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PERFORMANCE SPECIFICATION

LENS, GOGGLE AND VISOR, HELMET, OPTICAL CHARACTERISTICS, GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This is a general specification for optical characteristics of helmet visor and goggle lenses.

1.2 Classification. The visor and goggle lenses will be of the following classes, as specified (see 6.2).

Class 1 - Clear

Class 2 - Neutral gray

Class 3 - 98% filter

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are cited in sections 3 and 4 of this specification. These lists do not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of these lists, document users are cautioned that they must meet the

Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this document should be addressed to: Resources & Logistics Services Division, SA-ALC/TILDD, 485 Quentin Roosevelt Rd., Kelly AFB, Texas 78241-6425, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

requirements specified in the documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the applicable issues are those cited in the solicitation.

NBS 374 - Method for Determining the Resolving Power Of Photographic Lenses

(Application for copies should be addressed to National Institute of Standards and Technology, Publications and Programs Inquiries, Room A903, Administration Building, Gaithersburg, MD 20899-0001.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the applicable issues of the documents which have been adopted by the DoD are those listed in the specific issue of the DoDISS cited in the solicitation. Unless otherwise specified, the documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR QUALITY (ASQ)

ANSI/ASQC Z1.4 - Sampling Procedures And Tables For Inspection By Attributes (DoD-adopted)

(Application for copies should be addressed to American Society for Quality, P.O. Box 3066, Milwaukee, WI 53201-3066, or to the American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics (DoD-adopted)

ASTM D 1044 - Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion (DoD-adopted)

ASTM G 23 - Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials. (DoD-Adopted)

(Application for copies should be addressed to American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.)

RADIO TECHNICAL COMMISSION FOR AERONAUTICS (RTCA)

RTCA/DO-160 - Environmental Conditions and Test Procedures for Airborne Equipment

(Application for copies should be addressed to RTCA Inc., 1140 Connecticut Avenue, NW, Suite 1020, Washington, DC 20036-4001.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Materials. All materials shall be suitably treated to resist corrosion due to electrolytic decomposition, fungus, salt spray, and any other atmospheric condition that may be encountered during operational use or storage.

3.2 Design and construction. The visor and goggle lens shall be in accordance with the applicable specifications or drawings. Figure 1 is an example of a typical lens showing test reference point C and the location of critical and noncritical areas of vision. This figure is a guide since visor and goggle lens configurations differ for different helmets. Noncritical areas of vision shall meet the same criteria for optical characteristics as the critical areas of vision except where otherwise specified.

3.3 Performance.

3.3.1 Prismatic deviation (see 6.3.1).

3.3.1.1 Vertical prismatic deviation. The vertical prismatic deviation between point C for the right eye and point C for the left eye shall not be more than 0.18 diopters nor shall the vertical prism at any point in the critical area of vision exceed 0.18 diopters.

3.3.1.2 Horizontal prismatic deviation. The algebraic sum of the horizontal prismatic deviation at point C for the left eye and at point C for the right eye shall not exceed 0.75 diopters. The algebraic difference between the horizontal deviation at point C for the left eye and at point C for the right eye shall not exceed 0.18 diopters.

3.3.2 Refractive power. The refractive power of the visor and goggle lens shall not exceed, by more than ± 0.06 diopters, the inherent power in a spherical lens with concentric surfaces having the proper radii of curvature and thickness. The inherent power of the visor shall be calculated by use of the following equations:

$$F = F_1 + F_2 - \frac{t}{n'} F_1 F_2; \quad F_1 = \frac{n' - n}{r_1}; \quad F_2 = \frac{n - n'}{r_2}$$

Where:

F = Inherent power of the lens in diopters
F_1 = Inherent power of the convex surface in diopters
F_2 = Inherent power of the concave surface in diopters
n = Index of refraction of air
n' = Index of refraction of the material
r_1 = Radius of first or convex surface
r_2 = Radius of second or concave surface
t = Thickness in meters.

3.3.3 Luminous transmittance (see 6.3.2.1).

3.3.3.1 Class 1 visor and goggle lens. The luminous transmittance of the class 1 visor and goggle lens shall not be less than 90% throughout the critical area. The noncritical area shall not vary in transmittance by more than ± 2% of the critical area transmittance.

3.3.3.2 Class 2 visor and goggle lens. The luminous transmittance of the class 2 visor and goggle lens shall be 15% ± 5% when measured at point C. The luminous transmittance of point C for the left eye and point C for the right eye of the same visor and goggle lens shall not differ by more than 20%. The total luminous transmittance at the top of the visor and goggle lens shall not exceed the total luminous transmittance at the bottom of the visor and goggle lens (see 6.3.2).

3.3.3.3 Class 3 visor and goggle lens. The luminous transmittance of the class 3 visor and goggle lens shall be 2.0% (± 0.5%) at any point in the critical areas. For the noncritical areas, the luminous transmittance shall be between 1.5 and 3.0%. The difference between the luminous transmittance measured at any two points in the critical or the noncritical areas shall not exceed 0.75%.

3.3.4 Optical distortion. There shall be no optical distortion visible in the critical areas of the lens.

3.3.5 Haze. The haze value of the visor and goggle lens shall not exceed 5%.

3.3.6 Extended electromagnetic radiation transmittance of class 3 visor and goggle lens. The average transmittance in the two ranges between 200 and 380 nanometers (nm) and 770 and 1,500 nm shall not exceed 2.5%. The average transmittance within the critical areas for the range between 380 and 770 nm shall be 2.0% (± 0.5%). For the noncritical areas the average transmittance for the range between 380 and 770 nm shall be 1.5 to 3.0%; however, the measured values of transmittance within this range shall not vary more than 0.75% for any individual visor or goggle lens. The color of the lens shall be essentially neutral; consequently, no spike between 380 and 770 nm shall exceed 5.0% transmittance.

3.3.7 Erythemal ultraviolet transmittance of class 1 and class 2 visor and goggle lens. The erythemal ultraviolet transmittance of class 1 and class 2 visor and goggle lens shall be less than 5%.

3.3.8 Neutrality of class 2 visor and goggle lens. The spectral transmittance of the class 2 visor and goggle lens may vary with wave lengths between 380 and 770 nm, but the average spectral transmittance deviation percentage within nine spectral bands shall be less than 12 (see 6.3.3).

3.3.9 Spectral transmittance.

3.3.9.1 Class 1 visor and goggle lens. The spectral transmittance of the class 1 visor and goggle lens shall not be less than 90% throughout the critical areas. The spectral transmittance in the noncritical areas shall be within 25% of the spectral transmittance in the critical areas.

3.3.9.2 Class 2 visor and goggle lens. The spectral transmittance of the class 2 visor and goggle lens shall not exceed 15% ± 5% when measured at point C. The transmittance of point C for the left eye and point C for the right eye of the same visor and goggle lens shall not differ by more than 20%. The total visible transmittance at the top of the visor and goggle lens shall not exceed the total visible transmittance at the bottom of the visor and goggle lens.

3.3.10 Chromaticity of class 2 visor and goggle lens. The chromaticity coordinates x and y of the class 2 visor and goggle lens shall be within the limits indicated in figure 2.

3.3.11 Colorfastness to light of class 3 visor and goggle lens. After the class 3 visor and goggle lens are subjected to the colorfastness test, the average spectral transmittance of the class 3 visor and goggle lens in the range between 380 and 770 nm shall be 2% (± 0.5%). There shall be no evidence of peeling, warping, cracking, crazing, optical distortion of the critical area, or any other optical defects.

3.3.12 Resistance to thermal shock of class 3 visor and goggle lens. After the class 3 visor and goggle lens has been subjected to the thermal shock test, the average spectral transmittance of the class 3 visor and goggle lens in the range between 380 and 770 nm shall be 2% (± 0.5%). There shall be no evidence of peeling, warping, cracking, crazing, optical distortion of the critical areas, or any other optical defects.

3.3.13 Durability of coatings for class 3 visor and goggle lens.

3.3.13.1 Adhesion of metallic film. If coatings are incorporated on either surface, the metallic film shall not dislodge, pull away, or tear.

3.3.13.2 Abrasion resistance. If coatings are incorporated on either surface, there shall be no visible abrasion of, or removal of, the coating during testing.

3.4 First article. When specified, two visor and goggle lenses of each class shall be subjected to the first article test in accordance with 4.2.

3.5 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable.

3.6 Toxic chemicals, hazardous substances, and ozone depleting chemicals (ODCs). The use of toxic chemicals, hazardous substances, or ODCs shall be avoided, whenever feasible.

4. VERIFICATION

4.1 Classification of inspections and tests. The inspection and testing of the visor and goggle lenses shall be classified as follows:

a. First article tests (see 4.2)

b. Conformance tests (see 4.3)

4.2 First article test. First article test shall consist of all tests in 4.4.

4.3 Conformance tests. Conformance tests shall consist of:

a. Individual tests

b. Sampling tests

4.3.1 Individual tests. Each visor and goggle lens shall be subjected to the examination of product test (see 4.4.1).

4.3.2 Sampling tests.

4.3.2.1 Sampling. Each lot of completed lenses shall be subjected to the tests listed below in accordance with an appropriate plan selected from ANSI/ASQC Z1.4 or another commercially acceptable sampling procedure.

a. Class 1, 2, and 3 lenses

(1) Refractive power (see 4.4.3)

(2) Prismatic deviation (see 4.4.2)

(3) Luminous transmittance (see 4.4.4)
(4) Optical distortion (see 4.4.5)

(5) Haze (see 4.4.6)

b. Additional tests for class 3 lenses

(6) Extended electromagnetic radiation transmittance (see 4.4.7)

(7) Colorfastness to light (see 4.4.12)

(8) Resistance to thermal shock (see 4.4.13)

(9) Durability of coatings (see 4.4.14)

4.4 Tests.

4.4.1 Examination of product. Each visor or goggle lens shall be visually examined to determine conformance to this specification with respect to materials; design and construction; peeling, warping, cracking, crazing, optical distortion of the critical areas, or any other optical defects during testing; and interchangeability.

4.4.2 Prismatic deviation. A telescope, lensometer, projection lantern, or any other suitable instrument shall be used to test the prismatic deviation. The instrument shall include a target which can be brought into sharp focus, as observed through an eyepiece or projected upon a screen, and an aperture not over 1 centimeter in diameter fixed at a definite position along the axis of the optical system. The design of the instrument shall be such that the refractive power in the principal meridian of the visor placed across the test aperture can be determined to within 0.03 diopter. Vertical and horizontal prismatic deviations shall apply to readings taken on the visor as worn, that is, the distance of 1.70 inches from the concave surface of the visor when instruments other than the lensometer are used. All measurements shall be made in areas delineated in the end item specification, drawing, or as specified by the procurement activity (see 6.2.f).

4.4.2.1 Vertical prismatic deviation. Base up prism shall be designated positive (+) and base down prism shall be designated negative (-). The vertical prismatic deviation is calculated by determining the algebraic difference between point C for the right eye and point C for the left eye.

4.4.2.2 Horizontal prismatic deviation. Base out prismatic deviation shall be designated positive (+) and base in prismatic deviations shall be designated negative (-). The horizontal prismatic deviation shall be calculated by determining both the algebraic sum and difference between point C for the right eye and point C for the left eye.

4.4.3 Refractive power. The refractive power shall be determined with the same apparatus used for measuring prismatic deviation (see 4.4.2 and 6.3.5).

4.4.4 Luminous transmittance. The luminous transmittance of the critical and non-critical areas (see figure 1) of class 1, class 2, and class 3 visor or goggle lenses shall be determined using an acceptable commercial process such as that contained in ASTM D 1003 (see 6.3.2.1).

4.4.5 Optical distortion. To determine optical distortion in the critical areas, the visor or goggle lens shall be inserted with its surface normal to the line of sight into a distortion test apparatus, an example of which is described in figure 3. The observed distortion patterns shall be equal to or more parallel than pattern numbers 1-5 in figure 4.

4.4.6 Haze. The haze value shall be determined in accordance with an acceptable commercial process such as that contained in ASTM D 1003 and shall be 5% or smaller.

4.4.7 Extended electromagnetic radiation transmittance of class 3 visor and goggle lens. The extended electromagnetic radiation transmittance of the class 3 visor and goggle lens shall be measured with an automatic recording spectrophotometer. The average for each range shall be calculated separately, taken every 10 nm. The monochromator of this spectrophotometer shall vary continuously from 200 to 2500 nm. The recording sheet for each visor and goggle lens tested shall show a base line and the two smooth curves, one for each point C. Transmittance shall be measured at points C for the left and the right eyes by examination of the transmission curves and by calculating the averages.

4.4.8 Erythemal ultraviolet transmittance of class 1 and class 2 visor and goggle lens. Erythemal ultraviolet transmittance shall be measured by a spectrophotometer, and shall be less than 5% when computed as the average spectral transmittance at wave lengths of 250, 270, 290, 300, 310, and 320 nm.

4.4.9 Neutrality. The spectral transmittance (380-770 nm) of the class 2 visor and goggle lenses shall be measured by a spectrophotometer having a monochromator band width of 10 nm or less and a reproduction of ± 1%. The neutrality shall be calculated by the Judd Daylight Duplication Method (see 6.3.3), or equivalent.

4.4.10 Spectral transmittance. The spectral transmittance of class 1 and 2 visor and goggle lenses shall be determined with an automatic recording spectrophotometer or equal (see 6.3.3).

4.4.11 Chromaticity of class 2 visor and goggle lens. The chromaticity coordinates x and y shall be calculated from spectrophotometric data. Table II illustrates a method of such calculations (see 6.3.4).

4.4.12 Colorfastness to light of class 3 visor and goggle lens. The colorfastness test shall be conducted using the appropriate portions of ASTM G 23 or an equivalent commercial testing procedure. Each side of the visor and goggle lens shall be subjected to the test procedures. After this test, the average spectral transmittance of the visor and goggle lens in the range between 380 and 770 nm shall be 2% (± 0.5%).

4.4.13 Resistance to thermal shock of class 3 visor and goggle lens. The visor and goggle lenses shall be exposed in air to temperature extremes alternately for 10 cycles. Each cycle shall consist of exposure to 40±5 °F, followed immediately by exposure to 160±5 °F. The length of time in minutes of exposure to each temperature is determined by multiplying the thickness in inches of the visor and goggle lens by 400. After completion of the 10 temperature cycles, the average spectral transmittance of the visor and goggle lens in the range between 380 and 770 nm shall be 2% (± 0.5%)

4.4.14 Durability of coatings for class 3 visor and goggle lenses. Before and after subjecting a class 3 coated lens to any durability of coating tests, the coated lens shall be thoroughly and carefully cleaned to remove dirt, oil, film, finger marks, and grease marks, using a mild detergent and water followed by drying with a soft cloth or lens tissue. Tests 4.4.14.1 and 4.4.14.2 shall be performed on the metallic coating of the clean class 3 lens.

4.4.14.1 Adhesion of metallic film. A strip of pressure sensitive cellophane tape shall be firmly pressed lengthwise on the metallic coated surface of the class 3 lens so that a minimum of 6 inches of the tape adheres to the lens. The cellophane tape shall be 1 inch in width and shall possess a minimum adhesion value of not less than 40 ounces per inch of width. The tape shall be removed quickly with a snap action which exerts the greatest possible stripping effect on the coating.

4.4.14.2 Abrasion resistance. An optical coating abrasion tester, an example of which is shown in figure 5, shall be rubbed across the surface of the clean, coated lens from one point to another, over the same path, for 20 complete cycles with the force of 2.0 to 2.5 pounds continuously applied. Wherever possible, rubs of about 1 inch length are preferred. After the rubbing has been completed, the lens shall be thoroughly cleaned as described in 4.4.14 and the surface shall be visually inspected (unaided eye) for evidence of abrasion or removal of coating. An alternate surface abrasion procedure is contained in ASTM D 1044. Superficial abrasion which does not degrade the filter effectiveness is permissible.

4.4.15 Salt spray. The visor and goggle lens shall be tested for resistance to salt spray specified in RTCA/DO-160.

4.4.16 Fungus. The visor and goggle lens shall be tested for resistance to fungus specified in RTCA/DO-160.

4.5 Requirements cross-reference matrix. Table III provides a cross-reference matrix of the section 3 requirements tested or verified in this section .

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department or Defense Agency automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. This specification provides the optical characteristics of visor and goggle lenses used by flight personnel to protect their eyes from wind blast, sunlight, and electromagnetic radiation.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification and class lens being procured.

b. Issue of the DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).

c. Packaging requirements (see 5.1).

d. Data required.

e. When first article test is required (see 3.4).

f. Visor and lens measurements.

g. Packaging requirements including protective coverings (see 5.1 and 6.4).

6.3 Definitions.

6.3.1 Prismatic deviation. Prismatic deviation, for the purpose of this specification, includes the inherent prismatic power resulting from nonparallel surfaces of the material.

6.3.2 Transmittance. Transmittance, T, is the ratio of transmitted to homogeneous radiant flux.

6.3.2.1 Luminous transmittance. Luminous transmittance is defined as the ratio of the luminous flux transmitted by the visor and goggle lens to the luminous flux incident. It is measured with a sensor corrected to compare with the photopic sensitivity of the human eye without regard to specific wave lengths. ASTM D 1003 or a specified modification thereof is a way of determining luminous transmittance.

6.3.2.2 Spectral transmittance. Spectral transmittance, T_c, is the radiant energy transmitted evaluated for a specific range of wave lengths of incident energy. It is desirable that it be measured with an automatic recording spectrophotometer of the required range of sensitivity and evaluated according to the applicable instructions.

6.3.3 Average spectral transmittance deviation calculation. An example for calculation of spectral transmittance deviations is shown in table I. The average spectral transmittance deviation percentage within nine spectral bands is the total of the products of the percent deviation and the weights in table I divided by the total weight, i.e., average deviation = 261/71, or 3.7%. Table I is based on the International Commission on Illumination (CIE) illuminant D65 which represents the colorimetric specification for daylight.

6.3.4 Chromaticity coordinate calculation. An example for calculation of chromaticity coordinates is shown in table II.

6.3.5 Refractive power. The applicable portion of National Bureau of Standards (NBS) Special Publication 374 is suggested as a method of checking refractive power.

6.3.6 Flash blindness goggle (FBG). The class 3 lens (98% filter) is a constituent part of the FBG.

6.4 Protective cover. In previous procurements, each visor and goggle lens was protected from damage during handling and shipping by a suitable cover. Also, each visor and goggle lens was accompanied by a printed circular. The circular cautioned the handler to use care in cleaning and installing the visor and goggle lens to prevent damage to the ophthalmic surfaces and recommended a suitable cleaning agent.

6.5 Subject term (key word) listing.

Chromaticity
Distortion
Eye protection
Flash blindness goggle (FBG)
Luminance
Optical
Prismatic deviation
Radiation
Refraction
Transmittance
Vision

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

TABLE I. Example for calculation of spectral transmittance deviations.

Wave length (nm)	T	Band n	Wave length range	Average transmittance T_n	Percent Deviation $100(1-T_n/T_c)$	Weight	Product
430	0.114						
440	0.118						
450	0.127						
460	0.137	1	430-490	0.133	14	5	70
470	0.142						
480	0.144						
490	0.145	2	460-520	0.145	7	10	70
500	0.147						
510	0.149						
520	0.151	3	490-550	0.151	3	10	30
530	0.153						
540	0.154						
550	0.155	4	520-580	0.155	0	10	0
560	0.157						
570	0.158						
580	0.159	5	550-610	0.159	2	10	20
590	0.160						
600	0.160						
610	0.160	6	580-640	0.160	2	10	30
620	0.161						
630	0.161						
640	0.160	7	610-670	0.160	3	10	30
650	0.159						
660	0.159						
670	0.158	8	640-700	0.158	2	5	10
680	0.157						
690	0.156						
700	0.153	9	670-730	0.153	1	1	1
710	0.151						
720	0.149				Totals	71	261
730	0.148						

LEGEND:
T_c = Spectral transmittance (Use 0.155).
T = Transmittance at 10 nm intervals.
T_n = Average transmittance of 60 nm band.

NOTES:
1. This table is based on CIE illuminant D65(see 6.3.3)
2. T_n for a given band is the average of the seven tabulated values within that band, except that the first and last values are divided by 2, and the average computed by dividing the sum of the values by 6.

TABLE II. Sample computation table of chromaticity coordinates.

Wave length (nm)	$\bar{x}$	$\bar{y}$	$\bar{z}$	T	$\bar{x}$T	$\bar{y}$T	$\bar{z}$T
380	4		20	0.104	0	0	2
390	19		89	0.240	5	0	21
400	85	2	404	0.301	26	1	122
410	329	9	1,570	0.275	90	2	432
420	1,238	37	5,949	0.174	215	6	1,035
430	2,997	122	14,628	0.110	330	13	1,609
440	3,975	262	19,938	0.093	370	24	1,854
450	3,915	443	20,638	0.092	360	41	1,899
460	3,362	694	19,299	0.100	336	69	1,930
470	2,272	1,058	14,972	0.110	250	116	1,647
480	1,112	1,618	9,461	0.122	136	197	1,154
490	363	2,358	5,274	0.132	48	311	696
500	52	3,401	2,864	0.140	7	476	401
510	89	4,833	1,520	0.142	13	686	216
520	576	6,462	712	0.142	82	918	101
530	1,523	7,934	388	0.141	215	1,119	55
540	2,785	9,149	195	0.141	393	1,290	27
550	4,282	9,832	86	0.155	664	1,524	13
560	5,880	9,841	39	0.170	1,000	1,673	7
570	7,322	9,147	20	0.167	1,223	1,528	3
580	8,417	7,992	16	0.153	1,288	1,223	2
590	8,984	6,627	10	0.142	1,276	941	1
600	8,949	5,316	7	0.136	1,217	723	1
610	8,325	4,176	2	0.136	1,132	568	0
620	7,070	5,153	2	0.137	969	432	
630	5,309	2,190		0.137	727	300	
640	3,693	1,443		0.138	510	199	
650	2,349	886		0.150	352	133	
660	1,361	504		0.199	256	94	
670	708	259		0.270	191	70	
680	369	134		0.368	136	49	
690	171	62		0.475	81	29	
700	82	29		0.576	47	17	
710	39	14		0.620	24	9	
720	19	6		0.636	12	4	
730	8	3		0.643	5	2	
740	4	2		0.642	3	1	
750	2	1		.0.632	1	1	
760	1	1		0.620	1	1	
770	1			0.600	1	0	
				Totals	X=13,992	Y=14,790	Z=13,228

LEGEND:

$X = \Sigma\bar{x}T$, $Y = \Sigma\bar{y}T$, $Z = \Sigma\bar{z}T$

T_C = Spectral transmittance, = Y/1,000 = 14.8 percent

Chromaticity coordinates:

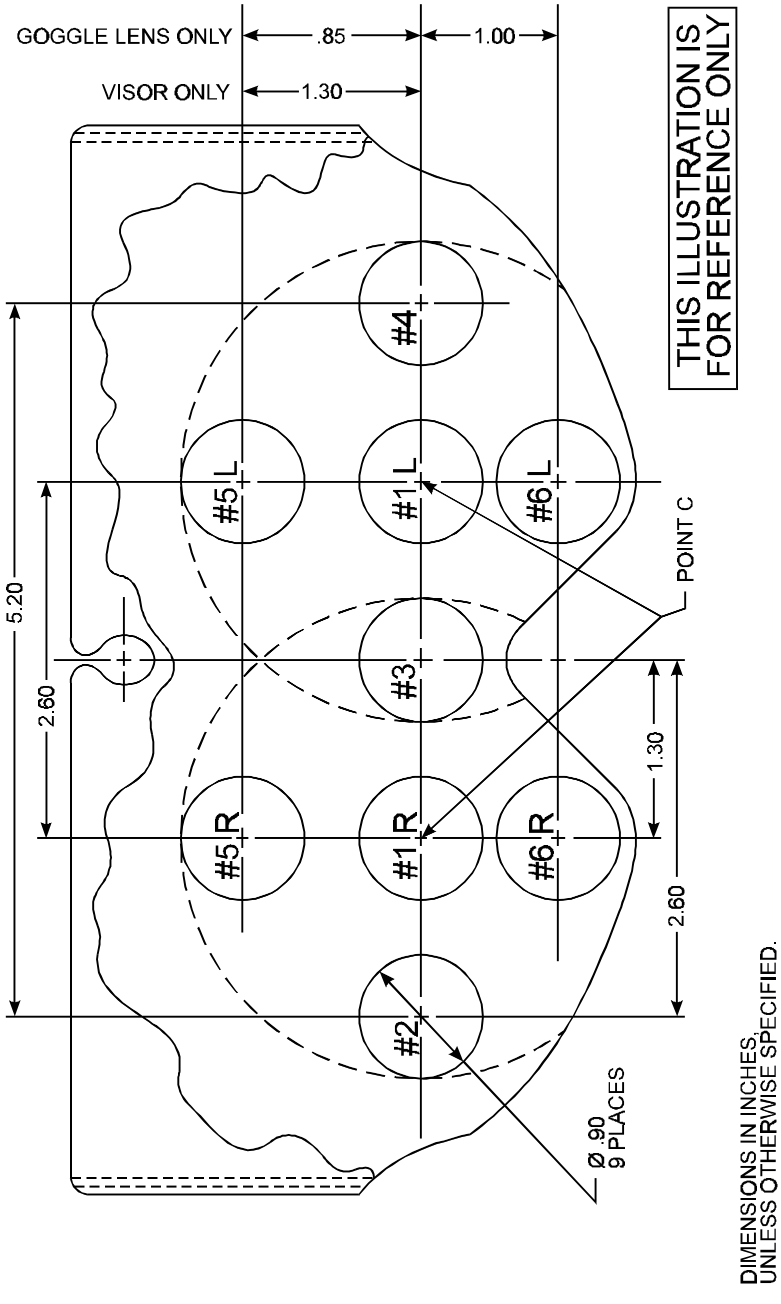
x = X/(X+Y+Z) = 13,992 / (13,992 + 14,970 +13,228) = 0.3331

y = Y/(X+Y+Z) = 14,790 / (13,992 + 14,970 +13,228) = 0.3521

NOTE: Spectral transmittance, T_C, and chromaticity coordinates, x and y, are for CIE illuminant D65 (see 6.3.3).

TABLE III. Requirements cross-reference matrix.

Requirement	Verification
3.1	4.4.1, 4.4.15, 4.4.16
3.2	4.4.1
3.3.1.1	4.4.2, 4.4.2.1
3.3.1.2	4.4.2, 4.4.2.2
3.3.2	4.4.3
3.3.3.1	4.4.4
3.3.3.2	4.4.4
3.3.3.3	4.4.4
3.3.4	4.4.5
3.3.5	4.4.6
3.3.6	4.4.7
3.3.7	4.4.8
3.3.8	4.4.9
3.3.9.1	4.4.10.1
3.3.9.2	4.4.10.2
3.3.10	4.4.11
3.3.11	4.4.1, 4.4.12
3.3.12	4.4.1, 4.4.13
3.3.13.1	4.4.14, 4.4.14.1
3.3.13.2	4.4.14, 4.4.14.2
3.4	4.4.1
3.5	4.4.1
3.6	4.4.1



For the sample goggle and lens shown, critical areas are located within the dotted circles. Noncritical areas are located outside dotted circles. Numbered circles within the critical areas are designated as points of choice for prismatic and distortion tests. When measuring refractive power or prismatic deviations, points bearing the same number, for example, 5R and 5L, are compared with each other, except that point No. 2 is compared with point No. 3 and point No. 3 is compared with point No. 4.

FIGURE 1. Critical and noncritical areas.

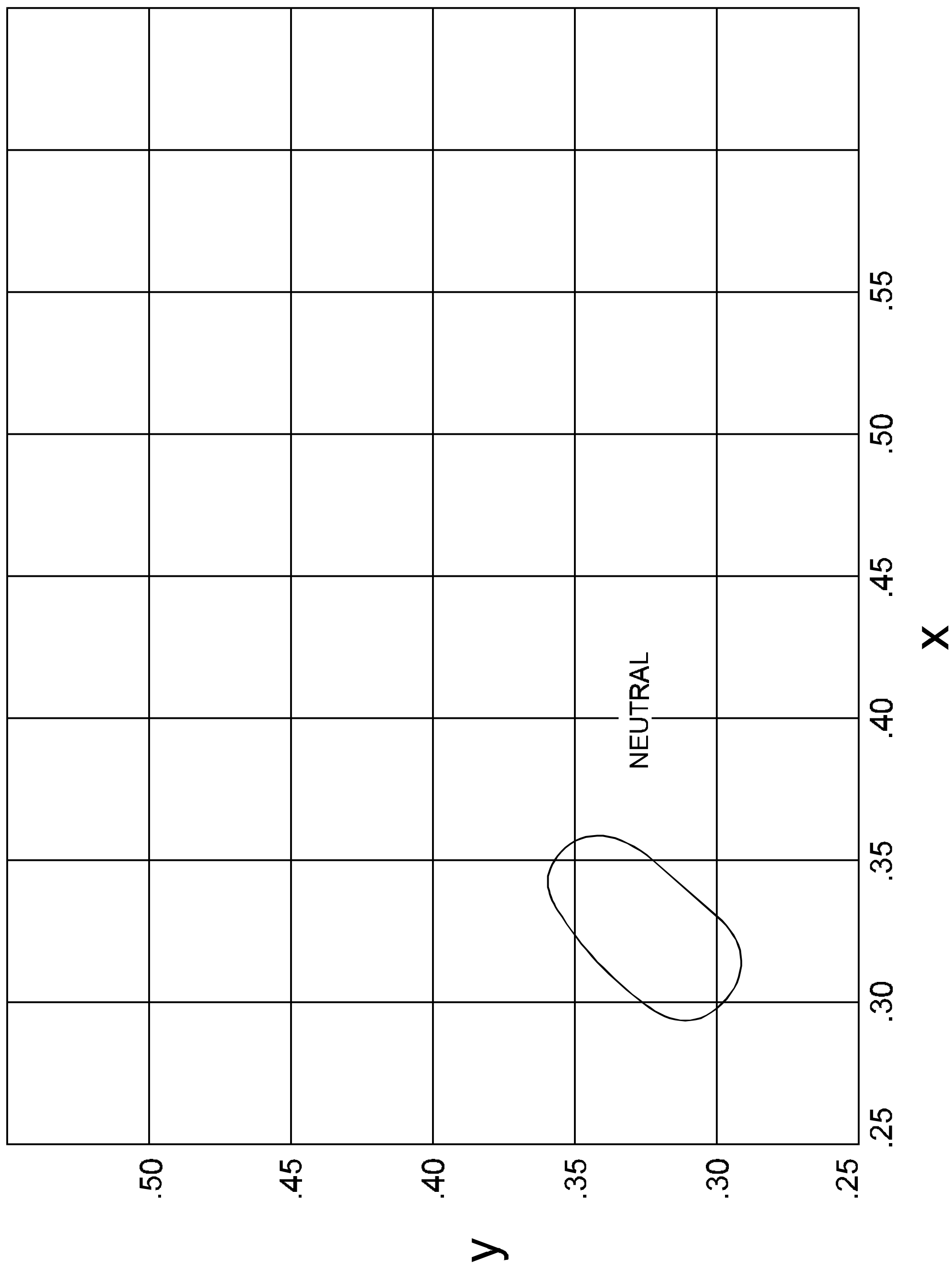
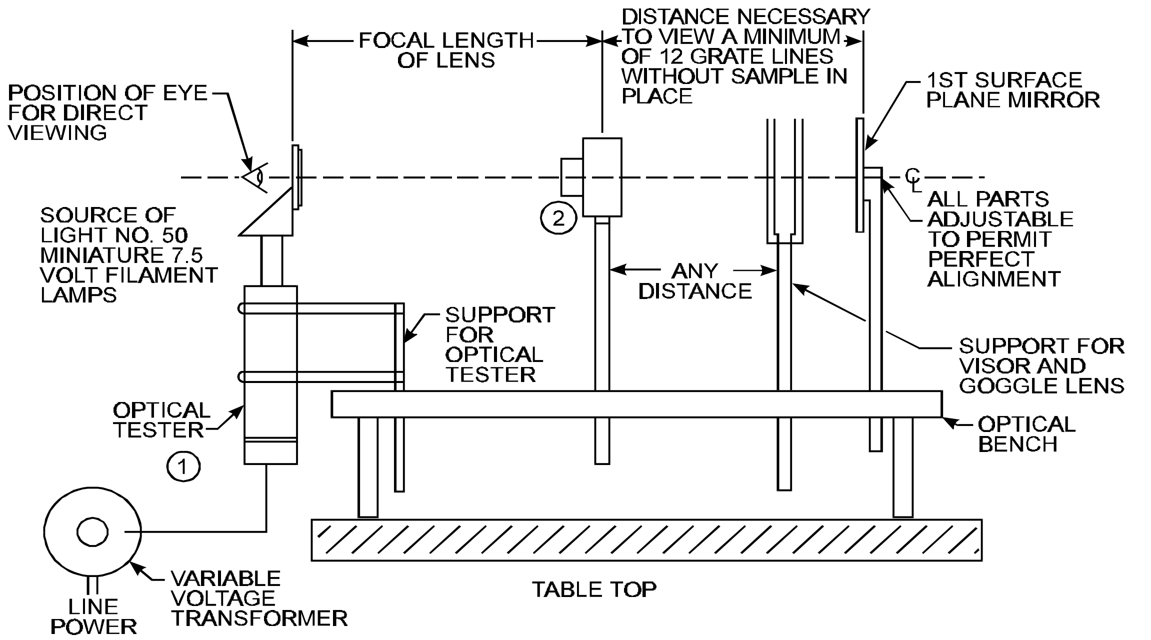


FIGURE 2. Chromaticity coordinates.



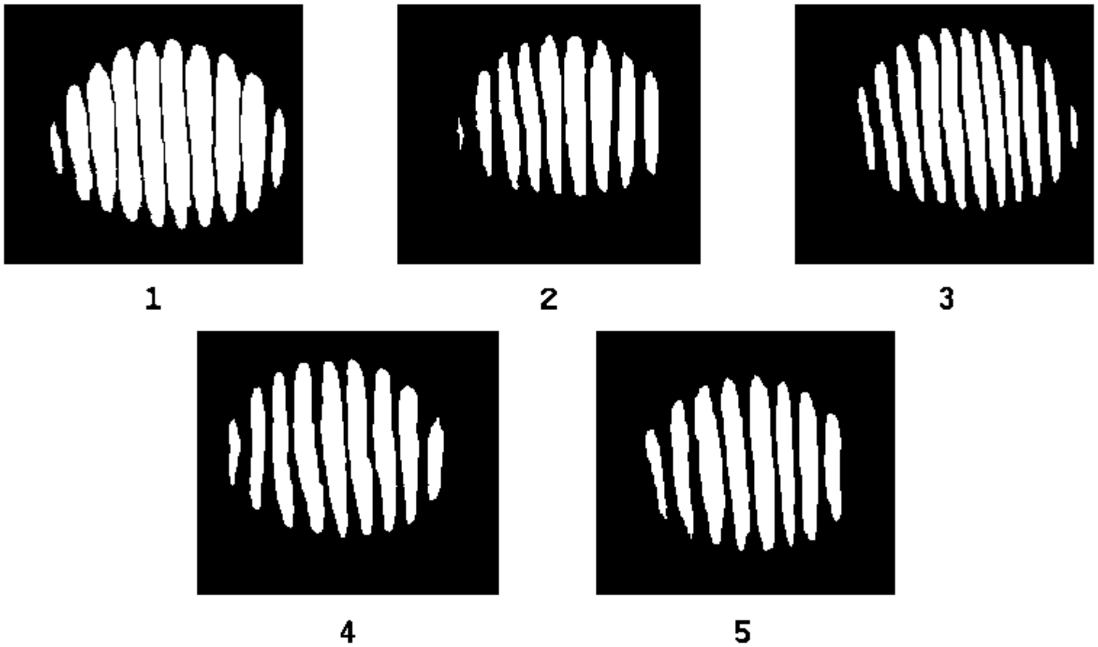
NOTES:

1. OPTICAL TESTER WITH A 60-LINE GRATING AND OPTICAL BENCH ADAPTER OR EQUIVALENT.
2. TELEPHOTO CAMERA LENS - 1:5.5/240 MM, NORMAL COLOR COATED, BARREL ONLY OR EQUIVALENT.
3. UNAIDED EYE IS ACUTE VISIBILITY 20/20 OR BETTER WITH OR WITHOUT CORRECTIVE LENSES.

THIS ILLUSTRATION IS FOR REFERENCE ONLY

FIGURE 3. Distortion tester.

ACCEPTABLE PATTERNS



UNACCEPTABLE PATTERNS

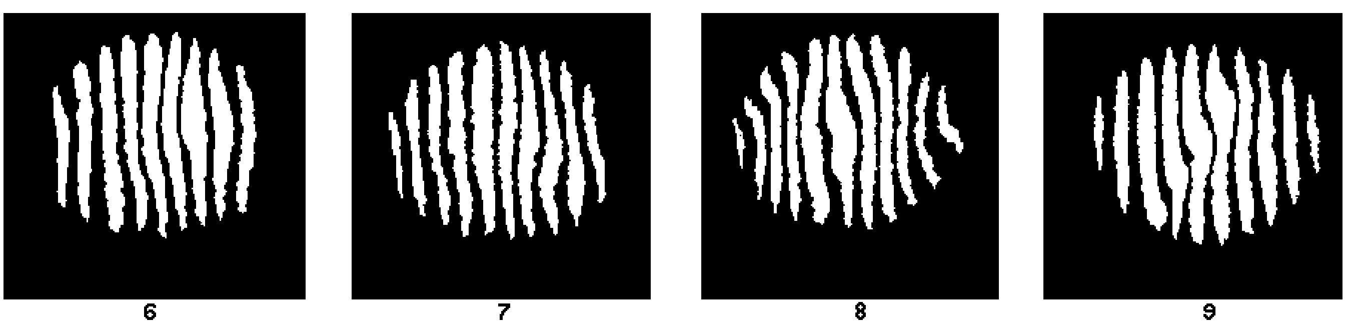


FIGURE 4. Examples of visor distortion patterns.

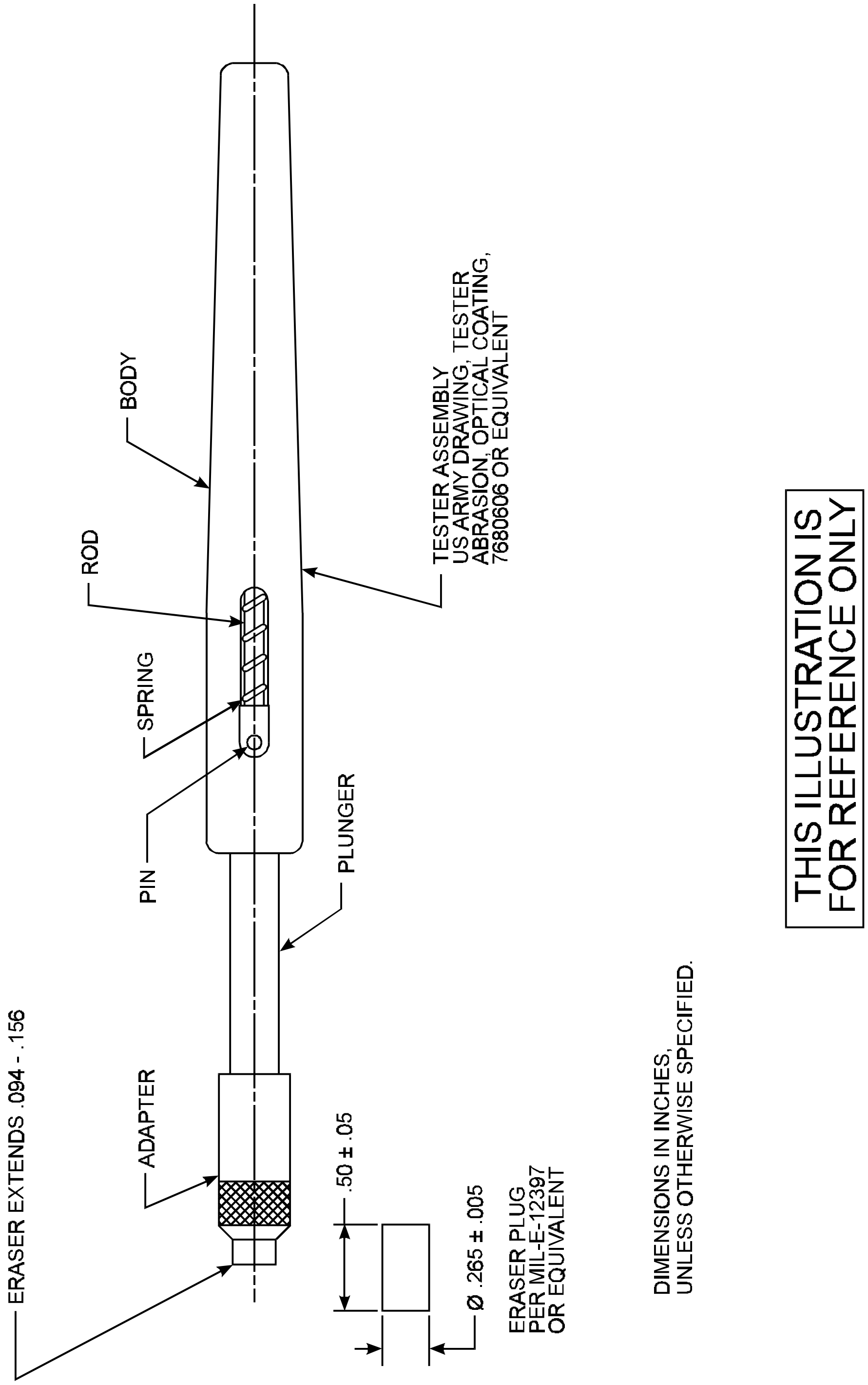


FIGURE 5. Standardized eraser.

Custodians:
Air Force - 99

Review activities:
DLA - CT

Preparing Activity:
Air Force - 82

(Project No. 8475-0240)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-38169A	2. DOCUMENT DATE (YYMMDD)

3. DOCUMENT TITLE
Lens, Goggle and Visor, Helmet, Optical Characteristics, General Specification for

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. Organization

c. ADDRESS *(Include zip code)*	d. TELEPHONE *(Include Area Code)* (1) Commercial (2) DSN *(if applicable)*	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME SA-ALC/TILDD	b. TELEPHONE *(Include Area Code)* (1) Commercial 210-925-6314 (2) DSN 945-6314
c. ADDRESS ***(Include Zip Code)*** 485 Quentin Roosevelt Rd. Kelly AFB, Texas 78241-6425	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 DSN 289-2340