AN AMERICAN NATIONAL STANDARD

A-42-51

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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE STANDARD

American National Standard

SAE AS 8017A

Issued 1-16-78
Revised 1-30-86

Superseding AS 8017

MINIMUM PERFORMANCE STANDARD FOR ANTICOLLISION LIGHT SYSTEMS

1. PURPOSE: This Aerospace Standard establishes minimum performance standards for anticollision light systems for nighttime operation. It is intended to describe suitable means for compliance with current Federal Aviation Regulations defining minimum anticollision light requirements. It is not intended that this standard require the use of any particular means for generating light such as quartz-halogen lamps, flashtubes, incandescent or any other specific lamp designs.

2. SCOPE:

2.1 This Aerospace Standard will define minimum light intensity in terms of "effective intensity" as defined in paragraph 3.5 of this standard and specified vertical and horizontal directions about the longitudinal and vertical axis of the airplane. It will also define flash rate and color for the anticollision light system.

2.2 The anticollision light system will consist of all components necessary to produce the required intensity distribution, flash rate, etc. about the airplane. It may consist of one or more lighting units mounted in various places on the airplane such as top and bottom fuselage, vertical fin, tail cone, wing tips, or other location. Timing devices, power supplies necessary for proper operation of the anticollision light system will also be considered as part of the system.

2.3 The anticollision light system will meet the minimum performance standards for one of the following classes:

Aircraft Type		Effective Intensity
Class I - Rotorcraft	-	150 Candelas
Class II - Fixed Wing Aircraft	-	400 Candelas
Class III - Fixed Wing Aircraft and Rotorcraft	-	100 Candelas

2.3.1 It is necessary to establish these classes in order to define performance standards for lights as required by FAR's.

Amendment 27-10 of FAR 27 and 29-11 of FAR 29 established minimum intensity requirements for Rotorcraft as listed for Class I lights. Generally, all rotorcraft certificated prior to these amendments must meet requirements of Class III lights.

Anticollision lights for fixed wing aircraft must meet requirements for Class III lights if certificated prior to August 11, 1971 and the requirements for Class II lights if certificated after that date.

3. GENERAL STANDARDS:

3.1 Class I - Rotorcraft - 150 Candelas:

3.1.1 Color: Each light in the system will produce light having an Aviation Red color as defined in 3.4.1.

3.1.2 Minimum Effective Intensity: The system must provide effective intensity equal to or exceeding the values shown in the following table:

Angle above or below the horizontal plane	Effective Intensity (Candelas)
0° - 5°	150
5° - 10°	90
10° - 20°	30
20° - 30°	15

3.1.3 Flash Rate: Each light in the system must produce an effective flash frequency of not less than 40 nor more than 100 flashes per minute.

3.2 Class II - Fixed Wing Aircraft - 400 Candelas:

3.2.1 Color: The anticollision light system must produce lighting having either an Aviation Red color as defined in 3.4.1 and/or an Aviation White color as defined in 3.4.2.

3.2.2 Minimum Effective Intensity: The system must provide effective intensity equal to or exceeding the values shown in the following table:

Angle above or below the horizontal plane	Effective Intensity (Candelas)
0° - 5°	400
5° - 10°	240
10° - 20°	80
20° - 30°	40
30° - 75°	20

3.2.3 Flash Rate: Each light in the system must produce an effective flash frequency of not less than 40 nor more than 100 flashes per minute.

3.3 Class III - Fixed Wing Aircraft and Rotorcraft - 100 Candelas:

3.3.1 Color: The anticollision light system must produce lighting having either an Aviation Red color as defined in 3.4.1 and/or an Aviation White color as defined in 3.4.2.

3.3.2 Minimum Effective Intensity: The system must provide effective intensity equal to or exceeding the values shown in the following table:

Angle above or below the horizontal plane	Effective Intensity (Candelas)
0° - 5°	100
5° - 10°	60
10° - 20°	20
20° - 30°	10

3.3.3 Flash Rate: Each light in the system must provide an effective flash frequency of not less than 40 nor more than 100 flashes per minutes.

3.4 Color Specifications: Each anticollision light color must have the applicable International Commission on Illumination chromaticity coordinates as follows:

3.4.1 Aviation Red:

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

3.4.2 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 $y = 0.440$

3.4.3 For Class II and Class III systems where both Aviation Red and Aviation White lights are used to comprise the anticollision light system, in areas where the red and white overlap, a mixture of the colors is permitted.

3.5 Effective Intensity: The light intensity in any direction for either Aviation Red or Aviation White as applicable, must meet the requirements of paragraphs 3.1.2, 3.2.2 or 3.3.2 as applicable. The following relation must be assumed:

$$I_e = \left[\frac{\int_{t_1}^{t_2} I(t)\, dt}{0.2 + (t_2 - t_1)} \right]_{max}$$

where: I_e = effective intensity (candelas)
$I(t)$ = instantaneous intensity as a function of time
$t_2 - t_1$ = flash time interval (seconds)

The maximum value of effective intensity is obtained when t_2 and t_1 are chosen so that the effective intensity is equal to the instantaneous intensity at t_2 and t_1. The computed value for effective intensity will vary for a given light-time curve with choice of values for t_2 and t_1.

3.5.1 Some anticollision light systems may be designed to produce multiple flashes within a short time interval. Where all flashes in a multiple flash or burst of flashes are contained within a time interval of 0.2 seconds, the "effective" intensity as defined in 3.5 may be computed in either of two methods to demonstrate compliance with minimum effective intensity requirements of paragraphs 3.1.2, 3.2.2 or 3.3.2.

3.5.1.1 The effective intensity of any one flash in the burst can be computed using the energy in that single flash as the numerator and the time duration of that flash as the denominator of the formula in 3.5.

3.5.1.2 The effective intensity can be computed by adding together the energy of each flash in the burst to form the numerator of the formula in 3.5 for effective intensity. In this case, the value for $(t_2 - t_1)$ will be the total time from the beginning of the first flash to the end of the last flash in the burst, subject to rule in 3.5.

3.5.2 Where the anticollision light system consists of more than one light to provide total required coverage shown in paragraphs 3.1.2, 3.2.2 or 3.3.2, the required intensity in any one direction must be provided by a single light. A light in a direction from more than one light source cannot be added together to show compliance.

3.6 Flash Frequency: The flash frequency in paragraphs 3.1.3, 3.2.3, and 3.3.2 apply to individual lights which can comprise the anticollision light system. Where two or more lights are visible from a given direction of viewing, the effective flash frequency is the frequency at which the airplane's complete anticollision system is observed from a distance and applies to each sector of light including any overlaps that exist when a system consists of more than one light source. In overlaps, flash frequencies may exceed 100, but not 180, cycles per minute.

3.6.1 Where a timing system is used so that multiple lights or single lights in multiple flash modes in a system always flash in a given time relationship with each other, all flashes visible in a given direction which occur in a 0.2 second time interval will be considered as one flash for purposes of counting flashes. This is indicated in Fig. 1.

3.7 Explosion: All components of the anticollison system shall meet Category A requirements of RTCA Document No. DO-160B. All components containing a light source and intended for mounting within wing tip enclosures or on the bottom of the fuselage shall meet the explosion containment requirements of DO-160B for Category A equipment.

4. PERFORMANCE STANDARDS UNDER ENVIRONMENTAL CONDITIONS:

4.1 Unless otherwise specified herein, the test procedures called out in Section 4.2 of this standard are those set forth in Radio Technical Commission for Aeronautics (RTCA) Document No. 160B entitled "Environmental Conditions and Test Procedures for Airborne Equipment", dated July, 1984.

4.1.1 Prior to subjecting the anticollision light system to the environmental tests specified in Section 4.2 of this standard, performance tests must be conducted to determine that the system meet requirements of paragraphs 3.1 through 3.6 of this standard.

During these tests, the following parameters should be recorded:

1. Effective intensity
2. Flash rate
3. Input voltage
4. Input current

4.1.2 Performance tests which must be made after subjection to test environments may be made after exposure to several environmental conditions, and tests to determine effective intensity may be conducted in a single direction only for comparison with initial tests.

4.1.3 The order of tests must be in accordance with DO-160B. The test procedures specified or referenced are satisfactory for use in determining the performnance of anticollision lighting systems under normal and extreme environmental conditions. Alternate approved test procedures that provide equivalent results may be used.

4.2 Environmental Tests:

4.2.1 Temperature and Altitude Tests: When components are subjected to the tests of DO-160B as appropriate, the anticollision system must operate electrically and show no significant changes in the parameters recorded per paragraph 4.1.1 of this standard.

4.2.2 Humidity: When subjected to tests of DO-160B, standard humidity environment, there shall be no significant changes in the parameter recorded per paragraph 4.1.1 of this standard. Optical parts may be cleaned if necessary.

4.2.3 Vibration: When the system is tested in accordance with DO-160B, standard vibration environment, there shall be no significant change in the parameters recorded per paragraph 4.1.1 of this standard.

4.2.4 Explosion: All components of the system must be tested in accordance with DO-160B to show compliance with paragraph 3.7 of this standard.

4.2.5 Waterproofness: Instruments which are to be marked Waterproofness Category R or W must be tested in accordance with DO-160B. Following this test the system shall show no significant change in the parameters recorded per paragraph 4.1.1 of this standard.

4.2.6 Fluids Susceptibility: Systems which are to be marked Category F must be tested in accordance with DO-160B. Following this test the system shall show no significant changes in the parameters recorded per paragraph 4.1.1 of this standard.

4.2.7 Sand and Dust: Systems which are to be marked Sand and Dust Category D must be tested in accordance with DO-160B. Following this test the system shall show no significant change in the parameters recorded per paragraph 4.1.1 of this standard. Optical parts may be cleaned if necessary.

4.2.8 Fungus Resistance: Systems which are to be marked Fungus Resistance Category F must be tested in accordance with DO-160B. Following this test the system shall show no significant change in the parameters recorded per paragraph 4.1.1 of this standard.

4.2.9 Salt Spray: Systems which are to be marked Salt Spray Category S must be tested in accordance with DO-160B. Following this test, the system shall show no significant changes in the parameters recorded per paragraph 4.1.1 of this standard. Optical parts may be cleaned if necessary.

4.2.10 Power Input Test: Systems will be subjected to tests for normal operating conditions of DO-160B. Systems shall meet performance standards of paragraphs 3.1 through 3.6 of this standard.

4.2.10.1 When the system is subjected to abnormal operating conditions of DO-160B, this system shall sustain no damage and the degree of performance degradation shall be specified by the manufacturer.