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ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION

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

1. PURPOSE. This Advisory Circular describes specification requirements for high intensity obstruction lighting systems.
2. CANCELLATION. Advisory Circular 150/5345-43, FAA/DOD Specification L-856, High Intensity Obstruction Lighting System, dated 19 August 1970.
3. SCOPE. The systems covered by this specification describe day and night lighting required for obstructions to air navigation. The classes of light systems are for tall structures and supporting structures of overhead wires.
4. EXPLANATION OF REVISIONS. In addition to minor changes in the text, specification requirements have been included for obstruction lighting systems for supporting structures of overhead wires.
5. HOW TO OBTAIN THIS CIRCULAR. Obtain copies of this Advisory Circular 150/5345-43A, FAA/DOD Specification L-856, High Intensity Obstruction Lighting Systems, free of charge from the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D.C. 20590

A handwritten signature in black ink, appearing to read "Clyde W. Page, Jr.", written over a horizontal line.

CLYDE W. PAGE, JR.
Deputy Director, Airports Service

Initiated by: AS-550

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION SPECIFICATION
HIGH INTENSITY OBSTRUCTION LIGHTING SYSTEMS

1. SCOPE.

1.1 Scope. The systems covered by this specification describe lighting required for structures to provide obstruction warning during day and/or night for pilots operating under Visual Flight Rules. Two classes of light systems are covered by this specification.

System A - Obstruction Lighting System for Tall Structures.

System B - Obstruction Lighting System for Supporting Structures of Overhead Wires.

2. APPLICABLE DOCUMENTS.

2.1 Illuminating Engineering Society Document. Obtain copies of Illuminating Engineering Society (IES) Guide for Calculating the Effective Intensity of Flashing Signals Lights, published in Illuminating Engineering, Vol. LIX, page 747 (November 1964) from IES, 1345 East 47th Street, New York, New York 10017.

2.2 FAA Specification. Obtain copies of FAA-G-2100, Electronic Equipment, General Requirements Part 1, Basic Requirements for all Equipments, from the Federal Aviation Administration, Configuration Control Branch, FI-110, Washington, D.C. 20591.

2.3 FAA Circular. Obtain copies of Advisory Circular 70/7460-1A, Obstruction Marking and Lighting, free of charge, from the Department of Transportation, Distribution Unit, TAD 484.3, Washington, D.C. 20590.

3. REQUIREMENTS.

3.1 General. Each system shall be designed for operation during day and night and shall consist of the units specified herein:

3.1.1 System A. This system shall be designed for installation on towers, chimneys, poles, and other similar structures. Specific criteria for the installation of this system is contained in the latest issuance of Advisory Circular 70/7460-1A. The system shall consist of the following:

Lighting Units - Height of structure will determine the number required.

Control Unit

Day-Night Switching Unit

Power Supply (regulator, if required)

3.1.2 System B. This system shall be designed for installation on the supporting structure of overhead wires. The number of lighting systems used for overhead wires will be determined by the number of supporting structures included within the extremities of the overhead wires. The system shall consist of the following:

Three Light Units

Control Unit

Day-Night Switching Unit

Power Supply (regulator, if required)

3.2 Detail Design Requirements.

3.2.1 Design Requirements Applicable to System A and System B.

3.2.1.1 Maintainability. All components of the light system mounted on a structure shall be designed to be maintained on that structure by a single maintenance man using only hand tools normally carried by an electrician. Provision should be made to simplify maintenance with minimum downtime.

3.2.1.2 System Design. The light system shall conform to applicable portions of Specification FAA-G-2100, Parts 1, 2, 3, and 4, except as follows:

Motors. If motors are used, they shall employ high temperature permanently lubricated bearings. Motors shall meet the other requirements for ventilation and cooling.

Service Conditions. The ambient conditions for equipment installed outdoors (Environment III) shall have wind conditions from 0 to 150 miles per hour.

3.2.1.3 Light Unit. The light unit may be composed of one or more flash tubes or an assembly of other light equipment placed in one container to be mounted separately from other similar units. When assembled, this light unit, however it may be composed, shall meet the requirements stated and

shall be designed for outdoor operation. Provisions shall be made to prevent accumulation of water in the light unit. Failure of components in one light unit will not affect other units.

3.2.1.3.1 Color. The color of the light shall be white. Xenon gas light meets this requirement.

3.2.1.3.2 Effective Intensity. The effective intensity in candelas shall be determined from the instantaneous intensity against time trace of the light unit. The effective intensity in candelas shall be determined from the Blondel-Rey equation and calculated as shown in the IES Guide for Calculating the Effective Intensity of Flashing Signal Lights.

3.2.1.3.3 Beam Center Adjustment. The center of the beam shall be readily adjustable to any point between 0 degrees and 8 degrees above the horizontal. A device such as a goniometer or spirit level shall be provided as an integral part of each light unit for determining the angle of the light beam.

3.2.1.3.4 Size and Shape. The light unit shall be designed for minimum space and shape so as to create minimum wind resistance when installed.

3.2.1.3.5 Lamp Life. The light unit shall be designed so that it will provide one year continuous operation during which time the intensity shall not deteriorate below 200,000 candelas and the lamp shall not require replacement when operated at 200,000 candelas during daylight and 1,000 candelas at night.

3.2.1.3.6 Thermal Design. Thermal design shall be in accordance with FAA-G-2100, section 1-3.4.7.

3.2.1.4 Control Unit. The control unit shall contain the components required to control the flash rate, synchronization, and intensity of the light units. The control unit shall be suitable for installation outdoors near the base of the structure. The control unit shall be provided with a door to allow access to controls. The door shall be provided with a hasp or other suitable means to secure the control unit with a lock to prevent operation by unauthorized personnel. The control unit shall have provisions to switch the system to the intensity indicated by the day-night switching unit. The control unit shall have provisions for remoting to the distances specified in paragraph 4.1.2. Supplemental heat may be provided in unit to meet low temperature requirements.

3.2.1.5 Day-Night Switching Unit. The day-night switching unit shall provide a signal to the control unit when day changes to night and when night changes to day. The unit shall signal a nighttime condition when the north sky illumination falls to a level of three-foot candles but before the level reaches one-half-foot candles. Daytime shall be signalled when the north sky light illuminance rises to one-half-foot candles but before the level reaches three-foot candles. The switching unit shall be designed for outdoor operation.

3.2.1.6 Power Supply. The light system shall operate from a single phase, 60 hertz source with either of the following: 440 volts (± 10 percent voltage), 240 volts (± 10 percent voltage) or 120 volts (± 10 percent voltage) power source. The complete light system with all controls, regulators, etc., shall have a design goal power factor not less than 80 percent. Supplemental heat may be provided in the unit to meet low temperature requirements.

3.2.1.7 Cable and Wire. Cable and wire required to interconnect the system are not a part of this specification, however, these components shall meet voltage and current requirements of the obstruction lighting systems. The type and amount of cable and wire shall be specified in the equipment manufacturer's instruction booklet.

3.2.2 Design Requirements Applicable to System A.

3.2.2.1 Installed System. The total number of levels at which light units are installed will depend on the height of the structure. (See FAA Advisory Circular 70/7460-1).

3.2.2.2 Flash Rate. The flash rate of each System A light, at rated voltage and frequency, shall be 40 flashes per minute. A plus or minus 5 percent tolerance due to environmental circumstances will be allowed.

3.2.2.2.1 Flash Duration. The flash duration shall be no less than 90 microseconds and no more than 5,000 microseconds.

3.2.2.3 Simultaneous Operation. The system shall be designed so that when installed, all light units on a specific vertical line flash simultaneously, but not necessarily with other vertical line of lights.

3.2.2.4 Visibility Control. Where specified as an additional optional feature, the control unit shall be equipped for manually switching the light units from the normal full intensity of 200,000 candelas to one-half of this intensity when the day visibility is more than 5 miles. Without such visibility control, the system shall operate at full intensity.

3.2.2.5 Intensity Control. The units shall be capable of being operated at full intensity (200,000 candelas), one-half full intensity (100,000 candelas), and for night, at one-half percent of 200,000 candelas (1,000 candelas).

3.2.2.6 Light Unit. In addition to the requirements contained under 3.2.1.3 above, the following requirements apply to System A:

3.2.2.6.1 Intensity and Beam Spread. The effective intensity at any point throughout 360° on the horizontal plane shall not be less than 200,000 candelas when operated at full intensity and flashing at 40 flashes per minute. The vertical spread to 50 percent of effective intensity shall not be less than 3 degrees and to 10 percent of effective intensity shall be no less than 6 degrees. The bottom of the beam should have a sharp vertical cutoff.

3.2.3 Design Requirements Applicable to System B.

3.2.3.1 Installed System. The lights shall be installed at the following levels: at the top of the overhead wires supporting structure; near the height above ground or water of the lowest point of the catenary; and about midway between the top and bottom light unit(s). The middle light should normally be a minimum of 50 feet from the other two lights. A minimum of three light units will normally complete the system on each of the two supporting structures of the catenary. One or more light fixtures may be installed at each level in order to obtain 180 degrees of horizontal coverage centered on the transmission line, e.g., two 90-degree, or greater, lamps may be joined to produce 180 degrees total horizontal spread. All lights operated in the same direction should provide the required sequential operation in that direction. Additional systems may be installed as needed when the catenary is supported by more than two towers. (See Advisory Circular 70/7460-1 for installation details.)

3.2.3.2 Flash Rate. The flash rate of the system, at rated voltage and frequency, shall be 60 flashes per minute (each light unit of the system shall flash at 60 flashes per minute). A plus or minus 5 percent tolerance due to environmental circumstances will be allowed.

3.2.3.3 Flash Sequence. The light units shall flash in order, the middle light first, the top light second, and the bottom light last. The OFF interval between the second and third light should be about twice as long as between the first and second light. The interval between the end of one sequence and beginning of the next should be about 10 times the interval between the first and second light. The ON time of any flash normally should not be less than 20 microseconds or more than 5,000 microseconds. The ON time is the time when the instantaneous intensity exceeds the effective intensity.

3.2.3.4 Intensity Control. In daytime the light units shall be operated at an intensity of 100,000 candelas, while at night the intensity will be between 500 to 1,000 candelas.

3.2.3.5 Light Unit. In addition to the requirements contained in 3.2.1.3 above, the following requirements apply to System B:

3.2.3.5.1 Intensity and Beam Spread. The light unit shall be designed so that when installed it will have a horizontal coverage of 180 degrees centered on the overhead wires. In the event that several light assemblies are employed to obtain the light intensity and beam spread, any overlap shall be provided nearest the vertical plane through the center of the overhead wires. When at full intensity, the effective intensity of the light unit shall be no less than 100,000 candelas. The vertical spread to 50 percent of effective intensity shall not be less than 3 degrees and to 10 percent of effective intensity shall not be less than 6 degrees. The peak of the effective intensity shall be approximately at the center of the beam. The bottom of the beam should have a sharp vertical cutoff.

3.2.3.5.2 Light Shield. When required by the contract, a light shield shall be provided. The shield shall be designed to effectively cut off the light beam at any specified horizontal point.

3.3 Parts List and Installation Instructions For Systems A or B. A complete parts list and installation instructions shall be furnished with each shipment of light assemblies or each shipment of light assembly components. Sufficient drawings or illustrations shall be provided to indicate clearly the method of assembly and installation.

4. QUALITY ASSURANCE PROVISIONS.

4.1 Quality Testing. The light system shall be tested in accordance with the tests cited below and in a testing laboratory acceptable to the Federal Aviation Administration, Airports Service, Washington, D.C. 20591. These tests shall be performed in the order shown and may be witnessed by a representative of the FAA, Airports Service. This testing is required to certify the manufacturer's ability to produce a light system meeting the requirements of this specification. More than one light system may be submitted for tests. At least three light units shall normally be included with each light system. The necessary interconnecting wire and cable to demonstrate installation on tower or to simulate installation on a tower shall be provided. In the event a light system fails, it may be resubmitted for test after the cause of failure has been corrected. The manufacturer shall furnish a sample unit and two certified copies of the testing laboratory's report and installation instructions to the Federal Aviation Administration, Airports Service, Washington, D.C. 20591, for review and approval. The manufacturer shall retain the equipment used for qualification until after approval has been granted. When approved, the name of the qualified manufacturer and a description of this equipment will be included in Advisory Circular 150/5345-1C, Approved Airport Lighting Equipment. The manufacturer shall bear all testing costs and the cost of preparing the instruction booklet. The manufacturer of an item listed in Advisory Circular 150/5345-1C, shall not change quantity or quality of materials, methods of manufacture, quality of castings or other parts, make substitution, or change catalog or style numbers without prior concurrence of FAA, Airports Service.

4.1.1 Local Operation. The system shall be connected with necessary wire and cable to electrically simulate an actual installation in which the top and bottom light are separated on structure about 1,500 feet apart for System A and 500 feet apart for System B. The remaining lights of the system shall be equally spaced (electrically) between the top and bottom light. Dummy cable loads may be used in lieu of full lengths of cable and wire. Unless otherwise specified, the light units shall be operated at full intensity. With the indicating panel mounted in the control unit, conduct the following tests:

4.1.1.1 Synchronism or Sequential Operation

4.1.1.1.1 With the system operating normally for at least 250 hours, determine by photometric, mechanical, or electrical means that the actual light units are operating in synchronism for System A and in sequence for System B and that this condition is shown on the indicating panel.

4.1.1.1.2 Disconnect or stop one of the light units and determine that the indicator panel shows that this light is not in synchronism or not operating in proper sequence, as applicable, with the other light units.

4.1.1.1.3 Repeat 4.1.1.2 above with each of the other light units.

4.1.2 Remote Operation. With the control remotod to a distance of 2,500 feet from the structure for System A and 500 feet from the structure for System B (remoting can be accomplished by electrically simulating the distance using dummy loads), repeat 4.1.1.1 through 4.1.1.1.3.

4.1.3 Day-Night Operation. Operate the system under actual or simulated day and night conditions to check conformance with paragraph 3.2.1.5.

4.1.4 Photometric Test. Each of the light units shall be tested to determine that the effective intensity and beam distribution meet the requirements for the applicable system. The system shall be operated at rated values.

4.1.5 Beam Center Adjustment. Each of the lights shall be tested to determine whether the beam center is adjustable within specified requirements.

4.1.6 High Temperature Test. The system shall be installed in a chamber and subjected to a high humidity and an ambient temperature of 55°C. ($\pm 2^\circ\text{C}.$) The equipment shall be operated at full intensity for a period of 24 hours and not be damaged as a result of this test.

4.1.7 Low Temperature Test. The equipment shall be placed in a chamber and subjected to an ambient temperature of -50°C. ($\pm 2^\circ\text{C}.$) for a period of 12 hours without operation. It shall, while in the chamber, be operated at full intensity for 3 hours while exposed to -50°C. ($\pm 2^\circ\text{C}.$) temperature. The equipment shall then be shut down and the chamber operated for 10 hours while subjected to an ambient temperature of -50°C. ($\pm 2^\circ\text{C}.$). At the completion of this period, the unit shall be operated 10 minutes. The entire test shall be repeated immediately for an additional cycle for each system. No damage to the equipment shall result from this test.

4.1.8 Wind. Evidence shall be provided to assure the installed light unit can meet the wind requirements of 3.2.1.2.

4.2 Production Testing. Each production system shall be subjected to the following qualification tests:

4.2.1 Operation Test. Each system shall be tested in accordance with the requirements of 4.1.1.1 through 4.1.1.3, and 4.1.3.

4.2.2 Photometric Tests. Each unit shall have photometric check for peak effective intensity only to determine if the peak is within design requirements.

4.3 Certification. The manufacturer shall furnish a certification that the lamp life meets the minimum requirements of paragraph 3.2.1.3.5.

5. PREPARATION FOR DELIVERY.

5.1 Packaging and Packing. The system shall be packaged to permit shipment by common carrier without damage to the equipment. Each unit of the system shall be individually packaged in a durable, domestic type carton. Each unit shall be protected by proper cushioning. For convenience of shipment, more than one unit may be packed in a large container, provided the container weight, with equipment, does not exceed 400 pounds.

5.2 Shipping Marking. Packaging and packing containers shall be durably and legibly marked with:

Consignee's Name and Address
Components Name and Part No.
Specification No. L-856
Contract No.
Manufacturer's Name and Address