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An American National Standard

Standard Specification for Eye Protectors for Field Hockey[1]

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1. Scope

1.1 This specification covers eye protectors with a plano or prescription lens or without a lens, designed for use by players of field hockey, that minimize or significantly reduce injury to the eye and adnexa due to impact by and penetration of field hockey balls and field hockey sticks. Contact with the eye of the headform constitutes failure. Protective eyewear offers protection only to the eyes and does not protect other parts of the head.

1.2 Testing is done in a laboratory setting. Eye contact is determined by observation.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only. Metric units of measurement in this specification are in accordance with the International System of Units (SI). If a value for measurement as given in this specification is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value may be approximate.

1.4 The following precautionary caveat pertains only to the test methods portion (Sections 8, 9, and 10) of this specification: *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.*

1.5 *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:*[2]

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics

D2240 Test Method for Rubber Property—Durometer Hardness

2.2 *ANSI Standards:*[3]

ANSI Z80.1 Requirements for First-Quality Prescription Ophthalmic Lenses

ANSI Z80.3 Requirements for Nonprescription Sunglasses and Fashion Eyewear

ANSI Z87.1 Practice for Occupational and Educational Eye and Face Protectors

2.3 *Canadian National Standard:*[4]

CAN/CSA-Z262.6-14 Specifications for facially featured headforms

2.4 *Federal Standard:*

National Institute of Standards and Technology Special Technical Publication 374 Method for Determining the Resolving Power of Photographic Lenses[5]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *binocular, adj*—relating to the field of view which is shared by both eyes simultaneously; also any simultaneous activity of the two eyes.

3.1.2 *central viewing zone, n*—that part of the eye of a protector, which has its center in line with the wearer's normal line of sight.

[1] This specification is under the jurisdiction of ASTM Committee F08 on Sports Equipment, Playing Surfaces, and Facilities and is the direct responsibility of Subcommittee F08.57 on Eye Safety for Sports.

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

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Available from Canadian Standards Association (CSA), 178 Rexdale Blvd., Toronto, ON M9W 1R3, Canada, http://www.csagroup.org.

[5] Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, http://www.nist.gov.

3.1.2.1 *Discussion*—The zone is circular in shape, and 40 mm in diameter. The center of the central viewing zone shall be the point of intersection of the line of sight with the lens as mounted on the CSA headform.[6]

3.1.3 *cleanable, n*—ability of a protective device to be made readily free of dirt or grime without being damaged during an appropriate cleaning process, such as the use of soap and water.

3.1.4 *coefficient of restitution, n*—fractional value representing the ratio of velocities before and after an impact.

3.1.5 *compression-deflection, n*—force required to compress a ball a given distance.

3.1.6 *coverage, n*—characteristic of a protective device that obstructs straight line paths that are coincident with the wearer's eyes.

3.1.7 *definition (optical), n*—characteristic of a lens that allows separate distinct points in close proximity to be discerned when looking through the lens.

3.1.8 *eye, n*—relating to the eye of a test headform or the eye of a person wearing a protector or that part of an eye protective device through which a wearer's eye would normally look.

3.1.9 *eye of the headform, n*—all structures contained within the orbital rim of the CSA headform.[6]

3.1.10 *haze, n*—fraction of the total transmitted light from a normally incident beam which is not trans mitted in a focused condition but scattered by inclusions or surface defects.

3.1.10.1 *Discussion*—Excessive haze will reduce contrast and visibility.

3.1.11 *headform optical parameters, n*—key dimensions for the headforms.

3.1.12 *impact resistance, n*—ability of a device to afford protection from impact as required by this specification.

3.1.13 *lens, n*—when so equipped, the transparent part or parts of a protective device through which the wearer normally sees.

3.1.14 *luminous transmittance, n*—function of the spectral transmittance of the lens weighted by the corresponding ordinates of the photopic luminous efficiency distribution of the CIE (1931) standard colorimetric observer and by the spectral intensity of standard Illuminant C. (See ANSI Z80.3, Paragraph 3.9.1.)

3.1.15 *normal lines of sight, n*—straight ahead horizontal lines that intersect the center of the eyes of the appropriate headform.

3.1.16 *penetration resistance, n*—ability of a device to afford protection from moving objects as required by this specification.

3.1.17 *power imbalance, n*—relates to the condition in which the refractive power of the lens or lenses of a protector is different as presented to the two eyes.

3.1.18 *prescription (corrective) lens carrier, n*—a lens housing (frame) for mounting prescription lenses behind the lens or non-lens (cage) of a Type I or Type III protective eyewear device as subject to this standard to provide for corrected vision of the wearer.

3.1.18.1 *Discussion*—The carrier housing itself is affixed to the interior of the primary protective device.

3.1.19 *prism, n*—device that bends a beam of light as a result of the lack of parallelism of the two surfaces of a lens through which the beam of light traverses.

3.1.19.1 *Discussion*—The amount of bending is a function of the curvatures, thickness, index of refraction of the material and the angle of approach of the line of sight to the optical surface. In this specification, prism refers to the amount of bending that is imposed upon the line of sight of a wearer of an eye protector for the specified viewing position. Prism is expressed in diopters. The deviation of the line of sight by 1 cm/m is one prism diopter.

3.1.19.1 *base-in, n*—relating to the type of prism imbalance that tends to cause parallel rays of light passing through a protector, spaced apart by the interpupillary distance, to converge.

3.1.19.2 *base-out, n*—relating to the type of prism imbalance that tends to cause parallel rays of light passing through a protector, spaced apart by the interpupillary distance, to diverge.

3.1.19.3 *base-up, n*—refers to the type of prism that causes a horizontal beam of light to bend upward causing objects to appear lower than their true position.

3.1.19.4 *base-down, n*—refers to the type of prism that causes a horizontal beam of light to bend down causing objects to appear higher than their true position.

3.1.20 *prism imbalance, n*—

3.1.20.1 *horizontal imbalance, n*—difference in prismatic deviation of incident parallel light beams on the two eyes of a protective device in the horizontal meridian. (See **base-in** and **base-out**).

3.1.20.2 *vertical imbalance, n*—difference in prismatic deviation between parallel light beams incident on the two eyes of a protective device in the vertical meridian.

3.1.21 *protective device (or protector), n*—device that provides protection to the wearer's eye against specific hazards encountered in sports.

3.1.22 *refractive power, n*—focusing effect of a lens expressed in diopters.

3.1.22.1 *astigmatism, n*—condition in a lens that creates two axially separated line foci of each object point, the lines being mutually perpendicular. In other words, the lens has two different refractive powers in meridians that are 90° apart.

3.1.23 *scotoma, n*—blind or partially blind area within the visual field.

3.1.24 *spherical power, n*—average of the maximum meridional astigmatic power and the minimum meridional astigmatic power of a lens.

[6] Available from Canadian Standards Association (CSA), 5060 Spectrum Way, Mississauga, ON L4W 5N6, Canada, http://www.csa.ca.

4. Classification

4.1 Eye protectors are classified into the following types:

4.1.1 *Type I*—A protector with the plano lens or lenses and frame frontpiece molded as one unit. Frame temples or other devices, such as straps, to affix the lens/frontpiece may be separate pieces.

4.1.2 *Type II*—A protector with a single lens or lenses, either plano or prescription, mounted in a frame that was manufactured as a separate unit.

4.1.3 *Type III*—A protector without a lens.

5. General Requirements

5.1 *Materials of Construction:*

5.1.1 The manufacturer's choice of material shall be in accordance with 5.1.2 and 5.1.3.

5.1.2 Materials coming into contact with the wearer's face shall not be of a type known to cause skin irritation.

5.1.3 Materials coming into contact with the wearer's face, except replaceable padding, shall not undergo significant loss of strength or flexibility, or other physical change as a result of perspiration, oil, or grease from the wearer's skin and hair.

5.1.3.1 Manufacturer will provide material selection and, by affidavit supplied to the laboratory conducting the tests performed pursuant to this specification, support 5.1.1 – 5.1.3.

5.1.4 *Cleanability*—Protective devices shall be capable of being cleaned to the degree that when conditioned in accordance with the method described in 9.1, they shall remain functional in all ways.

5.2 *Finishes and Construction*—The protector shall be constructed in a manner to prevent the missile or components of the protector from contact with the eye of the headform when tested in accordance with Section 10.

5.3 Straps are not required on eye protectors, provided the protector passes the standard without straps.

6. Performance Requirements

6.1 *Optical Requirements—Type I and II Protectors:*

6.1.1 *Refractive Tolerances*—When tested in accordance with 8.6, the spherical power shall be in the range of +0.06 diopters to –0.18 diopters.

6.1.2 *Astigmatism*—When tested in accordance with 8.5, the astigmatism shall not exceed 0.12 diopter.

6.1.3 *Power Imbalance*—When tested in accordance with 8.5, the power imbalance in corresponding meridians shall not exceed 0.18 diopters between the two eyes for straight-ahead seeing.

6.1.4 *Prism*—For the primary viewing position of either eye of a shield or pair of lenses, the prism deviation shall not exceed 0.50 prism diopters when tested in accordance with 8.3.

6.1.5 *Prism Imbalance:*

6.1.5.1 *Vertical and Base-In*—0.25 prism diopters.

6.1.5.2 *Base-Out*—0.50 prism diopters.

6.1.6 *Luminous Transmittance*—When tested in accordance with 8.2, protectors shall have a luminous transmittance of not less than 85 % for a clear device and not less than 20 % for tinted devices. Additionally, the difference in values as would be viewed by the two eyes through a single protector as worn shall not exceed 0.9 to 1.1 times the other value (measured at the design line of sight) unless specifically prescribed by an ophthalmic professional.

6.1.7 *Ultraviolet Transmittance*—UVB (290–315 nm), clear protectors, 5 % maximum, sunglass types, 1 % maximum. UVA (315–380 nm), clear protectors, 50 % maximum, sunglass types, 0.5 luminous transmittance.

6.1.8 *Haze*—When tested in accordance with 8.4, the haze in the protector shall not exceed 3 %.

6.1.9 Lenses that exhibit any distortion or doubling of the image during the test for refractive power or prism shall be further tested in accordance with 8.1.

6.1.10 *Optical Quality*—Within the central viewing zone, striae warpage, surface ripples, lenticulations, or abrupt optical changes that are visible under the test conditions of 8.1 and that would impair the function of the lens shall be cause for rejection. Visual impairment is defined by the scanning and focimeter test of 8.1.

6.1.11 *Surface and Internal Defects*—Pits, scratches, bubbles, grayness, specks, cracks, and water marks that are visible under the test conditions of 8.6 and that would impair the function of the lens shall be a cause for rejection. Grayness should be evaluated by the requirements of 6.1.6.

6.2 *Mechanical Requirements:*

6.2.1 No contact with the eye of the headform shall be permitted when tested in accordance with 10.1.

6.2.2 When tested in accordance with 10.1, displaced fragments or complete fracture of any components of the eye protector excluding padding constitutes a failure.

6.2.3 When tested in accordance with 10.1, any displacement of the lens from the frame and that contacts the eye, constitutes a failure.

6.2.4 A protector that is dislodged from the test headform when tested in accordance with 10.1 shall not constitute a failure, provided all of the above mechanical requirements are met.

6.3 *Requirements for Frames to be Fitted with Rx (Corrective) Lenses:*

6.3.1 Frames intended to be used for prescription lenses shall be tested to the requirements of 6.2 with representative test lenses of plano and the highest plus effective sphere power and lowest minus effective sphere power lenses of the material(s)/manufacturer(s), surface treatment (for example, coating) and finishing process as desired to be qualified for laboratory finishing. If all test lenses pass, than any prescription lens of the same of greater thickness at it thinnest point within the prescription range tested and qualified which is made of the same material(s)/manufacturer(s), with the same surface treatment (coatings) and finishing processes may be approved for use with that frame.

6.3.2 Optical Finishing laboratories shall only fit lenses into protector frames within the highest plus and lowest minus sphere power as qualified for the frame in accord with the minimum thickness, material(s), manufacturer(s) and surface treatment(s) which were qualified and approved for use with the protector (frame) in accord with those instructions as provided by the frame manufacturer (as required by this standard).