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ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Obs

SUBJECT: FAA/DOD SPECIFICATION L-856, HIGH INTENSITY OBSTRUCTION LIGHTING SYSTEMS

1. PURPOSE. This advisory circular contains equipment specifications for high intensity obstruction lighting systems.

2. CANCELLATION. Advisory Circular 150/5345-43A, FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems, dated November 19, 1971, is cancelled.

3. EXPLANATION OF REVISIONS. The specification has been completely revised. Major changes that have been made are:

   a. The 100,000 candela effective intensity step has been deleted from the Type A system.

   b. A twilight effective intensity step of 20,000 ± 25 percent candelas has been added to both the Type A and Type B systems for use during twilight periods.

   c. The nighttime effective intensity step has been increased and is now 4,000 ± 25 percent candelas with an effective flash duration of 1/10 to 1/4 second for the Type A system and approximately 1/10 second for the Type B system.

   d. The inclusion of a condenser discharge lamp for use on television antennas in conjunction with Type A systems.

4. EFFECTIVE DATE. Six months after the issuance date of this advisory circular, only those manufacturers whose equipment meets the new requirements in this circular will be listed as an approved supplier in Advisory Circular 150/5345-1, Approved Airport Lighting Equipment.

Initiated by: AAS-550

5. HOW TO OBTAIN THIS CIRCULAR. Additional copies of this advisory circular may be obtained, free of charge, from the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D.C. 20590.

CLYDE W. PACE, JR.
Director, Airports Service

1. SCOPE AND CLASSIFICATION.

1.1 Scope. This specification covers high intensity lighting systems for use on structures to provide obstruction warning to pilots.

1.2 Classification. Two types of lighting systems are covered by this specification as follows:

Type A System - For use on structures such as chimneys and towers.

Type B System - For use on supporting structures of power transmission lines.

2. APPLICABLE DOCUMENTS.

2.1 General. The following documents, of the issue in effect on the date of qualification tests, form part of this specification and are applicable to the extent specified herein.

2.1.1 FAA Specifications.

FAA-G-2100/1	Part 1	Electronic Equipment, General Requirements; Basic Requirements for all Equipments
FAA-G-2100/2	Part 2	Requirements for Equipments Employing Electron Tubes
FAA-G-2100/3	Part 3	Requirements for Equipments Employing Semiconductor Devices
FAA-G-2100/4	Part 4	Requirements for Equipments Employing Printed Wiring Techniques
FAA-G-2100/5	Part 5	Requirements for Equipments Employing Microelectronic Devices
Specification	CAA-446	Specification for Code Beacons

(Copies of FAA specifications may be obtained from the Federal Aviation Administration (FAA), Configuration Control Branch, AAF-110, Washington, D.C. 20591.)

2.1.2 FAA Advisory Circulars.

AC 70/7460-1 Obstruction Marking and Lighting

(Copies of FAA advisory circulars may be obtained from the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D.C. 20590.)

2.1.3 Military Standards.

MIL-STD-810 Environmental Test Methods

(Copies of military specifications and standards may be obtained from the Commanding Officer, Naval Pulications and Forms Center, 5801 Tabor Avenue, Attention: NPFC-105, Philadelphia, Pennsylvania 19120.)

2.1.4 Other Publications.

IES Guide for Calculating the Effective Intensity of Flashing Signal Lights, published in Illuminating Engineering, Volume LIV, page 747 (November 1964).

(Copies of IES documents may be obtained from the Illuminating Engineering Society, 345 East 47th Street, New York, New York 10017.)

3. REQUIREMENTS.

3.1 General. The lighting systems described herein are intended for use on structures to provide obstruction warning to aircraft. The Type A system is for installation on structures such as chimneys, poles, towers, and other similar structures. The Type B system is for installation on the supporting structures of transmission lines or similar structures. The criteria for the configuration, spacing of lights, and number of lights required is contained in Advisory Circular 70/7460-1, Obstruction Marking and Lighting.

3.2 Equipment to be Furnished. The following items are covered by this specification for both the Type A and Type B systems:

Light Units
Power Supplies
Control Unit (including photoelectric lighting control)
Instruction Books

3.2.1 Connecting Cables. Cables for interconnection of the system component parts listed in 3.2 are not included in this specification. However, full information shall be given in the instruction book (3.6) on the voltage and power rating of the equipment to permit selection of cables to meet operating requirements.

3.3 Environmental Conditions. The equipment shall be designed for continuous outdoor operation under the following conditions:

3.3.1 Wind. Wind velocities up to 150 miles (240 kilometers) per hour.

3.3.2 Temperature. A temperature range from -50°C. to +55°C.

3.4.2 Flash Rate and Sequence. The flash rates shall be as specified within a tolerance of ± 5 percent.

Type A System - All light units on a structure shall flash simultaneously at a rate of 40 flashes per minute. The flash duration for the high and intermediate steps shall not exceed 10 milliseconds. The low intensity step shall have an effective flash duration of 100 to 250 milliseconds.

Type B System - With three light units installed on a structure, one near the top, one near the middle, and one near the bottom, the flash sequence shall be such that the middle light flashes first, the top light flashes next, and the bottom light flashes last. The OFF interval between the top light and the bottom light shall be about twice as long as between the middle light and top light. The interval between the end of one sequence and the beginning of the next shall be about 10 times the interval between the middle and top light. The flash duration shall be no more than 10 milliseconds for the high and intermediate intensity positions and shall have an effective flash duration of approximately 100 milliseconds for the low intensity position. Each light unit of the system shall flash at a rate of 60 flashes per minute.

3.4.3 Intensity Step Changing. The systems shall automatically change intensity steps when the north sky illumination is as follows:

From high to intermediate - when the illumination drops to 60 footcandles but before it drops below 30 footcandles.

From intermediate to low - when the illumination drops to 5 footcandles but before it drops below 2 footcandles.

This order shall be reversed in transitioning from the night to the day mode. The reversed order differential shall not be more than 5 footcandles.

The design shall prevent intensity step changes during short periods of changing illumination caused by flashes of lightning, stray light sources of short duration or abrupt periods of darkness and shadow. Failure of the switching unit shall cause all lights to operate in the high intensity mode.

3.4.4 Light Color. The color of the light shall be white. Xenon gas emission meets this requirement.

3.5 Design Requirements.

3.5.1 General. The light systems shall conform to applicable portions of specification FAA-G-2100, Parts 1, 2, 3, 4, and 5, except service conditions shall be as specified in 3.3 of this specification.

3.5.2 Maintenance. All components in the systems, including the light source, shall be designed to provide the required performance for a period of at least one year without any maintenance. With preventive maintenance performed on a yearly basis, the system mean-time-between-failures shall not be less than six months.

3.5.3 Light Units. The light units shall be designed to be as small and lightweight as feasible and to provide minimum wind resistance when installed. The light beam center shall be adjustable to any point from zero degrees up to eight degrees above the horizontal. A spirit level or other means shall be provided as part of each light unit for determining the angle of light beam. Vertical adjustments shall be indicated in one-degree increments. Provision shall be made to lock the light unit at the desired vertical angle. Multiple light fixtures may be used to obtain full horizontal light coverage. Failure of any light unit shall not affect operation of other light units.

3.5.4 Power Supply. The power supply shall be designed to operate under the specified environmental conditions from a single phase, 60 Hertz (± 5 percent) source and from at least the following voltages: 480 volts (± 10 percent); 240 volts (± 10 percent); 120 volts (± 10 percent). The power supply shall provide sufficient energy to the flash tubes to meet the photometric requirements under the above voltage ranges. Supplemental heat may be provided in the unit to meet the low temperature requirements.

3.5.5 Control Unit. The control unit shall contain the components required to control the flash rate, flash sequence, and light intensity step and shall have a panel to indicate individual light unit and system status. The control unit shall be suitable for installation outdoors, either near the base of the structure or remoted up to a distance of 2,500 feet (750 meters). The control unit shall be provided with a means for locking to prevent entry by unauthorized personnel. Supplemental heat may be provided to meet low temperature requirements. Failure of this unit shall not cause the light units to be inoperative. In event of failure of the timing or intensity step changing circuits, the light units shall continue to operate but do not have to flash in sequence. Failure of the intensity step changing circuit shall cause all light units to operate in the high intensity mode.

3.5.6 Transient Voltage. The complete light system shall be capable of withstanding a voltage transient of ± 20 percent of nominal from any point within the plus or minus steady-state tolerance band within two seconds.

3.3.2 Humidity. A humidity range up to 95 percent.

3.3.3 Rain. Exposure to driving rains.

3.4 Performance Requirements.

3.4.1 Effective Intensity.

TYPE A SYSTEM - THREE LIGHTS PER LEVEL

Step	Minimum Intensity 1/	Beam Spread Vertical (Peak) Min	Max	Beam Spread Horizontal	Beam Peak Intensity 2/
Day	100,000 cds	3°	7°	120°	200,000 cds minimum
Twilight	8,000 cds	3°	7°	120°	20,000 cds ± 25%
Night	1,500 cds	3°	7°	120°	4,000 cds ± 25%

1/ Minimum intensity measured throughout the 120 degree sector.

2/ Per light unit.

TYPE A SYSTEM - FOUR LIGHTS PER LEVEL

Step	Minimum Intensity 1/	Beam Spread Vertical (Peak) Min	Max	Beam Spread Horizontal	Beam Peak Intensity 2/
Day	100,000 cds	3°	7°	90°	200,000 cds minimum
Twilight	8,000 cds	3°	7°	90°	20,000 cds ± 25%
Night	1,500 cds	3°	7°	90°	4,000 cds ± 25%

1/ Minimum intensity measured throughout the 90 degree sector.

2/ Per light unit.

TYPE B SYSTEM - 180-DEGREE COVERAGE

Step	Minimum Intensity 1/	Beam Spread Vertical (Peak) Min	Max	Horizontal 2/	Beam Peak Intensity 3/
Day	50,000 cds	3°	7°	180° minimum	100,000 cds minimum
Twilight	8,000 cds	3°	7°	180° minimum	20,000 cds ± 25%
Night	1,500 cds	3°	7°	180° minimum	4,000 cds ± 25%

1/ Measured throughout the 180 degree sector.

2/ Two or more light units may be used.

3/ Per light unit.

TYPE B SYSTEM - 360-DEGREE COVERAGE

Step	Minimum Intensity 1/	Beam Spread Vertical (Peak) Min	Max	Horizontal 2/	Beam Peak Intensity 3/
Day	100,000 cds	3°	7°	360°	100,000 cds minimum
Twilight	15,000 cds	3°	7°	360°	20,000 cds ± 25%
Night	3,000 cds	3°	7°	360°	4,000 cds ± 25%

1/ Sum of lights measured throughout 360 degrees.

2/ Three or more light units may be used.

3/ Per light unit.

Momentary impairment of operation during the transient is permissible but the transient shall not cause failure of any part or prevent resumption of normal operation.

3.5.7 Interlock Switches. Cover operated interlock switches shall be incorporated in both the light unit and power supply housings. These switches shall be connected so that upon the opening of either cover, accidental contact with high voltage will be prevented and the flash capacitor will discharge to a maximum of 50 volts within 30 seconds. Provision shall be included to discharge the flash capacitor, as required above, if the cover operated interlock switches fail to operate.

3.5.8 Warning Signs. Warning signs shall be located on the equipment near points of high voltages to warn maintenance personnel of potential danger.

3.5.9 Identification. Identification data shall be affixed to each equipment unit (light fixture, power supply, control unit, etc.) and shall contain the following minimum information:

Name of unit (light unit, power supply, etc.)
Specification FAA-L-856
System type number (A or B)
Manufacturer's name and address

3.5.10 Optional Items. The following items are required for qualification but need not be furnished unless requested by the customer:

3.5.10.1 Light Shields. The light shields shall be designed to effectively cut off the light beam over any specified vertical and/or horizontal segment but shall not affect the desired light output. The shields may be necessary at some locations to prevent disturbance of persons on the ground or for other reasons.

3.5.10.2 Intensity Override Switch. This switch shall be mounted on the control unit and may be used to manually regulate the light intensities in the event of a failure or malfunction of the automatic switching unit(s). (See paragraph 3.4.3, Intensity Step Changing.)

3.5.10.3 Remote Monitoring Pickup Points. Terminals shall be available within the control unit to allow for the remoting of an alarm, or system operating status readout device, for relaying the operational condition of the lighting system and to signal a malfunction in the event of one or more system failures.

3.5.10.4 Antenna Obstruction Light. Objects, such as a television antenna or similar appurtenance extending above the main structure of an obstruction, shall be equipped with a single condenser discharge light indicating the highest point of the obstruction.

3.5.10.4.1 Size. The light shall be suitable for installation on a television antenna and shall be no larger than 36 inches (90 centimeters) in height by 15 inches (37.5 centimeters) in diameter.

3.5.10.4.2 Flash Rate and Sequence. It shall be compatible with the Type A system and flash in sequence and simultaneously with the rest of the system.

3.5.10.4.3 Intensity. The light unit shall operate in the night intensity position when the Type A system is in the low intensity position and shall operate in the day/twilight intensity position when the Type A system is in either the intermediate or high intensity position.

ANTENNA OBSTRUCTION LIGHT

Step	Minimum Vertical Intensity	Beam Spread Vertical (Peak) 1/	Beam Spread Horizontal	Beam Peak Intensity
Day/Twilight	8,000 cds	3° minimum	360°	20,000 cds ±25%
Night	1,500 cds	3° minimum	360°	4,000 cds ±25%

1/ Lower beam angle shall be between 1 and 2 degrees below the horizon and a minimum of 1.5 degrees above. The upper beam angle is unlimited.

3.5.10.4.4 Optical System. The lenses shall be made of clear, hard heat-resisting optical glass. All glass shall be high transmission and polished. The cover lense may be 300 millimeters in diameter and may be made up of a single unit or in two cylindrical sections.

3.5.10.4.5 Beam Spread. The light shall be visible from 360 degrees about the horizontal plane from any normal angle of approach.

3.5.10.4.6 Lamps. Multiple lamps may be used.

3.6 Instruction Books. An instruction book shall be supplied as part of each system and shall contain the following information:

Information as to safety requirements while maintaining the equipment.

Theory of circuit and system operation.

Complete schematics and interconnecting wiring diagrams.

Complete parts list with each circuit component keyed to the designation assigned on schematics or wiring diagrams. Complete information shall be given for each part to permit ordering for replacement purposes.

Recommended preventive maintenance.

Troubleshooting information.

Physical characteristics (weight, size, mounting dimensions)

Installation instructions.

Operating instructions.

4. QUALITY ASSURANCE PROVISIONS.

4.1 Qualification Procedures. Manufacturer's producing products, certified by the FAA as having met the requirements specified herein, will be listed as an approved supplier in Advisory Circular 150/5345-1, Approved Airport Lighting Equipment. Requests for qualification should be submitted, in writing, to the Airports Engineering Division, AAS-500, Airports Service, FAA, Washington, D.C. 20591, at least two weeks prior to start of qualification tests. The request shall include: (1) A statement that the manufacturer agrees to comply with all provisions of this specification; (2) A copy of proposed test procedures and test data sheets; and (3) A preliminary copy of the instruction book with drawings, photographs, and installation instructions to permit a preliminary analysis of the manufacturer's design. Successful completion of all tests specified herein, approval of the instruction book, and written agreement by the manufacturer to comply with all provisions herein is required for qualification. All tests may be witnessed by an authorized FAA representative and may be conducted at the manufacturer's plant or at an independent testing laboratory acceptable to the FAA. The manufacturer shall bear all testing costs. A certified copy of the test results of all qualification tests shall be submitted to the FAA. After successful completion of all tests, the manufacturer shall provide the FAA, free of charge, 10 copies of the final approved version of the instruction book. A product, once listed in Advisory Circular 150/5345-1, may not be changed as to design, method of manufacture, quality or quantity of materials, or substitution of components without prior concurrence of the FAA.

4.2 Production Testing. The tests specified in 4.4.10 shall be conducted by the manufacturer on all production units. Test results shall be recorded and kept by the manufacturer for a period of at least three years and shall be made available to the FAA upon request.

4.3 Guarantee. The manufacturer shall provide each customer with at least the following minimum guarantee: That the product has been manufactured in accordance with and will perform as required by the governing specification and that any defect in material or workmanship which may develop during proper and normal use during a period of one year from date of installation or a maximum of two years from date of shipment will be corrected by repair or replacement by the manufacturer f.o.b. factory.

4.4 Qualification Tests.

4.4.1 Visual Examination. The equipment will be visually inspected for conformance to the applicable design requirements of specification FAA-E-2100, Parts 1, 2, 3, 4, and 5. Particular attention will be paid to quality of workmanship.

4.4.2 Operation Test. The 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 a distance of 2,000 feet (600 meters) for the Type A system and 500 feet (150 meters) for the Type B system and the controller separated an additional 2,500 feet (750 meters). One additional light unit shall be located electrically midway between the top and bottom light units. Simulated interconnecting cables may be used in lieu of full cable lengths. The system shall be energized and operated to determine compliance with all specification operating requirements such as flash rate and sequence, operation of photoelectric switching of intensity steps, operation of status indicator panel under normal and failure modes, operation of interlock devices, and satisfactory operation under special voltage input variations.

4.4.3 Photoelectric Test. The light units shall be tested to determine compliance with the system photometric requirements. The effective intensity shall be determined as shown in the IES Guide for Calculating the Effective Intensity of Flashing Signal Lights.

4.4.4 Rain Test. A rain test shall be conducted on the equipment in accordance with MIL-STD-810, Environmental Test Methods. The equipment shall be operated during the last 10 minutes of the test. No water shall enter the equipment which could affect operation or performance.

4.4.5 High Temperature Test. The high temperature test shall be conducted in accordance with Procedure II of MIL-STD-810, Environmental Test Methods. The equipment shall be operated to ensure no degradation of system performance.

4.4.6 Low Temperature Test. The low temperature test shall be conducted in accordance with Procedure I of MIL-STD-810, Environmental Test Methods. No degradation of system performance shall result from the test.

4.4.7 Wind. Evidence shall be provided, either by testing or calculations, to assure the installed light units meet the wind requirement of 3.3.1.

4.4.8 Humidity. The test shall be in accordance with Method 507, Procedure I of MIL-STD-810, except the maximum temperature shall be 55°C. and a total of three complete cycles (72 hours) will be required.

4.4.9 Certification. The manufacturer shall provide certification that the system mean-time-between-failures is not less than six months.

4.4.10 Production Tests. Production units shall be subject to the following tests:

Operation test (4.4.2)

Photometric test - Each light unit shall be checked to determine if peak effective intensity meets specification requirements.