.

3.2.13 *laser, n*—luminous device used for alignment of the sensors.



- Key
- |                  |                 |
|------------------|-----------------|
| 1 Median plane   | 5 Mouth impact  |
| 2 Headform       | 6 Eye impact    |
| 3 Face protector | 7 Frontal plane |
| 4 Side impact    |                 |

FIG. 2 Puck Impact Sites for Testing Face Protectors

3.2.14 *luminous transmittance, n*—ratio of the light transmitted by a medium to the incident light.

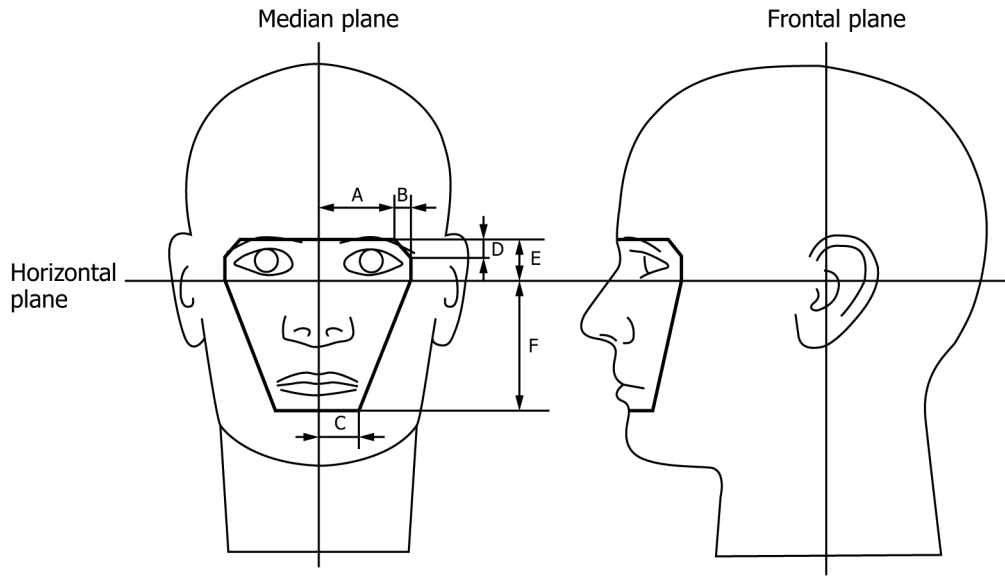
3.2.15 *menton, n*—lowest point on the mandibular symphysis.

3.2.16 *no-contact zone, n*—designated zone of the headform in which contact is not permitted during the puck impact resistance test (see 4.84.7 and Fig. 3).

3.2.17 *optical clarity, n*—sharpness of an image.

3.2.18 *optical quality field-of-vision area, n*—that area on a transparent face protector or visor determined by the outline of a cone whose axis projects along the primary position of the gaze and extends 35° (radius of fixation), the apex of the cone is centered on each pupil, and the area generated by each cone is joined above and below and is extended to a point 90° laterally to each side in the horizontal plane (see Fig. A1.1).

3.2.19 *orbit, n*—the bony cavity containing the eyeball.



Facially Featured Headform (according to CSA Z262.6-02/Z262.6-14)	Dimensions (mm)					
	A	B	C	D	E	F
Adult Male (50th Percentile)	48	16	28	17	36	68
Juvenile Male (50th Percentile)	60	0	25	0	36	60
Child (50th Percentile)	55	0	23	0	35	55

FIG. 3 No-Contact Zone (Projected Dimensions)

3.2.20 *orbitale, n*—lowermost point on the inferior margin of the orbit (infraorbital margin).

3.2.21 *peripheral field of vision, n*—oval-shaped field extending 90° temporally, 60° inferiorly, 45° nasally, and 35° superiorly (see Fig. 1).

3.2.22 *permanent, n*—information that remains legible and cannot be removed in its entirety under conditions of normal use.

3.2.23 *photosensors, n*—sensors 5 mm in diameter centered in the pupils of the headform covered by a 5-mm translucent lens of 8-mm radius of curvature, convex forward.

3.2.23.1 *Discussion*—

(1) The photosensors are cosine corrected, for example, provided with diffusing covers that are a means of correcting the light-sensitive surface for wide angles of incidence. (2) Light contact with the sensors produces an electrical signal that is fed into a computer interface.

3.2.24 *planes:*

3.2.24.1 *basic plane of a headform, n*—plane relative to the headform that corresponds to the basic plane of the human head.

3.2.24.2 *basic plane of the human head, n*—plane that is located at the level of the external upper borders of the ear canal (external auditory meatus) and the inferior margins of the orbits of the eyes.

3.2.24.3 *frontal plane, n*—vertical plane that is perpendicular to the median and reference planes and passes through the top of the headform (see Fig. 4).

3.2.24.4 *horizontal plane, n*—plane that passes across the head at right angles to both the frontal and median plane (see Fig. 4).

3.2.24.5 *median plane, n*—vertical plane that passes through the headform from front to back and divides the headform into right and left halves (see Fig. 4).

3.2.24.6 *reference plane, n*—construction plane parallel to the basic plane of the headform at a distance from it which is a function of the size of the headform.

3.2.25 *porion, n*—highest point on the upper margin of the cutaneous, external auditory meatus.

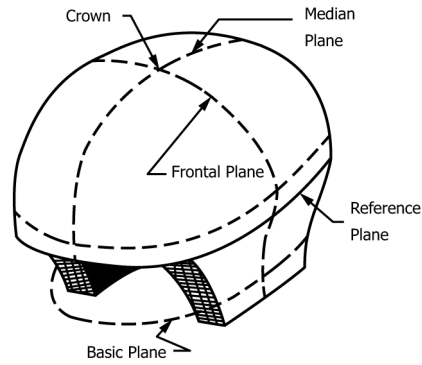


FIG. 4 Orientation Planes

3.2.26 *primary position of gaze, n*—line running forward from the center of the pupil parallel to the median and horizontal planes (see Fig. 4).

3.2.27 *prism dioptre, n*—unit used in measuring the deviating power of a prism; this power in prism dioptres is 100 times the tangent of the angle of deviation of a ray of light.

3.2.28 *prism imbalance, n*—light passing through a lens and entering the one eye is deviated by an amount differing in direction from the same light passing through the lens and entering the fellow eye.

3.2.29 *protector, n*—comprises a face protector either specially adapted to the helmet or forming a continuous unit designed to protect the whole or parts of the wearer's head and face against injury.

3.2.29.1 *full-face protector, n*—device intended to reduce the risk of injury to the eyes and face of ice hockey participants.

3.2.29.2 *visor, n*—device intended to reduce the risk of injury to the eyes of ice hockey participants.

3.2.30 *resolution, n*—ability of an optical system to distinguish two points at their minimum separation.

3.2.31 *scan area, n*—oval, peripheral fields area specified by superior, temporal, inferior, and nasal directions.

3.1.33 *scotoma, n*—blind spot in the field of vision.

3.2.32 *subnasale, Sn, n*—deepest point on the concavity of the anterior surface of the maxilla in the midline within 3.0 mm of the floor of the nose (see Fig. 5).

3.2.33 *threshold value, n*—output reading obtained when the columnated light beam has been centered on the midpoint between the pupils in the primary position of gaze and the headform is rotated 90° in the horizontal plane and the collimated light source contacts the pupillary sensor closest to the light source.

3.2.34 *vertex, n*—point of intersection on the headform of the median plane with the frontal plane (see Fig. 4).

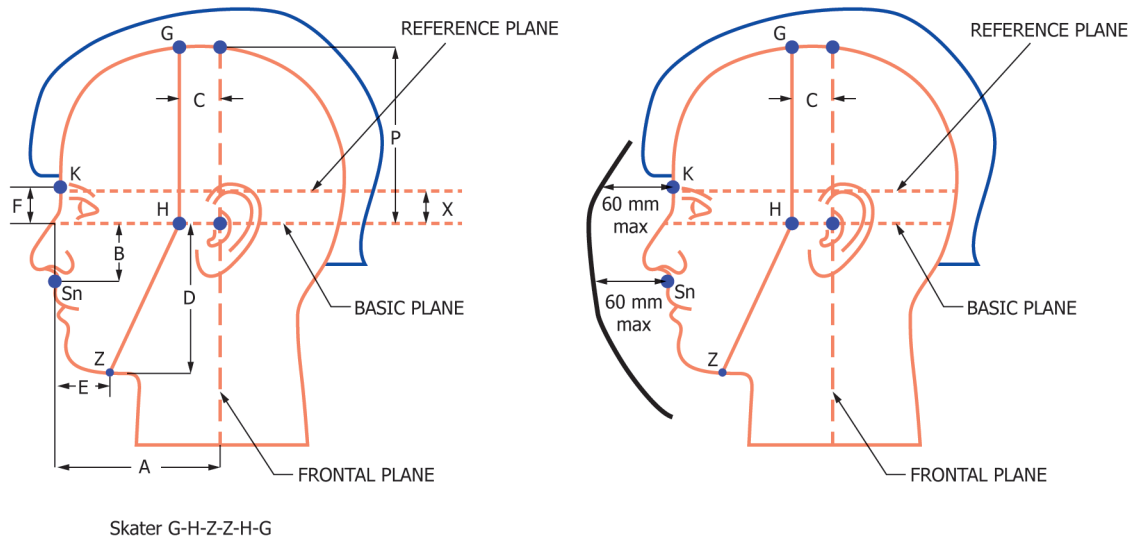
## 4. Requirements

### 4.1 Materials:

4.1.1 *Documentation*—The manufacturer shall provide written documentation indicating that the materials used in the construction of the face protector fulfill the requirements of 4.1.2 – 4.1.6.

4.1.2 *Cleaners*—All materials used shall be known not to be adversely affected by ordinary household soap and cleaners as recommended by the manufacturer.

4.1.3 *Finishes*—Paints, glues, and finishes used in manufacturing shall be compatible with the materials used in the construction of the head and face protector.



Facially-featured Headform (according to CSA Z262.6-02/Z262.6-14)	Dimensions (mm)							
	A	B	C	D	E	F	P	X
Adult Male (50th Percentile)	100.8	34	25.4	100.5	25	32	130	27.5
Juvenile Male (50th Percentile)	94.3	28	25.4	90	21	31	120	25.5
Child (50th Percentile)	91.1	22.5	25.4	79.5	21	21	102	24.5

FIG. 5 Definition of Protected Area for Full-Face Protector (Side View)

4.1.4 *Nonirritants*—Material coming in contact with the wearer’s head shall not be of any type known to cause skin irritation or disease or undergo significant loss of strength, flexibility, or other physical changes as a result of contact with perspiration, oil, or grease from the wearer’s head.

4.1.5 *Adhesives*—Adhesive material used to attach padding or straps to the face protector or visor shall be of a formulation that will not alter the chemical or physical properties of the materials to an extent so as to reduce their protective qualities.

4.1.6 *Polymeric Changes*—All materials used in the construction of the face protector shall be resistant to irreversible polymeric changes when exposed to temperatures up to 70°C or ultraviolet radiation.

4.2 *Finish*—All parts shall be well finished and free of sharp edges and other irregularities that would present a potential hazard to the user or other players.

4.3 *Attachment System*—The attachment system of a face protector to a helmet shall be so designed so that the face protector can be easily attached to the helmet without requiring any machining operation by the user.

4.4 *Mass Restriction (Type B2 Only)*—Helmet and Type B2 face protector combinations that, according to manufacturer’s recommendations, fit headforms Size E or smaller shall have a mass no greater than 900 g.

4.5 *Optical Quality:*

4.5.1 *Visual Inspection:*

4.5.1.1 The following is a list of matters for which the face protector will be subjectively inspected in a visual and tactile fashion within the field of vision:

- (1) Localized power errors;
- (2) Aberrations caused by waves, warpage, and so forth; and
- (3) Lens defects such as scratches, greyness, bubbles, cracks, watermarks, and so forth.

4.5.1.2 If any of the above deficiencies are present, no further testing shall be conducted and the product is failed.

#### 4.5.2 Test Requirements:

4.5.2.1 When testing in accordance with 5.5 at  $20 \pm 2^\circ\text{C}$ , face protectors shall:

NOTE 1—Items (1) to (4) apply for materials you have to look through only.

- (1) Possess adequate definition to permit resolution of the 240-s ring;
- (2) Have a luminous transmittance of not less than 80 % and face protectors specifically identified as being tinted or intended for filtering by the manufacturer shall have a minimum luminous transmittance of 20 %;
- (3) Have a prism imbalance not exceeding 0.5 prism dioptre; for two eyes, the prism imbalance test allows a total of up to 1.0 prism dioptre of prismatic deviation;
- (4) Have a haze reading that does not exceed 3 %; and
- (5) Have no occultation in the field of vision as indicated in Fig. 1.

~~4.6 Scotomas—When tested in accordance with 5.5.2, there shall be no overlapping bilateral scotomas in the peripheral field of vision.~~

#### 4.6 Penetration (Test Blade):

4.6.1 Types B1, B2, and C—With the exception of the ear apertures, there shall be no contact with the bare headform by the test blade within the protected areas when testing in accordance with 5.6.

#### 4.7 Puck Impact Resistance:

4.7.1 Types B1, B2—With the exception of the toughness test, neither the protector nor the puck shall touch the facially featured headform within the no-contact zone (Fig. 3) when tested in accordance with 5.7. The shock-absorbing material at the load-bearing area shall remain securely attached to the face protector. There shall be no breakage of the structural components of the face protector or failure of the face protector's points of attachment to the helmet. Cracking of surface coatings is permissible but chips (see 3.1.23.2.1) are not permitted.

4.7.2 Type C—With the exception of the toughness test, neither the visor nor the puck shall touch the facially featured headform when tested in accordance with 5.7. There shall be no chips, cracking, or breakage of the eye protector or failure of the face protector's points of attachment to the helmet or separation of the eye protector from the helmet.

#### 4.8 Design:

##### 4.8.1 Types B1, B2:

4.8.1.1 Maximum Distance—The distance measured on the median plane and parallel to the basic plane between the inside of the face protector and Points K and Sn on the facially featured headform shall not exceed 60 mm (see Fig. 5).

4.8.1.2 Overlap—Face protectors shall overlap the lower edge of the helmet (forehead area) by at least 6 mm.

4.8.1.3 Padding Area—The face protector shall have a padded load-bearing area with a minimum area as shown in Fig. 6.

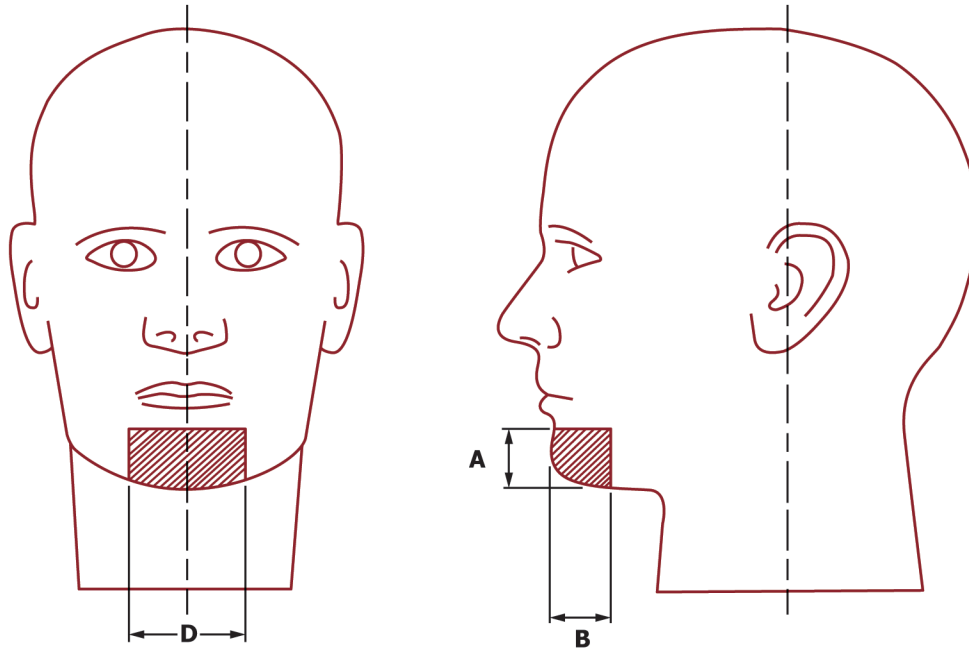
4.8.1.4 Minimum Distance—Except where it is covered by padding, no part of the face protector shall be closer than 10 mm to the surface of the facially featured headform.

##### 4.8.2 Type C:

4.8.2.1 Maximum Distance (Headform to Eye Protector)—The distance measured on the median plane, parallel to the basic plane from the headform between the inside of the eye protector and Points K and Sn on the facially featured headform shall not exceed 60 mm (see Fig. 7).

4.8.2.2 Overlap—The eye protector shall overlap the lower edge of the helmet (forehead area) by at least 6 mm.





Facially-featured Headform (according to CSA Z262.6-02/Z262.6-14)	Dimensions (mm)		
	D	A	B
Adult Male (50th Percentile)	53	18-27	18
Juvenile Male (50th Percentile)	48	15-24	15
Child (50th Percentile)	42	15-24	15

FIG. 6 Minimum Load-Bearing Area

4.8.2.3 *Maximum Distance (Helmet to Eye Protector)*—The maximum distance between the helmet and the eye protector shall not exceed 20 mm.

4.9 *Protected Area of Coverage:*

4.9.1 *Type B1 and B2—Full-Face Protectors:*

4.9.1.1 The area protected by the face protector and helmet combination shall extend laterally and vertically around the headform at least to the Line GHZZHG in Fig. 5, as seen from the side, when the face protector is assembled and mounted on the appropriate helmet in accordance with the manufacturer’s instructions and when placed on a facially featured headform as described in 5.4.3.

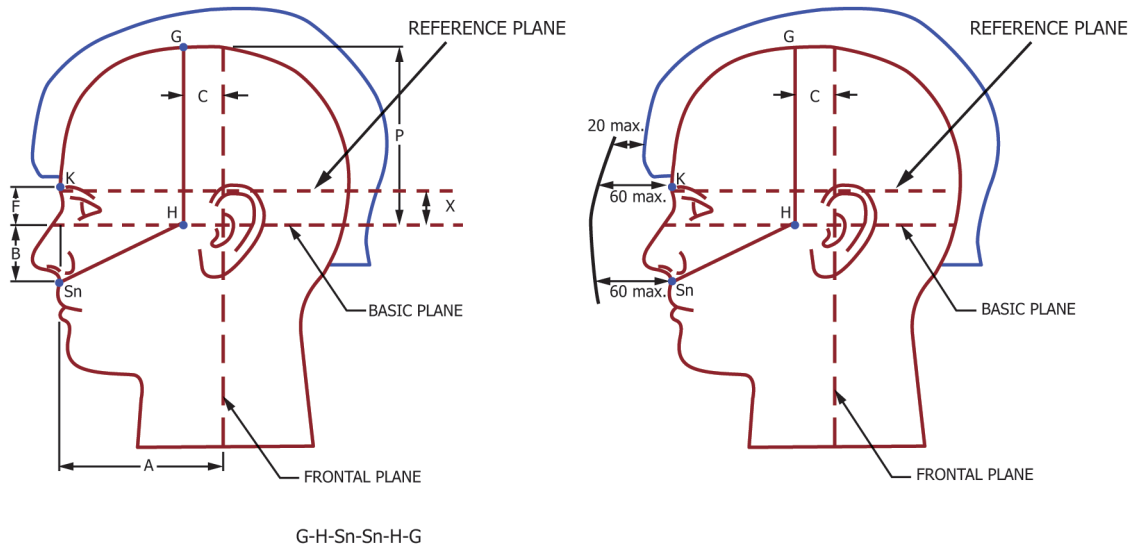
4.9.1.2 Where the helmet provides protection in front of the Line GHZZHG, the face protector need not extend back to the GHZZHG line provided the face protector overlaps the helmet by at least 6 mm as seen from the side.

4.9.2 *Type C—Visors*—The area protected by the visor and the helmet combination shall extend laterally and vertically around the headform at least to the Line GHSnSnHG in Fig. 7, as seen from the side when the eye protector is assembled, mounted on the appropriate helmet in accordance with the manufacturer’s instructions, and placed on a facially featured headform as described in 5.4.2. Where the helmet provides protection in front of the Line GHSn, the visor need not extend back to the GHSn line, provided the visor overlaps the helmet by at least 6 mm when viewed from the side.

5. Test Methods

5.1 *Sampling:*

5.1.1 *Types*—Only new, full-face protectors and visors as offered for sale shall be tested. The helmets shall be inspected visually and by hand before conditioning.



Facially-featured Headform (according to CSA Z262.6-02/Z262.6-14)	Dimensions (mm)					
	A	B	C	F	P	X
Adult Male (50th Percentile)	100.8	34	25.4	32	129.9	27.5
Juvenile Male (50th Percentile)	94.3	28	25.4	31	121.5	25.5
Child (50th Percentile)	91.1	22.5	25.4	21	102	24.5

Head Circumferences	Dimensions (mm)
Adult Male (50th Percentile)	575
Juvenile Male (50th Percentile)	535
Child (50th Percentile)	515
For References Only	

FIG. 7 Definition of Protected Area for Visors (Side View)

5.1.2 *Documentation*—Verify that the manufacturer shall provide written documentation indicating that the materials used in the construction of the helmet and face protector fulfill the general requirements in 4.1.2 – 4.1.6.

5.1.3 *Face Protectors*—Face protectors shall be assembled and mounted on the appropriate helmets in accordance with the instructions of the manufacturer.

5.2 *Inspection and Determination of Mass (for Helmet/ B2 Face Protector Combinations Fitting Headforms Size E or Smaller)*—Determine the mass of the head protector/face protector combinations of the same model and size submitted for testing that are conditioned in accordance with 5.3.1. Calculate and record the mean value in grams rounded to the nearest 10 g.

5.3 *Conditioning:*

5.3.1 *Ambient Conditioning (for Contact Test)*—The sample shall be exposed to a temperature of  $(20 \pm 2)^\circ\text{C}$  and a relative humidity not exceeding 55 % for not less than 4 h.

5.3.2 *Low-Temperature Conditioning (for Toughness Test)*—The sample shall be exposed to a temperature of  $(-25 \pm 2)^\circ\text{C}$  for not less than 4 h. Testing shall begin within 40 s of removal from the refrigeration chamber.

5.3.3 *Testing Conditioned Face Protectors*—For 5.3.2, complete all testing within 5 min after removal of the face protector or visor from the conditioning environment. Face protectors or visors may be returned to the conditioning environment to meet this requirement. Before the resumption of testing, the face protector or visor shall remain in the conditioning environment for a minimum of 15 min for each 5-min period they are out of the conditioning environment.

5.4 *Positioning:*

5.4.1 *Determination of Head-Positioning Index (HPI)*—The HPI and corresponding headform size shall be specified by the helmet manufacturer. If the HPI and corresponding headform size is not available from the manufacturer, the helmet-face protector combination shall not be tested.

5.4.2 *Positioning of Helmets with Visors*—Adjust and position the helmet on the largest headform for the helmet’s size range using the HPI.

5.5 *Determination of Vision Quality for Face Protectors:*

5.5.1 *Peripheral Fields of Vision*—Test in accordance with [Annex A2](#).

~~5.5.2 *Scotoma*—Test in accordance with [Annex A2](#).~~

5.5.2 *Optical Quality Field of Vision*—[Annex A1](#) provides the test method for the optical quality of eye protectors. Other test methods may be used provided that they give equivalent results.

5.6 *Determination of Penetration Characteristics:*

5.6.1 *Test Apparatus*—The apparatus consists of:

5.6.1.1 Facially featured headform in accordance with [5.7.1.4](#); and

5.6.1.2 Test blade in accordance with [Fig. 8](#), made of steel.

5.6.2 *Procedures:*

5.6.2.1 *Penetration Test—Types B1, B2*—Attempt to make contact with the headform in the protected area (see [Fig. 5](#)) by trying to enter, at any angle, any part of the test blade end, in principle without force, through all of the openings. Record whether contact with the bare headform surface is made.

5.6.2.2 *Penetration Test—Type C (Visors)*—Test visors within the area of coverage (see [Fig. 7](#)) from the front and side, and not from above or below by trying to enter, at any angle, any part of the test blade end, in principle without force, through all of the openings. Record whether contact with the bare headform surface is made.

5.7 *Face Protectors—Determination of Puck Impact Resistance:*

5.7.1 *Equipment:*

5.7.1.1 *Puck Accelerator*—A device (puck accelerator, see [Fig. 9](#)), which can give a hockey puck a specific velocity, direction, and with minimal rotation, shall be used. The velocity shall be variable between 10 and 36 m·s<sup>-1</sup> with an accuracy of ±1.0 m·s<sup>-1</sup>.

5.7.1.2 *Maximum Distance*—The puck shall be directed toward the impact site with as little rotation as possible. The distance between the impact site on the sample and the end of the guiding device shall not exceed 600 mm.

5.7.1.3 *Headform Base*—The test apparatus shall include a plain horizontal base for a facially-featured headform. The headform shall be aligned vertically on and attached to the plane horizontal base.

5.7.1.4 *Facially Featured Headform*—Facially featured headforms shall be in accordance with [CSA Z262.6-02:Z262.6-14](#). The largest facially featured headform that the protector being tested fits on shall be used.

5.7.1.5 *Puck*—The hockey puck shall be in accordance with [Annex A3](#).

5.7.1.6 *Velocity Measurement*—The velocity shall be measured no more than 600 mm from the site of impact. The equipment for measuring and recording the velocity of the puck shall be capable of measuring the velocity with a tolerance of ±1 %.