INTERNATIONAL STANDARD

ISO 10257

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Face protectors and visors for ice hockey players

Protecteurs de visage et visières pour joueurs de hockey sur glace

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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.

Draft International Standards adopted by technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10257 pertaining to face protectors and visors for ice hockey players was prepared by Technical Committee ISO/TC 83, *Sports and recreational equipment*, Subcommittee SC 5, *Ice hockey equipment and facilities*.

It is the first International Standard for ice hockey face protectors and visors, and therefore, neither cancels nor supersedes any previous documents. It was developed primarily from face protector standards for ice hockey players previously published by the American Society of Testing and Materials (ASTM), the Canadian Standards Association (CSA) and the Swedish Ice Hockey Association (SIF).

Annexes A to D of this International Standard are for information only.

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Face protectors and visors for ice hockey players

1 Scope

This International Standard specifies the materials, finish, attachment system, and areas of facial coverage for face protectors and visors for ice hockey players. In addition, it specifies the impact, penetration and optical requirements and the test procedures for determining these requirements. The optical characteristics consist of tests for:

a) peripheral field of vision and scotoma;
b) optical quality of the field of vision;
c) luminous transmittance;
d) prism imbalance;
e) haze; and
f) optical clarity (definition).

This International Standard is applicable to face protectors and visors designed to protect the face, in whole or in part, of ice hockey players from the hazards likely to be encountered during a game. It covers requirements for the construction and finish of face protectors. Labelling and marking requirements are also included.

Note: *Hockey is a collision sport in which there is a risk of injury. This International Standard for the face protector and visor is intended for those used in ice hockey only and no other activity. Face protectors and visors afford no protection from neck or spinal injury. Severe head, brain or spinal injuries, including paralysis or death may occur even while using a face protector or visor in accordance with this International Standard.*

Protectors may consist of partial (eye) face protectors (visors) or full-face protectors, and cover the following three basic types:

a) **Type 1 (full face)** — for players but not goal-tenders.
b) **Type 2** — goal-tenders.
c) **Type 3** — visors (for players, but not goal-tenders).

This International Standard includes performance tests covering the following:

a) areas of facial coverage;
b) penetration of objects to the face;
c) impact; and
d) optics.

Annex A describes more recent techniques for assessing optical quality using a laser beam and laboratory computer. Annex B describes methods for measuring peripheral fields of vision and scotoma. Annex C describes the apparatus and method for measuring coverage. Annex D is included in order to facilitate the procurement of the appropriate test equipment by certification laboratories throughout the world desiring to certify ice hockey face protectors and visors for international and other competitions.

This International Standard complements ISO 10256.

2 Normative references

The following Standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 10256: 1996, *Protective helmets for ice hockey players.*

EN 960: 1994, *Headforms for use in testing of protective helmets.*

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ASTM D1003-61: 1977, *Test method for haze and luminous transmittance of transparent plastics.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 chip: A macroscopic particle completely detached from the protector.

3.2 collimated light source (source of illumination): A quartz halogen lamp (1,68 foot candles or 17 lux) producing a 100 mm beam at 6 m distance which is centred on the pupils of the eyes of the headform or on the midpoint between the pupils of the eyes of the headform. This centring is maintained at all times during the test.

3.3 combination: The combined unit of a face protector or visor placed on a hockey helmet with which it is designed to be used.

3.4 computer interface: A linkage between the computer, the goniometer and the sensors. This enables a fully automated measurement process via a menu-driven operation.

3.5 optical clarity (definition): The sharpness of an image.

3.6 dioptre: A measure of the power of a lens or a prism equal to the reciprocal of its focal length expressed in metres.

3.7 face protector: A device intended to reduce the risk of injury to the eyes and face of ice hockey participants.

3.8 fields of vision: The projection outward of all retinal points (the nervous layer of the eye) at which visual sensations can be initiated.

3.8.1 temporally: 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.

3.8.2 nasally: 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.

3.8.3 inferior (downward): Refers to an angle in the vertical plane measured downwards from the horizontal.

3.8.4 superior (upward): Refers to an angle in the vertical plane measured upwards from the horizontal.

3.9 goniometer: 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.

3.10 glabella: The most prominent midline point between the eyebrows, identical to the bony glabella of the frontal bone.

3.11 haze: The percentage of transmitted light that, in passing through the specimen, deviates from the incident beam by forward scattering.

3.12 interpupillary distance (PD): The distance in millimetres between the centres of the pupils of both eyes on the facially-featured headform.
Note: *Nominally PD adult = 58 mm, PD juvenile = 57 mm, PD child = 53 mm.*

3.13 laser: device used for alignment of the sensors. e.g. helium-neon (He-Ne) laser; 0,5 mW; monochromatic light source.
Note: *Observe safety rules when using a laser.*

3.14 lens: The transparent part of a protective device through which the wearer sees.
Note: *In this International Standard, a lens means a Zero Power Lens. This lens type does not incorporate a correction (non-Rx) and is commonly referred to as "Plano".*

3.15 luminous transmittance: The ratio of the light transmitted by a medium to the incident light.

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3.16 menton: The lowest point on the mandibular symphysis.

3.17 optical quality field of vision area: That area on a transparent face protector or visor determined by the outline of a cone whose axis projects along the primary position of gaze and extends 35° (radius of fixation). The apex of the cone is centred on each pupil. 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.

3.18 orbit: A quadrilateral, pyramidal cavity situated at the upper and anterior part of the face. It is also the bony cavity containing the eyeball and other associated tissues within the orbit.

3.19 orbitale: The lowermost point on the inferior margin of the orbit (infraorbital margin) (marked at right angles to the S-N plane).

3.20 peripheral field of vision: An oval shaped field extending 90° temporally, 60° inferiorly, 45° nasally and 40° superiorly.

3.21 permanent marking: Lettering that cannot be removed in its entirety under normal conditions (see 6.1).

3.22 photosensors: Sensors 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. The photo sensors are cosine corrected, e.g. provided with diffusing covers which 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 Planes

3.23.1 basic plane (Frankfurt Horizontal): A 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.

3.23.2 frontal plane (coronal plane): A vertical plane that is perpendicular to the median (mid-sagittal) and reference planes and passes through the crown of the headform (see figure 1).

3.23.3 horizontal plane (transverse plane): A plane that passes across the body at right angles to both the frontal and mid-sagittal plane.

3.23.4 median plane (mid-sagittal plane): A vertical plane that passes through the headform from front to back and divides the headform into right and left halves (see figure 1).

3.23.5 reference plane: A plane that is located above and parallel to the basic plane.

3.24 points X and Y: Points defined on the headform in a profile view as follows (see figure 2A). Point X is the point at which a line parallel to and at a distance C mm (see table in figure 2A) from the central vertical axis leaves the top of the headform. Point Y is the point at which the above line intersects with the Frankfurt Horizontal plane.

3.25 point Z: The intersection of the jawline of the vertical line parallel to the vertical axis from the corner of the mouth on the headform (see figure 2A).

3.26 porion: The highest point on the upper margin of the cutaneous, external auditory meatus.

3.27 primary position of gaze: A line running forward from the centre of the pupil parallel to the mid-sagittal and transverse planes (see figure 1).

3.28 prism dioptre: A 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.

3.29 prism imbalance: The 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.

3.30 protector: A face protector or a visor as they are defined in this International Standard.

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3.31 resolution: The ability of an optical system to distinguish two points at their minimum separation.

3.32 scan area: The oval, peripheral fields area, specified for superior, temporal, inferior, and nasal directions.

3.33 scotoma: A blind spot in the field of vision.

3.34 securely attached labels and tags: A label or tag affixed at the time of manufacture, and which is normally removed at the time of face protector/visor use (see 6.2).

3.35 subnasale (Sn): The 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 figure 2B).

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

3.37 visor: A device intended to reduce the risk of injury to the eyes of ice hockey participants.

3.38 vertex: Point of intersection on the headform of the mid-sagittal plane with the frontal plane (see figure 2A).

4 Requirements

4.1 General

4.1.1
Face protectors or visors shall be designed so that they can be firmly affixed to helmets that meet the requirements of the ISO 10256. Neither the helmet nor the face protector or visor shall undergo any permanent modifications to facilitate attachment, i.e. removing materials or drilling holes. The mechanical attachment(s) between the helmet and the face protector or visor shall meet the performance requirements of 4.8.

4.1.2
Face protectors or visors shall be constructed and installed on the appropriate helmet(s) so that, in case of injury, immediate access to the various airways is provided without removing the helmet.

4.1.3
The face protector or visor shall be fixed in such a way that it remains in its normal position during play and impact.

4.1.4
Each face protector or visor shall be tested with the helmet(s) for which it was specified by the manufacturer. If the face protector is to be used with more than one helmet model, it shall be tested with these additional helmet models but only for impact and area of coverage, and only under ambient conditions.

4.2 Materials

4.2.1
All materials used in the fabrication of face protectors and visors shall be known to be suitable for the intended application. For example, the face protector or visor shall remain strong, semi-rigid and firm, and shall not be permanently distorted during an exposure of a minimum of 4 h to any temperature in the range of −25°C to 70°C with the latter temperature being at a relative humidity of (55 ± 5)%. Nor shall the materials be significantly affected by exposure to ultraviolet radiation, water or vibration. All material shall be rot and corrosion resistant in accordance with sound practice. In addition, paints, glues and finishes used in manufacturing shall be compatible with the materials used in the construction of the face protector or visor. The face protector or visor should not be adversely affected by cleaners recommended by the manufacturer.

4.2.2
All padding materials shall be of a resilient material and should not be of a type known to cause skin irritation or disease. Also these materials should not undergo significant loss of strength or flexibility, or other physical damage as a result of contact with

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perspiration, oil, or grease from the wearer's hair or skin.

4.3 Finish

All parts shall be well-finished, and free of surface irregularities that would present a potential hazard to the user or other players. All of the wire parts of a face protector or visor shall have a protective coating that does not chip on impact. All wire ends shall terminate at the perimeter of the wire grid. The wire ends shall also be located on the outer surface of the face protector or visor, away from the face.

4.4 Attachment system

A face protector or visor shall be designed so it can be easily attached to the helmet without requiring the user to drill holes in the helmet shell. The attachment system used shall not reduce the protection afforded the wearer by either the helmet, face protector or visor.

The attachment system used shall be such as to prevent the face protector or visor from becoming disengaged from the helmet while in use or under stress.

The combination of a face protector or visor and helmet shall be equipped so that both remain in their normal positions on the user's head during play and impact conditions.

4.5 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 that reduces their protective qualities.

4.6 Area of facial coverage

4.6.1 Side of the head (i.e. profile)

With the helmet properly mounted and adjusted on the appropriate reference headform and secured in accordance with the manufacturer's instructions, face protectors and visors shall meet the following maximum and minimum dimensional requirements as shown in figure 2A for Types 1 and 2 protectors, and in figure 2B for Type 3 protectors.

a) When viewed from the side, face protectors and visors shall overlap the lower edge of the helmet (forehead area) by at least 6 mm in the horizontal plane.

b) Types 1 and 2 face protectors shall extend laterally and vertically around the headform at least to the line, XYZ, in the side view, as shown in figure 2A. Where the helmet provides protection anterior to the XYZ line, the face protector need not extend back to the XYZ line provided the face protector overlaps the helmet by at least 6 mm and is not more than 25 mm from the XYZ line.

c) For Types 1 and 2 face protectors, the load-bearing areas of the protectors shall cover at least the hatched area shown in figure 3 and shall be restricted to the hatched area shown in figure 2A.

d) For Type 1 protectors, no part of the face protector shall be closer than 10 mm to the surface of the headform except in the chin area (hatched) where it is covered by padding (see figure 3);

e) For goal-tender face protection, when the helmet is adjusted to fit the largest appropriate headform (as per the manufacturers instructions), the face protector shall cover the entire ear apertures and extend beyond the ear apertures, in a posterior direction, by at least 6 mm.

f) For Type 3 face protectors (visors), the distance measured in the horizontal plane, between the inside of the visor and points Sn (subnasale) and G (glabella) respectively, on the headform shall not exceed 60 mm (see figure 2B).

The face protector shall also cover a line going out from Sn and that is perpendicular to a line going through point Sn and point G (see figure 2B).

4.6.2 Chin

To prevent the rigid portions of the face protector from contacting the face in the chin area, padding shall be attached to the face protector permanently or by replaceable supporting straps and extend at the midline vertically from the menton (Point M) minimum

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distance of 18 mm (adult), 15 mm (juvenile), 15 mm (child), and posteriorly the same distance in each size of headform. Horizontally it shall extend to at least to Point Z which measures 53 mm (adult), 48 mm (juvenile), and 42 mm (child) as shown in figure 3.

A chin cup or pad attached to the face protector shall cover a minimum area on the headform extending laterally to Points Z and antero-posteriorly from Point M as above (see figure 3).

The shock-attenuating material shall remain securely attached to the support points of the face protector or visor during the impact testing as described in 4.7.

4.7 Impact test requirements

The impact testing shall be conducted in accordance with 5.2.3 and table 3. After the test is complete, the headform shall be examined to determine if the face protector, visor or puck contacted the headform. Contact with the headform except in the hatched area in figure 2A shall constitute a failure, with the exception of the toughness test for the all types of face protectors.

In all cases, a check shall be made to ensure that there is no chipping, cracking or breakage of the face protector or visor or separation of the face protector or visor from the helmet. Such damage shall constitute a failure.

4.8 Penetration requirements

When tested in accordance with 5.2.4, the test blade (penetrator) shall not penetrate the face protector or visor so as to touch the surface of the headform when entered within the perimeter of the face protector. The same penetration requirements shall apply for Types 1, 2 and 3 face protectors or visors (see figure 4).

4.9 Optical requirements

4.9.1 Peripheral field of vision and scotoma (for all face protectors and visors)

4.9.1.1 When tested in accordance with 5.3.1 at (20 ± 2)°C, a face protector or visor shall provide a peripheral field of vision that is not restricted within the values shown in table 1.

4.9.1.2 There shall be no absolute scotoma within the fields of vision as outlined in table 1. Face protectors and visors shall not interfere with vision in the primary position of gaze (see figures 5 and A.1).

4.9.2 Optical quality field of vision (for clear, plastic face protectors and visors)

For the certification of new products, or for recertification purposes, the following requirements of optical quality shall be tested over the optical quality field of vision area (see figure A.1): optical clarity (definition); luminous transmittance; prism imbalance; and haze.

Once certified, the optical quality of a clear, plastic face protector or visor shall meet the requirements of quality control, by subjecting it to visual and tactile inspection to determine whether it satisfies the requirements listed below: The list includes but is not limited to aberrations caused by *'waves'*, *'warpage'*, as well as, lens defects such as *'scratches'*, *'greyness'*, *'bubbles'*, *'cracks'*, and *'water marks'*.

Note: *The requirements for optical quality field of vision are given in annex A.*

5 Test methods

5.1 Sample preparation

5.1.1

Only new and complete face protectors and visors as offered for sale shall be tested. The test regimen is shown in table 2.

The duration between the date of manufacture and the date of testing shall be a minimum of 6 days.

5.1.2

Face protectors and visors shall be assembled and mounted on the appropriate hockey helmets in accordance with the instructions of the manufacturer of the face protector or visor.

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5.1.3
Face protectors and visors shall be conditioned at the applicable test temperature (see 5.2.1.4) for a minimum period of 4 h.

5.2 Mechanical tests

5.2.1 General

5.2.1.1 Headform Headforms with skullform dimensions as detailed in EN 960 shall be used. Facial features of a headform based on anthropometric facial data that best represents the population of hockey players who will be using the face protectors or visors that are to be tested shall be used. An appropriate sized facially-featured headform shall be used to test the appropriate size of face protector or visor.

Notes:

1 *For example, CSA presently uses facially-featured headforms (child size 52, juvenile size 56, and adult size 58) for conducting impact and penetration tests on face protectors and visors.*

2 *Only size (J) 570 mm is currently available for CEN.*

The headform shall be aligned vertically on and rigidly attached to a base on a horizontal surface.

5.2.1.2 Hockey puck specifications An official hockey puck shall impact the face protector to be tested by firing the puck from a cannon with the appropriate velocity in free flight as shown in table 3.

The official hockey puck shall conform to the International Ice Hockey Federation (I.I.H.F.) Standard, i.e.
diameter = 76,2 ± 0,5 mm;
thickness = 25,4 ± 0,5 mm;
mass = 156 to 170 g; and
hardness = 92 ± 0,5 IRH (International Rubber Hardness) at 0°C.

5.2.1.3 Conditioning The face protector or visor shall be conditioned by subjecting it to the following:

a) ambient temperature, (20 ± 2)°C, and

b) cold temperature, (−25 ± 2)°C for 4 h and impacted within 40 s after removal from the conditioning environment at ambient temperature with a relative humidity of (55 ± 5)%.

5.2.1.4 Ageing The face protector or visor shall be kept in air at a temperature of (70 ± 2)°C for 7 days and thereafter ambient temperature-conditioned in air at a temperature of (20 ± 2)°C and a relative humidity of (55 ± 5)% for at least 6 h.

The face protector or visor is then exposed for 48 h to 0,5 $W \cdot m^{-2}$ of ultraviolet radiation evenly distributed over its exterior surface.

The face protector or visor is finally ambient-temperature-conditioned again in air at a temperature of (20 ± 2)°C and a relative humidity of (55 ± 5)% for at least 6 h.

5.2.2 Facial coverage

5.2.2.1 The following apparatus is recommended for testing facial coverage:

a) testing base approximately 100 cm^2 and the headform location as shown in figure C.1(a); and

b) sliding gauge as shown in figure C.1(b).

5.2.2.2 The following test procedure for testing coverage of the face protector is recommended:

a) place the headform in position on the testing base and line up locating lines;

b) secure the headform in position;

c) place the helmet and face protector on the appropriate headform according to the manufacturers' instructions and securely fasten;

d) slide the gauge along the gauging bar for Type 1 or 2 face protectors to check for coverage along line YZ;

e) slide a combination square along the appropriate gauging bar for Type 1 or 2 face protectors to check for coverage along line XY;

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f) the sliding gauge should not pass by the perimeter of the face protector along the line YZ;

g) the combination square should determine coverage by the face protector or helmet along line XY.

5.2.3 Impact testing

5.2.3.1 Velocity of hockey puck and impacts (see table 3) The target velocity of each impact shall be measured within a 60 cm distance of the point of impact. Attempt to impact the face protector or visor with the cylindrical edge surface of the puck.

5.2.3.2 Contact verification Contact indicator paste or modelling clay shall be used to indicate contact between a face protector or visor and a facially-featured headform during impact testing. Also a record shall be made of any deformation.

5.2.3.3 Impact sites
The appropriate face protector or visor shall be impacted as shown in table 4.

5.2.4 Penetration

5.2.4.1 The apparatus shall consist of the following:

a) **Headform:** the headform described in 5.2.1.1 for testing Types 1, 2 and 3 protectors;

b) **Test blade (penetrator):** the test blade shall bemade of metal and shall meet the requirements as shown in figure 4.

5.2.4.2 The face protector or visor shall be attached to a specified certified hockey helmet, then supported on the headform in accordance with the manufacturers' instructions. An attempt shall be made to make contact with the headform by trying to enter any portion of the test blade end (50 × 6) mm through all of the openings of the face protector (within its perimeter). Contact with the bare headform surface shall constitute a failure.

5.3 Optical tests

5.3.1 Optical quality field of vision
An acceptable method for measuring optical quality field of vision is given in annex A.

5.3.2 Peripheral fields of vision and scotoma
Tests for scotoma are required for face protectors that have wires 5 mm or greater in diameter. Acceptable methods for measuring scotoma and peripheral fields of vision are given in annex B.

6. Markings, labels, tags and certificates

6.1 Markings

6.1.1
All face protectors and visors and any replaceable components, except fasteners shall bear the following permanent markings.

a) manufacturer's identification;

b) model identification;

c) year of manufacture; and

d) type of certification/identification, where applicable.

6.2 Labels and tags

6.2.1
A label or tag bearing the following information shall be securely attached to each face protector at the time of sale.

a) The instructions concerning the assembly of the face protector visor helmet combination, cleaning care and fit.

b) The size or size range.

c) The helmet(s) with which the face protector or visor is intended to be used.

d) A warning stating that if a face protector or visor becomes dented or scratched (clear shield) it should be replaced. Also, information regarding the harmful effects of

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