U.S. Department of Transportation

Federal Aviation Administration

Advisory Circular

Subject: SPECIFICATION FOR RUNWAY AND TAXIWAY LIGHT FIXTURES

Date: 5/19/2009

Initiated by: AAS-100

AC No: 150/5345-46D

Change:

1. PURPOSE. This advisory circular (AC) contains the Federal Aviation Administration (FAA) specifications for light fixtures to be used on airport runways and taxiways.

2. EFFECTIVE DATE. Effective six months after the issue date of this AC, only that equipment qualified per the specifications herein will be listed per AC 150/5345-53, *Airport Lighting Equipment Certification Program*.

3. CANCELLATION. AC 150/5345-46C, *Specification for Runway and Taxiway Light Fixtures*, dated September 12, 2006, is canceled.

4. APPLICATION. The Federal Aviation Administration (FAA) recommends the guidance and specifications in this Advisory Circular for Runway and Taxiway Light Fixtures. In general, use of this AC is not mandatory. However, use of this AC is mandatory for all projects funded with federal grant monies through the Airport Improvement Program (AIP) and with revenue from the Passenger Facility Charges (PFC) Program. See Grant Assistance No. 34, "Policies, Standards, and Specifications," and PFC Assurance No.9, "Standards and Specifications." All lighting designs contained in this standard are the only means acceptable to the Administrator to meet the lighting requirements of Title 14 CFR Part 139, *Certification of Airports*, Section 139.311, Marking, Signs and Lighting.

5. PRINCIPAL CHANGES. The following principal changes are added:

a. Paragraph 1.2.1a: L-850T in-pavement fixture is added for Runway Status Lights (RWSL) Takeoff Hold Light (THL) and Runway Intersection Light (RIL).

b. Paragraph 1.2.1b: RWSL Runway Entrance Light (REL) function is added to the L-852S in-pavement light fixture.

c. Paragraph 1.2.1c: red-yellow color combination is added to the L-862 elevated light fixture.

d. Table 1: L-850T photometric requirements are added to the table. L-850T is added to Note (g).

e. Table 1: the 10 percent vertical beam angle for L-852J and L-852K is changed to 0 to 15 degrees.

f. Paragraph 3.4.2.3: The length of the stake is changed to not exceed 30 inches.

g. Paragraph 3.5.4: the hydraulic impact requirement is changed to reference the test performed in paragraph 4.5.3.1.

h. Paragraph 4.3.2: note is changed to add L-850T in-pavement fixture.

i. Paragraph 4.3.3: an additional requirement is added for the computation of average intensity.

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

7. COMMENTS OR SUGGESTIONS for improvements to this AC should be sent to:

Manager, Airport Engineering Division
Federal Aviation Administration
ATTN: AAS-100
800 Independence Avenue, S.W.
Washington, DC 20591

8. COPIES OF THIS AC. The public may obtain electronic copies of this AC by visiting the FAA home page (www.faa.gov) and selecting the "Advisory Circulars" link. A printed copy of this AC and other ACs can be ordered from:

U.S. Department of Transportation
Subsequent Distribution Office
Ardmore East Business Center
3341 Q 75th Avenue
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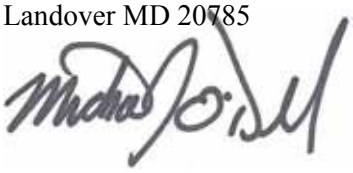

Michael O'Donnell
Director of Airport Safety and Standards

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CHAPTER 1. SCOPE AND CLASSIFICATION.

1.1. Scope.

This specification covers the requirements for light fixtures for use on airport runways and taxiways.

1.2. Classification.

The following light fixtures are covered by this specification:

1.2.1. Types.

a. Runway In-pavement Lights.

Type	Use	Light Direction and Colors
L-850A	Runway centerline, Land and Hold Short Operations (LAHSO)	Bidirectional: white-white, white-red Unidirectional: white, red
L-850B	Runway Touchdown Zone; Medium Intensity Approach Lighting System	Unidirectional: white
L-850C	Runway edge, displaced threshold	Bidirectional: White-white, white- yellow, white-red, yellow-red, yellow-green
L-850D	Runway threshold/end	Bidirectional: green-red, red-red Unidirectional: green
L-850E	Medium Intensity Approach Lighting System; Runway threshold	Unidirectional: green
L-850F	LAHSO	Unidirectional: white; flashing
L-850T	Runway Status Lights (RWSL) Takeoff Hold Light (THL), Runway Intersection Light (RIL)	Unidirectional: red

b. Taxiway In-pavement Lights.

Type	Use	Light Direction and Colors
L-852A	Taxiway centerline, Straight sections; Clearance bar (≥1200 Runway Visual Range (RVR))	Bidirectional (narrow beam): green-green, green-yellow, yellow-yellow Unidirectional (narrow beam): green, yellow

Type	Use	Light Direction and Colors
L-852B	Taxiway centerline, Curved sections; (≥1200 RVR)	Bidirectional (wide beam): green-green, yellow-yellow Unidirectional (wide beam): green, yellow
L-852C	Taxiway centerline Straight section; Clearance bar (<1200 RVR)	Bidirectional (narrow beam): green-green, green-yellow, yellow-yellow Unidirectional (narrow beam): green, yellow
L-852D	Taxiway centerline, curved sections (<1200 RVR)	Bidirectional (wide beam): green-green, yellow-yellow Unidirectional (wide beam): green, yellow, white
L-852E	Taxiway intersections (≥1200 RVR)	Omni-directional: yellow
L-852F	Taxiway intersections (<1200 RVR)	Omni-directional: yellow
L-852G	Runway Guard	Unidirectional (wide beam): yellow; alternately flashing
L-852J	Taxiway centerline, curved sections ≥1200 RVR)	Bidirectional (wide beam): green-green, yellow-yellow Unidirectional (wide beam): green, yellow
L-852K	Taxiway centerline, curved sections (<1200 RVR)	Bidirectional (wide beam): green-green, yellow-yellow Unidirectional (wide beam): green, yellow
L-852S	Stop bar, RWSL Runway Entrance Light (REL)	Unidirectional (wide beam): red
L-852T	Taxiway edge, Apron edge	Omni-directional: blue

c. Elevated Lights.

Type	Use	Light Direction and Colors
L-804	Runway Guard	Unidirectional: yellow; alternately flashing
L-860	Runway edge, Visual Flight Rules (VFR) runways	Omni-directional: white
L-860E	Runway threshold/end, VFR runways	Bidirectional: red-green, red-red Unidirectional: green

Type	Use	Light Direction and Colors
L-861	Runway edge, non- precision Instrument Flight Rules (IFR) runways, displaced threshold	Omni-directional: white, yellow Bidirectional: white-yellow, white-red, yellow-red, green-yellow
L-861E	Runway threshold/end, displaced threshold, non-precision IFR runways	Bidirectional: red-green, red-red Unidirectional: green
L-861SE	Runway threshold/end, non-precision IFR runways	Bidirectional: red-green Unidirectional: green
L-861T	Taxiway edge, Apron edge	Omni-directional: blue
L-862	Runway edge, threshold, displaced threshold, precision IFR runways	Bidirectional: white-white, white-yellow, white-red, green-yellow, red-yellow
L-862E	Runway threshold/end, displaced threshold, precision IFR runways	Bidirectional: red-green, red-red Unidirectional: green
L-862S	Stop bar	Unidirectional: red

1.2.2. Classes.

The class designation applies only to in-pavement fixtures:

Class 1	Direct-mounted fixtures
Class 2	Base-mounted fixtures

1.2.3. Modes.

The mode designation describes the type of electrical power supply required for the fixture:

Mode 1	Constant current fixture, supplied by 6.6 amperes (A)
Mode 2	Constant voltage fixture, supplied by 120/240 volts AC (VAC)

1.2.4. Styles.

The style designation applies only to in-pavement fixtures and describes the total height above finished grade (X) where:

Style 1*	1/2 inch (12.70 mm) < X ≤ 1 inch (25.40 mm)
Style 2	1/4 inch (6.35 mm) < X ≤ 1/2 inch (12.70 mm)

Style 3 X ≤ 1/4 inch (6.35 mm)

* Applies only to L-850 C, D, and E, and L-852 E and F

1.2.5. Optional Items.

The manufacturer may provide the following optional features. These options must meet the requirements of 3.12:

Option 1 Lamp By-Pass (in-pavement lights)

Option 3 Shields (elevated lights)

Option 4 Mounting Hardware (elevated lights)

Option 5 Two lamps for bidirectional taxiway centerline fixtures

CHAPTER 2. APPLICABLE DOCUMENTS.

2.1. General.

The following documents, of the issue in effect on the date of application for qualification, are applicable to the extent specified in this AC.

2.2. Federal Aviation Administration (FAA) Advisory Circulars (ACs) and Engineering Briefs.

AC 150/5200-30	*Airport Winter Safety and Operations*
AC 150/5340-30	*Design and Installation Details for Airport Visual Aids*
AC 150/5345-10	*Specification for Constant Current Regulators and Regulator Monitors*
AC 150/5345-26	*Specification for L-823, Plug and Receptacle, Cable Connectors*
AC 150/5345-42	*Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories*
AC 150/5345-47	*Specification for Series to Series Isolation Transformers for Airport Lighting Systems*
AC 150/5345-53	*Airport Lighting Equipment Certification Program*
Engineering Brief 67	*Light Sources Other Than Incandescent and Xenon for Airport and Obstruction Lighting Fixtures.*

2.3. Federal Standard.

FED-STD-595B	*Colors Used in Government Procurement*

2.4. Military Publications.

2.4.1. Military Standard.

MIL-STD-810F	*Environmental Test Methods and Engineering Guidelines*

2.4.2. Military Specifications.

MIL-C-7989B	*General Specification for Covers, Light-Transmitting, for Aeronautical Lights*
MIL-DTL-13924C	*Coating, Oxide, Black, for Ferrous Metals*

2.5. American National Standards Institute (ANSI) Publications.

ANSI/ASQC Z1.4	*Sampling Procedures and Tables for Inspection by Attributes 1993*
ANSI B1.1	*Unified Inch Screw Threads (UN and UNR Thread Form)*
ANSI B46.1	*Surface Texture (Surface Roughness, Waviness, and Lay)*

ANSI/EIA 557 *Statistical Process Control Systems*

2.6. American Society for Testing and Materials (ASTM) Standard.

B-633 *Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel*

2.7. Illuminating Engineering Society (IES) Publications.

IES LM-35 *IES Approved Method for Photometric Testing of Floodlights Using Incandescent Filament or Discharge Lamps*

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

IES LM-54 *Lamp Seasoning*

2.8. Institute of Transportation Engineers (ITE) Standard.

ST-017 *Equipment and Material Standards of the ITE, Vehicle Traffic Control Signal Heads*

2.9. Society of Automotive Engineers (SAE) Publication.

SAE-AS25050 *Colors, Aeronautical Lights and Lighting Equipment, General Requirements For*

FAA ACs may be obtained from:

U.S. Department of Transportation
Subsequent Distribution Office
Ardmore East Business Center
3341 Q 75th Ave.
Landover, MD 20785

Telephone: (301) 322-4961
FAX: (301) 386-5394
Website: www.faa.gov/airports_airtraffic/airports/resources/advisory_circulars/

FAA Engineering Briefs may be obtained from:

Website: www.faa.gov/airports_airtraffic/airports/construction/engineering_briefs

Federal standards and specifications may be obtained from:

Federal Supply Services
Specification Section
470 L'Enfant Plaza East
SW Suite 8100
Washington, DC 20407

Telephone: (202) 619-8925
FAX: (202) 619-8985
Web site: www.dsp.dla.mil

Military Standards and Specifications may be obtained from:

DAPS/DODSSP
Building 4, Section D
700 Robbins Avenue
Philadelphia, PA 19111-5094

Telephone: (215) 697-2179
FAX: (215) 697-1460
Website: dodssp.daps.dla.mil

ANSI publications may be obtained from:

ANSI
1819 L Street NW
(between 18th and 19th Streets)
6th Floor
Washington, DC 20036

Customer Service/Document Sales
Telephone: (212) 642-4980
Website: webstore.ansi.org/ansidocstore/default.asp

ASTM standards may be obtained from:

ASTM International
100 Barr Harbor Drive
PO Box C700
West Conshohocken, PA 19428-2959

Telephone: (610) 832-9585
FAX: (610) 832-9555
Website: www.astm.org/cgi-bin/SoftCart.exe/index.shtml?E+mystore

IES of North America (IESNA) documents may be obtained from:

IESNA
120 Wall Street, Floor 17
New York, NY 10005

Telephone: (212) 248-500
FAX: (212) 248-5017
Website: www.iesna.org/shop/

ITE publications may be obtained from:

ITE
1099 14th Street, NW
Suite 300 West
Washington, DC 20005-3438

Telephone: (202) 289-0222
Website: www.ite.org/bookstore/index.asp

CHAPTER 3. REQUIREMENTS.

3.1. General.

This specification covers the requirements for in-pavement and elevated light fixtures used on airport runways and taxiways.

3.2. Environmental Requirements.

The light fixtures must achieve specified performance under the following environmental conditions:

a. Temperature.

(1) Operating: exposure to any temperature from -40 degrees Fahrenheit (F) (-40 degrees Celsius (C)) to 131 degrees F (55 degrees C).

(2) Storage/shipping: exposure to any temperature from -67 degrees F (-55 degrees C) to 131 degrees F (55 degrees C).

b. Temperature shock. Exposure of the hot light fixture to cold water spray.

c. Salt fog. Exposure to a corrosive salt atmosphere.

d. Wind. Exposure to wind velocities of 300 mph (482 kph) for all L-804, L-861, and L-862 fixtures, and 150 mph (241 kph) for all other elevated fixtures.

e. Precipitation. Exposure to rain, snow, ice, and standing water.

f. Solar radiation. Exposure to solar radiation.

3.3. Photometric Requirements.

a The photometric performance of the fixtures is defined in Tables 1, 2, and 3. The beam coverage angles in the table define the size of an ellipse, circle, or rectangle. (For this discussion, it is assumed to be an ellipse, but the same guidelines apply to a circle or a rectangle.)

b The light intensity inside the ellipse, when averaged per paragraph 4.3, must equal or exceed the intensity specified in the table. Additionally, the intensity must be at least one-half the specified value everywhere inside the ellipse.

c For some fixtures, a 10 percent ellipse is also defined. The two ellipses are concentric; i.e., the main beam ellipse is exactly centered in the 10 percent ellipse. At every point on the 10 percent ellipse, the light intensity must be at least 10 percent of the specified value.

d For in-pavement lights, part of the 10 percent ellipse may lie below grade; this area may be disregarded. The light color must match the aviation colors defined in SAE-AS25050 except, as noted in the tables 1 and 2.

e The average measured intensity may not be more than three times the specified average intensity. For fixtures with a minimum but no average intensity requirement, the measured minimum may

be no more than three times the specified minimum intensity. Bi-directional, split color, fixtures are exempt from this requirement if a single light source is used.

Table 1. Photometric Requirements for In-pavement Lights.

Type	Minimum beam coverage (degrees) (a)				Intensity (candelas) (b)				
	Main beam (c)		10 percent (d)						
	H	V	H	V	White	Yellow	Green	Red	Blue
L-850A	±5	0.2 to 9	±7	-4 to 13	5,000			750	
L-850T **(g)**	±5	0.2 to 9	±7	-4 to 13				1500	
L-850B **(i)**	-1 to 9	2 to 9	-3 to 11	-0.5 to 11.5	5,000				
L-850C	-2 to 9	0.2 to 7	-4 to 11	-2.5 to 9.5	10,000	5,000	3,300	1,500	
L-850D	-2 to 9	1 to 10					3,300		
	±6	0.2 to 4.7	±7.5	-2.5 to 7.5				2,500	
L-850E	±6	1 to 9					5,000		
L-850F	±5	0.2 to 9	±7	-4 to 13	5,000**(e)**				
L-852A	±10	1 to 4	±16	0.5 to 10		20	20		
L-852B	±30	1 to 4	±30	0.5 to 10		20	20		
L-852C	±3.5	1 to 8	±4.5	0 to 13		200	200		
L-852D	±30	1 to 10	±30	0 to 15	150	100	100		
L-852E	360	1 to 8				50**(f)**			
L-852F	360	1 to 10				200**(f)**			
L-852G	±24	1 to 10	±30	0.5 to 13		1,000**(g)**			
L-852J	-3.5 to 35	1 to 4	-4.5 to 36	0.5 to 15		20	20		
L-852K	-3.5 to 35	1 to 10	-5.5 to 37	0 to 15		100	100		
L-852S	±24	1 to 10	±30	0.5 to 13				300**(g)**	
L-852T	360	1 to 6							2**(h)**

NOTES:

(a) For runway fixtures, beam coverage given is for the extremities of an ellipse. For taxiway fixtures, beam coverage is for the extremities of a rectangle with the exception of L-852G for which corners may be rounded on a 5-degree radius.

(b) Values given represent minimum average intensity except for L-850E and L-852T, where minimum intensity is given. See paragraph 4.3.1 for a method of calculating average beam intensities.

(c) In addition to the average intensity requirements, all points within the main beam must be at least fifty percent of the specified average intensity.

(d) The intensity in this isocandela curve must be at least 10 percent of the specified minimum average intensity. The main beam and 10 percent curves are concentric; that is, the main beam curve lies exactly in the center of the 10 percent curve. For in-pavement lights, any part of the curve that falls below grade may be disregarded.

(e) In the case of L-850F, each lamp must independently meet the photometrics.

(f) Twenty-five percent reduction of candela intensity is allowed at structural ribs.

(g) L-852S and L-850T must be traffic signal red and L-852G must be traffic signal yellow per the ITE Standard for Vehicle Traffic Control Signal Heads (ST-017).

(h) L-852T coverage is 2 candelas minimum from 1 to 6 degrees vertically and must be visible for angles from 15 to 90 degrees (visually verified) as projected. Use of this light should be restricted to where elevated lights may be damaged by jet blast or where they interfere with aircraft operations. Manufacturers must advise potential users of this fact before providing these lights or tag them to that effect.

(i) L-850B photometrics are for a toed left fixture. The fixture may also be supplied as toed right or straight.

Table 2. Photometric Requirements for Directional Elevated Lights.

Type	Minimum Beam Coverage (Degrees)					Intensity (candelas) (b)			
		Main beam (e)		10 percent (e)					
	Notes	H	V	H	V	White	Yellow	Green	Red
L-804	**(f)**	±8	±8	±25	±25		3,000 **(g)**		
L-861E	**(d)**	±1.5	3.5 to 5.5					300	
	(d)	±3	1.5 to 7.5					180	
	(d)	±5	0 to 9					90	10
L-861SE	**(a)**	±15	2 to 10	±20	-3 to 15			600	
	(d)	±5	0 to 9						20
L-862	**(a) (c)**	-2 to 9	0 to 7	-4 to 11	-2.5 to 9.5	10,000	5,000	2,500	2,000
L-862E	**(a)**	±6	0.2 to 4.7	±7.5	-2.5 to 7.5				2,500
	(a)	-2 to 9	1 to 10					3,200	
L-862S	**(d)**	±7	±4	±14	±8				2,000 **(g)**

NOTES:

(a) Beam coverage is given for the extremities of an ellipse.

(b) Values given represent minimum average intensity. See paragraph 4.3.1

(c) Minimum of 50 candelas (measured in white light) required omni-directionally for all vertical angles to 15 degrees.

(d) Beam coverage is given for the extremities of a rectangle.

(e) See notes (c) and (d) of Table 1.

(f) Beam coverage is given for the extremities of a circle, except that the area below -10 degrees vertical is ignored. Additionally, the intensity must be at least 1,000 cd at every point within a circle of ±15 degrees.

(g) Red for L-862S must be traffic signal red, and yellow for L-804 must be traffic signal yellow per the Institute of Transportation Engineers Standard for Vehicle Traffic Control Signal Heads (ST-017).

Table 3. **Photometric Requirements for Omnidirectional Elevated Lights.**

Type	Color	Intensity (candelas) (a)		
		2 to 10 degrees		10 to 15 degrees
		Minimum	Minimum Average Intensity	Minimum
L-860	White	15	25	10
L-860E	Green	10	15	5
	Red	3	5	1
L-861	White	75	125	40
	Yellow	37	67	20
	Green	28	46	14
	Red **(c)**	3	5	1
L-861T	Blue	2**(b)**		

NOTES:

(a) Angles measured in vertical plane.

(b) L-861T coverage is 2 candelas minimum from 0 to 6 degrees vertically and must be visible from 15 to 90 degrees vertical (verified visually) as projected.

(c) L-861 red is only 180 degrees of horizontal coverage for unidirectional and bidirectional.

3.4. Dimensional Requirements.

The light fixtures described in this specification may be installed directly in the ground or pavement, or they may be mounted on top of a standard FAA light base and transformer housing (specified in AC 150/5345-42). Dimensional requirements for both methods of mounting and other essential dimensions are given below.

3.4.1. In-pavement Lights.

The slope of the top surface of the light fixture, which protrudes above finish grade, must be no more than 20 degrees (recesses excepted).

3.4.1.1. Class 1 (Direct Mounted).

When not installed on an L-868 base, the in-pavement light fixture is typically installed in a recess cut in the pavement and secured by an adhesive compound poured around the lights. The power conductors are run to the light fixture through a saw kerf in the pavement. The light fixture must be designed to maximize adhesion via the securing compound and to resist rotation and uplift. All optical components and electrical components (except those used to carry the incoming power) must be removable for servicing without breaking the adhesive bond. Any associated shallow base or other installation accessories must withstand the specified loading and environmental stress. The manufacturer must

specify in the installation instructions the shape and dimensions of the recess required for installation of the light. If installation bolts are used, they must be furnished with their companion lock washers.

3.4.1.2. Class 2 (Base Mounted).

a. Interface details and dimensions of L-868 bases are shown in AC 150/5345-42, *Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories.* Installation standards may be found in AC 150/5340-30, *Design and Installation Details for Airport Visual Aids.*

b. Critical interface areas of the light fixture are the outer diameter, top flange, bolt holes, and throat projection. For L-850 A and B, the outer diameter of the light fixture must be 11.94 inches (303.27 mm) ±0.05 inch (1.27 mm) and must mate with an L-868 base size B. For 8-inch (203.20 mm) fixtures, the outer diameter must be 8.00 ±0.05 inch (1.27 mm) and must mate with an L-868 base size A or B. Adapter rings must be qualified with the fixture.

c. For L-850 C, D, and E, the fixture must have an outside diameter of 17.25 inches (438.15 mm) ±0.09 inch (2.29 mm), and must mate with an L-868 base size C (alternatively, the C, D, and E may use the same dimensions as the A and B).

d. The light fixture must have a projection that extends at least 1/4 inch (6.35 mm) down through the L-868 assembly. The diameter of this projection must be 0.06 inch +0.00, -0.01 inch (1.52 mm +0.0, -0.25 mm) less than the nominal diameter of the top flange cut-out.

e. Semi-flush lights must be designed to mount on an L-868 base whose top surface is 3/4 inch (19.05 mm) below grade; flush lights may be designed to fit atop a base placed up to 1-1/4 inch (31.75 mm) below grade (L-850 C, D, and E may use either criteria).

f. If the installation of the light requires grooves or recesses in the surrounding pavement, the manufacturer must describe the dimensions of these recesses and how they are to be drained.

g. The fixture (with the exception of 8 inch fixtures) must be designed to be secured by six mounting bolts supplied with the base and described in AC 150/5345-42.

h. The fixture bolt hole configuration must match the Type L-868 base that it is sized to fit (with the exception of 8 inch fixtures). In addition, the axis between one pair of bolt holes on opposite sides of the fixture must be perpendicular to the direction of the runway centerline.

3.4.2. Elevated Lights.

The standard installed height of elevated light fixtures must not exceed 14 inches (355.60 mm) (except L-804 that has a minimum height of 14 inches (355.60 mm) from the bottom of the light emitting surface to ground level). However, this height may be increased, in increments of 2 inches (50.80 mm), to a maximum 30 inches (762.00 mm) for applications in snow areas (except L-804 that has a maximum of 26 inches (660.40 mm) including fixture pitch).

a. Installation standards are contained in AC 150/5340-30.

b. When the purchaser specifies that a mounting system be provided, it must be per paragraphs 3.4.2.1 through 3.4.2.3.

3.4.2.1. Yield Device.

a. Each elevated light fixture must have a yield point near the point or position where the light attaches to the base plate or mounting stake. The yield point must be no more than 1-1/2 inches (38.10 mm) above grade, must give way before any other part of the fixture is damaged, and must withstand a bending moment of 150 foot-pounds (203 Newton-meters (N-m) without failure.

(1) This yield point must also separate cleanly from the mounting system before the bending moment reaches 500 foot-pounds (678 N-m). However, L-860 fixtures may bend instead of separating. The fixture must not sway more than 1 inch from vertical under the specified wind loading. If the yield device uses a threaded connection to the base plate or stake, it should have a male external thread with either 2 inch (50.80 mm)-11.5 National Pipe Thread (NPT) or National Pipe Straight (NPS) thread, or 1.5 inch (38.10 mm)-12 Unified Fine (UNF) thread. If threaded, the yield device must have a faceted surface, i.e., hexagonal section, below the yield point to facilitate removal. The yield device should be easily replaceable after breakage.

b. For Mode 1 (series-powered) fixtures, the yield device must be hollow to allow a receptacle and socket to be positioned internally per paragraph 3.7.2. If the yield device is of the "pop-out" variety that may be reassembled after separation, the manufacturer must provide test data demonstrating the number of times the device may be separated before falling outside of the acceptable yield device performance band. This information must be included in the instruction manual.

c. Nonmetallic yield devices must provide specified performance over the full temperature range with appropriate grounding capability for the attached fixture.

3.4.2.1.1. Yield Device for L-804.

a. Each L-804 elevated light fixture must have a yield point near where the light attaches to the base plate. The yield point must withstand a bending moment of 1,300 foot-pounds (1,762.5 N-m) without failure, but must separate cleanly at the yield point before the bending moment reaches 2,100 foot-pounds (2,847.2 N-m).

b. The center of the light source must not sway more than 2 inches (50.80 mm) from vertical under the specified wind loading.

c. The yield point must not be more than 1.5 inches (38.10 mm) above grade and must give way before any other part of the fixture is damaged.

d. The yield device must have a threaded connection to the base plate, with a male external thread with 2 inch (50.80 mm)-11.5 NPT or NPS threads.

e. The yield device must have a feature below the yield point to facilitate removal of the yield device from the base plate. The feature may be either external or internal.

f. The yield device must be easily replaceable after breakage.

g. The yield device must be hollow to allow a receptacle and socket to be positioned internally per paragraph 3.7.2.

h. Nonmetallic yield devices must provide specified performance over the full temperature range with appropriate grounding capability (see AC 150/5340-30 for details about grounding methods) for the attached fixture.

3.4.2.2. Base Mounting.

a. When the elevated light fixture is mounted on an L-867 base, it must be mated with a base plate whose diameter and bolt-hole circle corresponds to one of the L-867 base sizes.

b. The base plate must be designed to receive the frangible device provided; typically, this is a straight female thread.

c. A neoprene gasket (or equivalent) must be provided with the base plate to form a watertight seal between the base plate and the L-867 light base. This gasket must have a nominal thickness of 1/8 inch (3.16 mm) and must fit the bolt circle of the L-867 light base flange.

d. When the base plate is bolted to an L-867 light base, it must withstand an evenly distributed static compressive load of 2,500 pounds (1134 kg) and a bending moment of 2,500 foot-pounds (3,389.50 N-m) for the L-804 and 700 foot-pounds (949.07 N-m) for all other applications without damage or permanent deformation.

3.4.2.3. Stake Mounting.

When not installed on a base, the elevated light fixture must be mated with a stake made of 2x2x3/16 inch (50.80x50.80x4.76 mm) steel angle stock. The stake must have a fitting attached at the top to receive the yield device. The length of the stake and fitting must not exceed 30 inches (762.0 mm). Alternate staking methods may be used if it can be demonstrated that equal support and durability are provided. L-804 fixtures must not be stake mounted.

3.4.3. L-804 Runway Guard Light.

a. This fixture must consist of two alternately illuminated, unidirectional light sources. These light sources must be circular, 8 inches (203.20 mm) in diameter, and in the same horizontal plane. Their spacing must be 15 inches (381.0 mm) center-to-center.

b. The light sources must be alternately illuminated at the rate of 45-50 flashes per minute over all specified brightness levels.

c. The front face of the fixture must consist of a minimum of 2 inches (50.80 mm) surrounding each light source which must be a low luster black finish (per paragraph 3.10.2).

d. The fixture must be designed to reduce the amount of incident sunlight on the light emitting surface to maximize the contrast between the lamp-on and lamp-off states. This must be accomplished by providing one visor per light source. Each visor must extend 6.5 inches (165.10 mm) from the front face of the fixture and must be installed no higher than 1.5 inches (38.10 mm) above the top of the light source. The bottom of the visor must extend at least 0.5 inch (12.7 mm) below the center of the light source. The visor is to be mounted in such a manner as to prevent light from escaping from the area where the visor attaches to the fixture. The visor must be tapered to the minimum necessary to not obstruct the level line of sight extending from the center of each light source to a horizontal angle of ±60 degrees while the fixture is aimed vertically at any angle between 0 and +20 degrees. All surfaces of the visors must be a low luster black finish (per paragraph 3.10.2).

e. The center of the specified beam spread must be capable of being aimed vertically and horizontally. The fixture and/or the mounting system must be designed to permit vertical adjustment of the light beam from 0 degrees to +20 degrees above the horizontal. The adjustment mechanism must be detented in a minimum of 1 degree increments and must be able to be locked in place to hold the desired vertical setting.

f. The mounting system must be designed to permit horizontal adjustment of the light beam through a range of ±20 degrees. The adjustment mechanism must be designed to provide horizontal aiming in increments of a maximum of 5 degrees.

g. The fixture must be designed and installed so that jet blast does not turn the fixture either horizontally or vertically.

h. A flexible corrosion resisting steel tether must be provided to prevent the fixture from being blown onto a neighboring runway or taxiway. The tether must have a minimum tensile strength of 6,800 pounds (9,214 kg) and be designed to anchor the fixture to the L-867 base. Approximately 6-10 inches (152.40-254.0 mm) of slack should be provided.

i. All components required for installation must be supplied and all mounting legs must have yield devices as described in paragraph 3.4.2.1.1.

3.5. Structural Integrity.

The in-pavement light fixtures must withstand (without damage) the mechanical stresses detailed below:

3.5.1. Vibration.

In-pavement light assemblies must withstand vibration along any axis; they must withstand an inertial load of up to 15 Gs when vibrated at frequencies between 20 and 2000 Hertz (Hz). The lamp filament must withstand an inertial load of 3 Gs when vibrated between 20 and 2000 Hz.

3.5.2. Static Load.

When installed according to the manufacturer's recommendations, the light assembly must withstand a static loading (in pounds) of 450 times the top area of the light fixture (in square inches) distributed uniformly over the top surface.

3.5.3. Shear Load.

The light assembly must withstand a shear load of 3,000 pounds (1,360.78 kg) applied to the top of the light in any direction parallel to the mounting surface.

3.5.4. Hydraulic Impact.

The top of the light assembly (all surfaces exposed when properly installed) must withstand a momentary hydraulic pressure per test in paragraph 4.5.3.1.

3.5.5. Mechanical Impact.

For L-850 lights, the light assembly must withstand the repeated impact of a steel ball with 29.5 foot-pounds (40 Joules) of energy.

3.5.6. Leakage Resistance.

The subassembly containing the optical components, including the lamp, must be resistant to water leakage or infiltration from above or below the light fixture. Specifically, the optical assembly must withstand an internal pressure of 20 psi (137.90 kPa) without leakage.

3.5.7. Surface Temperature.

The light fixture must be designed so that the surface temperature will not exceed 320 degrees F (160 degrees C) when the fixture is operating at maximum intensity while covered by the wheel of a heavy ground vehicle or aircraft for a period of 10 minutes.

3.6. Drainage.

3.6.1. Elevated Lights.

Elevated light fixtures must be constructed so that a tight seal is formed between the components. A gasket must be used between the fixture cover and body to improve the seal. The fixture must be constructed so that any water developed internally will drain down past the yield point. The L-804 fixture may use a drain hole rather than drain down the mounting legs. The design should not allow water build-up around the yield point.

3.6.2. In-pavement Lights.

a. Class 2 light fixtures must be designed for either a “dry” or “wet” system. A “wet” system requires the light installer to supply sufficient drainage in the base/conduit system to allow the light fixture to drain into the base.

b. In a “dry” system, no water drains from above the light into the base. The optical assembly must be sealed from above and below. “Dry” systems may use an “O” ring (supplied with the base) in the mounting flange of the base to improve sealing; flat gaskets must not be used at this interface.

c. For “wet” systems, water from the channel in front of the optical window and any associated recessed areas may be drained into the base to prevent water from obstructing the light beam.

d. If part of the optical window is below grade, the light fixture must emit at least 50 percent of the specified light output when that portion of the window below grade is blocked. For designs that have more than half the window below grade, the fixture must emit 50 percent intensity with the lower half of the window area blocked.

3.7. Electrical Requirements.

a. The L-804 light fixture must have monitoring capability to detect failures as defined below.

b. All L-862 and in-pavement light fixtures must use a Mode 1 (constant current) power supply of 6.6 amperes.

c. All L-860 light fixtures must use a Mode 2 (constant voltage) power supply; the L-861 and L-804 light fixtures may be either Mode 1 or Mode 2.

d. Mode 1 fixtures must be designed to interface with an isolation transformer (specified in AC 150/5345-47) and must be compatible with all certified L-828 constant current regulators and monitors.

e. The names and addresses of certified regulator manufacturers may be found in AC 150/5345-53 Addendum. Upon request, they will provide oscilloscope photographs of the constant current regulator's output waveform per AC 150/5345-10.

3.7.1. In-pavement Lights.

a. The light fixture must have a minimum insulation resistance of 50 meg-ohms lead-to-case when dry or while soaking in salt water.

b. Leads must be stranded copper insulated with a material suitable for the electrical and temperature requirements, and must be at least 18 inches (457.20 mm) long. Leads for Class 2 fixtures must be terminated with an L-823 plug (specified in AC 150/5345-26) to mate with the socket on the secondary lead of an isolating transformer. Leads for Class 1 light fixtures must be sealed at the entry to the fixture and must have the ends ready for splicing.

c. Moisture must not wick into the fixture through the leads.

3.7.2. Elevated Lights.

a. The light fixture must have a minimum insulation resistance of 50 meg-ohms lead-to-case.

b. A lead assembly of appropriate length must be supplied to connect the lamp socket to the power source. Two stranded copper conductors must be provided, with adequate current capacity and insulation for the operating environment.

c. A clamp or similar device must prevent any strain or tugging on the lead from affecting the lamp socket.

d. All wiring must be run internally; L-860 fixtures may use external wiring if desired.

e. At the yield point on elevated lights with frangible or "pop-out" devices, the electrical circuit must have a means of disconnecting (such as a plug and receptacle) to break the electrical circuit and allow the light fixture to separate cleanly.

3.7.2.1. Mode 1(Series-Powered) Fixtures.

On Mode 1 fixtures, the receptacle leads must be terminated in an L-823 plug. This plug mates with the receptacle on the secondary lead of an isolating transformer. The mounting system (either base plate or stake) must firmly position this isolating transformer receptacle so its mating face is at the yield point and so it will not be dislodged by separation from the plug. Drainage must be provided around the receptacle retainer to prevent water buildup around the yield point (per paragraph 3.6.1).

3.7.2.2. Mode 2 (Parallel-Powered) Fixtures.

The lead from the lamp socket to the underground power cable must be provided with a disconnect device at the yield point of the fixture. For L-860 fixtures with flexible mounting systems or external wiring, the disconnect device may be at any convenient point. The lead must be secured so that no strain is placed on

the primary power cable when the disconnect device is pulled apart by the separation at the yield point of the light fixture. When the disconnect device is separated, the energized leads from the power cable must not be exposed.

3.7.3. L-804 Runway Guard Light Fixture.

The L-804 fixture may be designed to accept a Mode 1 or Mode 2 power supply. The power input cable must have sufficient length to reach at least 6 inches (152.40 mm) below grade when installed, and must have provision for strain relief. The power input cable must terminate in a plug; for Mode 1 circuits, this must be an L-823 plug. Plugs and receptacles for Mode 2 circuits must be of good quality, weatherproof, and suitable for direct burial. If a standard L-823 plug is not used, the mating receptacle for the plug must be provided for field installation.

3.7.3.1. L-804 Flasher.

The two lights in the runway guard fixture must be alternately illuminated 45 to 50 times a minute per lamp over all specified brightness levels. The flashing mechanism used to switch the two lights must maintain the flash rate within tolerance under the specified environmental conditions. If required, filters must be included to suppress electromagnetic interference (EMI). See AC 150/5340-30, Appendix 2, *AIRPORT TECHNICAL ADVISORY*, for additional information about EMI effects and mitigation strategies. Power must be applied alternately to each lamp for 50 percent (± 0.5 percent) of the total cycle. When operating on the highest intensity setting, the light output for each lamp must rise to at least 70 percent of the steady-burning intensity for that lamp during the "on" cycle, and must fall to 17 percent (or less) of the steady-burning intensity during the "off" cycle.

3.7.3.2. L-804 Component Failure.

When a lamp failure occurs, the remaining lamp must continue to flash normally. When flasher failure occurs, at least one of the lamps must remain "on" at the selected intensity. See AC 150/5345-26, *Maintenance of Airport Visual Aid Facilities,* for tolerance/limits and operating standards.

3.7.3.3. L-804 Control.

One of two methods may be used to control the brightness of the L-804. One method is to allow the lamp intensity to vary with the current delivered to the fixture via a series circuit (mode 1). Depending on the regulator used to energize the circuit, this current may vary from 4.8 to 6.6 amps or from 2.8 to 6.6 amps. The other method, when using 120 or 240 volts ac (mode 2), is to use a photocell to switch the lamps to 30 percent intensity at low light levels. The photocell must turn the fixture to high intensity when the light falling on it reaches 50 to 60 foot-candles, and low intensity when the light falling on it reaches 25 to 35 foot-candles. A time delay must be incorporated to prevent mode switching due to transient light conditions.

3.7.3.4. Mandatory L-804 Monitoring.

Monitoring must detect the failure of a lamp(s), failure of a lamp(s) to flash, and failure of the monitoring device. An option may be provided for an L-804 without monitoring, however this option must only be derived by removal of components from the fixture and/or replacement of power/control lead cabling. For the purpose of providing this monitoring function with a single support leg for breakaway for Mode 1 circuits, use of multiple pin/plug connector that is not a L-823, is acceptable until such time as an appropriate L-823 connector is available. In this situation, the mating connector must be furnished with the fixture. The connector design should meet environmental concerns, electrical concerns, and

separation criteria intended of an L-823 connector. Connection to the isolation transformer must be with L-823 plug for Mode 1 circuits.

3.8. Optical Requirements.

The internal components of the optical assembly must be protected from dirt, corrosion, humidity, or other environmental factors that might degrade performance. Reflectors must have a finish of high specular reflectivity. All light transmitting surfaces must conform to MIL-C-7989B, Class B, C, or D. Covers must resist abrasion or other damage from sandblasting, sunlight, and chemicals in the air. A durable permanent label with replacement lamp identification data must be placed in the fixture near the lamp. Lamps for the Type L-850, L-862, L-861SE, and the L-852 E, F, S, and G lights must have a minimum rated life of 500 hours; all others must have a minimum rated life of at least 1,000 hours.

3.9. Maintainability Requirements.

a. All interior components of the light fixture must be easily removable for cleaning or replacement.

b. The optical components must be keyed so that they may not be reassembled incorrectly.

c. The lamp must be accurately and firmly positioned at the proper focal point.

d. Any interior lenses or filters must be securely positioned.

e. After the light fixture has been reassembled, all components must be properly aligned, original water resistance must be restored, and the required photometrics must be produced.

f. Special tools (tools that are not commercially available) must not be required for maintenance.

g. Directional light fixtures must be marked to indicate the correct orientation with respect to the runway centerline.

h. Elevated fixtures with exposed metal parts that might present a shock hazard must be grounded.

i. The fixture must be permanently marked with the manufacturer’s name and the fixture type.

j. For L-861 and L-862 fixtures, at least 4 degrees of adjustment must be provided in all directions to allow leveling of the fixture after installation.

k. For in-pavement lights, a fitting must be supplied to allow pressurization of the sealed optical assembly. The fitting may be permanent, or a plug for installation may replace it. This fitting will be used to test the seals after field maintenance.

l. Pry slots, threaded holes, or other means must be supplied on the top of in-pavement lights and elevated light base plates to assist in removing stubborn fixtures adhering to the mating surfaces.

3.10. Materials and Finish.

All components must be suitable for the intended purpose and adequately protected against corrosion. The components must have adequate capacity and must not be operated in excess of the component manufacturer's recommended rating.

3.10.1. In-pavement Lights.

3.10.1.1. Hardware.

a. All bolts, studs, nuts, lock washers, and other similar fasteners used in the light fixture must be fabricated from either 18-8, 410, or 416 stainless steel, passivated and free from discoloration.

b. Bolts or screws made of 410 or 416 stainless steel must be given a black oxide finish per MIL-DTL-13924C, Class 3.

c. The manufacturer should recommend use of an anti-seize compound when providing 18-8, 410, or 416 stainless steel hardware. The manufacturer does not normally supply anti-seize compound.

d. All screw threads must be Class 2 or Class 3 per ANSI B1.1. This paragraph does not apply to current-carrying components.

3.10.1.2. Finish.

All surfaces of the finished top assembly must be smooth, without burrs or sharp edges. Any "O" ring grooves must have a surface finish of 64 rms maximum as defined in ANSI B46.1. In addition, all edges above the pavement must be rounded to not less than 1/16-inch (1.59 mm) radius. The surface on the light fixture that mates with the base flange must have a smooth finish to provide good load transfer and sealing.

3.10.1.3. Elevated Lights.

3.10.1.4. Protection of Metals.

Ferrous metals must be galvanized or given other equal corrosion protection. Copper bearing hardware in contact with aluminum must be plated with nickel or zinc.

3.10.1.5. Finishes.

For non-optical surfaces, the exterior finish must match color No. 13538, Aviation Yellow, Table V of FED-STD-595B unless otherwise specified.

3.10.1.5.1. Metal Part Coatings.

Metal parts must be protected by at least one prime coat (or other suitable preparatory painting process) and one finish coat. Paint for the finish coat must be high quality paint suitable for the drying process used. Paint for the prime coat must be suitable for the metal treatment involved.

NOTE: *Powder or other coatings may be substituted for paint if equivalent environmental stresses, corrosion protection, metal treatment compatibilities, and color (per paragraph 3.10.1.5) properties are provided.*

3.10.1.5.2. Nonmetallic Parts.

Nonmetallic parts must have the color integral to the material or must be protected by a finish coat of paint suitable for the drying process and compatible with the material. The finish must be able to endure the environmental stresses specified in paragraph 3.2 for a suitable period.

3.11. Instruction Manual.

An instruction manual must be included with each order and must contain at least the following information:

a. Diagram showing layout of parts and wiring;

b. Complete parts list with the names and addresses of the component suppliers and their part numbers;

c. Assembly and installation instructions, including dimensions of any pavement cuts, recommended torques, and special mounting requirements;

d. Maintenance instructions, including durability information on "pop-out" yield devices for elevated lights.

3.12. Optional Items.

3.12.1. Option 1 - Lamp Bypass.

For in-pavement lights installed on series circuits, an electrical bypass device may be available for specification by the purchaser. This device must close an auxiliary circuit around the lamp within 15 seconds after failure of the lamp. A film disc cutout or other suitable device may be used for this function. A suitable holder and bypass wiring must be furnished for this device.

3.12.2. Option 3 - Shields.

For elevated lights, except for L-804, the manufacturer may provide shields to eliminate unneeded light. These shields are attached after the fixture is in place and are oriented according to the needs of a particular installation. All shields are subject to the same wind loading and other environmental requirements as the fixture to which they attached.

3.12.3. Option 4 - Mounting Hardware.

The manufacturer must provide the type of mounting system specified by the user of the elevated lights. The user may specify a base plate, stake, or may purchase the light without mounting hardware. The user may also order elevated fixtures of a specified height. If a mounting system is provided, it must meet the requirements of paragraph 3.4.2 and subparagraphs.

3.12.4. Option 5 - Two Lamps for Bidirectional Taxiway Centerline Fixtures.

For taxiway centerline fixtures, L-852, the manufacturer may provide bidirectional fixtures with two lamps, one for each direction, that are independently controllable with separate external leads.

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CHAPTER 4. QUALIFICATION REQUIREMENTS.

4.1. Qualification Request.

Procedures for obtaining qualification approval are contained in the latest edition of AC 150/5345-53.

4.2. General.

Each type, class, mode, option, and style of light fixture to be approved must be tested. Only one set of mechanical tests is required for each light fixture structural design.

4.3. Photometric Testing.

a. The optical performance of each light fixture, in combination with different lamp manufacturers, wattages, types, etc. must be determined by photometric measurements.

b. Additionally, each light fixture must have light output verified for each filter, lens, and light cover intended for use.

c. All lamps must be steady-burning during photometric testing.

d. All in-pavement fixtures tested must be mounted on a facsimile that simulates the below grade requirements per paragraph 3.4.1.2e.

4.3.1. Procedures.

a. Before testing, photometric test equipment must be calibrated per paragraph 6 of IES LM-35. The photometric axes are established in relation to a properly installed fixture; the horizontal axis passes through the center of the fixture and is parallel to the runway centerline (for in-pavement lights it is at grade), and the vertical axis runs through the center of the fixture and is perpendicular to the ground plane. Horizontal angles toward the runway centerline are positive.

b. The fixtures must be operated for at least 15 minutes before taking measurements. Photometric measurements must be taken with at least five random production-run lamps.

c. For fixtures with a 10 percent ellipse specified in Tables 1 through 3, at least 8 points must be measured on this ellipse. The method of measurement required to demonstrate compliance with the specification is given below.

4.3.1.1. Narrow-Beam Fixtures.

For fixtures with a horizontal main beam width specified less than or equal to ±10 degrees, intensities must be measured along the horizontal and vertical axes at intervals of a maximum of 1 degree - a minimum of ten readings on each axis must be taken. The average value of each axis, per paragraph 4.3.3, must meet the minimum average intensity requirements contained in Tables 1 and 2. Additionally, each intensity reading must be at least one-half the specified value for the minimum average intensity requirement. For the L-850E, each reading must equal or exceed the minimum intensity.

4.3.1.2. Wide-Beam Fixtures.

a. For fixtures with a horizontal beam width greater than 20 degrees but less than 180 degrees, horizontal "cuts" must be taken to measure the light intensity at each one degree interval throughout the required vertical beam spread.

b. At least 10 readings must be taken at each horizontal "cut." The results of these horizontal "cuts" must be averaged collectively, per paragraph 4.3.3, and this average must meet the minimum average intensity requirements contained in Tables 1 and 2.

c. Additionally, each of the intensity readings taken in a horizontal "cut" must be at least one-half the specified value for the minimum average intensity requirement.

d. The full measurements must be taken with at least one lamp, and the other four may be submitted with a single representative horizontal "cut." However, additional data may be required on the other lamps to ensure compliance.

4.3.1.3. Omnidirectional Fixtures.

a. For fixtures with a specified horizontal beam width greater than 180 degrees, the vertical beam spread must be measured at least every 30 degrees of the horizontal beam width.

b. Each reading must meet the minimum intensity requirement, and the average of each vertical "cut" must meet the minimum average intensity requirement contained in Tables 1 and 2.

c. Additionally, each of the intensity readings taken in a vertical "cut" must be at least one-half the specified value for the minimum average intensity requirement.

d. For in-pavement lights, a 25 percent intensity reduction may occur at structural ribs with the exception of L-852T fixtures.

4.3.2. Chromaticity.

a. Each fixture must be tested with each type of filter, lamp, and optical system to be used in the fixture to ensure that it meets the intensity and chromaticity requirements.

b. Spectral transmittance measurements of the filter are at the operating temperature of the light fixture.

c. The fixture must meet the chromaticity requirements of SAE-AS25050 and the ITE Equipment and Material Standard, ST-017B, Chapter 2, *Vehicle Traffic Control Signal Heads*, when tested at full brightness and at the center of the main beam and the extremes of the horizontal and vertical beam distribution. Chromaticity outside of distribution boundaries may be verified visually.

NOTE: *The ITE Standard applies to Type L-850T, L-852G and L-852S inset light fixtures (see note (g) in Table 1) and Type L-862S and L-804 elevated light fixtures (see note (g) in Table 2).*

4.3.3. Calculations.

The average measured intensity may not be more than three times the specified average intensity. For fixtures with a minimum but no average intensity requirement, the measured minimum may be no more

than three times the specified minimum intensity. When computing the average intensity for a test beam, the largest value used may be no more than three times the smallest value for the axis. Bi-directional and split color fixtures are exempt from this requirement if a single light source is used.

4.3.4. Special Conditions - In-pavement Lights.

For in-pavement lights, photometric tests must follow the shock and hydraulic impact tests to determine if the lamp filament has sustained any damage. If an in-pavement light is designed so that any portion of the exterior lens or prism is below pavement level, that portion must be obscured by opaque tape, but no more than half the lens area should be blocked. The resulting intensity distribution, in the applicable color, must be no less than 50 percent of that required in Tables 1, 2, or 3. The center of the light beam may be shifted ±0.5 degree vertically, and ±1.0 degree horizontally, to meet the photometric curve. Type L-852B and D fixtures may be shifted ±2.5 degrees horizontally.

4.3.5. Special Conditions - Elevated Lights.

The resultant isocandela curves may be shifted a maximum of one degree horizontally and one degree vertically to achieve compliance with the specified photometric curve. For L-804 fixtures, the flasher must be disabled and each light measured independently while steady-burning.

4.3.6. L-804 Flash Intensity Ratio Test.

The L-804 Runway Guard Light must be operated while flashing for a period of 30 minutes. A peak value reading must be taken, with a photo detector with an adequate response time, in the center of the beam and recorded. The flasher mechanism must then be disabled. After a five minute re-warm period, a steady state reading must be recorded. The ratio of the peak reading to the steady state reading must meet the requirements of paragraph 3.7.3.1.

4.4. Load Test.

a. A static load test must be performed on the complete in-pavement light fixture (and a shallow base or L-868 facsimile) and on the elevated light base plate. The base plate must be mated to an L-867 base (or equivalent) for testing.

b. The test load must be applied to the top part of the test assembly through a rubber block of a diameter at least 1 inch (25.40 mm) less than the outside diameter of the light assembly. The rubber block must be 1 inch (25.40 mm) thick and have a “Shore A” hardness of 55-70.

c. For in-pavement light fixtures, the total load (in pounds) to be applied must be 450 times the area (square inches) of the light fixture.

d. For base plates, the load must be 2,500 foot-pounds (1,133.98 kg). The load must be applied uniformly over the rubber at a rate not greater than 10,000 pounds (4,535.92 kg) per minute; full load must be applied for at least 1 minute. When the base plate is bolted to an L-867 light base, it must withstand a bending moment of 2,500 foot pounds (3,389.50 N-m) for the L-804 and 700 foot pounds (949.07 N-m) for all other applications.

e. The test is considered unsatisfactory if there is any permanent deformation, cracking of material or finish, breaking, or damage to any part of the light, base assembly, or base plate.

4.5. In-pavement Light Fixture Testing.

Unless otherwise noted, the in-pavement light fixtures must be tested under simulated installed conditions. Class 1 lights must be tested with any shallow base or other accessories used for installation. Class 2 lights must be tested while attached to an L-868 base or facsimile.

4.5.1. Mechanical Tests.

4.5.1.1. Vibration Test.

a. The light fixtures must be subjected to a sinusoidal vibration along three mutually perpendicular axes (parallel to the centerline, perpendicular to the centerline, and vertically).

b. The test must be conducted in two parts; the second part is only necessary if the lamp is damaged during the first part.

(1) For the initial test, the lamp must be shunted and the continuity continuously monitored. The fixture must be vibrated over a frequency range of 20 to 500 Hz, with a maximum acceleration of 10 Gs.

(2) The fixture must then be vibrated from 500 to 2,000 Hz, with a maximum acceleration of 15 Gs. The duration of each sweep must be 10 minutes.

(3) After vibrating, the light fixture must be inspected. Mechanical failure of any component, loosening of any part or fastener, loss of continuity during testing, or any discernible movement of lamps in lamp holders during the test is cause for rejection. If the lamp is damaged, it must be replaced, the shunt removed, and the test rerun, with the maximum G loading being 3 Gs. After performance of the second test, breakage of the lamp filament and/or envelope is cause for rejection.

4.5.1.2. Shock Test.

a. For L-850 type light fixtures, the assembled unit must be mounted rigidly on either a 1-inch thick (25.40 mm) steel plate or a 4-inch (101.60 mm) or thicker concrete base. The dimensions of the steel or concrete base must be at least 3×3 feet (0.91×0.91 m).

b. The light fixture must be turned on at full brightness for at least 2 hours prior to starting the test. With the light still on at full brightness, a case hardened steel ball weighing 5 pounds (2.27 kg) must be dropped on the center of the top of the light fixture from a height of 6 feet (1.83 m), 10 times with a 5-minute interval between each drop. Upon conclusion of the test, the light fixture must be opened to determine if the optical assembly has been damaged or any component displaced. Any evidence of damage inclusive of lamp and filament is cause for rejection.

4.5.1.3. Horizontal Shear Test.

This test simulates the shearing load applied to the top of any in-pavement fixture by a braking aircraft tire.

a. A bar must be attached (welded) to the top of the fixture so it is parallel to the runway centerline when the light is installed.

b. The ends of the bar should extend beyond the edges of the fixture to facilitate loading.

c. The light fixture, attached to a base receptacle or facsimile, and torqued to manufacturer's specifications, must be installed in a press with the attached bar in line with the piston of the press.

d. A load of 3,000 pounds (1,360.70 kg) must be applied to the end of the bar by the press. The load must be applied and release 20 times to each end of the bar.

e. Any structural damage, movement of any part, or loosening of fasteners must be cause for rejection.

4.5.2. Thermal Tests.

4.5.2.1. Low Temperature Test.

a. The light must be totally immersed in water.

b. While immersed, the fixture must be subjected to a low temperature of -40 degrees F (-40 degrees C) for 24 hours.

c. The cold soak must be followed immediately by operation at rated current for 30 minutes or until free from ice, whichever comes first. This must be repeated for a total of three cycles.

d. Any evidence of damage must be cause for rejection.

4.5.2.2. Cycling and Thermal Shock Test.

a. The light fixture must be subjected to an on-off cycling test by operating the unit at rated current at room temperature (dry) for not less than 4 hours.

b. The fixture must then be de-energized and immediately submerged under at least 1 foot (304.80 mm) of water for at least 4 hours. The temperature of the water before submersion of the fixture must be 41 degrees F (5 degrees C) or lower. This cycle must be repeated a total of three times, and the fixture must be immediately inspected at the completion of the third cycle. Any evidence of glass breakage or lens damage, any leakage of water into the optical assembly, or damage to any part of the fixture must be cause for rejection.

4.5.2.3. Surface Temperature Test.

a. Tests must be conducted to demonstrate that the maximum temperature on top of the inset light does not exceed 320 degrees F (160 degrees C), when the light is covered with the tire of a heavy ground vehicle of at least 6,000 pounds (2721.50 kg) gross vehicle weight (GVW) rating for a period of 10 minutes.

b. Before this 10-minute test period, the light unit must be operated at high intensity for at least 2 hours in still air with an ambient temperature of at least 77 degrees F (25 degrees C). The fixture must use the lowest transmissivity filter to be qualified. The thermocouple must be located between the hottest point of the fixture and the tire to register the test temperature.

4.5.3. Water Tests.

4.5.3.1. Hydraulic Impact Test.

a. Fort in-pavement type light fixtures, the light assembly must be submerged in water to a depth of approximately 1/2 inch (12.70 mm).

b. The upper surfaces of the light fixture around the windows must be encased in a leak-proof metal housing with a 1-3/4 inch (44.45 mm) diameter steel piston.

c. The chamber must be filled with water and purged of all air.

d. A 5-pound (2.27 kg) steel ball must be dropped from a height of 6 feet (1.83 m) onto the piston.

e. The light must not have any mechanical failure, optical damage, or water penetration into the optical cavity after this test has been repeated five times.

4.5.3.2. Leakage Test.

a. This test must be performed after the assembled light unit has successfully passed the vibration test, impact test, hydraulic impact test, and load test.

b. Prior to performing this test, the wire leads must be subjected to a 30-pound (13.61 kg) tension for 5 minutes to test the integrity of the seal where the leads enter the fixture.

c. The entire assembly must then be submerged in water at least 3 inches (76.20 mm) below the surface, subjected to an internal air pressure of 20 psi (137.90 kPa) and maintained for a period of 10 minutes.

d. Any leakage must be cause for rejection. Leakage tests on production units may use this method, a gas leak detector, or other approved method to ensure that the optical assembly is watertight.

4.5.4. Accelerated Life Test.

a. An accelerated life test must be performed on in-pavement light fixtures.

b. The light fixture must be set in dry sand and stabilized to a temperature of at least 131 degrees F (+55 degrees C), simulating its installation in pavement. The sand must be at least 5 inches (127.00 mm) thick around the sides and bottom of the light assembly. The sand must fill any openings in the light assembly that would be below pavement level. Only Class 2 fixtures must be mounted to a standard L-868 base that is buried in sand.

c. The unit must be operated for at least one-half the minimum rated lamp life at rated current. Light units supplied with filters should have the lowest transmissivity filter in place during this test. After this, all sand must be removed and the photometric performance of the unit must be measured per paragraph 4.3. Intensities must not be less than 80 percent of the intensities specified in the appropriate table.

d. After this test, the light assembly must be taken apart and thoroughly examined. Any deformation, blistering, evidence of heat damage, or corrosion must be cause for rejection.

4.5.5. Insulation Resistance Check.

The fixtures must be subjected to a 500-volt insulation resistance test (lead-to-case). The initial resistance must be at least 50 meg-ohms. The light assembly must then be operated for 1 hour at rated current and must be immediately submerged in a saturated salt-water solution except for the ends of the leads. The resistance test must be repeated. Resistance must be at least 50 meg-ohms.

4.5.6. Protective Plating Test.

Zinc plating must be tested by the appropriate method described in ASTM B 633.

4.6. Elevated Light Tests.

4.6.1. High Temperature Test.

a. A high temperature test must be conducted per MIL-STD-810F, Method 501.4, Procedure II.

b. The equipment must be subjected to 3 cycles according to Table 501.4-II except that the temperature must be adjusted upward so that the maximum is 131 degrees F (55 degrees C).

c. The fixture must be installed in a normal operating configuration and must be operated throughout the test.

d. Any deterioration in the materials or performance is cause for rejection.

e. This test must be run with the highest wattage lamp and lowest transmissivity filter to be qualified.

f. A separate test must be run to demonstrate the performance of any nonmetallic yield device at high temperature.

4.6.2. Low Temperature Test.

a. A low temperature test must be conducted per MIL-STD-810F, Method 502.4, Procedure II.

b. The fixture must operated and then cold soaked (fixture off) at the storage/shipping temperature (-67 degrees F (-55 degrees C) for one hour. The test chamber must then be ramped to the -40 degree F (-40 degree C) equipment operating temperature at no more than 6 degrees F (3 degrees C) per minute to prevent thermal shock to the equipment.

c. With input power off, the fixture must be exposed to a 24-hour soaking period at -40 degrees F (-40 degrees C). After the cold soak, the fixture must be energized.

d. Any deterioration in materials or performance is cause for rejection.

e. A separate test must be run to demonstrate the performance of any “pop-out” or nonmetallic yield device at low temperature.

4.6.3. Rain Test.

A rain test must be conducted per MIL-STD-810F, Method 506.4, Procedure I, Rain and blowing rain, with a rain rate of 5.2 inches/hr (132.08 mm/hr). The test duration must be 30 minutes per side. Any leakage of water into the lamp body must be cause for rejection.

4.6.4. Salt Fog Test.

If the fixture has external metal components, a salt fog test must be conducted on the assembled light fixture per MIL-STD-810F, Method 509.4. Any evidence of damage, rust, pitting, or corrosion is cause for rejection.

4.6.5. Yield Device.

a. All tests, demonstrating compliance to the requirements of paragraph 3.4.2.1 (3.4.2.1.1 for L-804) must be performed with the light unit fully assembled at nominal height (14 inches or 355.60 mm) and mounted to a rigidly secured base plate.

b. The load must be applied to the body at a point just below the lens, no faster than 50 pounds (222.41 N) per minute until the minimum bending moment of paragraph 3.4.2.1 (3.4.2.1.1 for L-804) is achieved.

c. After it has been determined that the light unit will sustain this load without damage, the loading must continue at the same rate until yielding at the yield point occurs.

d. For "pop-out" or other friction-type devices, the test must be repeated 10 times on the same device to check for loosening of the attachment.

e. The test must be repeated on five frangible fittings. Temperature tests for nonmetallic yield devices must also be conducted at -40 degrees F and 131 degrees F (-40 degrees C and +55 degrees C (±15 degrees)).

f. Failure of any of the devices to meet the requirements of paragraph 3.4.2.1 (3.4.2.1.1 for L-804) or damage to any part of the light unit before the yield device gives is cause for rejection. For friction type devices, the manufacturer must provide data on how many "pop-outs" may be expected before the device falls below the minimum yield value.

4.6.6. Solar Radiation Test.

A sunshine test must be conducted per MIL-STD-810F, Method 505.4, Procedure II, Steady state (actinic effects), for all light fixtures with nonmetallic non-glass exterior parts. The material must be subjected to a minimum of 56 cycles. At the conclusion of the test, any evidence of deterioration or alteration of the light fixture is cause for rejection. For plastic optical lenses or covers, the photometric performance must be measured after this test. Certification from the plastic manufacturer that the material has previously passed this test may be provided in lieu of performing the test.

4.6.7. Wind Test.

The manufacturer must demonstrate (by wind test or static loading) that, when subjected to the wind requirements in paragraph 3.2, no part of the light, mounting system, or yield device is damaged, and the light does not sway more than 1 inch (25.40 mm) with exception of L-804 that must not sway more than 2

inches (50.80 mm). If a light for snow areas is offered (paragraph 3.4.2), it must also be wind tested. No plastic deformation must result from the wind-loading test.

4.6.8. Certification.

The manufacturer must furnish a certification from the lamp manufacturer that the proposed lamp will meet the lamp life requirements. Evidence must be submitted that the lens conforms to the requirements of paragraph 3.8.

4.6.9. L-804 Operational Test.

An operational test, using the appropriate electrical power mode, must be conducted on the L-804 to demonstrate flash rate, flash duration, intensity control, vertical adjustment, and any other required operational features inclusive of visual verification of tethering device attachment.

4.6.10. Elevated Light Insulation Test.

The fixtures must be subjected to a 500-volt insulation resistance test (lead-to-case). The initial resistance must be at least 50 meg-ohms. The light assembly must then be operated for 1 hour at rated current and retested - resistance must be at least 50 meg-ohms.

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CHAPTER 5. PRODUCTION TESTING.

5.1. Testing.

a. Each fixture must be energized and visually inspected for proper operation.

b. The optical assembly of all in-pavement fixture must be pressurized internally to 20 psi (137.90 kPa) and tested for leaks.

c. A sampling of all in-pavement and elevated fixtures must be subjected to the photometric tests.

d. In the photometric tests, the fixtures must meet the requirements of paragraph 3.3.

e. For conventional testing, sampling is defined by ANSI/ASQ Z1.4-1993, Inspection Level II, Acceptance Quality Level (AQL) 2.5. For Statistical Process Control (SPC) systems, sampling must be per ANSI/EIA557 and must show statistical capability with a Cpk>1.0 and σ>3.0.

f. If abbreviated photometric test methods are used for production testing, these methods must have prior approval by the certifying agent.

5.2. Production Test Records.

Records showing actual test results of all tests required by paragraph 5.1 must be maintained for three years by the manufacturer. All records must be traceable to the units tested by serial number or test lot.

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