SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS8037 | REV. B

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Superseding AS8037A

# Minimum Performance Standard for Aircraft Position Lights

## RATIONALE

This document establishes minimum performance levels for aircraft position lights including chromaticity, and light intensity in support of TSO and system certification. Information contained herein has been expanded from AS8037A in the areas of measurement conditions, lumen maintenance, and the inclusion of specific information relative to the use of Light Emitting Diode source technology. It provides minimum requirements for night operation not addressed in CFR Title 14. Position lights shall be capable of daytime operation as well.

## 1. SCOPE

This SAE Aerospace Standard (AS) establishes minimum performance standards for new equipment position lights.

This Aerospace Standard defines minimum light intensity in terms of candelas in vertical and horizontal directions about the longitudinal, vertical, and lateral axes of the aircraft. It also defines color tolerances in terms of limiting chromaticities for the light emitted from the position lights. It is not intended that this standard require the use of any particular light source such as quartz-halogen, incandescent, or any other specific design of lamp.

## 2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and 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.

### 2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

J1330 Photometer Laboratory Accuracy Guidelines

### 2.2 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

TSO-C30c AIRCRAFT POSITION LIGHTS

AC20-74 Aircraft Position and Anticollision Light Measurements





**TO PLACE A DOCUMENT ORDER:** Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
**SAE WEB ADDRESS:** http://www.sae.org

2.3 RTCA Publications

Available from Radio Technical Commission for Aeronautics Inc., 1828 L Street, NW, Suite 805, Washington, DC 20036, Tel: 202-833-9339, www.rtca.org.

Document No. 160 Environmental Conditions and Test Procedures for Airborne Equipment

2.4 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-9495, https://assist.daps.dla.mil/quicksearch/.

MIL-DTL-7989C Covers, Light-Transmitting, for Aeronautical Lights, General Specification for

2.4.1 OTHER PUBLICATIONS

Code of Federal Regulations Title 14, Part 23, 25, 27, 29

Some applicable sections may include, but are not limited to the following:

§2-.1385 Position light system installation.

§2-.1387 Position light system dihedral angles.

§2-.1389 Position light distribution and intensities.

§2-.1391 Minimum intensities in the horizontal plane of forward and rear position lights.

§2-.1393 Minimum intensities in any vertical plane of forward and rear position lights.

§2-.1395 Maximum intensities in overlapping beams of forward and rear position lights.

§2-.1397 Color specifications.

3. GENERAL STANDARDS

3.1 Dihedral Angle Coverage, Forward Position Lights, Types I and II, and Rear Position Lights, Type III

When mounted on the aircraft in accordance with manufacturer's instructions, the forward and rear lights shall show unbroken light within the dihedral angles specified in Figure 1, and defined in 3.1.1.

| Position Light Type | Dihedral Angle |
|---|---|
| Type I (forward, red) | L (left) |
| Type II (forward, green) | R (right) |
| Type III (rear, white) | A (aft) |

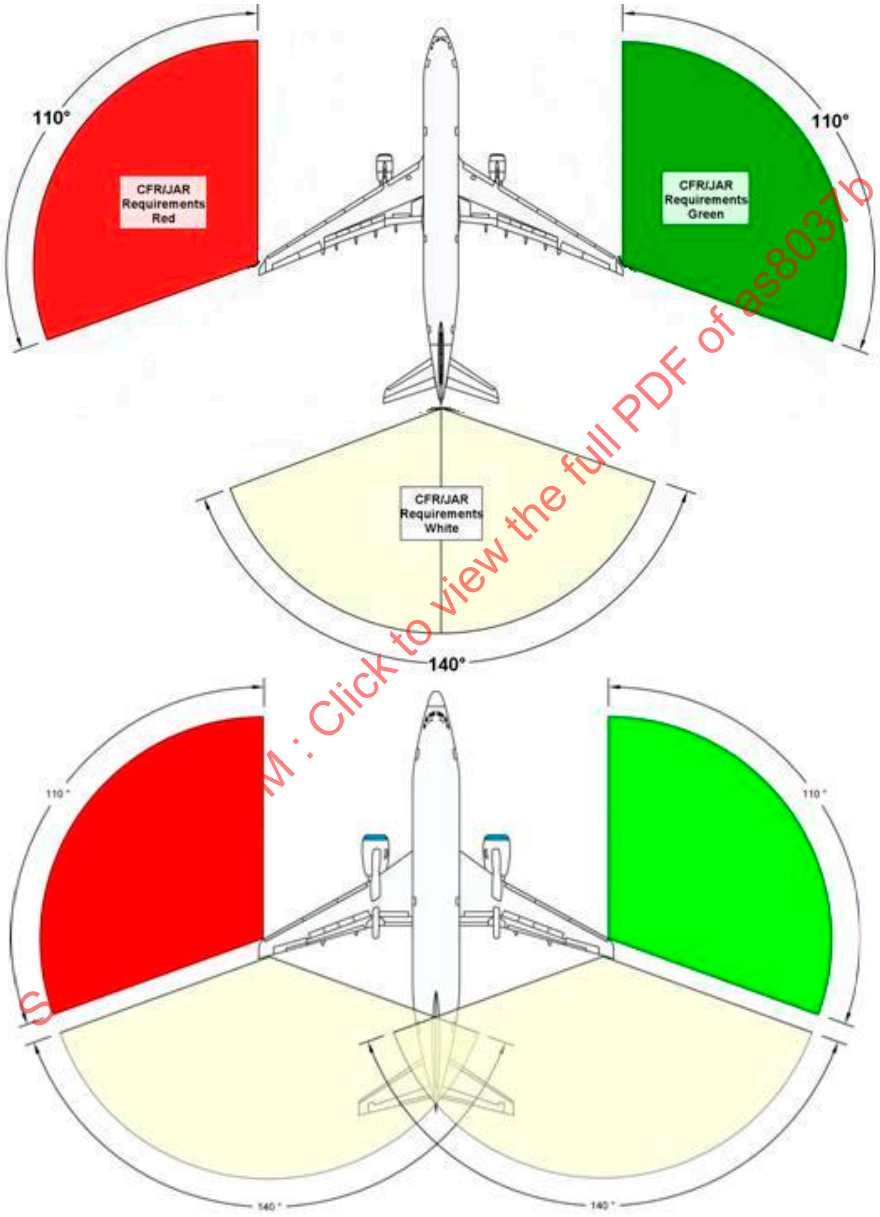




FIGURE 1 - DIHEDRAL ANGLE COVERAGE, FORWARD AND REAR POSITION LIGHTS, SHOWING BOTH SINGLE AND DUAL AFT INSTALLATIONS

3.1.1 Definitions of Dihedral Angles:

a. Dihedral Angle L (Left): The dihedral angle formed by two intersecting vertical planes, one parallel to the longitudinal axis of the airplane, and the other at 110 degrees to the left of the first when looking forward along the longitudinal axis (Figure 2).

b. Dihedral Angle R (Right): The dihedral angle formed by two intersecting vertical planes, one parallel to the longitudinal axis of the airplane, and the other at 110 degrees to the right of the first when looking forward along the longitudinal axis (Figure 2).

c. Dihedral Angle A (Aft): The dihedral angle formed by two intersecting vertical planes making angles of 70 degrees to the right and 70 degrees to the left, respectively, looking aft along the longitudinal axis, to a vertical plane passing through the longitudinal axis (Figure 3).

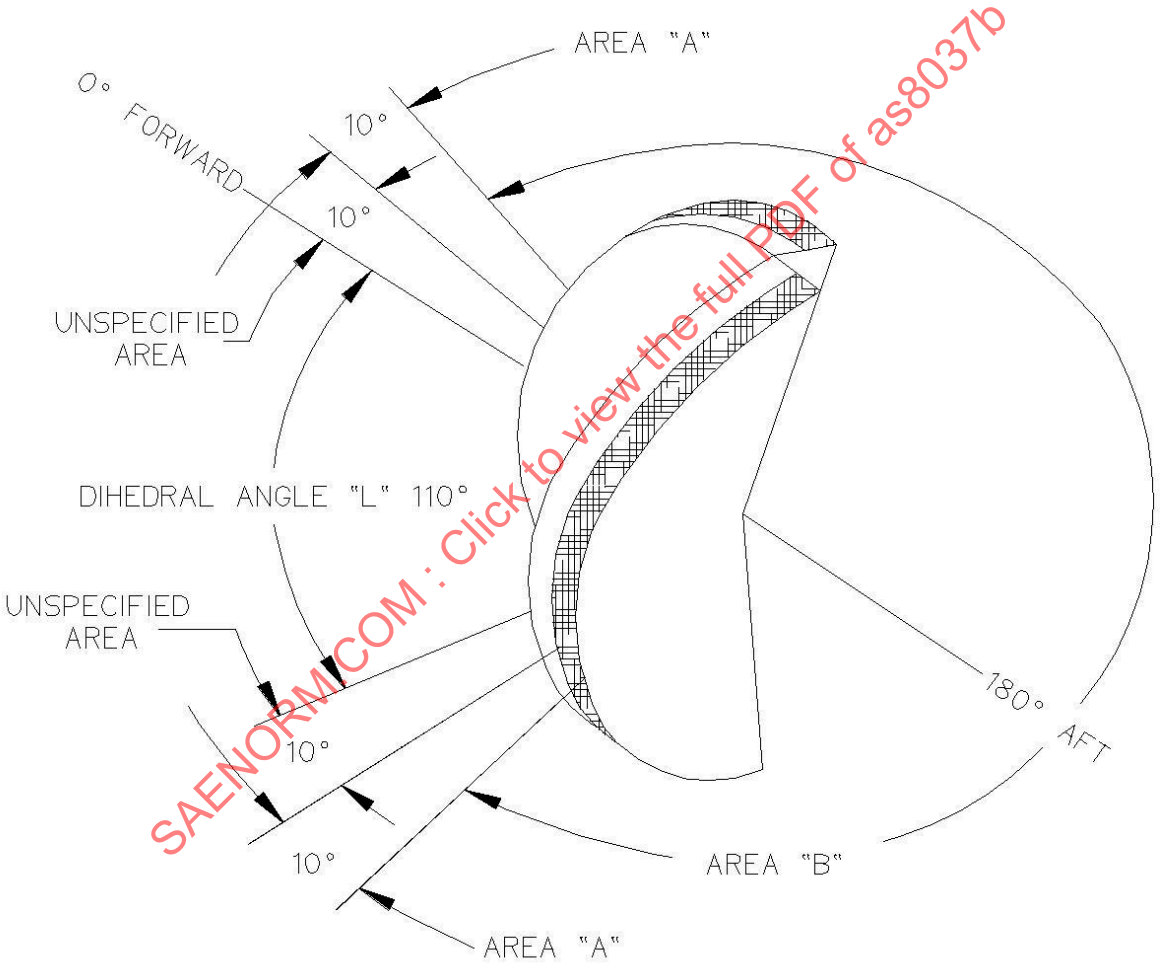




FIGURE 2 – REPRESENTATION OF ANGLES FOR LEFT FORWARD POSITION LIGHT

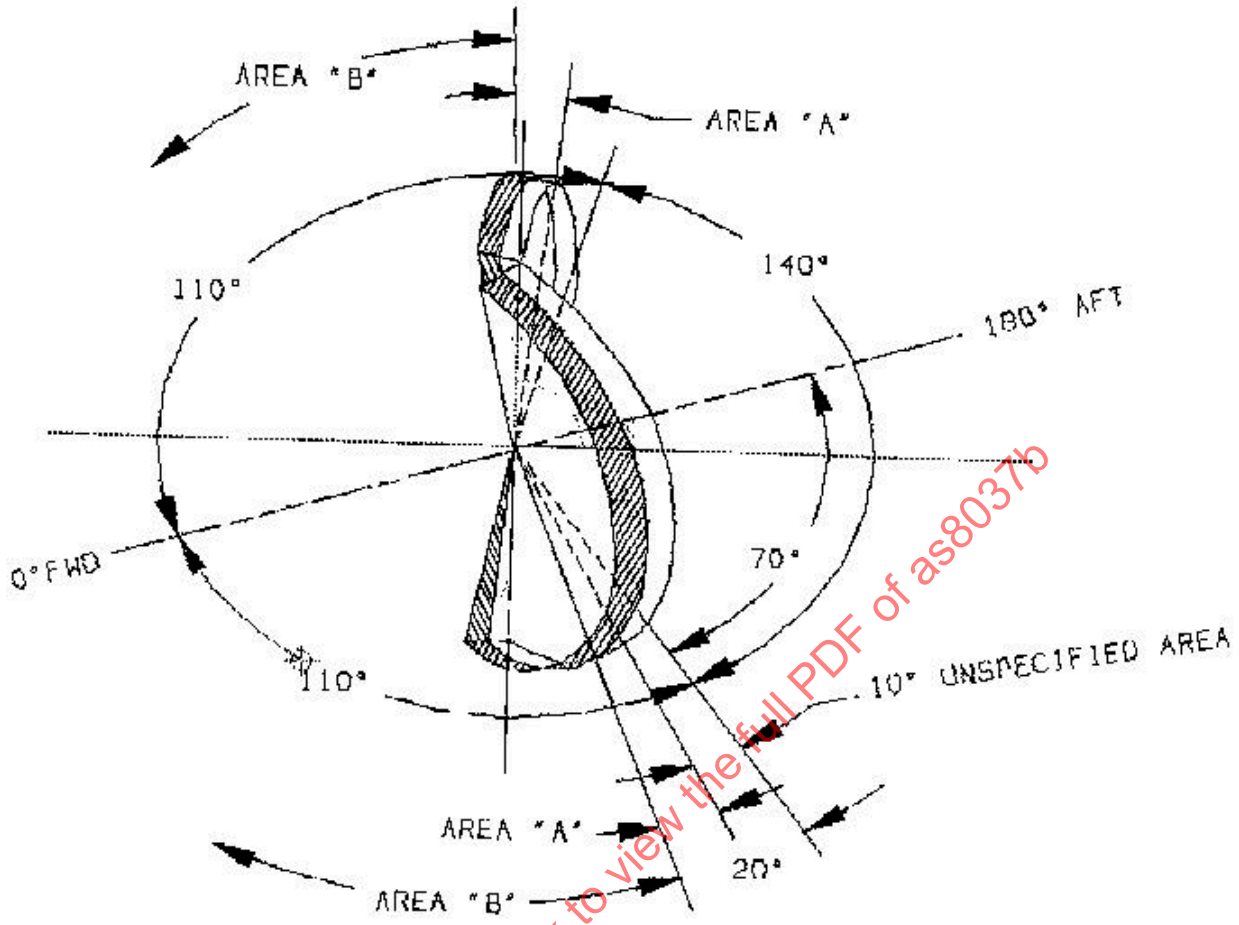


FIGURE 3 – REPRESENTATION OF ANGLES FOR AFT POSITION LIGHT



3.2 Position Light Intensity Distribution

3.2.1 General: The intensities specified in this section shall be provided by new equipment, with all light covers and color filters in place, when mounted on aircraft in accordance with the manufacturer's instructions. Luminous intensity can be measured at nominal input voltage. If the luminous intensity varies with the input voltage, it should be shown that the light assembly meets the minimum intensity requirements over the rated (assembly) input voltage range.

3.2.2 Minimum Intensities in the Horizontal Plane: The intensities in the horizontal plane shall not be less than the values given in Figure 4. The horizontal plane is defined as the plane containing the longitudinal axis of the airplane and is perpendicular to the plane of symmetry of the aircraft. Intensities are per CFR Title 14, Part 23,25,27,29 § 2-.1391.

| Position Light Considered | Angle (x) from Right or Left of Longitudinal Axis measured from dead ahead ( 0°) | Minimum Intensity (candelas) |
|---|---|---|
| Type I (forward, red) | 0° ≤ x ≤ 10° | 40 |
| Type II (forward, green) | 10° < x ≤ 20° | 30 |
| | 20° < x ≤ 110° | 5 |
| Type III (rear, white) | 110° ≤ x ≤ 180° | 20 |

FIGURE 4 - MINIMUM INTENSITIES IN THE HORIZONTAL PLANE, FORWARD AND REAR POSITION LIGHTS

3.2.2.1 Minimum Intensities Above and Below the Horizontal Plane: The intensities in any vertical plane shall not be less than the appropriate value given in Figure 5 when I is the minimum intensity specified in Figure 4 for the corresponding angles in the horizontal plane. Vertical planes are defined as planes perpendicular to the horizontal plane. Intensities are per CFR Title 14, Part 23,25,27,29 § 2-.1393.

| Angle (y) above or below Horizontal, in any Vertical Plane | Minimum Intensity ( I ) |
|---|---|
| 0° | 1.00 x I |
| 0° < y ≤ 5° | 0.90 x I |
| 5° < y ≤ 10° | 0.80 x I |
| 10° < y ≤ 15° | 0.70 x I |
| 15° < y ≤ 20° | 0.50 x I |
| 20° < y ≤ 30° | 0.30 x I |
| 30° < y ≤ 40° | 0.10 x I |
| 40° < y ≤ 90° | 0.05 x I |

FIGURE 5 - MINIMUM INTENSITIES IN ANY VERTICAL PLANE, FORWARD AND REAR POSITION LIGHTS



3.2.3 Maximum Intensities in Overlap Regions, Forward Position Lights, Types I and II, and Rear Position Lights, Type III: The intensities in the overlap regions between any forward or rear position lights shall not exceed the values given in Figure 6. Area A includes all directions in the adjacent dihedral angle which pass through the light source and which intercept the common boundary plane at more than 10 degrees but less than 20 degrees. Area B includes all directions in the adjacent dihedral angle which pass through the light source and which intercept the common boundary plane at more than 20 degrees (Figures 2 and 3). Intensities are per CFR Title 14, Part 23,25,27,29 § 2-.1395.

| | Maximum (Candelas) | |
|---|---|---|
| | Area A | Area B |
| Type I (fwd, red) in dihedral angle R | 10 | 1 |
| Type I (fwd, red) in dihedral angle A | 5 | 1 |
| Type II (fwd, green) in dihedral angle L | 10 | 1 |
| Type II (fwd, green) in dihedral angle A | 5 | 1 |
| Type III (rear, white) in dihedral angle L | 5 | 1 |
| Type III (rear, white) in dihedral angle R | 5 | 1 |

FIGURE 6 - MAXIMUM INTENSITIES IN OVERLAPS BETWEEN FORWARD AND REAR POSITION LIGHTS

3.2.3.1 When the peak intensity is greater than 100 candelas, the maximum overlap intensity may exceed the values given in Figure 6, provided the overlap intensity in Area A is not greater than 10% of the peak position light intensity and the overlap intensity in Area B is not greater than 2.5% of the peak position light intensity.

3.3 Position Light Colors

The colors of the position light shall be in accordance with Figure 7 and shall conform to 3.3.1.

| Type | Dihedral Angle |
|---|---|
| Type I (forward, red) | Aviation Red |
| Type II (forward, green) | Aviation Green |
| Type III (rear, white) | Aviation White |

FIGURE 7 - POSITION LIGHT COLORS

3.3.1 Position Light Color Specifications: The colors of the position lights shall have the (CIE 1931, 2 degrees observer) International Commission on Illumination chromaticity coordinates preferably as per CFR, or per alternate color definitions reported in this section. Caution: compliance only to the alternate color definitions detailed in this section (without compliance to the CFR requirements) will require an Equivalent Level of Safety Finding by the Federal Aviation Administration in order to allow installation of the lights on certified aircraft.

CFR Title 14, Part 23,25,27,29 § 2-.1397 aviation color definitions:

(a) Aviation red—

y is not greater than 0.335; and

z is not greater than 0.002.

(b) Aviation green—

x is not greater than 0.440−0.320y;

x is not greater than y−0.170; and

y is not less than 0.390−0.170x.

(c) Aviation white—

x is not less than 0.300 and not greater than 0.540;

y is not less than x−0.040; or y0−0.010, whichever is the smaller; and

y is not greater than x+0.020 nor 0.636−0.400x;

Where $y_0$ is the y coordinate of the Planckian radiator for the value of x considered.

Alternate color definition that has been practiced by industry's TSO and certification programs.

a. Aviation Red

| | |
|---|---|
| Purple Boundary | y = 0.980 - x |
| Yellow Boundary | y = 0.335 |

b. Aviation Green

| | |
|---|---|
| Yellow Boundary | x = 0.360 - 0.080y |
| White Boundary | x = 0.650y |
| Blue Boundary | y = 0.390 - 0.171x |

c. Aviation White

| | |
|---|---|
| Yellow Boundary | x = 0.500 |
| Red Boundary | y = 0.382 |
| Purple Boundary | y = 0.047 + 0.762x |
| Blue Boundary | x = 0.285 |
| Green Boundary | y = 0.150 + 0.640x |
| and | y = 0.440 |

A representation of the color definitions is shown in Figure 8.

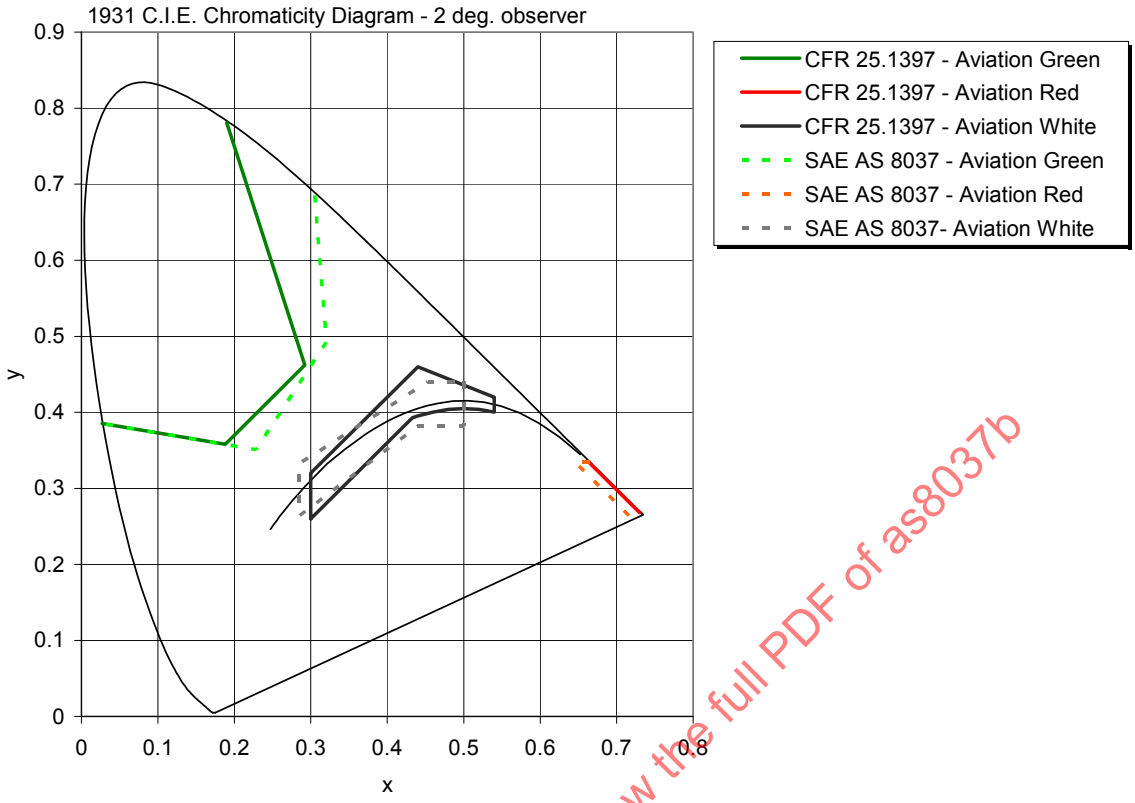


FIGURE 8 - AVIATION COLOR DEFINITIONS IN CIE1931 COLOR DIAGRAM



3.4 Light Covers, Color Filters, and Light Emitting Diodes (LED)

For all position lights, the light covers or color filters used shall not readily support combustion and shall be constructed so that they will not change shape or permanently change color or shape or suffer any appreciable loss of light transmission during normal use.

3.4.1 Red Filters: Red color filters commonly used have a characteristic where the color changes and luminous transmission decreases with temperature rise. Therefore, both the color and intensity distribution testing shall be performed under standard ambient temperature conditions of 25 °C ± 10 °C. This requirement is intended to produce results which will be more representative of actual aircraft installation and in-flight temperature environment.

3.4.2 LED's: LED's commonly used have a characteristic where the color (slightly) changes and luminous intensity decreases with temperature rise. Therefore, both the color and intensity distribution testing shall be performed under standard ambient temperature conditions of 25 °C ± 10 °C. This requirement is intended to produce results which will be more representative of actual aircraft installation and in-flight temperature environment.

3.5 Multiple Installations

If the lighting distribution for any one type of position light is supplied by two or more lights which are located immediately adjacent to each other (generally 2 ft or less), the intensity distribution shall be determined with both lights operating and mounted in the same relationship to each other as they would be on the aircraft. If the lights are not located immediately adjacent to each other, intensity distributions shall be determined individually for each light and the minimum intensity in any direction shall be provided by either one or the other light. Additive intensity cannot be used to demonstrate compliance with the minimum required intensity for non-adjacent lights.