INTERNATIONAL STANDARD

ISO 10256-3

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Protective equipment for use in ice hockey —

Part 3: Face protectors for skaters

Équipements de protection destinés à être utilisés en hockey sur glace —

Partie 3: Protections faciales pour les skateurs

Reference number
ISO 10256-3:2016(E)

International Organization for Standardization

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 83, *Sports and other recreational facilities and equipment*, Subcommittee SC 5, *Ice hockey equipment and facilities*.

This first edition of ISO 10256-3, together with ISO 10256-1, ISO 10256-2, ISO 10256-4, ISO 10256-5, and ISO 10256-6 cancels and replaces the ISO 10256:2003, which has been technically revised.

ISO 10256 consists of the following parts, under the general title *Protective equipment for use in ice hockey*:

— *Part 1: General requirements*

— *Part 2: Head protection for skaters*

— *Part 3: Face protectors for skaters*

— *Part 4: Head and face protection for goalkeepers*

— *Part 5: Neck laceration protection for ice hockey players*

The following parts are under preparation:

— *Part 6: Lower leg protectors for ice hockey players*

Introduction

Ice hockey is a high speed, collision sport in which there is a risk of injury. The object of this part of ISO 10256 is to specify requirements for face protectors, taking into account the risks inherent in participating in the sport, many of which cannot be eliminated by protective equipment. By playing this sport, participants accept the risk of serious injury, paralysis, or death.

The intention of face protection is to reduce the frequency and severity of localized injuries to the head and that part of the face surrounded by the protector. The protective function is such that the force from impacts against the protector is distributed and dampened and the penetration of objects is counteracted.

Face protectors can consist of eye protectors (visors) or full face protectors. They are always worn in conjunction with an ice hockey helmet. Face protectors are tested and assessed together with the helmet or helmets for which the face protector is intended.

To achieve the performance of which it is capable, and to ensure stability on the head, a helmet and associated face protector is intended to be as closely fitting as possible consistent with comfort. In use it is essential that the helmet and associated face protector are securely fastened, with any chin strap or neck strap adjusted according to manufacturer's instructions.

Protective equipment for use in ice hockey —

Part 3:
Face protectors for skaters

1 Scope

This part of ISO 10256 specifies performance requirements and test methods for face protectors (including visors) for use in ice hockey and is intended to be used in conjunction with ISO 10256-1.

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

a) construction and area of coverage;

b) resistance to puck impact;

c) penetration;

d) field of vision;

e) geometric (visual) optics and acuity;

f) transmittance and haze;

g) marking and information.

This part of ISO 10256 applies to face protectors worn by

— players other than goalkeepers, and

— certain functionaries (e.g. referees).

NOTE 1 The requirements of a Clause take precedent over a figure.

NOTE 2 The intent is to reduce the risk of injury to the face without compromising the form or appeal of the game.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10256-1:2016, *Protective equipment for use in ice hockey — Part 1: General requirements*

ISO 10256-2:2016, *Protective equipment for use in ice hockey — Part 2: Head protection for skaters*

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

ASTM D 1003, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*

CSA Z262.6-14, *Specifications for facially featured headforms*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
CIE standard illuminants
illuminants A and D65 defined by the CIE in terms of relative spectral power distributions

Note 1 to entry: See ISO 11664-2 developed with the International Commission on Illumination (CIE).

3.2
chin cup
protective component which covers the load bearing area

Note 1 to entry: As defined in Figure 5.

3.3
chip
readily visible particle missing from the protector with an area bigger than 9 mm^2

3.4
collimated light source
ratio of the visible light (380 nm to 780 nm) transmitted by a medium to the incident light

Note 1 to entry: As referenced to CIE Standard Illuminant A and a standard photopic observer.

3.5
combination
combined unit of a full-face protector or visor placed on a hockey helmet with which it is designed to be used

3.6
dioptre
unit of focusing power, expressed in reciprocal metres (m^{-1}), of a lens or surface, or of the vergence (refractive index divided by the radius) of a wavefront

3.7
face protector
protector, specially adapted to a helmet that is designed to protect the wearer's face against injury

3.7.1
full-face protector
device intended to reduce the risk of injury to the face of ice hockey participants

Note 1 to entry: As defined in 5.9.1.

3.7.2
visor
device intended to reduce the risk of injury to the eyes of ice hockey participants

Note 1 to entry: As defined in 5.9.2.

3.8
field of vision
<optical quality> extent of vision through the mounted protector in the "as worn" position measured with reference to the entrance pupil of the stationary eye when the protector is placed on the appropriate headform

Note 1 to entry: See Figure A.1.

3.9 field of vision directions

3.9.1
inferior
downward
angle in the vertical plane measured downwards from the horizontal

3.9.2
nasally
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

3.9.3
superior
upward
angle in the vertical plane measured upwards from the horizontal

3.9.4
temporally
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

3.10
fracture
full thickness crack, breaking, or complete separation of material

3.11
glabella
most prominent midline point between the eyebrows identical to the bony glabella of the frontal bone

3.12
goniometer
positioning device that moves the headform such that the angular rotation and movement in reference to the corneal eye point in both the horizontal and vertical directions can be recorded

3.13
haze
<wide angle scatter> percentage of transmitted light that, in passing through the specimen, deviates from the incident beam by forward scattering (total angle) as caused by imperfections in the ocular that reduce clarity of vision

3.14 impact sites for testing face protectors

3.14.1
impact site eye
point in the horizontal plane 25° from the median plane and in the direction of the eye

Note 1 to entry: See Figure 2.

3.14.2
impact site mouth
point in the intersection between the horizontal plane and the median plane in the direction of the center of the mouth in the horizontal plane

Note 1 to entry: See Figure 2.

3.14.3
impact site side
point halfway between the mouth level and the eye level in the horizontal plane, 25° from the median plane, and in the direction of the central vertical axis

Note 1 to entry: See Figure 2.

3.15
interpupillary distance
IPD
distance in millimetres between the centres of the pupils of both eyes on the facially featured headform

3.16
laser
visible coherent light source type which can be utilized as a collimated light source

3.17
luminous transmittance
ratio of the (visible) light transmitted by a medium to the (visible) incident light

3.18
menton
lowest point on the mandibular symphysis

3.19
no-contact zone
designated zone of the headform in which contact is not permitted during the puck impact resistance test

Note 1 to entry: See 5.8 and Figure 3.

3.20
optical clarity
sharpness of an image

3.21
orbitale
lower most point on the inferior margin of the orbit (infraorbital margin)

3.22
photosensor
sensor 5 mm in diameter centred in the pupils of the headform covered by a 5 mm translucent lens of 8 mm radius of curvature, convex forward

Note 1 to entry: 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. Light contact with the sensors produces an electrical signal that is fed into a computer interface.

3.23
primary position of gaze
PPG
line running forward from the centre of the pupils as forward looking parallel to the median and horizontal planes

3.24
prism dioptre
unit used in measuring the deviating power of a prism

Note 1 to entry: Power in prism dioptres is 100× the tangent of the angle of deviation of a ray of light.

3.25
prism imbalance
when the direction of light passing through a lens and entering one eye deviates from the direction of light passing through the lens and entering the other eye

3.26
puck accelerator
device which can give a hockey puck a specific velocity, direction, and with minimal rotation

Note 1 to entry: See Figure 7.

3.27
resolution
ability of an optical system to distinguish two points at their minimum separation

3.28
scan area
oval, peripheral fields area specified by superior, temporal, inferior, and nasal directions

3.29
subnasale
Sn
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

Note 1 to entry: See Figures 4 and 6.

3.30
threshold value
value obtained when the collimated 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

4 Types of face protectors

Type B1 — a full-face protector intended for use by persons other than goalkeepers.

Type B2 — a full-face protector intended for use by persons, other than goalkeepers 10 years of age or younger.

Type C — a protector that only covers the eyes (visor).

5 Requirements

5.1 Innocuousness

The manufacturer shall provide written documentation indicating that the materials used in the construction of the protector fulfil the requirements for innocuousness given in ISO 10256-1.

5.2 Ergonomics

Manufacturers shall provide documentation indicating that the protector shall meet the requirements for ergonomics given in ISO 10256-1.

5.3 Attachment

The protector shall be designed to allow it to be attached to the helmet without requiring the use of specialized tools.

5.4 Size and mass restriction (Type B2 only)

Type B2 protectors shall only be used with helmets intended to fit EN 960 headform sizes 535 and smaller and the mass of the helmet and face protector shall be no greater than 900 g.

5.5 Optical quality

5.5.1 Visual inspection

5.5.1.1 Lenses shall be visually inspected for the below listed defects within the optical field of view (see Figure 1) according to 6.6:

a) aberrations caused by waves, warpage, and so forth;

b) lens defects, such as scratches, greyness, bubbles, fractures, watermarks, and so forth.

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

5.5.2 Test requirements

When testing according to 6.6 under ambient conditions (see ISO 10256-1), face protectors, except for those with wire cages, shall:

a) have a minimum luminous transmittance of 80 % (clear);

b) be specifically identified by the manufacturer as being tinted or intended for filtering;

c) have a minimum luminous transmittance of 20 % throughout the lens area;

d) have a haze reading that does not exceed 3 %;

e) have no occultation in the field of vision as indicated in Figure 1;

f) meet the minimum optical requirements of Class 1 or 2 per Table 1.

Table 1 — Optical class limits

Class	Residual refractive power errors		Prismatic power error	Prismatic imbalance		Resolving power
	Sphere	Astigmatism		Vertical	Horizontal	
1	0,125	0,060	0,5	0,250	0,25 BI/0,75 BO	≥90°
2	0,125	0,125	0,5	0,250	0,25 BI/1,0 BO	≥120°

5.6 Field of vision

When tested under ambient conditions (see ISO 10256-1), the type C face protector shall not interfere with vision in the upward, down wards and horizontal directions as defined by the following angles:

a) upwards: 35°;

b) downwards: 60°;

c) horizontally: 90°.

NOTE Several methods exist for measuring visual interference.

5.7 Penetration (Test blade)

When tested according to 6.7, there shall be no contact with the bare headform by the test blade within the protected areas.

5.8 Puck impact resistance

5.8.1 Types B1, B2

5.8.1.1 Contact test

When tested according to 6.8:

a) neither the protector nor the puck shall touch the facially featured headform within the no-contact zone (see Figure 3);

b) the shock-absorbing material at the load-bearing area shall remain securely attached to the face protector;

c) there shall be no:

1) breakage of the structural components of the face protector;

2) chips (fracturing of surface coatings may be present);

3) failure of the protector's points of attachment to the helmet.

5.8.1.2 Toughness test

When tested according to 6.8, there shall be no:

a) wire breakage;

b) fracturing;

c) weld separations on the perimeter of the protector or at the ends of wires where they meet each other, in the case of welded wire protectors.

5.8.2 Type C

5.8.2.1 Contact test

When tested according to 6.8:

a) neither the visor nor the puck shall touch the facially featured headform within the no-contact zone (see Figure 3);

b) there shall be no:

1) breakage, fracturing, or chips of the eye protector;

2) separation of the eye protector from the helmet;

3) failure of the protector's points of attachment to the helmet.

5.8.2.2 Toughness test

When tested according to 6.8, there shall be no:

a) clear visor breakage and, in the case of a wire visor, wire breakage;

b) fracturing;

c) weld separations on the perimeter of the protector or at the ends of wires where they meet each other, in the case of welded wire protectors.

5.9 Design

5.9.1 Types B1, B2

5.9.1.1 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 Figure 4).

5.9.1.2 Overlap

The face protector shall overlap the lower edge of the helmet (forehead area) by at least 6 mm in the horizontal plane.

5.9.1.3 Padding area

The face protector shall have a padded load-bearing area with a minimum area as shown in Figure 5.

5.9.1.4 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.

5.9.2 Type C

5.9.2.1 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 Figure 6).

5.9.2.2 Overlap

The eye protector shall overlap the lower edge of the helmet (forehead area) by at least 6 mm in the horizontal plane.

5.9.2.3 Maximum distance (helmet to eye protector)

The maximum distance between the helmet and the eye protector shall not exceed 20 mm.

5.10 Protected area

5.10.1 Type B1 and B2 — Full-face protectors

The area protected by the face protector and helmet combination shall extend laterally and vertically around the headform at least to the continuous Line GHZ and ZHG (not shown) in Figure 4, as viewed perpendicular to the median plane, when the face protector is assembled and mounted on the appropriate helmet according to the manufacturer's instructions and when placed on a facially featured headform as described in 6.5.2.

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 viewed perpendicular to the median plane.

5.10.2 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 continuous Line GHSn and SnHG (not shown) in Figure 6, as viewed perpendicular to the median plane when the eye protector is assembled, mounted on the appropriate helmet according to the manufacturer's instructions, and placed on a facially featured headform as described in 6.5.3.

Where the helmet provides protection in front of the Line GHSnSnHG, the visor need not extend back to the GHSn line, provided the visor overlaps the helmet by at least 6 mm when viewed perpendicular to the median plane.

6 Test methods

6.1 Sampling

6.1.1 Types

Only new, face protectors as offered for sale shall be tested.

6.1.2 Quantity

The number of samples for testing and assessment of face protectors of a given type is provided in Table 2. The sample numbers corresponding to those given in Table 2 shall be of the same size and model.

Face protectors shall be new and assembled and mounted on the appropriate helmets according to the face protector manufacturer's instructions.

6.1.3 Face-protector/helmet combination

If the face protector is intended to fit several models of helmets, one such combination shall be tested completely. The other combinations shall be tested according to 5.6, 5.8.1.1 or 5.8.2.1, 5.9 and 5.10.

6.2 Tolerances

Unless otherwise specified, all tolerances are according to ISO 10256-1.

6.3 Inspection and determination of mass (for helmet/B2 face protector combinations fitting EN 960 headform size 535 or smaller)

Determine the mass of the head protector/face protector combinations of the same model and size submitted for testing that are conditioned under ambient temperature according to ISO 10256-1. Calculate and record the mean value in grams rounded to the nearest 10 g.

6.4 Conditioning

Only face protector samples shall be conditioned under ambient and low temperatures in according to ISO 10256-1:2016, 7.1 and ISO 10256-1:2016, 7.2.

6.5 Positioning

6.5.1 Determination of helmet-positioning index (HPI)

The HPI and corresponding helmet size shall be provided by the helmet manufacturer. The testing laboratory then selects the headform that is appropriate to that size range. Where the HPI and corresponding helmet size range are not available from the manufacturer, the helmet shall not be tested.

6.5.2 Positioning of helmets with full face protectors

6.5.2.1 General

The protector shall be positioned on the largest headform for its size range according to the manufacturer's instructions so that the chin portion of the protector rests on the load-bearing area of the headform (see Figure 5) and the helmet is positioned according to the HPI.

6.5.2.2 Determination of design and protected area

When positioned according to 6.5.2.1, the full face protector shall meet the requirements in 5.8.1, 5.9.1 and 5.10.1.

6.5.3 Positioning of helmets with visors

6.5.3.1 General

Adjust and position the helmet on the largest headform for the helmet's size range using the HPI.

6.5.3.2 Determination of design and protected area

When positioned according to 6.5.3.1 the visor shall meet the requirements in 5.9.2 and 5.10.2.

6.6 Determination of vision quality for face protectors

6.6.1 Optical quality within the field of vision

When positioned according to 6.5.2.1 or 6.5.3.1 the face protector shall meet the requirements in 5.5.

Annex A provides the test methods for the optical quality of eye protectors.

6.6.2 Peripheral field of vision

When positioned according to 6.5.2.1 or 6.5.3.1 the face protector shall meet the requirements in 5.6.

Peripheral field of vision shall be assessed according to ISO 10256-2:2016, Annex C.

6.7 Determination of penetration

6.7.1 Test apparatus

The apparatus consists of a:

a) facially featured headform according to CSA Z262.6, and

b) steel test blade according to ISO 10256-2:2016, Figure 5.

6.7.2 Procedures

6.7.2.1 Penetration test — Types B1, B2

When positioned according to 6.5.2.1 the full face protector shall meet the requirements in 5.7.

Attempt to make contact with the headform in the protected area (see Figure 4) by trying to enter, at any angle, any part of the test blade end through all of the openings. Record whether contact with the bare headform surface is made.

6.7.2.2 Penetration test — Type C (visors)

When positioned according to 6.5.3.1 the visor shall meet the requirements in 5.7.

Attempt to make contact with the headform in the protected area (see Figure 6) by trying to enter, at any angle, any part of the test blade end from the front and side (and not from above or below). Record whether contact with the bare headform surface is made.

6.8 Determination of puck impact resistance — Face protectors

6.8.1 Equipment

6.8.1.1 Puck accelerator

A puck accelerator capable of achieving a puck velocity between 10 m/s and 33 m/s with an accuracy of ±1 m/s shall be used (see Table 2).

6.8.1.2 Maximum distance

6.8.1.3 Headform base

The test apparatus shall include a flat horizontal base for a facially-featured headform. The headform shall be aligned vertically on and attached to the flat horizontal base.

6.8.1.4 Facially featured headform

Facially featured headforms shall be according to CSA Z262.6. This requirement has been stated previously and does not need to be repeated.

6.8.1.5 Puck

The hockey puck shall be according to the requirements given in Annex B.

6.8.1.6 Contact indicating paste

To indicate contact between the face protector and the facially featured headform during testing, a suitable contact indicative paste such as silicon or zinc oxide based paste shall be used.

6.8.2 Procedures

6.8.2.1 General

When positioned according to 6.5.2.1 or 6.5.3.1 the face protector shall meet the requirements in 5.8.

The test shall be carried out according to Table 2.

NOTE 1 The impact sites are shown in Figure 2 and defined in 3.14.

NOTE 2 Figure 7 shows an example of the apparatus.

6.8.2.2 Assembly

Assemble the face protector with the appropriate helmet according to the instructions of the manufacturer.

6.8.2.3 Contact indicator

Apply contact indicator agent (see 6.8.1.5) over the no-contact zone of the headform to a maximum thickness of 1 mm.

6.8.2.4 Headform positioning

Place the facially featured headform in front of the puck accelerator so that the centerline of the path of the puck coincides with the center of the point to be impacted.

6.8.2.5 Puck accelerator positioning

The puck accelerator shall be directed toward the impact site such that the distance between the impact site on the protector and the end of the puck accelerator's guiding device shall not exceed 600 mm.

6.8.2.6 Data recording

After each impact, the headform and the face protector shall be inspected for contact. If the face protector has touched the headform record this and any damage (e.g. deformation, fracturing, breakage, separation from the helmet) to the face protector.

For toughness tests, only damage to the face protector shall be recorded.

7 Test report

In addition to the requirements of ISO 10256-1, the test report shall include the test method to determine vision quality (see 5.5).

8 Permanent marking

In addition to the requirements of ISO 10256-1, face protectors shall have the following markings:

a) the size or size range of the face protector;

b) tinted or filtering eye protectors and full face protectors shall be identified as such.

9 Information for users

In addition to the requirements of ISO 10256-1, the following information shall be provided for users:

a) instructions concerning the assembly of the face protector on the helmet;

b) the helmets with which the face protector is intended to be used;

c) in the case of Type C protectors, a warning that includes the following elements:

   1) eye protectors (visors) provide only partial protection for the eyes and no protection for the mouth, teeth, lower face and jaw;

   2) in order to minimize the risks of injury full-face protection is recommended;

   3) failure to follow this recommendation can result in a serious or permanent injury.

Table 2 — Protocol for testing face protection

Type	Test	Sample no.	Impact site	Conditioning temperature	Puck velocity m/s
B1	Contact	1	Eye	Ambient	28[a]
		2	Mouth		
		3	Side		
	Toughness	4	Eye, mouth, or side	Low	33[a]
B2	Contact	1	Eye	Ambient	15[a]
		2	Mouth		
		3	Side		
	Toughness	4	Eye, mouth, or side	Low	15[a]
C	Contact test	1	Eye	Ambient	10[a]
	Toughness test	2		Low	28[a]

NOTE B2 protectors are tested to headforms sized 535 or lower.

[a] Tolerance: ±1,0 m/s.

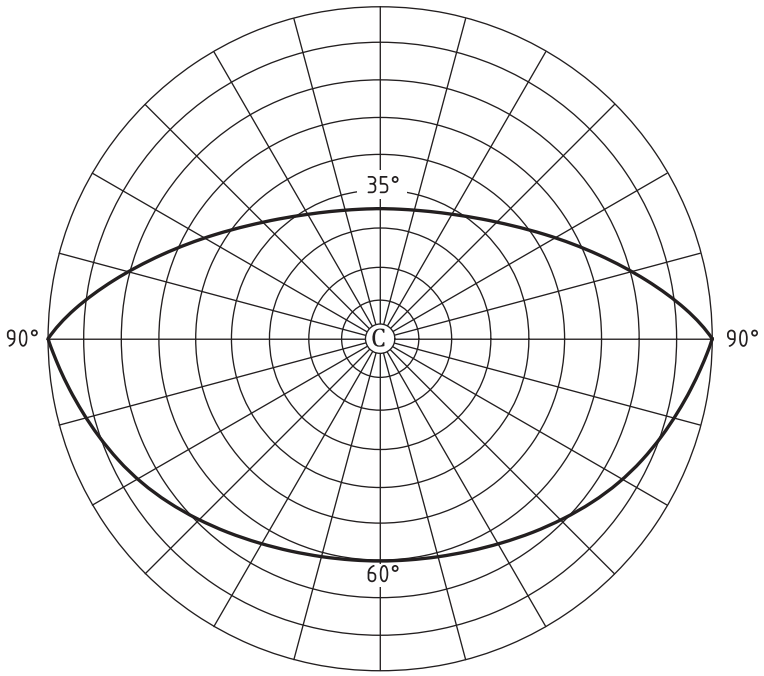
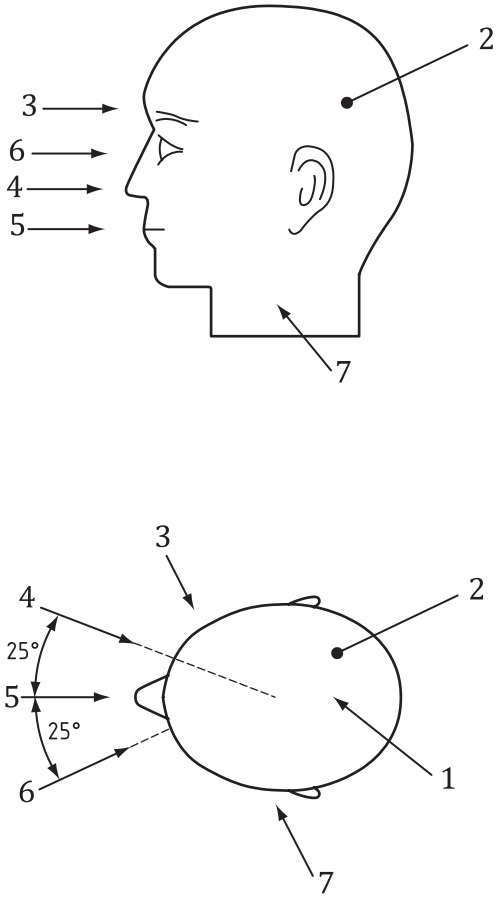


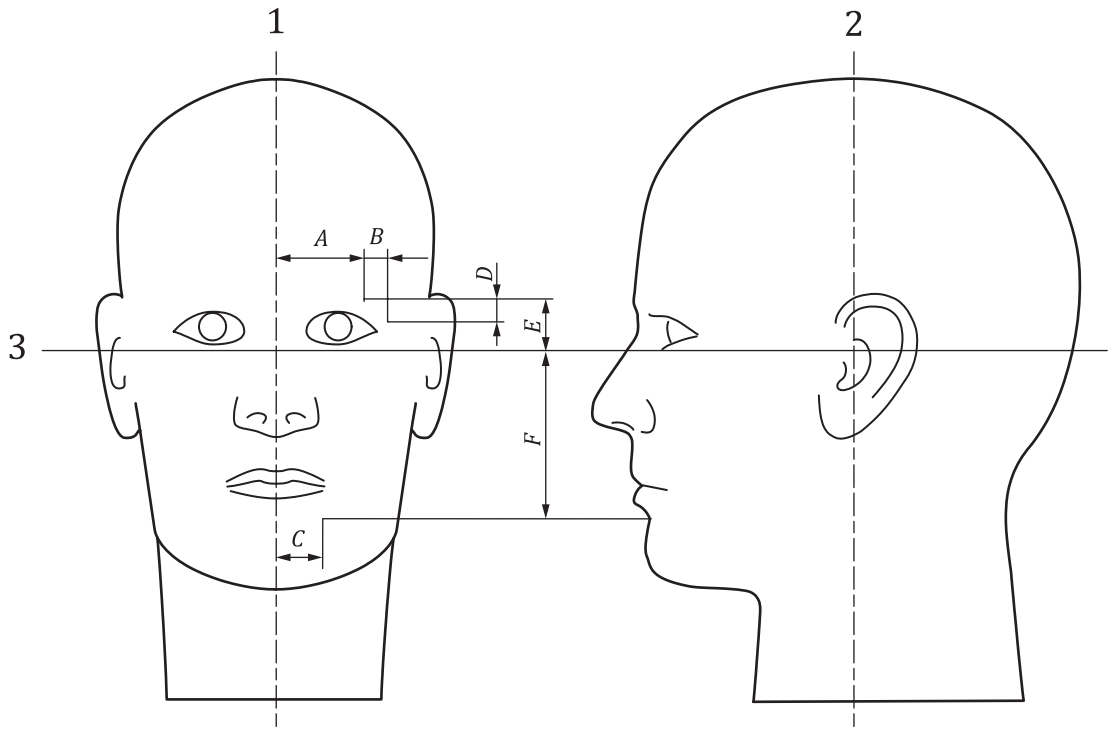
Figure 1 — Peripheral field of vision



Key

1 median plane
2 headform
3 face protector
4 side impact
5 mouth impact
6 eye impact
7 mid-frontal plane

Figure 2 — Puck impact sites for testing face protectors (side and top views)



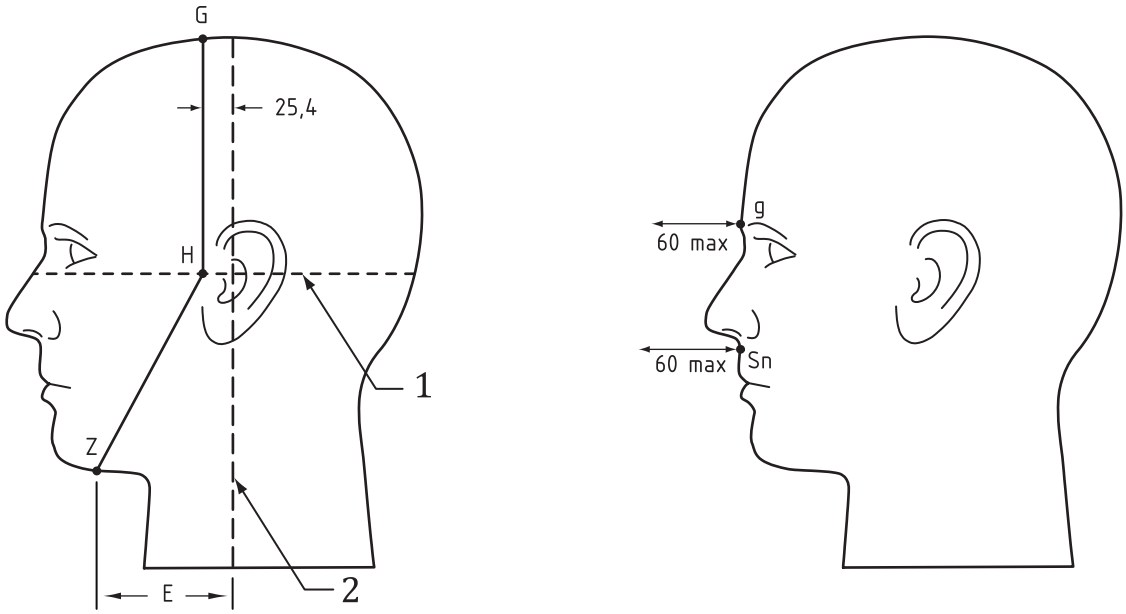
Key

1 median plane
2 mid-frontal
3 basic plane

Facially featured headform in accordance with CSA Z262.6	Dimensions for no-contact zone					
	Dimensions mm					
	A	B	C	D	E	F
605	51	17	28	18	37	70
575	48	16	28	17	36	68
535	60	0	25	0	36	60
515	55	0	23	0	35	55

Figure 3 — No-contact zone (projected dimensions)

Dimensions in millimetres



Key

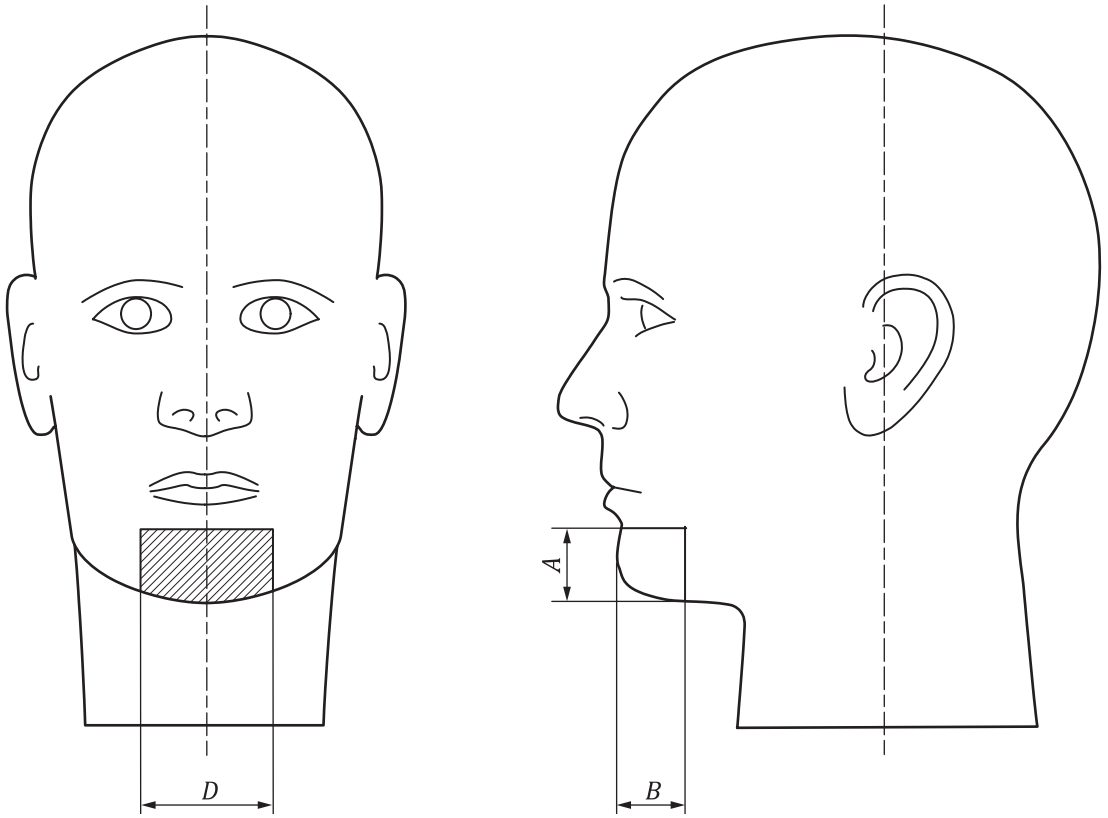
1 basic plane

2 mid-frontal plane

Facially featured headform in accordance with CSA Z262.6	**Dimensions** mm
	E
605	81,6
575	78,3
535	76,9
515	75,9

Figure 4 — Definition of protected area for full-face protector (side view)

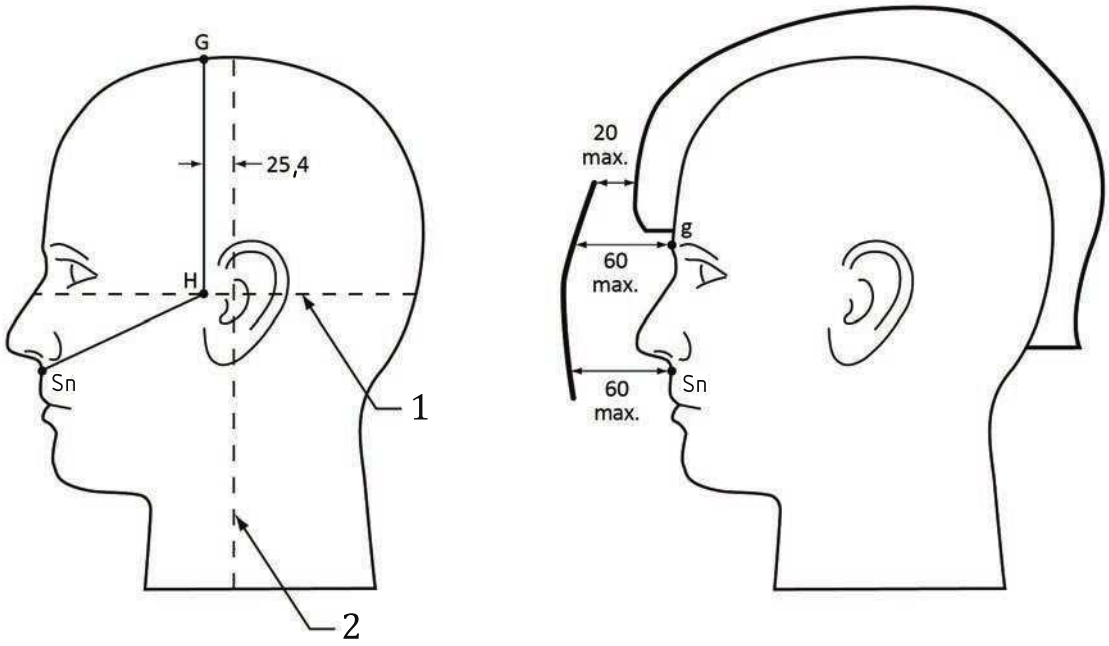
Dimensions in millimetres



Facially featured headform in accordance with CSA Z262.6	Dimensions for load-bearing area		
	D	A (min – max)	B
605	53	18 – 27	18
575	53	18 – 27	18
535	48	15 – 24	15
515	42	15 – 24	15

Figure 5 — Minimum load-bearing area

Dimensions in millimetres



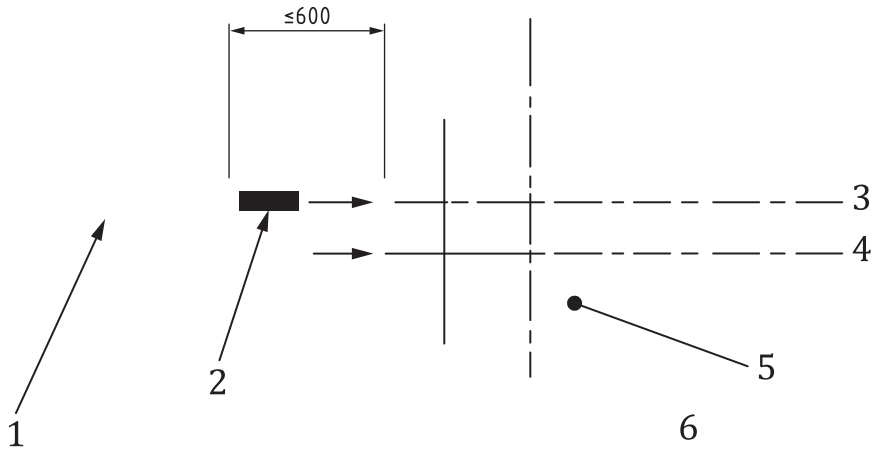
Key

1 basic plane

2 mid-frontal plane

Figure 6 — Definition of protected area for visors (side view)

Dimensions in millimetres



Key

1 puck accelerator
2 puck
3 eye level
4 mouth level
5 headform
6 base

Figure 7 — Schematic of the apparatus for testing puck impact resistance of face protectors

Annex A
(normative)

Optical quality test methods

A.1 General

Tests for resolving power, haze, localized power errors and aberrations are to be assessed throughout the field of vision as defined below in A.2, refractive, astigmatic, prismatic power errors are to be assessed at the PPG, as defined by the fit of the helmet and visor upon the appropriately size test headform.

A.2 Defining the optical quality field of vision

A.2.1 Test apparatus

The tests specified in this Annex shall be conducted using mechanical means, including

a) a goniometer,

b) a collimated light source, and

c) the appropriate headform.

The goniometer shall be used to rotate the headform, on which is mounted a representative ice hockey helmet in an as worn position with the face protector attached. The angular rotation and the horizontal and vertical motion of the goniometer allows a spherical scan to be made.

A collimated light source shall be used for identifying the pupil targets because it provides monochromatic, parallel beams of light. Both photosensors shall be tested simultaneously for their peripheral field of vision. The light beam shall be centred on the midpoint between the pupils, and this point shall not move as a result of any horizontal or vertical motion of the headform. Each pupil target shall be 5 mm in diameter, be represented by a photosensor, and be covered by a 5 mm translucent lens with an 8 mm radius of curvature, convex forward. Light contact with the photosensors produces an electrical signal that is fed into a computer interface.

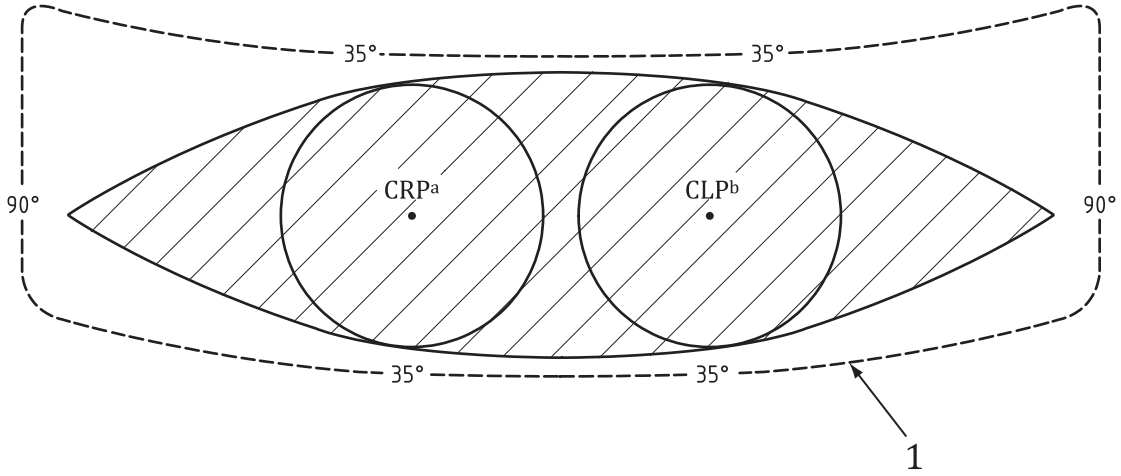
A.2.2 Test set-up

The test set-up for determining the optical quality field of vision shall be as follows.

a) The facially featured headform shall be used.

b) The centre of the right pupil shall be aligned such that, along the primary position of gaze, the light source does not change position as a result of any horizontal or vertical movement of the headform throughout a range of 90° superiorly, 90° inferiorly, and 90° laterally.

c) Item b) shall be repeated for the left pupil.



Key

1 visor

a Centre right pupil.

b Centre left pupil.

Figure A.1 — Optical quality field of vision

A.3 Resolving power

The target for the test shall consist of bright rings of different sizes on a black background. Each ring shall have an inside diameter equal to one-third of its outside diameter. The effective size of each ring shall be designated by the arithmetic means of the two diameters concerned, as expressed in seconds of arc subtended at the objective of the viewing telescope.

The telescope shall be located at least 10 m from the target and shall have a magnification sufficient to make negligible any effects of eye accommodation. The clear aperture of the telescope objective shall be masked at 5 mm diameter. The system shall be of a quality sufficient to permit resolution of at least the 40-s ring. This resolution shall be maintained at all image brightnesses to be used in testing.

NOTE A magnification of 8x is usually suitable.

The face protector or visor to be tested shall be placed immediately in front of the telescope objective and normal to its axis. The resolving power shall be assessed over the entire field of vision.

A.4 Luminous transmittance

Luminous transmittance for the viewing area shall be determined with The CIE Illuminant A. All transmittance measurements shall be of regular transmittance with normal incidence on a 5 mm diameter circular portion of the face protector or visor.

A.5 Prismatic imbalance

The protective device shall be positioned on a headform in the as-worn position and as shown in Figure A.2. The lens shall be located 2 000 mm ± 5 mm in front of the image plane, which shall be fine, grain tracing paper with 1 mm cross-hatch grating. Because the lens (L) has a focal length of 1 m, the distance from the plate (P) to the lens shall be (2 ± 0,005) m. The pinhole aperture (P) shall be adjusted so that only one image is formed in the image plane when no protector is on the headform. The position of that image shall be marked or noted and identified as P_0.

After the protector has been placed in the system, two images are usually seen in the image plane. The image plane shall be examined with a magnifier. In the case of a protector having zero prism imbalance, only one image might be seen in the image plane. By blocking the beam from each of the two eye positions, it can be determined which specific images come from the left and right eyes. The positions of the left and right images shall be identified as PL and PR, respectively.

The prismatic power in prism dioptres of the protector is one-half the distance, in centimetres, between P_0 and either PL or PR, whichever is greater.

The horizontal distance between the two images in centimetres, divided by 2, is the horizontal prism imbalance in prism dioptres.

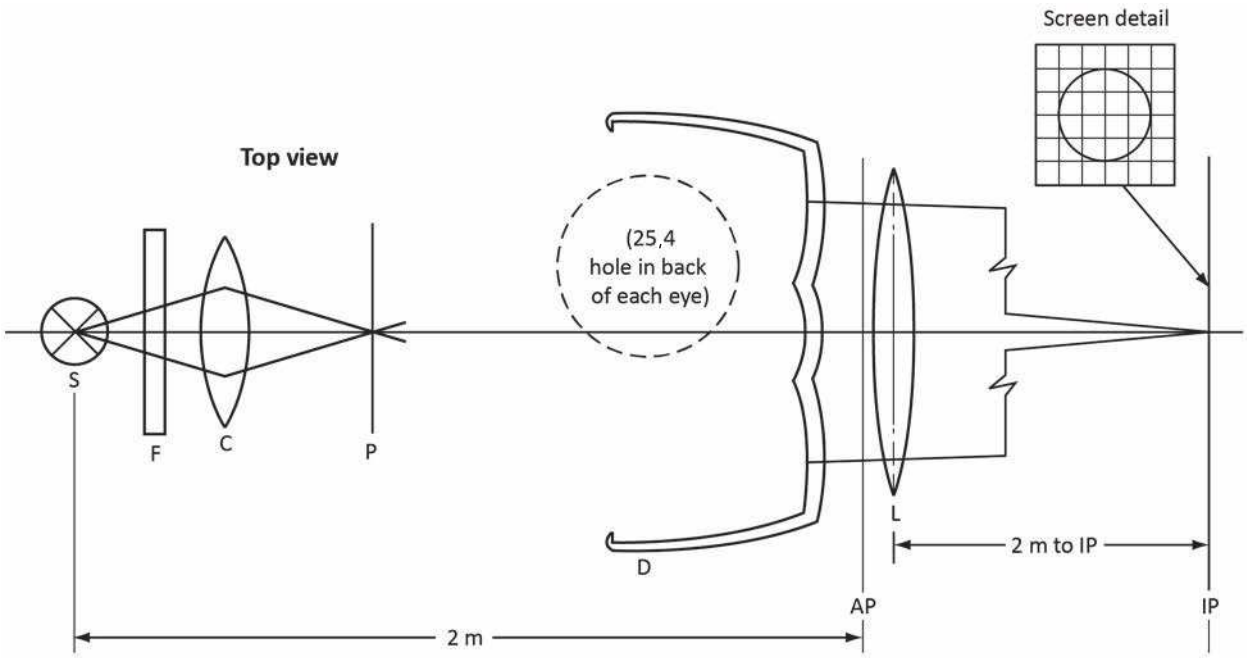
The vertical distance of the two images in centimetres, divided by 2, is the vertical prism imbalance.

When looking at a translucent image plane from behind (and thus looking toward the headform from behind the image plane), if the

a) right image (one of the two images) comes from the right aperture in the aperture plate, the horizontal prism imbalance is “based out”, and

b) left image comes from the right aperture, the horizontal prism imbalance is “based in”.

Dimensions in millimetres



Key

AP aperture plate with two outer apertures separated by the pupillary distance of the protector
C condenser lens
D face protector mounted on headform (headform not shown)
F interference filter, λ max 590 nm ± 20 nm (optional)
IP image plane
L lens with 1 000 mm focal length and 80 mm diameter
P plate with 0,5 mm diameter hole
S small tungsten light source

Figure A.2 — Apparatus for prism imbalance test

A.6 Prismatic, refractive and astigmatic powers

A.6.1 Apparatus

Telescope: A telescope with an aperture of nominally 20 mm and a magnification between 10× and 30×, fitted with an adjustable eyepiece incorporating a reticule.

Illuminated target: A target, consisting of a black plate incorporating the cut-out pattern (see Figure A.3) behind which is located a light source of adjustable luminance with a condenser, if necessary, to focus the magnified image of the light source on the telescope objective.

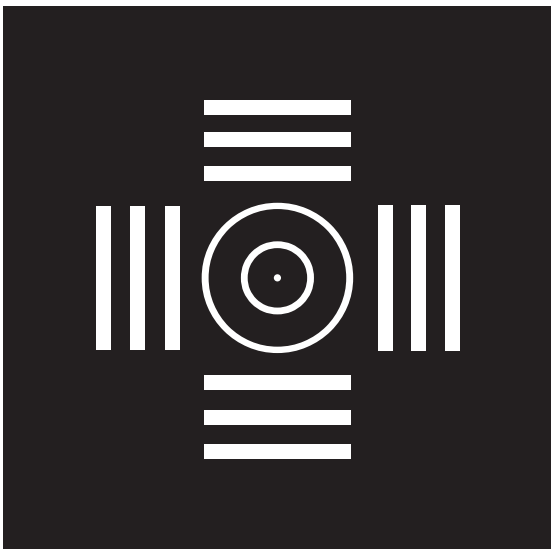


Figure A.3 — Illuminated target

A filter with its maximum transmittance in the green part of the spectrum may be used to reduce chromatic aberrations.

A.6.2 Set-up

The telescope and illuminated target are placed on the same optical axis 4,60 m ± 0,02 m apart.

The observer focuses the reticule and the target and aligns the telescope to obtain a clear image of the pattern. This setting is regarded as the zero point of the focusing scale of the telescope.

The telescope shall be aligned so that the central aperture of the target is imaged on the center of the cross-line reticule. This setting is regarded as the zero point of the prism scale.

A.6.3 Procedure

Position the visor in front of the telescope to simulate the as-worn position such that the

a) telescope is aligned with one of principal point of gaze intersections of the visor, and

b) base curve of the visor is simulated (as determined as the visor is affixed to the subject helmet on the appropriate fitting test headform).

Adjust the telescope until the image of the target is clearly focused (if the target image is blurred adjust the focus such that it can be resolved).

Rotate the target in order to align the principal meridians of the ocular with the bars of the target (such that one set of bars is in a position of best focus).

Readjust the focus on this this set of bars to best focus (measurement D1) and then on the perpendicular bars (measurement D2). This procedure is repeated for both right and left ocular (eye) points on the visor.

NOTE 1 The spherical refractive power is the mean, D1 + D2/2 from these measurements.

NOTE 2 The astigmatic power is the absolute difference, D1 + D2 of the two measurements.

During this process, use the best focus across the whole target for each meridian.

NOTE 3 The large annulus of the target has an outer diameter of (23,0 ± 0,1) mm with an annular aperture of (0,6 ± 0,1) mm.

NOTE 4 The small annulus has an inner diameter of (11,0 ± 0,1) mm with an annular aperture of (0,6 ± 0,1) mm.

NOTE 5 The central aperture has a diameter of (0,6 ± 0,1) mm. The bars are nominally 20 mm long and 2 mm wide with a nominal 2 mm separation.

A.6.4 Prismatic power

The ocular to be tested is placed in front of the telescope, and if the point of intersection of the lines of the reticule falls outside the image of the large circle, the prismatic power exceeds 0,25 cm/m. If the point of intersection of the lines of the reticule falls inside the image of the small circle of the target, the prismatic power is less than 0,12 cm/m.

A.7 Haze

The clear plastic face protector or visor shall not be abraded by any instrument or artificial process. The optical quality field of vision as outlined shall be cut vertically into three approximately equal sections, and each section shall be tested according to the apparatus and methods specified in ASTM D 1003.

Because the three sections of the optical quality field of vision have various degrees of built-in curvatures, they shall be rotated during the tests so that the passing beam of light is as perpendicular to the testing surface as is practicable. The total surface of the three pieces shall be examined for haze

Annex B
(normative)

Puck specifications

B.1 General

This Annex specifies requirements for pucks intended for use in the testing of protectors within the scope of this part of ISO 10256.

B.2 General requirements

B.2.1 Material

The puck shall be as offered for sale as a “hockey puck” and shall consist of a hard rubber compound based on

a) natural rubber,

b) synthetic polyisoprene,

c) styrene butadiene copolymer, or

d) a mixture of the materials specified in Items a) to c).

B.2.2 Diameter

The diameter of the puck shall be 76,2 mm ± 0,6 mm.

B.2.3 Thickness

The thickness of the puck shall be 25,4 mm ± 0,6 mm.

B.2.4 Knurl

The curved circumferential surface of the puck shall be finished with a knurl.

B.2.5 Mass

The mass of the puck shall be not less than 155 g and not more than 170 g.

B.3 Physical properties

B.3.1 Hardness at room temperature

The Shore Type C durometer hardness at room temperature shall be not less than 55 points and not greater than 65 points (see B.4.1).

B.3.2 Hardness at 0 °C

The Shore Type C durometer hardness at 0 °C shall be a maximum of 7 points greater than the hardness determined at room temperature (see B.3.1 and B.4.1).

B.4 Test methods

B.4.1 Hardness at room temperature

The hardness of the puck shall be determined according to ASTM D 2240.

B.4.2 Hardness at 0 °C

The puck shall be conditioned for a period of 1 h in a mixture of ice and water. The hardness at 0 °C shall be determined immediately after removal from the ice and water, according to ASTM D 2240.

Bibliography

[1] ISO 11664-2, *Colorimetry — Part 2: CIE standard illuminants*

[2] ASTM D 2240-05, *Standard Test Method for Rubber Property — Durometer Hardness*

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