

# Federal Aviation Agency



## ADVISORY CIRCULAR

AC NO: AC 150/5345-24

AIRPORTS

EFFECTIVE :

6/30/65

**SUBJECT :** SPECIFICATION FOR L-849 CONDENSER DISCHARGE TYPE FLASHING LIGHT

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1. PURPOSE. This circular describes the subject specification requirements for a condenser discharge type flashing light. The specification is for the guidance of the public, and its use is required for project activity under the Federal-aid Airport Program.
  2. SCOPE OF SPECIFICATION. The specification requirements presented are for a condenser discharge type flashing light to be used as part of the economy approach lighting aids. These light units will be used in two separate systems. The systems are the Runway End Identifier Light System (REILS), and the Medium Intensity Approach Light System with sequenced flashing lights (MALS/SF).
  3. APPLICABLE SPECIFICATIONS. The following specifications of the issue in effect on the date of application for qualification (see paragraph 11) apply to this circular. This circular shall govern in case of conflict.
    - a. Federal Specification and Standard.
      - (1) TT-E-489 - Enamel, Alkyd, Gloss (for exterior and interior surfaces).
      - (2) Federal Standard No. 595 - Colors.
    - b. FAA Specifications.
      - (1) CAA-1100 - Photometric Test Procedure.
      - (2) Specification for L-833 Individual Lamp Series-To-Series Type Insulating Transformer for 600 Volt or 3000 Volt Series Circuits, AC 150/5345-31.
      - (3) Specification for L-834 Individual Lamp Series-To-Series Type Insulating Transformer for 5000 Volt Series Circuit, AC 150/5345-22.
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- (4) Specification for L-848 Medium Intensity Approach Light Bar Assembly, AC 150/5345-25.

4. SOURCE OF APPLICABLE SPECIFICATIONS AND STANDARD.

- a. Obtain copies of the Federal specification and standard from the Business Service Centers of the General Services Administration Regional Offices.
- b. Obtain copies of FAA specifications from the Federal Aviation Agency Distribution Section, HQ-438, Washington, D. C. 20553.

5. SYSTEMS COMPONENTS.

- a. REILS. The Runway End Identifier Light System consists essentially of two light units flashed twice a second simultaneously at the approach end of the runway. The components of the system are as follows:
- (1) The system shall have two condenser discharge type flashing light units. The master timer for flashing the two units may be located in either one of the units.
  - (2) The system shall be controlled as specified in paragraph 9f.
  - (3) Necessary hardware shall be provided for mounting the housing containing the optical system on a 2-inch pipe. Provisions may be made for attaching the power supply to the optical system or to a 2-inch pipe.
  - (4) Control wires, radio control, an outdoor type junction box, and necessary connectors or terminals for connecting the light units into the power and control circuits shall be provided as required. These items are not a part of this specification.
- b. MALS. The Medium Intensity Approach Light System consists of steady burning lights. Sequenced flashing lights may be installed with the steady burning lights if needed for operational requirements. The steady burning lights and their structures shall be as specified in Advisory Circular No. 150/5345-25, "Specification for L-848 Medium Intensity Approach Light Bar Assembly". The components of the system are as follows:
- (1) The MALS/SF system presents, in plan view, a configuration of steady burning and flashing lights arranged symmetrically about and along the extended centerline of the runway. This system begins 200 feet from the runway threshold and terminates at a distance 1400 feet from the runway threshold.

- (2) The MALS has seven stations. Each station has a bar with five steady burning lights. The station, 1000 feet from the runway threshold, has two additional bars (one on each side of the centerline bar). Each of these bars has five steady burning lights. The MALS/SF has one flashing light at each station. The flashing lights are installed along the extended runway centerline.
  - (3) The condenser discharge type flashing lights installed with the MALS, are flashed in sequence at the rate of two flashes per second. The flash rate is controlled by a master timer of the type specified in paragraph 9d.
  - (4) The "on-off" operation of the MALS/SF may be controlled from a remote location over control wires or the system may be controlled with radio control. The system controls are not a part of this specification.
  - (5) Necessary mounting hardware shall be provided for attaching the optical system of the condenser discharge type light to a MALS light bar assembly (AC 150/5345-25). Provisions may be made for attaching the power supply to the optical system or attaching it to a 2-inch pipe.
  - (6) Control wires, radio control, outdoor type junction boxes, and necessary connectors for connecting the light units into the lighting circuits shall be provided as required. These items are not a part of this specification.
6. MATERIAL AND WORKMANSHIP. All components and materials shall be of industrial quality or better. Workmanship shall be in accordance with high grade commercial practice.
7. TYPES AND STYLES.
- a. The light shall be made in four types as follows:
    - (1) Type I-Series unit for operation with a primary input current of 2.8 through 6.6 amperes.
    - (2) Type II-Series unit for operation with a primary input current of 4.8 through 6.6 amperes.
    - (3) Type III-Multiple unit for operation with a 120 volt primary input.
    - (4) Type IV-Multiple unit for operation with a 240 volt primary input.

6/30/65

b. The light units shall be made in either of two styles as follows:

- (1) Style "A"-With provisions for mounting on a 2-inch pipe.
- (2) Style "B"-With provisions for attaching to a L-848 Medium Intensity Approach Light Bar Assembly (AC 150/5345-25).

8. PERFORMANCE REQUIREMENTS.

a. The condenser discharge type lights shall be designed to provide the light distribution specified in paragraph 9b(5).

b. The lights shall be designed and constructed for continuous outdoor operation under all conditions including:

(1) Temperature. Any ambient temperature from a minimum of  $-45^{\circ}\text{F}$ . to a maximum of  $120^{\circ}\text{F}$ . at sea level.

(2) Wind. Wind velocities up to 100 miles per hour.

9. DETAIL REQUIREMENTS.

a. General. The REILS and SF light units shall have the same basic optical system and power supply. The optical system and power supply shall be housed in two separate housings. Provisions may be made for attaching the two sections to form one unit. The requirements for the light units, power supplies, and other items are as specified below. Items specified to be housed in the power supply housing may be installed in the optical system housing if required for proper operation of the equipment.

b. Optical System. The optical system consists essentially of a housing containing a lamp and reflector. The light from the system is transmitted through a cover glass. These components are assembled to form a unit capable of meeting all requirements specified in paragraph 8.

(1) Flash Lamp. The flash lamp shall have a minimum operating life of 500 hours, or 3,600,000 flashes.

(2) Reflector. A high quality metal reflector with a long life reflective surface shall be used to obtain the beam spread specified in paragraph 9b(5). An Alzak or equal finish is acceptable for the reflective surface.

- (3) Housing. The housing for the optical system shall be cast aluminum or other suitable metal. The metal shall be suitably protected to prevent corrosion and painted as specified in paragraph 9g. The rear section of the housing or cover shall be secured to the main body with stainless steel bolts. A suitable gasket shall be supplied between the two sections to obtain a watertight seal. Louvers or screened vents shall be provided as required. Provisions shall be made for grounding the housing.
  - (4) Cover Glass. A cover glass shall be attached to the housing and properly gasketed to obtain a watertight seal. The glass shall be of the highest commercial quality for this type of application.
  - (5) Photometric Requirements.
    - (a) The condenser discharge light shall be designed to produce a beam axis intensity of not less than 10,000 and not more than 17,000 effective candelas at rated input voltage or current. The light output at  $12\frac{1}{2}$  degrees from the beam axis and at any point within the cone so formed shall be not less than 5000 effective candelas.
    - (b) The flash duration shall be not less than 100 microseconds nor more than 300 microseconds at the 50 percent candela intensity level.
  - (6) Cable Entrance. All cables entering or leaving the optical system housing shall pass through squeeze watertight connectors.
  - (7) Mounting. The Style "A" units shall be designed to attach to a 2-inch pipe. The Style "B" units shall be designed to attach to a light bar assembly in accordance with Advisory Circular No. 150/5345-25.
  - (8) Aiming. The optical system of the light unit shall be designed so it can be aimed from 0 to 15 degrees in a vertical plane. An aiming device shall be furnished with the REILS and MALS/SF to permit vertical setting of the optical system of the flashing lights from 0 degrees to +15 degrees. The scale on the aiming device shall be graduated in 1 degree increments. Provision shall also be made for aiming the REILS in a horizontal plane from 0 to 15 degrees either side of the center of the fixture.
- c. Power Supply. The power supply consists essentially of a housing containing the input transformer, flash capacitor, rectifier, resistors, terminal blocks, and other necessary components. The power supply shall be designed to meet all requirements of paragraph 8b.

6/14/66

- (1) Housing. The housing for the power supply may be cast aluminum or other suitable metal. The metals shall be suitably protected to prevent corrosion and painted as specified in paragraph 9g. The hardware used to secure the cover of the housing in place shall be stainless steel. Proper gasketing shall be provided between the housing and cover to obtain a watertight seal. Louvers or screened vents shall be provided as required.
- (2) Cable Entrances. All cables entering or leaving the power supply shall pass through squeeze watertight connectors.
- (3) Input Transformers.
  - (a) Type I Unit. The transformer shall be designed to furnish adequate power to the equipment with an input current of 2.8 through 6.6 amperes, at 60 cycles.
  - (b) Type II Unit. The transformer shall be designed to furnish adequate power to the equipment with an input current of 4.8 through 6.6 amperes, at 60 cycles.
  - (c) Type III Unit. The transformer shall be designed to furnish adequate power to the equipment with an input voltage of 120 volts AC  $\pm 6$  volts.
  - (d) Type IV Unit. The transformer shall be designed to furnish adequate power to the equipment with an input voltage of 240 volts AC  $\pm 12$  volts.
- (4) Flash Capacitor. The capacitance of the flash capacitor and the operating voltage level shall be such as to produce an energy level for the optical system which results in the equipment meeting the photometric requirements of paragraph 9b(5). The capacitor shall be designed specifically for condenser discharge \* application. Capacitors shall be rated to perform at the temperature limits specified in paragraph 8b(1). \*
- (5) Electron Tubes. Where electron tubes are employed they shall be of highest grade industrial quality.
- (6) Trigger Relay. The trigger relay or device shall be of the plug-in type. It shall be designed to fit a standard socket. The relay or device contacts shall have an adequate rating for the service intended.

- (7) Terminal Block. A terminal block shall be provided for all wires entering or leaving the power supply housing. The terminal block shall be of rugged construction. It shall have non-corrosive pressure type terminals of the correct current carrying capacity and voltage rating.
- (8) REILS Master Timer. A reliable timing device may be installed in the power section of one of the pair of light units. The device shall flash both units simultaneously at the rate of two flashes per second. The design and construction of the timer and its component parts shall be suitable for operation under all environmental conditions specified in paragraph 8b.
- (9) Components. All resistors, capacitors, and other components shall be operated within the manufacturers suggested rating. The components shall be arranged in the power supply to simplify maintenance.
- (10) Grounding Lug. A lug shall be provided for grounding the power supply. The lug shall be adequate for a No. 6 AWG wire.

d. MALS/SF Master Timer.

- (1) The master timer housing shall have a weatherproof construction. It shall be of sturdy construction and designed to hold its shape under normal methods of shipment, installation, and field maintenance. The metal used for the housing shall be suitably protected for use outdoors under all environmental conditions specified in paragraph 8b. All metal parts or hardware attached to the housing shall be noncorrosive. The housing shall be painted as specified in paragraph 9g.
- (2) The master timer shall be capable of operating not less than 10 condenser discharge lamps in sequence. The total of the flash duration plus the dark interval between adjacent units shall be 1/60 second  $\pm$ 25 percent. The remaining time each cycle has shall be used after the flashing of the last light in the system.
- (3) The trigger circuit of each condenser discharge unit shall be energized from the master timer over separate control wires. The nominal voltage used for a trigger signal shall be 120 volts AC. The control wires shall be No. 19 AWG minimum. The system shall be designed for reliable and satisfactory operation over a distance of 5000 feet of this wire. The control wires are not a part of this specification.

- (4) The master timer shall be designed to operate properly with an input of 120 volts AC.
- (5) The master timer components shall be designed and constructed to have a minimum operating life of 5000 hours.
- (6) An area sufficient for the entry of the timing and power conductors shall be kept clear in the bottom or side area of the master timer housing.

e. Interlock Switches.

- (1) Cover operated interlock switches shall be incorporated in both the optical system and power supply housings. These switches shall be connected so that upon the opening of either cover, the following will occur:
  - (a) Power and control circuits to the unit are disconnected.
  - (b) Through a suitable resistor network, the flash capacitor is discharged to a maximum of 50 volts within 30 seconds.
- (2) The circuit design shall have a bleeder resistor permanently connected to discharge the flash capacitor in case the interlock switches fail to operate. The bleeder resistors shall reduce the capacitor voltage to a maximum of 50 volts within 60 seconds.

f. Controls.

- (1) The Type III or IV Unit shall be capable of being controlled from a remote location over control wires. The control wires may connect to a switch on an existing lighting panel or to radio control. The remote control switch, a radio control and control wires are not a part of this specification.
- (2) A local control switch shall be furnished as optional equipment for the Type I, II, III, or IV Units containing the REILS master timer. The on-off local switch shall have an adequate rating for the service intended. The switch shall turn on and off both light units.
- (3) Automatic controls shall be furnished as optional equipment for the Type I and II Units. The control shall permit the REILS to be turned on or off from a remote location without the use of control wires or radio frequencies. The control device shall be activated to its on and off positions by the runway primary current.



- (4) A standard industrial photoelectric or astronomic time control switch can be used to control the Type III or IV Units. Neither of these devices are a part of this specification.
- g. Painting. The exterior of the power supply housing, light unit housing, MALS master timer housing, and mounting items, shall be protected by not less than a primer coat, a body coat, and a finish coat of paint. The final paint shall be aviation surface orange color, baked enamel finish with the paint meeting the requirements of Federal Specification TT-E-489. The color shall be aviation gloss orange No. 12197, Federal Standard No. 595. The final painted surface must be free of blotches, scratches, runs, etc., and be in accordance with general practices for such work.
- h. Warning Sign. There shall be stenciled on the cover or covers of the condenser discharge units the following: "Danger, High Voltage - Deenergize Flasher Power Circuit Before Removing Cover". A conspicuous warning sign shall be placed within the power supply housing which reads: "Caution, Short and Ground all Terminals Before Proceeding". A permanent type stencil or sign shall be placed on the light unit which reads: "Danger, High Voltage - Deenergize Flasher Circuit Before Removing Cover".
- i. Nameplate.
- (1) A nameplate, permanently and legibly filled in with at least the following information, shall be attached to the outside of the light unit power supply.
- (a) Condenser Discharge Type Light.
  - (b) Type.
  - (c) Identification: FAA-L-849.
  - (d) Rating: \_\_\_\_Volts, \_\_\_\_Amperes, Single Phase, 60 Cycle.
  - (e) Manufacturer's Part No.\_\_\_\_\_.
- (2) The nameplate for the Runway End Identifier Unit shall have the above information and an indication as to which unit contains the master timer.
- j. Parts List and Installation Instructions. A complete parts list and installation instructions shall be furnished with each new installation. The parts list and installation instructions shall also be furnished with individual assemblies shipped for maintenance or replacement purposes. Sufficient drawings or illustrations shall be provided to indicate clearly the method of assembly and installation.

10. QUALIFICATION TESTING. One sample unit of each type lighting unit submitted for approval shall be subjected to and checked for compliance with the tests described below. If desired, more than one unit may be subjected to the test series. This may be done to avoid interruption to the testing in the event of accidental damage to a unit in the course of the series.
- a. Photometric.
- (1) The optical performance of the unit shall be determined to check conformance with the requirements in paragraph 9b(5). The method of testing shall be in accordance with FAA Specification CAA-1100, "Photometric Test Procedure".
  - (2) A test shall be made to determine that the flash frequency is 120  $\pm$  2 flashes per minute.
- b. Synchronizing Equipment. A test shall be made to demonstrate that the REILS and MALS/SF master timers operate in accordance with specification requirements.
- c. Temperature Rise. The complete sample unit shall be assembled within a room not subjected to excessive air movement. It shall then be energized at rated voltage or current and flashed continuously at twice per second for a minimum of 48 hours. During the test the ambient temperature shall be maintained at 120°F. minimum. Failure of any components or skipping of flashes shall be cause for rejection.
- d. Input Power. The maximum RMS volt-amperes measured at the input terminals of the light units power supply with the fixture operating shall not exceed 500 volt-amperes. The input volt-amperes shall be used for calculations.
- e. Interlock Switches. A test shall be made to check satisfactory operation of the interlock switches in accordance with the requirements of paragraph 9e.
- f. Dielectric. A dielectric test shall be made on all power and control wiring. For control wiring it shall be 1000 volts, 60 cycles AC, applied for one minute between insulated parts and ground. Power wiring shall be checked in the same manner using voltages specified in paragraphs (1), (2), and (3) below. Where circuit components are not designed for a KV test, such as motors, capacitors, rectifiers, etc., they may be disconnected for this test. The dielectric test shall be conducted after complete assembly.

- (1) Type I Units - 5000 volts, 60 cycles AC.
- (2) Type II Units - 2500 volts, 60 cycles AC.
- (3) Type III and IV Units - 1500 volts, 60 cycles AC.

g. Operational.

- (1) The tests described below are designed to check the operation of the Type I and Type II Units in high and medium intensity lighting circuits, respectively. Since the Type I Unit may also be used in a medium intensity lighting circuit, there are two tests for this unit. One test is to check the operation of the Type I Unit when it is connected across a 10 KW power supply and the primary current is set for 2.8 amperes. The second test is to check the operation of the Type I Unit when it is connected across a 4 KW power supply and the primary current is set for 4.8 amperes. If a 4 KW power supply is available with controls to obtain 2.8 amperes through 6.6 amperes, it may be used in lieu of the 10 KW power supply specified in paragraph (a) below.

- (a) Two Type I Units shall be connected into a simulated series runway lighting circuit. A 10 KW maximum constant current power supply shall be used for this test. The series circuit shall include at least one L-833 and one L-834 Type II transformer. Each transformer shall have a series runway lamp of the proper rating connected across its secondary circuit. The Type I flashing lights shall be operated while in the series circuit under the conditions specified in paragraphs 1 and 2 below.

1 With rated load connected to the series circuit power supply and 6.6 amperes in the primary circuit, the units shall be flashed for one minute.

2 Without changing the components used during the test in paragraph (a) above, the units shall be flashed while the primary current is 5.2 amperes, 4.1 amperes, 3.4 amperes, and 2.8 amperes. The light unit shall be flashed for one minute at each current setting.

- (b) Any evidence of improper operation of the flashing light or pulsation of the series lamp connected across each insulating transformer shall be cause for rejection. The pulsation of the series lamps shall be checked by visual observations.

- (2) The test procedures described in the above paragraphs for the Type I Unit shall be repeated for the Type I Unit and performed for the Type II Unit with the following modification. A 4 KW maximum constant current power supply shall be used for this test. Each of the units shall be flashed while the primary current is 6.6 amperes, 5.5 amperes, and 4.8 amperes. The duration of operation at each current setting shall be one minute.
- (3) The Type III and Type IV Units shall be checked to demonstrate that they will operate satisfactorily within the voltage range of 120 volts  $\pm 6$  volts and 240 volts  $\pm 12$  volts, respectively.

h. Additional inspections and tests shall be made as deemed necessary by the Federal Aviation Agency, Airports Service, Washington, D.C. 20553, to determine compliance with this specification.

11. QUALIFICATION. The manufacturer shall furnish a sample of each type lighting unit listed in paragraph 7a to an independent testing laboratory acceptable to the Federal Aviation Agency, Airports Service, Washington, D.C. 20553. These units shall be tested as described in paragraph 10 to obtain certification regarding the ability to manufacture lighting equipment meeting the requirements of this specification. The manufacturer shall furnish two copies of the testing laboratory's reports to the Airports Service for review and approval consideration.
- a. In addition to the test reports by the independent testing laboratory, the manufacturer shall furnish parts lists, installation instructions, and drawings to the Federal Aviation Agency, Airports Service, Washington, D.C. 20553, for review and approval.
  - b. Upon approval of the independent testing laboratory's test reports and the additional data required in paragraph 11a, which have shown satisfactory conformance to specification requirements, the Airports Service will list the name of the qualified manufacturer and a description of their light fixture in Advisory Circular No. 150/5345-1, Approved Airport Lighting Equipment.
  - c. If the manufacturer has satisfactory laboratory facilities, the tests may be performed at the factory, and such tests shall be witnessed by a representative of the Federal Aviation Agency, Airports Service, Washington, D.C. 20553. The manufacturer shall furnish written reports of these tests.

d. The furnishing of products for Federal-aid airport projects which prove to be unequal to the approved equipment may be sufficient cause for removal of the equipment and the manufacturer's name from the list of approved equipment.

12. HOW TO GET THIS CIRCULAR. Obtain additional copies of this circular, AC 150/5345-24, Specification for L-849 Condenser Discharge Type Flashing Light, from the Federal Aviation Agency, Distribution Section, HQ-438, Washington, D.C. 20553.

  
Cole Morrow, Director  
Airports Service