MIL-C-25050A(ASG)
2 DECEMBER 1963

Superseding
MIL-C-25050(ASG)
29 October 1954

MILITARY SPECIFICATION

COLORS, AERONAUTICAL LIGHTS AND LIGHTING EQUIPMENT, GENERAL REQUIREMENTS FOR

This specification has been approved by the Department of the Air Force and by the Bureau of Naval Weapons.

1. SCOPE

1.1 Scope.- This specification covers the chromaticity and transmission requirements of equipment light transmitting ware in the descending order of transmission.

1.2 Classification.- Colors shall be furnished in two types in accordance with the following designations, as specified:

Type I - Aviation colors:

(a) Aviation red
(b) Aviation yellow
(c) Aviation green
(d) Aviation blue
(e) Aviation white
(f) Instrument and panel lighting red

Type II - Identification colors:

(a) Identification red
(b) Identification yellow
(c) Identification green
(d) Identification lunar white

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

FSC 7650

SPECIFICATIONS

Military

MIL-L-25467 Lighting, Integral, Aircraft Instrument, General Specification for

STANDARDS

Federal

FED. STD. NO. 3 Colors, Aeronautical Lighting

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Aviation colors.- Standards for aviation colors shall conform to the following fundamental colorimetric definitions. In figure 1, these limits are shown graphically in the coordinate system of the International Commission on Illumination (C.I.E.) in which they are stated numerically. Figure 2 is a transformation of figure 1 which the spacing of the colors more nearly corresponds to their apparent differences in chromaticity as seen by an average observer. (Reference: Journal of the Optical Society, Vol. 29, page 370; September 1939.) (See 6.3.1.)

3.1.1 Aviation red, type I(a), is any color for which:

y is not greater than 0.335, and
z is not greater than 0.002.

3.1.2 Instrument and panel lighting red, type I(f) is any color which:

y is not greater than 0.306
z is not greater than 0.001.

3.1.3 Aviation yellow, type I(b), is any color which: 1/

y is not less than 0.370, or greater than 0.425, and
z is not greater than 0.007.

3.1.4 Aviation green, type I(c), is any color for which:

x is not greater than 0.440 - 0.320 y, or greater than y - 0.170, and
y is not less than 0.390 - 0.170 x.

1/ The chromaticity requirements for aviation yellow are adjusted to require the same type of glass as identification yellow, but allowance is made for the difference in color temperature ranges of the lamps.

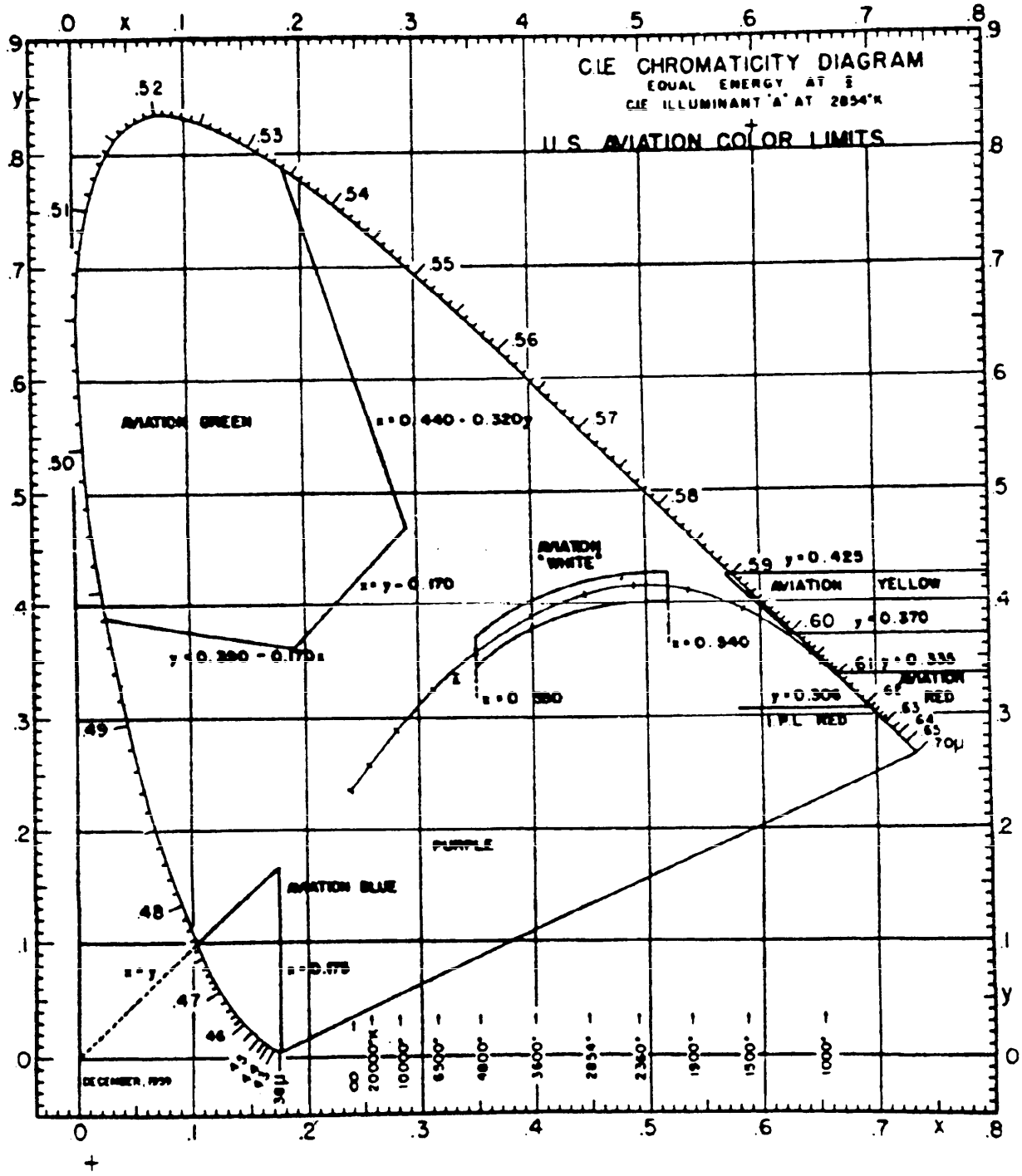

FIGURE 1. C.I.E. Mixture diagram showing aviation color limits

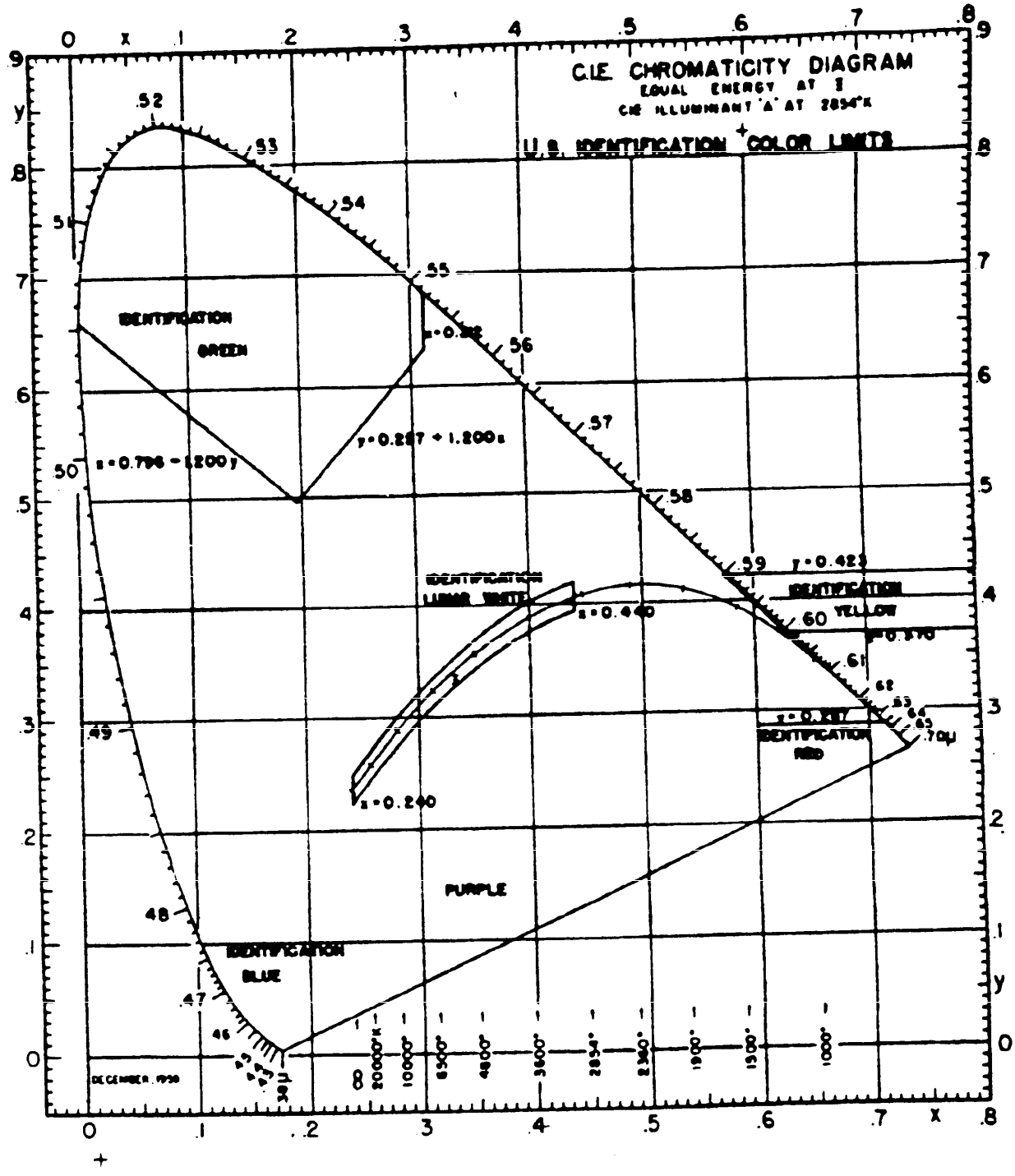

FIGURE 2. C.I.E. Mixture diagram showing identification color limits

3.1.5 Aviation blue, type I(d), is any color for which:

x is not greater than 0.175,
y is not greater than x,
ϕ_r divided by ϕ_v is not greater than 0.015. 2/

3.1.6 Aviation white, type I(e), is any color for which:

x is not less than 0.350, or greater than 0.540, and
$y - y_o$ is not numerically greater than 0.01. 3/

2/ ϕ_v is the total flux of the light under consideration, and ϕ_r is the part of that flux which is transmitted by a replica of identification red transmission standard filter deisgnation as National Bureau of Standards (NBS) 3055A.

3/ Y_o is the y coordinate of the Planckian Radiator for which $x_o = x$.

3.2 Identification colors.- Standards for identification colors shall conform to the following fundamental colorimetric definitions. In figure 3, these limits are shown graphically in the coordinated system (C.I.E.) in which they are stated numerically.

3.2.1 Identification red is any color for which:

y is not greater than 0.287, and
z is not greater than 0.001.

3.2.2 Identification yellow (amber ware) is any color for which:

y is not less than 0.370, or greater than 0.423, and
z is not greater than 0.005.

3.2.3 Identification green is any color for which:

x is not greater than 0.312, or less than
0.796 - 1.200 y, and
y is not less than 0.257 +1.200 x.

3.2.4 Identification lunar white is any color for which:

x is not less than 0.240, or greater than 0.440, and
$y - y_o$ is not greater than 0.015, and
$y_o - y$ is not greater than 0.045. (See footnote 3/ of 3.1.6).

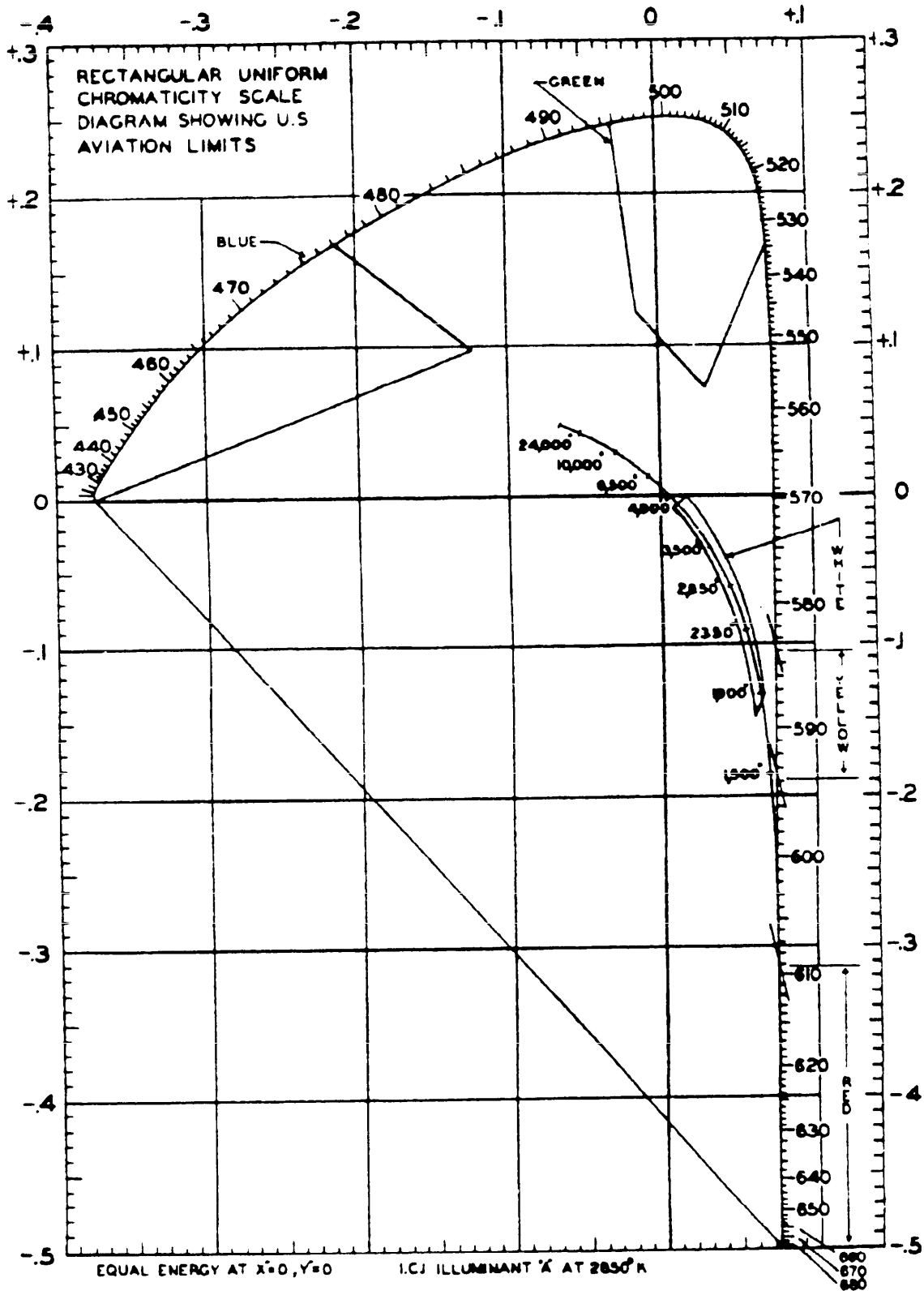

FIGURE 3. R.U.C.S. Mixture diagram showing aviation color limits

3.3 Standards.- Each color standard shall consist of a set of two or more filters and an illuminant of designated color temperature. One filter designated as the "pale limit" shall represent the minimum coloration that is acceptable. In general, this filter shall also represent a hue limit. One or more filters of the set, designated as "transmission standards", shall provide a basis for measuring the transmission of ware that is near the minimum acceptable transmission for its grade. In the case of grade A ware or other ware of similar chromaticity, the pale limit may be used as a basis for measuring the transmission. When a second chromaticity limit is deemed advisable, an additional filter may be used, or a transmission standard may be used as such, and these filters shall be designated as "red limit", "blue limit", etc. For identification green, separate yellow-green and blue-green standards are required.

3.3.1 Chromaticity.- In combination with the designated light source, each of the filters of a standard shall give a chromaticity conforming to the fundamental definition for the color represented. The chromaticity of the transmission standard shall also conform to the limits in table I. The same set of filters may be adopted for use with more than one illuminant, provided the resulting trichromatic coordinates fall within the fundamental definitions.

TABLE I. Chromaticity limits for transmission standards (illuminant 2,854° K)

Color	Limit	Color	Limit
Aviation red	$y < 0.310$	Identification red	$y < 0.280$
Aviation yellow	$y < 0.403$	Identification yellow	$y < 0.403$
Aviation green	$x < 0.210$	Identification green	$y > 0.150 + 2.000\ x$
Aviation blue	$y < 0.086$		
		Identification lunar white	$x < 0.285$
Instrument and panel lighting red	$y < 0.306$		

3.3.2 Similarity of material.- The chromaticity characteristics of the transmission standards shall be the same as those of the pale limit according to the definition (see 6.3.3).

3.3.3 Uniformity of coloring.- The coloring matter shall be uniformly distributed throughout the material, except in the case of selenium red and yellow filters for which a slight variation will be accepted as unavoidable.

3.3.4 Dimensions.- The standard filters shall be cut square, not more than 5.05 cm. (1.99 in.) nor less than 4.90 cm. (1.93 in.) on each side, and shall be not less than 1.5 mm. (0.059 in.) thick.

3.3.5 Optical quality.- Standard filters shall have sufficiently plane, parallel, and well-polished faces, and shall be sufficiently free from bubbles, striae, scratches, and other defects so as to be suitable, in the opinion of the National Bureau of Standards, for certification as standards.

3.3.6 Transmission.- The transmission of the standard filters for 2,854° K shall be not less than 0.60 times the minimum transmission ratio specified for the ware.

3.4 Illuminants.- Unless otherwise specified, the color temperatures specified in table II shall be standard for use in the purchase of equipment as indicated.

TABLE II. Standard illuminants

Equipment	Color temperature °K
Approach lights, airport	3,000 to 2,100
Approach lights, carrier	2,854 to 1,900
Beacons	3,000 to 2,854
Boundary lights	2,854 to 2,100
Code beacons	3,000 to 2,854
Course lights	3,000 to 2,854
Contact lights	2,854 to 2,100
Identification lights	2,854 to 1,900
Obstruction lights	2,854 to 2,100
Position (running) lights	2,854 to 2,365
Range lights	2,854 to 2,100
Traffic control lights	2,854
Signal and special lights 1/	2,854
Instrument and panel lights	2,165 to 1,800

1/ Unless otherwise specified in the proposal.

3.5 Color.-

3.5.1 Chromaticity of nondiffusing equipment.- When nondiffusing ware or equipment using such ware is procured in accordance with a standard, the light transmitted in every direction that is to be utilized in service shall conform to the following requirements at every color temperature within the range specified in table II.

3.5.1.1 Red ware.- The light transmitted by the ware furnished shall not be yellower nor less saturated than the light transmitted by the applicable pale limit..

3.5.1.1.1 Instrument and panel lighting red.- The light transmitted by the ware furnished shall not be yellower nor less saturated than the light transmitted by an NBS 3215 filter from a 2,854° K source.

3.5.1.2 Yellow ware.- The light transmitted by the ware furnished shall not be redder than the light transmitted by the applicable red limit, nor greener nor less saturated than the light transmitted by the applicable pale limit.

3.5.1.3 Green ware.- The light transmitted by the ware furnished shall not be less saturated than the light transmitted by the applicable pale limit, and shall be neither yellower nor bluer than the light transmitted by the applicable yellow and blue limits, respectively.

3.5.1.4 Aviation-blue ware.- The light transmitted by the ware furnished shall be not greener nor less saturated than the light transmitted by the pale limit, and when light transmitted by the ware is transmitted in turn through a replica of identification red transmission standard filter designated as NBS 3055A, the light transmitted by the combination shall be not more than 0.015 times the light transmitted by the ware without the red filter.

3.5.1.5 Aviation-white colorless ware.- The light transmitted by the ware furnished shall not be noticeably different in chromaticity from the illuminant.

3.5.1.6 Identification luner-white ware.- The light transmitted by the ware furnished shall not be yellower than the light transmitted by the pale limit, nor bluer than the light transmitted by the blue limit.

3.5.2 Chromaticity of diffusing ware.- When diffusing ware, or equipment using such ware, is specified to be in accordance with a standard, the chromaticity of every portion that is designed to be visible in service shall conform to the following requirements at every color temperature within the range specified in table II.

3.5.2.1 Aviation-white ware.- The illuminated surface of the ware shall not appear appreciably different in chromaticity from the surface of the white diffusing standard.

3.5.2.2 Identification-red ware.- The illuminated surface of the ware shall not be yellower nor less saturated than the surface of the white diffusing standard viewed through the applicable pale limit.

3.5.2.3 Identification-yellow (amber) ware.- The illuminated surface of the ware shall not be redder than the surface of the white diffusing standard viewed through the applicable red limit, nor greener nor less saturated than the surface of the same standard viewed through the applicable green limit.

3.5.2.4 Identification-green ware.- The illuminated surface of the ware shall not be less saturated than the surface of the white diffusing standard viewed through the applicable pale limit and shall be neither yellower nor bluer than the surface of the same standard viewed through the applicable yellow and blue limits, respectively.

3.5.2.5 Identification luner-white ware.- The illuminated surface of the ware shall not appear yellower than the surface of the white diffusing standard viewed through the applicable pale limit nor bluer than the surface of the same standard viewed through the applicable blue limit.

3.5.2.6 Assembled equipment.- When lighting units using incandescent lamps as illuminants are purchased under this specification and it is not practicable to inspect the light-transmitting ware by itself, the requirements for color shall apply to the complete units.

3.6 Transmission and brightness.-

3.6.1 Transmission of nondiffusing ware.- The transmission ratio of nondiffusing ware purchased under this specification shall be not less than the value specified in table III for nondiffusing ware of the grade and color stipulated.

TABLE III. Transmission and brightness limits
(illuminant 2,854° K)

Grade	Red	Yellow	Green	Blue	Lunar white	White	R_m 1/
Minimum acceptable transmission ratios							
Nondiffusing wares, type I colors (aviation):							
A 2/	0.200	0.450	0.225	0.026	- -	- -	
B 3/	0.175	0.400	0.200	0.022	- -	0.950	40(95) 1/
C 4/	0.150	0.350	0.175	0.016	- -	0.925	
D 5/	0.130	0.300	0.150	0.008	- -	0.900	
Nondiffusing ware, type II colors (identification):							
B	0.048	0.400	0.048	- -	0.120	- -	40
Acceptable brightness ratios							
Diffusing ware, type I colors (aviation):							
B (min)	- -	- -	- -	- -	- -	0.800	80
(max)	- -	- -	- -	- -	- -	1.200	120
Diffusing ware, type II colors (identification):							
B (min)	0.048	0.400	0.048	- -	0.120	- -	40
(max)	0.120	1.000	0.120	- -	0.300	- -	100

1/ R values are minimum or maximum acceptable readings when transmission and ratios are tested on the relative basis specified herein. In the case of aviation colors for nondiffusing ware, R_m is 95 for "white".

2/ Grade A is to be used only when the highest possible transmission is essential.

3/ Grade B is suitable for pressed ware of a uniform thickness of not more than 6 mm. (0.2 in.) throughout the working area, such as position light and identification cover glasses, smooth obstruction-light covers, and also for filters for carrier approach lights.

4/ Grade C is suitable for such blown ware as code-beacon and contact-light filters.

5/ Grade D is suitable for thick-sectioned glassware such as beacon lenses, including course lights, obstruction-light lenses, and contact-light lenses and also for filters for airport approach lights.

3.6.2 Brightness of diffusing ware.- The brightness of diffusing ware purchased under this specification shall be within the limits specified in table III for diffusing ware of the color and grade stipulated.

3.6.3 Assembled equipment.- When lighting units using incandescent lamps as illuminants are purchased under this specification and it is not practicable to inspect the light-transmitting ware by itself, units utilising diffusing ware shall conform to the requirements for brightness, but units using nondiffusing ware shall not be tested for transmission. In such cases, the procurement order shall contain candlepower requirements covering the performance of the assembled unit.

3.7 Procurement without a color standard.- Lighting units and lamps which derive their color from the highly chromatic nature of the illuminant, and other equipment for which it is impracticable to use a color standard, shall be purchased by fundamental definitions, in which case the chromaticity coordinates of the light transmitted or emitted shall conform to the applicable definitions (see 3.1 and 3.2). In the case of equipment using incandescent lamps, this requirement shall be met for all illuminants within the range to be used in service.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.- Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilise his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of tests.- All the tests required herein for the testing of colors are classified as quality conformance tests, for which necessary sampling techniques and methods of testing are specified in this section.

4.2.1 Sampling.- In cases where it is impracticable to inspect each piece for color, the sampling shall be done in such manner as to include extremes of chromaticity and transmission rather than in a random manner.

4.3 Test equipment.-

4.3.1 Certified equipment.- When certified test equipment is required, the contractor shall provide equipment certified within the preceding 12 months by a recognized competent laboratory.

4.3.2 Color standards.- Standard filters are specified in Federal Standard No. 3 or other standard pieces to be used in testing the transmission and brightness ratios shall be approved by the procuring activity.

4.3.3 Comparison lamp.- A certified seasoned lamp, that has been standardized for color temperature of 2,854° K and such other color temperatures as are required for the inspection, shall be used.

4.3.4 Test lamp.- A certified test lamp of the same types as used in the equipment, standardized for 2,854° K and such other color temperatures as are required for the inspection, shall be used.

4.3.5 Electric meter.- A certified voltmeter or ammeter suitable for the purpose shall be used for controlling the lamps.

4.3.6 Comparator.- A suitable photometer, color comparator, photoelectric cell with microammeter, or combination of such instruments, shall be used for testing the chromaticity and transmission.

4.3.7 Power.- The power for lighting the standard and test lamps shall be of sufficiently constant voltage to permit satisfactory testing.

4.4 Test methods.-

4.4.1 Chromaticity tests.-

4.4.1.1 Ware.- The determination of the chromaticity for ware made to instrument and panel lighting red limits shall be determined by the method specified in Specification MIL-L-25467. If a special color comparator or other special equipment is to be used, the instructions will be furnished with the equipment; otherwise, inspection shall proceed as specified herein. The lamp shall be adjusted to the correct voltages or currents corresponding to the color temperature at which the test is to be made. If the ware has the same chromaticity characteristics, according to the definition in 6.3.3, as the standard filters, the comparison of the ware with the standard shall be conducted with both standard and test lamps at a color temperature of 2,854° K; otherwise, separate tests shall be made with both lamps at the extreme limits of color temperature specified in table II. To determine whether or not the ware furnished has chromaticity characteristics equivalent to those of the standard filters, the inspector may compare the chromaticity differences between doubtful pieces of ware and the pale limit or hue limit standard at the extreme color temperature of the specified range, and if there is no difference he may assume equivalence.

4.4.1.1.1 The standard lens, cover, or other piece shall be placed in the position to be occupied by the test ware. The photometer shall be so positioned between the lamps, or otherwise adjusted, that the two fields, each illuminated by one of the lamps, are equally bright. For nondiffusing ware, the test fields shall be the surfaces of the test plates. For diffusing ware, portions of the standard and comparison pieces shall serve as test fields. The chromaticity of the two fields should be the same, but in case there is a slight difference in chromaticity the current through the test lamp shall be slightly decreased or increased if possible, and the position of the photometer changed until the brightness match is restored. Decreasing the current shall make the light yellower. The process shall be repeated until the brightness match and chromaticity match are both obtained with the same setting.

4.4.1.1.2 The pale limit shall then be inserted between the comparison lamp and the photometer field, and the ware to be tested shall be placed over the test lamp in its normal position with respect to the lamp. If a lens is being tested,a collector may be used to focus the light in the transmitted beam.

4.4.1.1.3 If the test piece is a lens which in service is combined with a clear colorless lens to form a doublet, this clear lens may be included in the test arrangement.

4.4.1.1.4 The brightness of the test and comparison fields shall be matched before determining the acceptability as to chromaticity. If the chromaticity of the part of the photometric field illuminated by the test lamp is on the allowable side of the limit, as represented by the chromaticity of the portion of the test field that is illuminated by the comparison lamp and standard filter, the equipment under test shall be so rotated that the test rays traverse some other part of the equipment. If the chromaticity in any direction is unsatisfactory, the equipment shall be unacceptable as to color and will be rejected.

4.4.2 Lighting units.- The procedure for testing assembled units shall be the same as that specified in 4.4.1.1, but the photometer shall be so equipped and positioned as to insure a fair average of the light emitted in the test direction. Both the lamp in the unit and the comparison lamp shall be operated at the extreme limits of color temperature specified in table II. If a standardized test lamp is not available, the lamp in the unit shall be adjusted to the correct color temperature either by comparing the direct light from this lamp with light from the comparison lamp, or by operating it at the voltages at which an average lamp of its type has the required color temperatures.

4.4.3 Conformity with fundamental definitions.- When equipment is purchased by fundamental definitions, the chromaticity of the transmitted or emitted light may be determined by comparing the chromaticity of the transmitted or emitted light with light of known chromaticity, provided the direction of the hue and saturation differences are such as to indicate definitely conformity or nonconformity with color requirements specified in 3.1 and 3.2. Quantitative colorimetric methods will be used if no satisfactory source filter combinations are available.

4.4.4 Transmission ratio and brightness ratio.- Unless a special photometer or a light collecting device is to be used, the instructions for use of which are furnished with the instrument, the inspector will proceed as specified herein. For transmission ratio test there shall be used either a visual or spectrally

LIGHT RECEPTACLE

corrected photoelectric photometer using a photocell of the type commonly called "color corrected", equipped with a filter correcting its spectral sensitivity to agree approximately with the luminosity function, y, of the standard observer. For the determination of brightness ratios, a visual photometer without a test-plate shall be used. With such a photometer, the observer shall see comparable portions of the test and comparison covers.

4.4.4.1 Before testing the ware submitted for inspection, the standard lens, cover, or other piece shall be placed in the position to be occupied by the test ware. If a visual photometer is used, an initial reading, R, shall be made with standard clear or diffusing piece in position but with no filter on either side of the test plate. (If the photometer does not read either illumination or brightness directly, all readings shall be reduced to values proportional to illumination or brightness, as the case may be.) The photometer reading thus obtained, which shall be represented by R_i, will be substituted in the following formula, together with the appropriate values of T_s, the transmission of the transmission standard, T_r, the minimum or maximum acceptable value of the transmission or brightness ratio from table III, to obtain the minimum or maximum acceptable reading, R_m.

$$R_m = R_i \ (T_r/T_s)$$

The transmission standard shall then be inserted between the comparison lamp and the test plate before proceeding with the testing.

4.4.4.1.1 If a photoelectric photometer is to be used, the transmission standard shall be placed in front of it and an initial reading, R_i, (corrected if necessary) will be taken. The transmission standard shall be removed before proceeding with the testing of the ware. The minimum acceptable reading is computed by substituting R_i in the formula specified in 4.4.4.1.

4.4.4.1.2 After the acceptable readings have been determined, the test pieces shall be substituted for the standard ware with either type of photometer, and any piece which does not give a photometer reading (corrected if necessary) within the acceptable limits shall be rejected. Pieces shall be so rotated that the transmission or brightness ratio is tested for several portions of the test piece.

4.4.5 Relative transmission and brightness ratios.- The limiting values specified in table III for the transmission ratios and brightness ratios for the several identification colors are related by simple ratios. For each of these colors, the minimum transmission ratio and brightness ratio are 40 percent of the maximum brightness ratio. For many purposes, it is convenient to adjust the photometer so that the minimum and maximum acceptable readings, R_m in the formula (4.4.4.1) will have the same values, that is 40 and 100. By a similar adjustment, the minimum acceptable readings for grade B nondiffusing ware in the aviation colors, except "white", may also be made 40. R_m will have these values if the initial reading R_i is equal to 100 times the ratio of the transmission of the transmission standard to the applicable value to T_a in table IV, that is, $R_i = 100\ T_s/T_a$. This makes $R_m = 40$ because $T_a = 100\ T_r/40$ in the table.

TABLE IV. Values of T_s

Color	T_s	Color	T_s
Aviation red	0.4375	Identification red	0.120
Aviation yellow	1.000	Identification yellow	1.000
Aviation green	0.500	Identification green	0.120
Aviation blue	0.055	Identification lunar white	0.300

4.4.5.1 For aviation white, no filters shall be used. If in this case the initial reading is made 100, the two minimum and the maximum acceptable readings will be the values specified in table III, namely 95, 80, and 120, respectively. When the above method is to be followed, it is convenient to mark the initial readings on the transmission standards.

4.5 Referee tests.-

4.5.1 General.- The contractor may appeal the decision of the procuring activity with reference to differences in hue and saturation from those specified in 3.5. If such an appeal is made, and if the procuring activity deems a referee test to be warranted, such a test shall be made by a competent laboratory. If the nature of the chromaticity differences are such that the inspector is unable to determine whether or not some of the units submitted conform to the applicable requirements, he shall select typical specimens of the doubtful units and submit them for referee tests. Requests for referee tests should state whether or not ware was inspected on the basis of ware having the same chromaticity characteristics as the pale limit. Referee tests shall be made by quantitative colorimetric methods, and the equipment tested shall conform to the requirements of 3.5 interpreted in accordance with the definitions of 6.3. The referee tests shall be correlated to 3.5 in accordance with the following interpretations.

4.5.1.1 Hue.- With the exception of aviation white and identification lunar white, the equipment shall conform to the hue requirements of 3.5 interpreted in accordance with the colorimetric definitions of 6.3.

4.5.1.2 Saturation.- The minimum acceptable saturation shall be defined for the respective colors, where x_s, y_s are the trichromatic coordinates for the accepted pale limits as follows:

(a) Aviation red: s shall not exceed 0.002.
(b) Instrument and panel lighting red: s shall not exceed 0.001.
(c) Aviation yellow: s shall not exceed 0.007.
(d) Aviation green: y shall be not less than $y_s + (x - x_s)$.
(e) Aviation blue: y shall not exceed $y_s - (x - x_s)$.

(f)	Identification red:	x shall not exceed 0.001.
(g)	Identification yellow:	z shall not exceed 0.005.
(h)	Identification green:	y shall be not less than $y_s + 1.200 (x - x_s)$.
(i)	Identification lunar white:	y shall be within the fundamental definitions of 3.2, and x shall be not less than the x-coordinate of the blue-limit standard nor greater than x-coordinate of the pale-limit standard.

4.5.1.3 Chromaticity for aviation white.- For aviation white, y shall be within the fundamental definitions of 3.1, and $x_i - x$ shall not be numerically greater than 0.02. (x_i is the x-coordinate of the illuminant viewed through the standard ware.)

4.5.1.4 Procurement by fundamental definitions.- When equipment is purchased by fundamental definitions, or without a color standard, the chromaticity coordinates of the light transmitted, shall conform to the fundamental definitions as applicable.

4.5.2 Method.-

4.5.2.1 Type of material.- If the inspector's tests were made on the basis of material having the same chromaticity characteristics as the standard filters, the referee laboratory shall first determine whether or not the specimens being tested conform to the definition for the same chromaticity characteristics in 6.3.3. If the material is found to conform to this definition, the chromaticity tests shall be made at a color temperature of 2,854° K; otherwise, chromaticity tests shall be made at the extreme limits of color temperature specified in table II.

4.5.2.2. Chromaticity.- The chromaticity shall be determined by any recognized colorimetric method, and if it does not meet the above requirements, the equipment shall be reported as not in accordance with this specification without further tests.

4.5.2.3 Transmission ratio or brightness ratio.- The transmission or brightness ratio shall be determined as specified herein, and if it does not conform to 3.6, the equipment shall be reported as not in accordance with the specification.

5. PREPARATION FOR DELIVERY

5.1 Not applicable to this specification.

6. NOTES

6.1 Intended use.- The colors are intended for use for aviation ground-lighting equipment and for aircraft lights.

6.2 Unless otherwise specified, glass and plastic ware will be procured according to color standards; and equipment utilising light sources of distinctive chromaticity will be procured by fundamental definitions.

6.3 Definitions.-

6.3.1 Standard observer.- The fundamental definitions of the color are expressed in terms of the "standard observer" and coordinate system adopted by the International Commission on Illumination (C.I.E.) at Cambridge, England, in 1931 and published in the Journal of the Optical Society, vol. 23, page 359, October 1933. Wherever chromaticity coordinates (x, y, z) appear in this specification they relate to this system.

6.3.2 Chromaticity.- The chromaticity of a color is determined by its hue and saturation which for the purposes of this specification are defined as follows:

6.3.2.1 Hue is that attribute of certain colors by which they are classified as reds, yellows, greens, blues, etc. For the purpose of referee tests, for which a colorimetric definition of the requirements is necessary, two colors will be considered as yielding the same hue if they have the same dominant wave length with reference to the point x = 0.333. Colors which have no hue are called neutral colors. In general, colors represented in the region near x = 0.333, y = 0.333 may be considered neutral. The yellow-blue distinctions referred to in connection with identification lunar white in 3.5.1.6 are differences in saturation and should not be confused with differences in hue.

6.3.2.2 Saturation expresses degree of difference from neutral; that is, the less prominent the hue, the lower the saturation.

6.3.3 Same chromaticity characteristics.- A piece of light-transmitting material will be considered as having the same chromaticity characteristics as a standard piece for a stated range of illuminants if it is possible to make a specimen of the same spectral transmissivity as the standard piece, the x and y coordinates of which, for every illuminant within the range, differ from those of the test piece with the same illuminant by less than a stated tolerance. In this specification, the range of illuminants is that specified in table II and the tolerance is 0.010.

6.3.4 Transmission ratio.- The transmission ratio is the ratio of the light transmitted by a test piece to the light transmitted from an equivalent light source within the same solid angle by a standard piece of the same design made from the colorless material of the same type as the test piece . If the candlepower of a unit with a clear lens or cover is multiplied by the transmission ratio, the product is approximately the candlepower to be expected with the test piece substituted for the colorless piece.

6.3.5 Brightness ratio.- The brightness ratio is the ratio of the brightness of a portion of a test piece of diffusing ware to the brightness of a corresponding portion of the indicated area of a standard piece of diffusing ware of the same design made from white or nearly white material of the same type as the test piece, the two pieces being illuminated by equipment light sources.

6.3.6 Procurement color standards.- A procurement color standard is a standard adopted by a procuring activity to control the purchase of ware to be furnished in accordance with the procurement specification. Such standards may be adopted from time to time after they have been certified by the National Bureau of Standards as conforming to the requirements of this specification. Filters other than replicas of these may be used as standards, provided the request for bids states the filter numbers, the designated color temperature of the illuminant, and the chromaticity coordinates computed for the standard observer and coordinate system described herein.

6.3.7 Manufacturer's color standards.- A manufacturer's color standard is a standard submitted by a bidder and accepted by the procuring activity to control the purchase of ware to be furnished in accordance with a procurement specification. The chromaticity coordinates represented by a manufacturer's standard will be determined by a laboratory equipped to make such determinations before such standard is accepted. Filters already furnished by the bidder, or his prospective subcontractor, to the activity requesting the bid, or to the National Bureau of Standards with the consent of that bureau, may be designated by the bidder as a manufacturer's standard for a specific quotation.

6.4 Marginal indicia.- The margins of this specification are marked to indicate where changes, deletions, or additions to the previous issue have been made. This is done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Figures are not so marked. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content as written, irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Navy - Weps
Air Force - ASD

Preparing activity:
Navy - Weps

Reviewer activity:
Navy - Weps
Air Force - SAA, ASD

User activity:
Navy - Weps
Air Force - ASD

Review/user information is current as of the date of this document. For future coordination of changes to this document, draft circulation should be based on the information in the current DoD Index of Specifications and standards.

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 12503 WASHINGTON D. C.

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

COMMANDING OFFICER
NAVLA AIR ENGINEERING CENTER
ENGINEERING SPECIFICATIONS AND STANDARDS
DEPARTMENT (ESSD) CODE 93
LAKEHURST, NJ 08733

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER *(Specify)*: _____
b. ADDRESS *(Street, City, State, ZIP Code)*	

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426 PREVIOUS EDITION IS OBSOLETE.

FIGURE 8. Candlepower distribution curves.