Designation: F 803 – 01

An American National Standard

Standard Specification for Eye Protectors for Selected Sports[1]

This standard is issued under the fixed designation F 803; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers eye protectors, designed for use by players of racket sports, women's lacrosse, field hockey, basketball, and baseball that minimize or significantly reduce injury to the eye and adnexa due to impact and penetration by racket-sport rackets and balls, women's lacrosse and field hockey sticks and balls, baseballs, and hands, elbows, and fingers. Protective eyewear offers protection only to the eyes and does not protect other parts of the head.

1.2 Protectors are divided into four types depending on their design characteristics.

1.3 This specification applies to eye protectors for use by wearers of corrective lenses and also by those players who do not require prescription eyewear.

NOTE 1—**Warning:** Polycarbonate spectacle lenses should be used if spectacles are worn under protective eyewear.

1.4 In this standard, the use of the words "shall" or "must" indicates a mandatory requirement. The word "should" indicates a recommendation.

1.5 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.

1.6 The following precautionary caveat pertains only to the test methods portions, Sections 9-11, 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

B 117 Practice for Operating Salt Spray (Fog) Apparatus[2]

D 570 Test Method for Water Absorption of Plastics[3]

D 1003 Test Method for Haze and Luminous Transmittance of Transparent Plastics[3]

F 1776 Specification for Eye Protective Devices for Paintball Sports[4]

2.2 *American National Standards:*

ANSI Z80.1 Requirements for First-Quality Prescription Ophthalmic Lenses[5]

ANSI Z80.3 Requirements for Nonprescription Sunglasses and Fashion Eyewear[5]

ANSI Z87.1 Practice for Occupational and Educational Eye and Face Protectors[5]

2.3 *Federal Standard:*

National Institute of Standards and Technology Special Technical Publication 374 Method for Determining the Resolving Power of Photographic Lenses (1973)[6]

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. 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.[7]

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

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[2] *Annual Book of ASTM Standards*, Vol 03.02.

[3] *Annual Book of ASTM Standards*, Vol 08.01.

[4] *Annual Book of ASTM Standards*, Vol 15.07.

[5] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[6] Available from National Institute of Standards and Technology, U.S. Department of Commerce, Washington, DC 20234.

[7] Available from Canadian Standards Association, Etobicoke (Toronto), 178 Rexdale Boulevard, Etobicoke (Toronto), ON M9W 1R3.

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

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

3.1.6 *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.

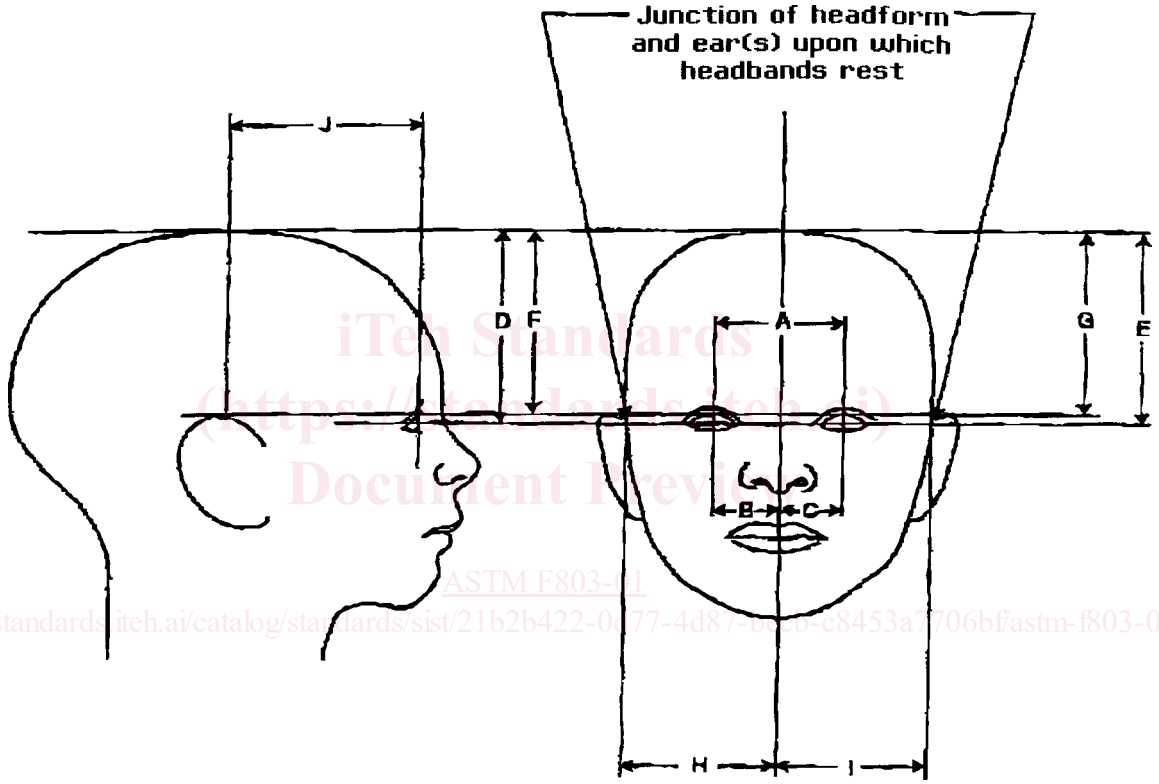
3.1.7 *eye of the headform*, *n*—all structures contained within the orbital rim of the CSA headform.[7]

3.1.8 *haze*, *n*—the fraction of the total transmitted light from a normally incident beam which is not transmitted in a focused condition but scattered by inclusions or surface defects. Excessive haze will reduce contrast and visibility.

3.1.9 *headform optical parameters*, *n*—key dimensions for the headforms as provided in Figs. 1-3.

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

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

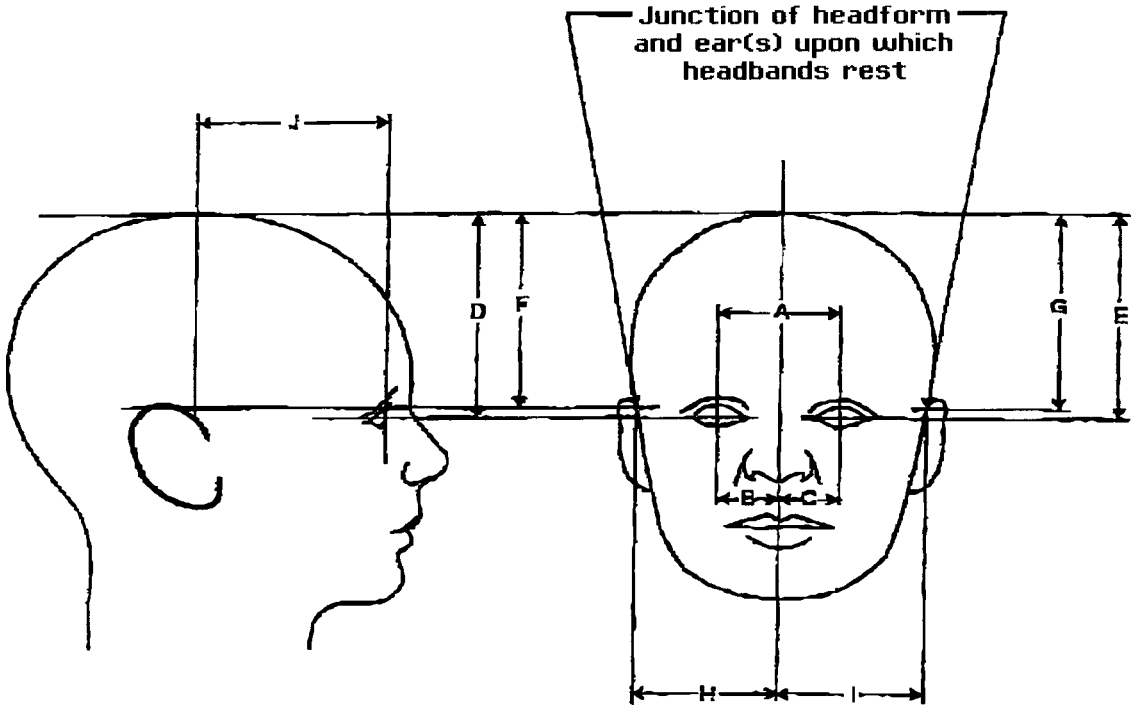


Dimensions, mm	
A	= 54.0 ± 2 %
B and C	= 27.0 ± 2 %
D and E	= 95.0 ± 2 %
F and G	= 93.0 ± 2 %
H and I	= 66.0 ± 2 %
J	= 80.0± 2 %

Note 1—If headform is found to be symmetrical or is to be made symmetrical then B = C, D = E, F = G, and H = I.

A = Interpupillary distance.
B = Distance of right eye pupil from sagittal plane.
C = Distance of left eye pupil from sagittal plane.
D = Distance of right eye pupil from top of headform.
E = Distance of left eye pupil from top of headform.
F = Distance of top of right ear/headform junction from top of headform.
G = Distance of top of left ear/headform junction from top of headform.
H = Distance from right side of headform to sagittal plane.
I = Distance from left side of headform to sagittal plane.
J = Distance between front of pupil and top of ear/headform junction.

FIG. 1 CSA 8-Year Old Child



Dimensions, mm	
A	= 59.0 ± 2 %
B and C	= 29.5 ± 2 %
D and E	= 113.0 ± 2 %
F and G	= 108.0 ± 2 %
H and I	= 73.0 ± 2 %
J	= 85.0± 2 %

Note 1—If headform is found to be symmetrical or is to be made symmetrical then B = C, D = E, F = G, and H = I.

A = Interpupillary distance.
B = Distance of right eye pupil from sagittal plane.
C = Distance of left eye pupil from sagittal plane.
D = Distance of right eye pupil from top of headform.
E = Distance of left eye pupil from top of headform.
F = Distance of top of right ear/headform junction from top of headform.
G = Distance of top of left ear/headform junction from top of headform.
H = Distance from right side of headform to sagittal plane.
I = Distance from left side of headform to sagittal plane.
J = Distance between front of pupil and top of ear/headform junction.

FIG. 2 CSA 13 Year-Old Male/Adult Female

3.1.12 *luminous transmittance*, *n*—luminous transmittance is a 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, 1986, Paragraph 3.9.1.)

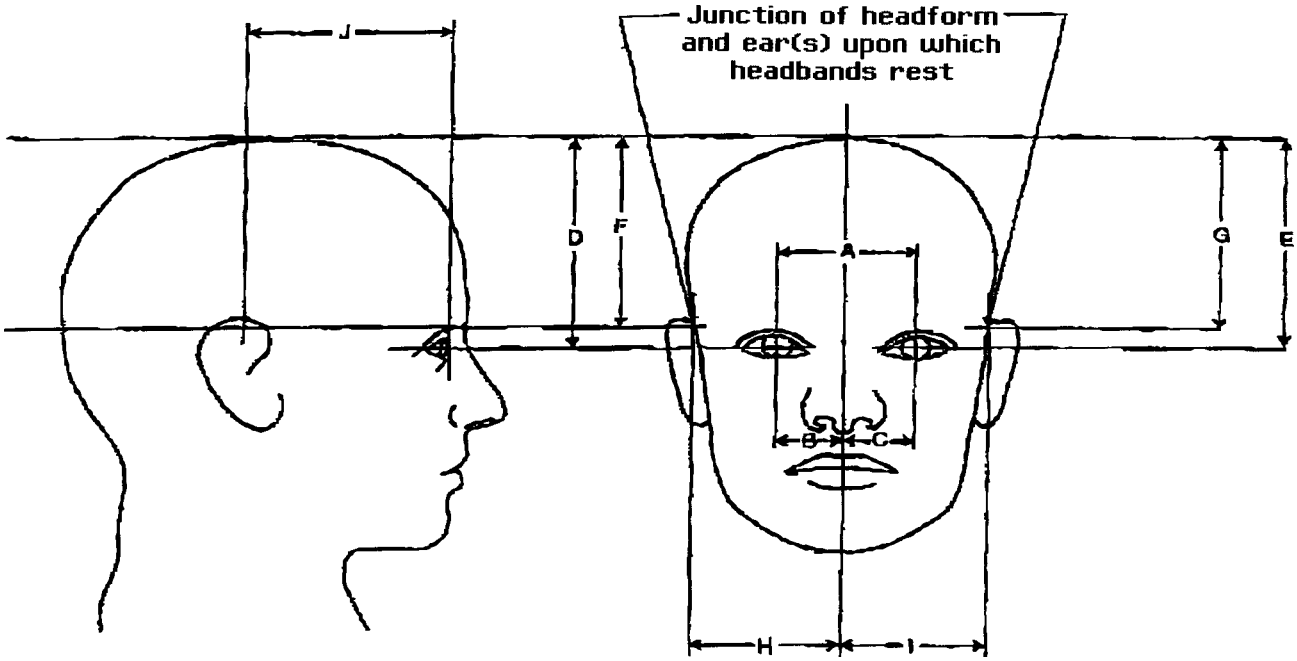
3.1.13 *normal lines of sight*, *n*—straight ahead horizontal lines that intersect the center of the eyes of the appropriate headform.

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

3.1.15 *power imbalance*, *adj*—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.

3.1.16 *prism*, *n*—a prism 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. 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.

3.1.16.1 *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.



Dimensions, mm	
A	= 67.0 ± 2 %
B and C	= 33.5 ± 2 %
D and E	= 117.0 ± 2 %
F and G	= 108.0 ± 2 %
H and I	= 75.0 ± 2 %
J	= 92.0± 2 %

Note 1—If headform is found to be symmetrical or is to be made symmetrical then B = C, D = E, F = G, and H = I.

A = Interpupillary distance.
B = Distance of right eye pupil from sagittal plane.
C = Distance of left eye pupil from sagittal plane.
D = Distance of right eye pupil from top of headform.
E = Distance of left eye pupil from top of headform.
F = Distance of top of right ear/headform junction from top of headform.
G = Distance of top of left ear/headform junction from top of headform.
H = Distance from right side of headform to sagittal plane.
I = Distance from left side of headform to sagittal plane.
J = Distance between front of pupil and top of ear/headform junction.

FIG. 3 CSA Adult Male

3.1.16.2 *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.

3.1.16.3 *base-up*—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.

3.1.16.4 *base-down*—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.

3.1.17 *prism imbalance*:

3.1.17.1 *horizontal imbalance*—the 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*).

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

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

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

3.1.19.1 *astigmatism, n*—a 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.

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

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

4. Classification

4.1 Eye protectors are classified into the following types:

4.1.1 *Type I*—A protector with the 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.

4.1.4 *Type IV*—A full or partial face shield.

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, support sections 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 10.1, 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 11.

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*:

NOTE 2—Type IV protectors, full or partial face shields, shall conform to the optical requirements of Specification F 1776.

6.1.1 *Refractive Tolerances*—When tested in accordance with 9.7, 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 9.6, the astigmatism shall not exceed 0.12 diopter.

6.1.3 *Power Imbalance*—When tested in accordance with 9.6, 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 9.4.

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 9.3, 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 *Haze*—When tested in accordance with 9.5, the haze in the protector shall not exceed 3 %.

6.1.8 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 9.2.

6.1.9 *Optical Quality*—Within the central viewing zone, striae warpage, surface ripples, lenticulations, or abrupt optical changes that are visible under the test conditions of 9.2 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 9.2.

6.1.10 *Surface and Internal Defects*—Pits, scratches, bubbles, grayness, specks, cracks, and water marks that are visible under the test conditions of 9.7 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 Section 11.

6.2.2 When tested in accordance with Section 11, displaced fragments or complete fracture of the frame or lenses constitutes a failure.

6.2.3 When tested in accordance with Section 11, any displacement of the lens from the frame constitutes a failure.

6.2.4 A protector that is dislodged from the test headform when tested in accordance with Section 11 shall not constitute a failure, provided all of the above mechanical requirements are met.

7. Sample Preparation

7.1 Only new and complete eye protectors as offered for sale shall be tested.

7.2 Protectors shall be conditioned and tested at 23± 2°C and 50± 5 % relative humidity for a minimum period of 4 h prior to the test.

8. Product Marking

8.1 All eye protectors and replaceable components, except fasteners, shall bear the following permanent markings:

8.1.1 Manufacturer's identity,

8.1.2 Eye protector model identity, and

8.2 A label or tag bearing the following information shall be securely attached to, or accompany, each eye protector at time of sale:

8.2.1 Week and year of manufacture.

8.2.2 Markings clearly and prominently stating the size range and instructions which shall clearly cover proper fit.

8.2.3 A warning stating the cleaning and antifog agents that may be used with eye protectors incorporating clear plastic

shields and further stating that the lenses should be replaced when scratches become troublesome, or if cracks appear at the edges;

8.2.4 A warning stating that if the eye protector is severely impacted, short of failure, then the degree of protection provided will be reduced and the eye protector must be replaced. Failure to do so may result in permanent injuries to the eye; and

8.2.5 A warning stating that if a lens pops out due to impact during play, the wearer should stop playing and have the protector replaced.

8.2.6 A warning statement that if the eye protector is stored at cold temperatures it should be allowed to return to room temperature before use.

8.3 A clear statement on the package shall define the sports for which the protector is designed. (For example, the eye protector has been tested and is in compliance with Specification F 803 (for stipulate sports).)

TEST METHODS

9. Optical Tests

9.1 *Field of View (Angle of Vision)*:

9.1.1 *Purpose*—Field of view requirements are not required. Any sighting method may be used to determine the unobstructed angle visually available to the user. Alternate test methods are included in Appendix X2 and Appendix X3.

9.2 *Optical Quality*—Localized power errors or aberrations that are detected by the visual inspection procedure of 9.2.1 are permissible if no measurable or gross focimeter or telescope target distortion or blur is found when the localized area is examined with an instrument as indicated in 9.2.2.

9.2.1 *Inspection Procedure*—One method of optical inspection is to view a high-contrast grid pattern of dark and white lines through the lens, scanning it area by area and moving it about. The grid pattern should be at least 18 by 18 in. and constructed of high contrast black lines on a white background (the white separations being equal to the black lines, both being approximately ¼ in. wide). The target should be at least 6 to 8 ft from the observer, and the lens should be held at least 18 to 24 in. from the eye. Any ripples in the lens detected by this test method should be further examined in accordance with 9.2.2.

9.2.2 The referee method of detecting optical defects and local aberrations is to scan the central viewing zone, especially areas of suspicion arising from the visual test of 9.2.1. The lens or shield should be scanned with a precision focimeter or an 8× to 10× telescope using the targets and arrangements described in 9.6.2 to 9.6.2.5. The aperture should be 5 to 7 mm for this examination. Areas outside the central viewing zone or within 6 mm of the edge need not be tested. When the central viewing area is scanned, there shall be no sudden jump, doubling, or blurring of the image greater than 0.08 diopters change in power. Gradual variations in the central viewing zone shall be within the power imbalance tolerances. An optical focimeter with electronic readout repeatable to 0.02 diopters is a satisfactory alternate method. These scanning procedures may be made by scanning across the lens surface not necessarily in the "as worn" mode.

9.3 *Luminous Transmittance*—Use a suitable photometer, such as a Gardner Hazemeter, or other device comprised of a light source of CIE Illuminant A at 2856°K color temperature, and a photometric probe and meter capable of reading transmission in percent over a range of 1 % to 100. Use a suitable enclosure to block against stray light and contain the test samples. Following the manufacturers instructions for the use of the instrument, measure the specimen for percent transmittance within each of the two central viewing zones. The measured values shall meet the established criteria for the device. A spectrophotometer, followed by appropriate photometric calculation, may also be used.

9.3.1 For the purposes of this specification, luminance transmittance may be measured with inexpensive photometers.[8] A fixturing device should be devised to exclude ambient light. The source need not be strictly Illuminate C. A tungsten lamp or a screw-in fluorescent lamp provides adequate simulation of the use environment.

9.3.2 *Ultraviolet Transmittance*—Average transmittances measured in no greater than 10 nm band widths with a commercially available spectrophotometer shall meet the requirements as follows:

9.3.2.1 UVB (290–315 nm), clear protectors, 5 % maximum, sunglass types, 1 % maximum.

9.3.2.2 UVA (315–380 nm), clear protectors, 50 % maximum, sunglass types, 0.5 luminous transmittance.

9.4 *Prismatic Deviation Measurements*:

9.4.1 *Purpose*—The test presented here is intended to measure the angular deviation of light rays created by the protective device as they pass through the lens(es).

9.4.2 *Apparatus*—A telescope, equipped with a cross hair reticule having a magnification of 8× to 10× and an aperture 19 mm in diameter shall be used. The test method outlined in ANSI Z87.1-1989 has been found satisfactory for this purpose. Other methods that yield comparable results may be used. For this test method the target distance is 4 m. This is easier to achieve than longer distances. The target can be metric graph paper divided into 1 cm and 5 mm squares or constructed with a ruler and compass. A circle with a 2 cm radius and a center dot about 1.5 mm in diameter will provide the tolerance for overall prism in one eye. If the 1 cm and 5 mm grids are darkened for 20 mm in each direction from center, with the center lines emphasized, measurements will be easier. Each 5 mm of the scale represents 0.125 prism diopters. The prism values off-center can be labeled along one edge of the 4 cm square vertically and horizontally departing from the central zero. The right side of the target should be labeled plus (+) and the left side minus (–) and vertical top plus (+) and bottom minus (–).

9.4.3 *Test Procedure*—The eye protector shall be mounted in a fixture so that the axis of the test instrument is aligned with the normal line of sight as defined in 3.1.13. An appropriate standard head with parallel horizontal holes drilled through the eyes would be convenient, but in some cases unnecessary. A fixture with a board and dowel sticks can be devised to

[8] Inexpensive photometers, available from Edmund Scientific Corp., have been found satisfactory for this purpose.