U.S. Department
of Transportation

**Federal Aviation
Administration**

Advisory Circular

Subject: SPECIFICATION FOR OBSTRUCTION LIGHTING EQUIPMENT

Date: 10/19/95 **AC No:**150/5345-43E
Initiated by: AAS-200 **Change:**

1. PURPOSE. This advisory circular (AC) contains the Federal Aviation Administration (FAA) specification for obstruction lighting equipment.

2. EFFECTIVE DATE. Effective 6 months after the date of this circular, only that equipment qualified in accordance with this specification will be listed in AC 150/5345-53, Airport Lighting Equipment Certification Program.

3. CANCELLATION. AC 150/5345-43D, Specification for Obstruction Lighting Equipment, dated July 15, 1988, is canceled.

4. APPLICATION. This specifications contained in this advisory circular are recommended by the FAA in all applications involving development of this nature. For airport projects receiving Federal funds under the airport grant assistance program, the use of these standards is mandatory.

5. DEFINITIONS.

a. Beam Spread. The angle between the two directions in a plane for which the intensity is equal to 50 percent of the minimum specified peak beam effective intensity.

b. Vertical Aiming Angle. The angle between the horizontal and a straight line intersecting the beam at its maximum intensity.

c. Steady-Burning (fixed) Light. A light having constant luminous intensity when observed from a fixed point.

d. Effective Intensity. The effective intensity of a flashing light is equal to the intensity of a steady-burning (fixed) light of the same color that produces the same visual range under identical conditions of observation.

6. PRINCIPAL CHANGES.

a. The designation of Class 1 and Class 2 for the L-810 has been eliminated (Reference paragraph 1.2).

b. The chromaticity standards for aviation colors have been changed to the ICAO standards for aeronautical ground lights (Reference paragraph 3.3.3).

c. The control unit requirements have been update and clarified (Reference paragraph 3.3.5).

d. The requirements for Dual Lighting Systems have been included (Reference paragraph 3.3.5.2.1).

e. The effective intensity for a group of short flashes (multiple pulse strobes) perceived as a single flash has been included (Reference paragraph 3.4.1.1) and the emitting rate was increased (Reference note (2) Table 4).

f. The intensity requirements were clarified with the addition of notes to Tables 1, 2, and 3.

g. Quality assurance provisions were updated and modified to include a leakage current test and expanded production test requirements (Reference section 4 and 5).

h. Flashtube minimum rated life has been increased to 2 years without loss of light output below minimum specified candela (reference paragraph 3.3.11.1).

i. L-885 has been added (reference paragraph 3.4.1.8).

7. METRIC UNITS. To promote an orderly transition to metric units, this advisory circular includes both English and metric dimensions. The metric conversions may not be exact equivalents, and until there is an official changeover to the metric system, the English dimensions will govern.

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SPECIFICATION OF OBSTRUCTION LIGHTING EQUIPMENT

1. SCOPE AND CLASSIFICATION.

1.1 Scope. This specification sets forth the Federal Aviation Administration (FAA) requirements for obstruction lighting equipment used to increase conspicuity of structures to permit early obstruction recognition by pilots.

1.2 Equipment Classification.

Type	Description
L-810	Steady-burning red obstruction light
L-856	High intensity flashing white obstruction light, 40 Flashes Per Minute (FPM)
L-857	High intensity flashing white obstruction light, 60 FPM
L-864	Flashing red obstruction light, 20-40 FPM
L-865	Medium intensity flashing white obstruction light, 40 FPM
L-866	Medium intensity flashing white obstruction light, 60 FPM
L-885	Flashing red obstruction light, 60 FPM

2. REFERENCED DOCUMENTS.

2.1 General. The following is a listing of documents referenced in this advisory circular.

2.2 FAA Advisory Circulars.

AC 70/7460-1	Obstruction Marking and Lighting
AC 150/5345-53	Airport Lighting Equipment Certification Program

2.3 Military Standards and Specifications.

MIL-STD-810	Environmental Test Methods
MIL-C-7989	Covers, Light-Transmitting, for Aeronautical Lights, Guide Specification for

(Copies of FAA advisory circulars may be obtained from the Department of Transportation, General Services Division, M-45, 400 7th Street SW., Washington, D.C. 20590.
Phone(202) 267-3161/3115/8329)

(Copies of Military standards and specifications may be obtained from the Defense Printing Service, 700 Robins Avenue (Bld 4d), Philadelphia, Pennsylvania 19111-5094
Phone (215) 697-2179 and Fax (215) 697-1460.)

3. EQUIPMENT REQUIREMENTS.

3.1 General. This section addresses environmental, design, and photometric requirements for obstruction light equipment. Criteria for selecting the proper obstruction lighting equipment, installation tolerances, and administrative information are contained in AC 70/7460-1, Obstruction Marking and Lighting.

3.2 Environmental Requirements. Obstruction lighting equipment shall be designed for continuous operation under the following conditions:

a. Temperature. -67^{o} F (-55^{o} C) to $+130^{o}$ F ($+55^{o}$ C).

b. Humidity. 95 percent relative humidity.

c. Wind. Wind speeds up to 150 mph (240 km).

d. Wind-blown Rain. Exposure to wind-blown rain from any direction.

e. Salt Fog. Exposure to salt-laden atmosphere.

3.3 Design Requirements.

3.3.1 Light Unit. The light unit shall be lightweight and designed for easy servicing and lamp (flashtube) replacement. Materials used within the light unit shall be selected for compatibility with their environment. Each light unit shall be an independent unit and will flash at the specified intensity or at its highest intensity when control signals are absent.

3.3.2 Light Covers. Light-transmitting covers for light units shall conform to the requirements of MIL-C-7989.

3.3.3 Light Colors. The aviation red shall be in accordance with ICAO (ANNEX 14, July 1990: Volume 1, Appendix 1, Fig. 1.1) colors for aeronautical ground lights at operating temperature within the following chromaticity boundaries:

purple boundary	$y = 0.980 - x$
yellow boundary	$y = 0.335$
	$x + y + z = 1$

Xenon flashtube emission is acceptable for white obstruction lights.

3.3.4 Aiming (for L-856 and L-857). Light units shall have a method for adjustment of the vertical aiming angle between 0 and + 8 degrees. A spirit level or other device shall be provided as part of each light unit for setting the vertical aiming angle of the light beam with an accuracy of 1 degree.

3.3.5 Control Unit.

3.3.5.1 Flashing White Obstruction Lighting Systems. The control unit shall set the system's flash rate, intensity and sequence. It shall be capable of controlling light units up to a distance of 2,500 feet (762m). If the control unit or control wiring fails, the light units shall continue to flash in accordance with Table 4 flash rate. Failure of an intensity step change circuit shall cause all light units to remain operating at their proper intensity or alternatively to operate at the high intensity step.

3.3.5.1.1 Monitoring. Each light unit shall be monitored for FLASH/FAIL status. FAIL status is defined as either of the following conditions: unit misses four or more consecutive flashes; unit flashes at wrong intensity step during day operation. Monitoring shall be fail safe (i.e., active signals for FLASH and absence of signals for FAIL). There shall be a provision to permit connection to a remote alarm device, (supplied by others or as an option), to indicate system and individual light unit FLASH/FAIL status.

3.3.5.1.2 Placement. The control and monitor functions may be consolidated in a light unit or in a single enclosure for remote mounting or they may be distributed into several light units.

3.3.5.1.2.1 Remote Mounting. In addition to the above, if placed in a remote mounted enclosure, the control unit shall display the status of each light unit. An intensity control override switch shall also be mounted in the enclosure to manually control light intensity during maintenance or in the event of a photoelectric control malfunction.

3.3.5.2 Red Obstruction Lights. The control unit shall set the system flash rate and flash sequence. Failure of the flashing circuit shall cause the light units to come "on" steady burning for incandescent lights. An override switch shall be mounted on the control unit to manually control the lights during maintenance or in the event of a lack of a photoelectric control signal. To insure proper operation, all flashing red obstruction lights inclusive of any associated system steady burning red lights shall be certified with a control unit whether internal or external to the lighting unit.

3.3.5.2.1 Dual Lighting Systems. The control unit may be a separate unit or incorporated as part of either the white or red obstruction light control unit. The control unit shall set the operating mode for each light unit in the system. Outage of one of two lamps in the uppermost red beacon (L-864 incandescent unit) or outage of any uppermost red strobe shall cause the white obstruction light system to operate in its specified "night" step intensity. At no time should both red and white systems be on simultaneously. An override switch shall be mounted on the control unit to manually control the operating mode of the system during maintenance or in the event of a lack of a photoelectric control signal.

3.3.5.2.2 Monitoring. Each separate L-864 light unit and each tier of L-810 light units shall be monitored for FLASH/FAIL status. FAIL is defined as outage of any lamp in an L-864 light unit, outage of any one lamp in a tier of L-810 light units, or failure of a flasher (steady on and/or total) for an L-864 light unit. Monitor signals shall be fail safe (i.e., active signals for FLASH and absence of signals for FAIL). There shall be a provision to permit connection to a remote alarm device, (supplied by others or as an option) to indicate FLASH/FAIL status.

3.3.6 Input Voltage. The obstruction lighting equipment shall be designed to operate from the specified input voltage ± 10 percent. (Note) incandescent lamps must be operated to within 3% of the rated lamp voltage to provide proper light output..

3.3.7 Transient Protection. The power input, control and monitor interface circuitry (if any) shall be designed to withstand and/or include separate surge protection devices which have tested against defined waveforms detailed in ANSI/IEEE C62.41-1991, namely, 3000 Amp, 8/2Oμs - short circuit current pulse and 6000 Volt, 1.2/50μs - open circuit voltage pulse.

3.3.8 Warning Labels. All enclosures which contain voltages, exceeding 150 volts dc or ac (rms) shall have high voltage warning label(s) placed at a conspicuous location(s). Also, a visual indicator shall be included within the enclosure to indicate that greater than 150 vdc is present on the high voltage capacitors.

3.3.9 Interlock Switches. Interlock switches shall be incorporated in each power supply and optionally in each flashhead so that opening either unit shall (1) interrupt incoming power and (2) discharge all high voltage capacitors within that enclosure to 50 volts or less within 30 seconds.

3.3.10 Nameplate. A nameplate, with the following information, shall be permanently attached to each unit, e.g.

a. Name of unit (light unit, control unit, etc.).

b. FAA type (e.g., L-856, L-864, etc.).

c. Manufacturer's catalog number.

d. Manufacturer's name and address.

e. Rated separation distance in feet is ____ to _____ between power supply and optical head using AWG ____ conductors. (Item e shall be required if a unique power supply and its associated optical head are separate components of the lighting system as in the case of some discharge lights.)

In addition to the above, the power supply shall include nominal input voltage, number of phases, frequency, and peak volt-ampere (VA) rating.

3.3.11 Component Ratings.

3.3.11.1 Discharge Lighting Equipment. All components in discharge lighting equipment except the flashtube, shall be designed for ease of servicing and to meet performance requirements for a minimum of 1 year without maintenance. Flashtube or flashtubes shall have a minimum rated life of 2 years without maintenance or loss of light output below minimum specified candela.

3.3.11.1.1 Component Separation Rating. If the light unit's power supply and optical head are separate components, the manufacturer shall rate each light unit for maximum and minimum separation at a given AWG wire size. The manufacturer shall include this rating on the nameplate per section 3.3.10. The rating certifies that the unit meets all requirements within the rated distances. The manufacturer shall maintain records of test results which support the stated separation rating.

3.3.11.2 Incandescent Light Equipment. All components in incandescent lighting equipment, except lamps, shall be designed to meet performance requirements for a minimum of 1 year without maintenance. Lamps shall have a minimum rated life of 2,000 hours at rated voltage.

3.3.12 Leakage Current. All obstruction lighting equipment classified in section 1.2 shall be designed to withstand application of 1000 volts AC or 1414 volts DC between the input power leads and equipment chassis for 10 seconds during which the leakage current shall not exceed 10 micro amperes at ambient room temperature and humidity.

3.4 Performance Requirements.

3.4.1 Photometric.

3.4.1.1 General. The effective intensity for flashing lights shall be calculated in accordance with the following formula by the method described for "Flashing Light Signals" in the IES Handbook, 1993 Reference and Application Volume 8th Edition, Page 96 and 97:

$$I_e = \left(\int_{t_1}^{t_2} I dt \right) / \left(0.2 + \left(t_2 - t_1 \right) \right)$$

Where:

I_e = Effective intensity (Candela)

I = Instantaneous intensity (Candela)

t_1 , t_2 = Times in seconds of the beginning and end of that part of the flash when the value of I exceeds I_e. This choice of the times maximizes the value of I_e.

For discharge flashing lights, the equipment shall provide the specified light output at the specified temperature extremes as the input voltage simultaneously varies by ±10 percent from nominal. The light

intensity and beam distribution requirements for obstruction lighting equipment are specified below. All intensities listed are effective intensities (except steady-burning red obstruction lights) measured at the flash rate specified in Table 4. All incandescent lights will be tested as steady burning lights.

The effective intensity for multiple pulse flashes as used in strobe lights during nighttime operation shall be calculated by:

$$I_e = \left(\frac{\int_{t_1}^{t_A} I dt}{0.2 + t_A - t_1} \right) + \left(\frac{\int_{t_B}^{t_C} I dt}{0.2 + t_C - t_B} \right) + \left(\frac{\int_{t_D}^{t_E} I dt}{0.2 + t_E - t_D} \right) + \bullet\bullet\bullet + \left(\frac{\int_{t_X}^{t_Z} I dt}{0.2 + t_Z - t_X} \right)$$

The frequency of the pulses shall not be less than 100 Hz and the interval $t_A - t_1$ shall not vary by more than ± 5% from the nominal value from pulse to pulse over the simultaneous extremes of temperature and input voltage.

3.4.1.2 L-810 Light Unit. The center of the vertical beam spread shall lie between +4 and +20 degrees. With a minimum vertical beam spread of 10 degrees and at all radials throughout the omnidirectional 360 degrees, there shall be a minimum intensity of 32.5 candela. Mechanical interface for installation shall be 3/4 or 1 inch NPT side and bottom.

3.4.1.3 L-856 Light Unit. The beam spread and effective intensity shall be in accordance with Table 1.

Table 1. L-856 Intensity Requirements

Step	Beam Spread		Peak Intensity (candela) (2)
	Horizontal (1) (degrees)	Vertical (degrees)	
Day	90 or 120	3 - 7	270,000 ± 25%
Twilight	90 or 120	3 - 7	20,000 ± 25%
Night	90 or 120	3 - 7	2,000 ± 25%

NOTES: (1) Multiple light units may be used to achieve a horizontal coverage of 360 degrees.

(2) When the light unit is leveled the intensity at zero degrees elevation angle (horizontal) shall be at least as great as the minimum specified beam peak intensity. The light unit must produce at least 1/2 the minimum allowable peak intensity at -1.0 degree. For stray light, the intensity at 10 degrees below horizontal, at any radial, shall not be greater than 3% of the peak intensity at the same radial.

3.4.1.4 L-857 Light Unit. Photometric requirements are defined in Table 2.

Table 2. L-857 Intensity Requirements

Step	Beam Spread		Peak Intensity (candela)(2)
	Horizontal (degrees) (1)	Vertical (degrees)	
Day	90 or 120	3 - 7	140,000 ± 25%
Twilight	90 or 120	3 - 7	20,000 ± 25%
Night	90 or 120	3 - 7	2,000 ± 25%

NOTES: (1) Multiple light units may be used to achieve a horizontal coverage of 360 degrees.

(2) When the light unit is leveled the intensity at zero degrees elevation angle (horizontal) shall be at least as great as the minimum specified beam peak intensity. The light unit must produce at least 1/2 the minimum allowable peak intensity at -1.0 degree. For stray light, the intensity at 10 degrees below horizontal, at any radial, shall not be greater than 3% of the peak intensity at the same radial.

3.4.1.5 L-864 Light Unit. At all radials throughout the omnidirectional 360 degrees, there shall be a peak effective intensity of 2,000 ± 25% candela. There shall also be a minimum effective intensity of 750 candela throughout a minimum vertical beam spread of 3 degrees.

3.4.1.5.1 Beam Adjustment. When the light unit is leveled the intensity at zero degrees elevation angle (horizontal) shall be at least as great as the minimum specified beam peak intensity. The light unit must produce at least 1/2 the minimum allowable peak intensity at -1.0 degree.

3.4.1.6 L-865 Light Unit. Photometric requirements are defined in Table 3.

Table 3. L-865 Intensity Requirements

Step	Beam Spread		Peak Intensity (candela)(2)
	Horizontal (degrees) (1)	Vertical (degrees)	
Day/Twilight	360	3 minimum	20,000 ± 25%
Night	360	3 minimum	2,000 ± 25%

NOTES: (1) Multiple light units may be used to achieve a horizontal coverage of 360 degrees.

(2) When the light unit is leveled, the intensity at zero degrees elevation angle (horizontal) shall be at least as great as the minimum specified beam peak intensity. The light unit must produce at least 1/2 the minimum allowable peak intensity at -1.0 degree. For stray light, the intensity at 10 degrees below horizontal, at any radial, shall not be greater than 3% of the peak intensity at the same radial.

3.4.1.7 L-866 Light Unit. The requirements are the same as the L-865 light unit, except the flash rate shall be 60 FPM.

3.4.1.8 L-885 Light Unit. The requirements are the same as the L-864 light unit, except the flash rate shall be 60 FPM.

3.4.2 Flash Rate and Duration.

Table 4. Flash Characteristics for Obstruction Lights

Type	Intensity Step	Flash Rate (1)	Flash Duration (2)
L-856	Day & Twilight	40 FPM	Less than 10 ms
L-856	Night	40 FPM	Between 100 and 250 ms inclusive
L-857	Day & Twilight	60 FPM	Less than 10 ms
L-857	Night	60 FPM	Between 100 and 250 ms inclusive
L-864	Single	20-40 FPM	1/2 to 2/3 of flash period if incandescent lighting (3), and between 100 and 2000 ms inclusive if discharge lighting
L-865	Day & Twilight	40 FPM	Less than 10 ms
L-865	Night	40 FPM	Between 100 and 1000 ms inclusive
L-866	Day & Twilight	60 FPM	Less than 10 ms
L-866	Night	60-FPM	Between 100 and 250 ms inclusive
L-885	Single	60 FPM	1/2 to 2/3 of flash period if incandescent lighting (3), and Between 100 and 670 ms inclusive if discharge lighting

NOTES: (1) Flash rates have a tolerance of ± 5 percent.

(2) When the effective flash duration is achieved by a group of short flashes, the short flashes shall be emitted at a rate of not less than 100 Hz.

(3) The light intensity during the "off" period shall be less than 10 percent of the peak effective intensity. The "off" period shall be at least 1/3 of the flash period.

3.4.3 System Flashing Requirements.

3.4.3.1 Simultaneous Flashing Systems. All obstruction lights in systems composed of either L-864 light units or L-856 and/or L-865 light units shall flash within 1/60 of a second of each other.

3.4.3.2 Sequenced Flashing Systems. Catenary support structure systems composed of L-857, L-866, or L-885 light units shall have a sequenced flashing characteristic. This system consists of three lighting levels on or near each supporting structure. One light level is near the top, one at the bottom or lowest point of the catenary, and one midway between the top and bottom. The flash sequence shall be middle, top, and bottom. The interval between top and bottom flashes shall be about twice the interval between middle and top flashes. The interval between the end of one sequence and the beginning of the next shall be about 10 times the interval between middle and top flashes. The time for the completion of one cycle shall be 1 second (± 5 percent).

3.4.4 Intensity Step Changing.

3.4.4.1 White Obstruction Lights. The light unit intensity shall be controlled by a photocell facing the northern (polar) sky. White obstruction lights shall automatically change intensity steps when the ambient light changes as follows:

a. From day intensity to twilight intensity when the illumination decreases below 60 foot-candles but before it reaches 35 foot-candles.

b. From twilight intensity to night intensity when the illumination decreases below 5 foot-candles but before it reaches 2 foot-candles.

c. From night intensity to twilight intensity when the illumination increases above 2 foot-candles but before it reaches 5 foot-candles.

d. From twilight intensity to day intensity when the illumination increases above 35 foot-candles but before it reaches 60 foot-candles.

3.4.4.2 Red Obstruction Lights. If automatic control is utilized, the light unit shall turn on when the ambient light decreases to not less than 35 foot-candles and turn off when the ambient light increases to not more than 60 foot-candles. Single L-810 light units are controlled in a manner compatible with the particular installation.

3.4.4.3 Dual Obstruction Lighting System. White obstruction lights shall turn off and red obstruction lights shall turn on when ambient light changes from twilight to night as specified in paragraph 3.4.4.1.b. Red obstruction lights shall turn off and white obstruction lights shall turn on when ambient light changes from night to twilight as specified in paragraph 3.4.4.1.c.

3.5 Instruction Manual. An instruction manual containing the following information shall be furnished with all obstruction lighting equipment.

a. Complete system schematic and wiring diagrams showing all components cross-indexed to the parts list.

b. Complete parts list of field replaceable parts with applicable rating and characteristics of each part, and with the component manufacturer's part number as appropriate.

c. Installation instructions, including leveling and aiming of light units.

d. Maintenance instructions, including lamp (flashtube) replacement, theory of operation, troubleshooting charts and, as appropriate, conspicuous warnings about alignment and replacement of lamps and light units with other than manufacturer recommended items. Explanation of testing requirements regarding light units with specific lamps should be provided in the text. A discussion should be included about mixing light units as replacements with other manufacturer's units with emphasis on assuring system design of obstruction lighting is not degraded.

e. Operating instructions.

4. EQUIPMENT QUALIFICATION REQUIREMENTS.

4.1 Qualification Procedures. Procedures for qualifying equipment to be furnished under the Federal grant assistance program for airports are contained in Advisory Circular 150/5345-53 -- Airport Lighting Equipment Certification Program.

4.2 Qualification Tests. Qualification tests shall be conducted on the light unit in the following order:

a. Initial photometric test, per 4.2.1

b. Environmental tests, per 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6, and 4.2.7 (in any order)

c. 1000 hours of continuous operation, per 4.2.8

d. System operational test, per 4.2.8

e. Leakage current test, per 4.2.9

f. Sampling photometric test, per 4.2.1

g. Visual examination, per 4.2.10

Sample photometric and system operational tests shall be conducted after completion of all environmental tests. The same unit(s) shall be used throughout the tests. The following tests are required to demonstrate compliance with this specification. The tests may be run on the control unit, power supply, and a single light unit, with a simulated load replacing the other light units. Equipment tested shall be complete with optional equipment.

4.2.1 Photometric Test. A full photometric test as described in this section shall be performed before all environmental tests. A sampling photometric retest shall be conducted after the unit has been operated continuously for 1000 hours with normal (12 hour) day/night cycling. This sampling shall consist of measuring the vertical beam pattern for compliance with photometric requirements at a minimum of two of the previously tested horizontal radials. Light units shall be energized by system power supply and control unit, and shall be tested for compliance with photometric requirements. For a discharge flashing light, the specified intensity shall be produced at high and low temperature extremes as the input voltage to the system power supply varies by ± 10 percent from nominal. Red light intensity may be measured in white light and then calculated if the glassware manufacturer certifies the chromaticity and transmissivity values of the red filter material for the particular source. If more than one lamp type is to be used, the qualification testing shall be completed for each lamp type. For a discharge flashing system, if the power supply and optical head are separate components, the manufacturer shall demonstrate that the required photometrics are produced with the units separated by maximum and minimum recommended distances and connected by cable recommended by the manufacturer. Photometric test results shall be in the forms of:

a. Vertical beam pattern: Distribution curve (vertical angle versus candela) with minimum 1^{o} spacing of test points over range of specified angles.

b. Horizontal beam pattern: Polar plot (horizontal angle versus candela) with minimum 30^{o} spacing of test points.

4.2.2 High Temperature Test. The high temperature test shall be conducted in accordance with MIL-STD-810E, Method 501.3, Procedure II. The equipment shall be subject to a constant temperature of $+130(\pm5)^{o}$ F ($+55^{o}$ C) for 4 hours after equipment temperature stabilization. The equipment then shall be turned on for testing. During the test, the manufacturer shall demonstrate that the equipment maintains the specified flash rate and (for discharge flashing light) the proper amount of energy is being delivered to the flashtube as the input voltage is varied by ± 10 percent from nominal. A visual examination shall be conducted after the equipment is removed from the chamber. Failure of the equipment to operate as specified or any deterioration in materials shall constitute failure of the test.

4.2.3 Low Temperature Test. The low temperature test shall be conducted in accordance with MIL-STD-810E, Method 502.3, Procedure II. The equipment shall be placed in a chamber which maintains a temperature of $-67(\pm5)^{o}$ F (-55^{o} C). Equipment operation shall be demonstrated at the beginning of the

test. The equipment, with input power off, shall then be exposed to a 24-hour soaking period after which the equipment shall be turned on for 1 hour, and shall achieve specified flash rate and intensity within 30 seconds after being energized. During 1 hour of operation, the manufacturer shall demonstrate that the equipment maintains the specified flash rate and (for discharge flashing light) the proper amount of energy is being delivered to the flashtube as the input voltage is varied by ± 10 percent from nominal. At the conclusion of the test, a visual inspection shall be conducted. Failure of the equipment to operate as specified or any deterioration in materials shall constitute failure of the test.

4.2.4 Rain Test. The wind-blown rain test shall be conducted in accordance with MIL-STD-810E, Method 506.3, Procedure I. The rain shall be at a rate of 5.2 inches per hour (130 mm/hour) with an exposure time of 30 minutes per side. The equipment shall be operated throughout the test. Failure of the equipment to operate as specified, or any deterioration in materials shall constitute test failure.

4.2.5 Wind. Evidence shall be provided, either by testing or by calculated of mechanical force, to demonstrate that installed light units meet the wind requirement in paragraph 3.2.

4.2.6 Humidity Test. The test shall be in accordance with MIL-STD-810E, Method 507.3, Procedure I. The equipment shall be subjected to three complete cycles (72 hours) according to Table 507.3-I, except the maximum temperature at Cycle 1 shall be $+130(\pm5)^{O}$ F ($+55^{O}$ C). Failure of the equipment to operate as specified or any deterioration in materials shall constitute test failure.

4.2.7 Salt Fog Test. The salt fog test shall be conducted in accordance with MIL-STD-810E, Method 509.3, Procedure I. Failure of the equipment to operate as specified or any evidence of damage, or corrosion in materials shall constitute test failure.

4.2.8 System Operational Test. System Operational test shall be performed after the unit has been operated continuously without failure for 1000 hours with normal (12 hour) day/night cycling. System components shall be connected with the necessary wiring to electrically simulate an actual installation in which the top and bottom light units on a structure are separated by 2,000 feet (600 m) for a system composed of L-856 and/or L-865 and 500 feet (150 m) for system composed of L-857 or L-866, and the controller separated an additional 2,500 feet (800 m). Simulated interconnecting cables with equivalent impedance may be used in lieu of full cable lengths. The system shall be energized and operated to demonstrate compliance with all specification operating requirements such as flash rate, flash sequence, photoelectric switching of intensity steps, operation of interlocked devices, and satisfactory operation under input voltage variations. If the power supply and optical head are separate components, it shall be demonstrated that with the maximum and minimum nameplate rated separation between components, proper energy is delivered to the light unit to produce the specified photometrics. Similarly, it shall be demonstrated that L-810 and L-864 lights produce the specified photometric requirement when energized over conductors (actual or simulated) representing the maximum and minimum nameplate rated cable length at the minimum input voltage.

4.2.9 Leakage Current Test. Light units shall be tested for compliance to the leakage current requirement in 3.3.12. Leakage current shall be measured between the primary power connection points to the equipment chassis. The primary power connection points may be connected together during this test, but all other internal wiring shall be connected as in normal operation. Devices for surge and lightning protection connected directly to input power wiring may be disconnected during this test.

4.2.10 Visual Examination. The obstruction lighting equipment shall be examined for compliance with the requirements on materials, finish, and quality of workmanship.

5.0 PRODUCTION TEST REQUIREMENTS.

5.1 System Production Tests. A visual examination shall be performed for all components in a system to verify proper materials and assembly. Each component of the system shall be energized and tested to verify specified operation and conformance to photometric requirements.

5.2 Incandescent Light Unit Production Tests. All light units shall be visually examined for proper materials and assembly. The manufacturer shall demonstrate that the on-going production photometric test results show the manufacturing process has statistical capability with Cpk ≥ 1.0 and $\sigma \geq 3.0$, conforming to light unit photometric requirements as specified in 3.4.1.5, 3.4.1.8, or 3.4.1.2.

5.3 Discharge Light Unit Production Test. All light units shall be visually examined for proper materials and assembly. The units shall be energized and tested to verify proper operation and conformance to photometric requirements as specified in 5.3.2 Tables 5 and 6.

5.3.1 Production Operational Test. All light units shall be tested to verify specified operation in accordance with the following minimum standards.

a. Each unit shall be operated a minimum of 24 hours at highest intensity and a minimum of 12 hours at lowest intensity.

b. During highest intensity operation each unit shall be monitored for FLASH/FAIL as defined in 3.3.5.1.1. Minimum acceptable quality is zero FAILs in 24 hours of high intensity operation.

c. After a minimum 36 hours elapsed time of operation each light unit shall be tested to verify proper operation of the following:

a). All intensity step changes per 3.4.4.1

b). Proper operation of monitoring per 3.3.5.1.1

c). Proper discharge time to 50 volts (bank potential) per 3.3.9

d). Simultaneous flashing and intensity changing for multi-light systems per 3.4.3.1 & 3.3.5.1

e). Leakage current test per 3.3.12

5.3.2 Production Photometric Test. Photometric testing shall be performed in accordance with Table 5 or Table 6 using either conventional sampling per column 2 or statistical process control (SPC) per column 3. If SPC is used for a characteristic, it must show statistical capability with Cpk≥1.0 and $\sigma \geq 3.0$.

Table 5. L-856/857 Production Photometric Requirements

CHARACTERISTIC TESTED (1)	TEST POINTS	
	CONVENTIONAL	SPC
a) Beam peak (Day Intensity)	3 radials each unit: 1 at center of Horizontal beam + 2 radials ± 45° or ±60° from center	1 radial each unit, random orientation
b) Beam peak (Twilight Intensity)	Same radials as (a)	Same radials as (a)
c) Beam peak (Night Intensity)	Same radials as (a)	Same radials as (a)
d) Intensity at -1°	Same radials as (a)	Same radials as (a)
e) Intensity at -10° (Night)	Same radials as (a)	Same radials as (a)

NOTES: (1) Characteristic must meet all specifications per 3.4.1.3 or 3.4.1.4.

Table 6. L-865/866/864(1) /885(1) Production Photometric Requirements

CHARACTERISTIC TESTED (2)	TEST POINTS	
	CONVENTIONAL	SPC
a) Beam peak (Day Intensity)	4 radials each unit: equally spaced, random orientation	1 radial each unit, random orientation
b) Beam peak (Night Intensity)	Same radials as (a)	Same radials as (a)
c) Intensity at -1°	Same radials as (a)	Same radials as (a)
d) Intensity at -10°	Same radials as (a)	Same radials as (a)

NOTES: (1) Discharge light only

(2) Characteristic must meet all specifications per 3.4.1.6 or 3.4.1.5.

5.4 Production Test Records. Records showing actual test results of all tests required by section 5.3 shall be maintained for a period of three years by the manufacturer. These records shall be traceable to the units tested and in the case of discharge light units traceable by serial number.

5.5 Production Test Equipment. All measuring and test equipment used in the production of lighting equipment classified under section 1.2 shall have its accuracy and precision maintained by a calibration program meeting the requirements of MIL-C-45662 latest revision. All production photometric testing equipment shall be shown by the manufacturer to correlate to the certifying laboratory's equipment to within ±5%. Photometric testing shall be performed in a properly designed photometric range using a calibrated photometer. All photometric measurements shall be based on a minimum five flash average.

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