U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Specification for Runway, Taxiway, Heliport, and Vertiport Light Fixtures	**Date:** Draft	**AC No:** 150/5345-46F
	Initiated By: AAS-100	**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 equipment qualified per this specification will be listed in AC 150/5345-53, *Airport Lighting Equipment Certification Program*.

3 Cancellation.

AC 150/5345-46E, *Specification for Runway and Taxiway Light Fixtures*, dated 10/18/2022, is cancelled.

4 Applicability.

The Federal Aviation Administration recommends the guidance in this publication for the design and installation of runway, taxiway, heliport, and vertiport light fixtures. This AC does not constitute a regulation and is not legally binding in its own right. It will not be relied upon as a separate basis by the FAA for affirmative enforcement action or other administrative penalty. Conformity with this AC is voluntary, and nonconformity will not affect rights and obligations under existing statutes and regulations, except for the projects described in subparagraphs 2 and 3 below:

1. The standards contained in this AC are specifications the FAA considers essential for the reliability of components to maintain acceptable level of safety, performance and operation of runway, taxiway, heliport, and vertiport light fixtures.

2. Use of these standards and guidelines is mandatory for projects funded under Federal grant assistance programs, including the Airport Improvement Program (AIP). See Grant Assurance #34.

3. This AC is mandatory, as required by regulation, for projects funded by the Passenger Facility Charge (PFC) program. See PFC Assurance #9.

4. If, and only if, a Part 139 certificate holder voluntarily chooses to indicate in its Airport Certification Manual that it will comply with this AC, the Part 139 certificate holder will be required to conform to the requirements of this AC.

This AC provides one, but not the only, acceptable means of meeting the requirements of 14 CFR Part 139, *Certification of Airports*. All lighting designs contained in this AC are acceptable to the Administrator to meet the lighting requirements under § 139.311, *Marking, Signs and Lighting*.

5 Principal Changes.

The following principal changes are added:

1. Added L-861H and L-852H heliport and vertiport fixture requirements and associated photometric requirements in Table 3-4 to applicable paragraphs in Chapter 3 and Chapter 4.

2. Paragraph 3.4.1.2(2) – Clarified L-852T and L-852H may be installed on L-867B light bases in non-load bearing applications for Class 2 fixtures.

3. Paragraph 3.4.2.1(6) – Thread length is 1 inch (25.4 mm) for 2 inch (50.80 mm) frangible devices and 0.75 inch (19 mm) for 1.5 inch (38.1 mm) frangible devices.

4. Paragraph 3.5.3 – Changed shear load requirement from 3,000 pounds (1360.78 kg) to 11,000 pounds (4989.51 kg)

5. Paragraph 3.9(9) – Added L-862S light fixtures requirements per AC 150/5340-30J paragraph 4.5.5.2, Light Beam Orientation for In-Pavement Stop Bar Lights.

6. Paragraph 3.10.1.1 – Addressed coatings for bolts and steel fasteners per EB 83A.

7. Paragraph 4.5.1.1 – Provided clarifications to the vibration test paragraph.

8. Updated the format of the document in this version and made minor editorial changes throughout.

6 Using this Document.

Hyperlinks (allowing the reader to access documents located on the internet and to maneuver within this document) are provided throughout this document and are identified with underlined text. When navigating within this document, return to the previously viewed page by pressing the “ALT” and “ ←” (left arrow) keys simultaneously.

7 Use of Metrics.

Throughout this AC, U.S. customary units are used followed with "soft" (rounded) conversion to metric units. The U.S. customary units govern.

8 Where to Find this AC.

You can view a list of all ACs at http://www.faa.gov/regulations_policies/advisory_circulars/. You can view the Federal Aviation Regulations at http://www.faa.gov/regulations_policies/faa_regulations/.

9 Feedback on this AC.

If you have suggestions for improving this AC, you may use the Advisory Circular Feedback form at the end of this AC.

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TABLES

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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, taxiways, heliports, and vertiports.

1.2 Classification.

This specification covers the following light fixtures:

1.2.1 Type.

Table 1-1. 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 • Unidirectional: red
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

122 **Table 1-2. Taxiway, Heliport, and Vertiport 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
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, white-white, white-yellow • Unidirectional (wide beam): green, yellow, white
L-852E	Taxiway intersections (≥1200 RVR)	• Omnidirectional: yellow
L-852F	Taxiway intersections (<1200 RVR)	• Omnidirectional: yellow
L-852G	Runway Guard	• Unidirectional (wide beam): yellow; alternately flashing
L-852H	Heliport and Vertiport touchdown and lift off (TLOF) perimeter, final approach and takeoff (FATO) perimeter, flight path alignment, and approach / landing direction	• Omnidirectional: green
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	• Omnidirectional: blue

Table 1-3. 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	• Omnidirectional: white
L-860E	Runway threshold/end, VFR runways	• Bidirectional: red-green, red-red • Unidirectional: green
L-861	Runway edge, non- precision Instrument Flight Rules (IFR) runways, displaced threshold	• Omnidirectional: 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-861H	Heliport and Vertiport TLOF perimeter, FATO perimeter, Flight path alignment, and approach / landing direction	• Omnidirectional: green
L-861SE	Runway threshold/end, non-precision IFR runways	• Bidirectional: red-green • Unidirectional: green
L-861T	Taxiway edge, Apron edge	• Omnidirectional: 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 • Unidirectional: red
L-862S	Stop bar	• Unidirectional: red

1.2.2 Class.

The class designation applies only to in-pavement fixtures:

Class 1 Direct mounted fixtures

Class 2 Base mounted fixtures

1.2.3 Mode.

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 Style.

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

Style 1*	1/2 inch (12.7 mm) < X ≤ 1 inch (25.4 mm)
Style 2	1/4 inch (6.35 mm) < X ≤ 1/2 inch (12.7 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 items. These optional items must meet the requirements of paragraph 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 qualification date of application for the following documents are applicable to the extent specified in this AC.

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

FAA ACs may be obtained from: www.faa.gov/airports/resources/advisory_circulars/

AC 150/5200-30	*Airport Field Condition Assessments and Winter Operations Safety*
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*
AC 150/5390-2	*Heliport Design*

FAA Engineering Briefs (EBs) may be obtained from:
www.faa.gov/airports/engineering/engineering_briefs

EB 67	*Light Sources Other Than Incandescent and Xenon for Airport and Obstruction Lighting Fixtures*
EB 83A	*In-Pavement Light Fixture Bolts*
EB 87	*Heliport Perimeter Light for Visual Meteorological Conditions*
EB 105	*Vertiport Design*

2.3 Federal Standard.

Federal standards and specifications may be obtained from: www.dsp.dla.mil

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

2.4 **Military Publications.**

Military Standards and Specifications may be obtained from: quicksearch.dla.mil/

2.4.1 Military Standard.

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

2.4.2 Military Specification.

MIL-DTL-7989B *General Specification for Covers, Light-Transmitting, for Aeronautical Lights*

2.5 **American National Standards Institute (ANSI) Publications.**

ANSI publications may be obtained from: webstore.ansi.org/

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.**

ASTM standards may be obtained from:
webstore.ansi.org/sdo/astm

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

ASTM B117-18 *Standard Practice for Operating Salt Spray (Fog) Apparatus*

ASTM D-610-08 *Standard Practice for Evaluating Degree of Rusting On Painted Steel Surfaces*

2.7 **Illuminating Engineering Society (IES) Publications.**

IES of North America (IESNA) documents may be obtained from: www.iesna.org/shop/

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.**

ITE publications may be obtained from: www.ite.org/

ITE 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*

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CHAPTER 3. Requirements

3.1 General.

This AC specifies requirements for in-pavement and elevated light fixtures used on airport runways, taxiways, heliports, and vertiports.

Note: For information about elevated light bases and mounting stakes, see AC 150/5345-42.

3.2 Environmental Requirements.

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

3.2.1 Temperature.

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

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

3.2.2 Temperature shock.

Exposure of the hot light fixture to cold water spray.

3.2.3 Salt fog.

Exposure to a corrosive salt atmosphere.

3.2.4 Wind.

Exposure to wind velocities of 300 mph (483 kph) for all L-804, L-861, and L-862 fixtures, and 150 mph (241 kph) for all other elevated fixtures.

3.2.5 Precipitation.

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

3.2.6 Solar radiation.

Exposure to solar radiation.

3.3 Photometric Requirements.

3.3.1 The photometric performance of the light fixtures is defined in Table 3-1, Table 3-2, Table 3-3, and Table 3-4. 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.)

3.3.2 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.

3.3.3 For some light fixtures, a 10 percent ellipse is also defined. The two ellipses are concentric; i.e., the main beam ellipse is 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.

3.3.4 For in-pavement light fixtures, 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 with exceptions per Tables 1 and 2 notes.

3.3.5 The average measured intensity may be no more than three times the specified average intensity. For fixtures with a minimum but no average intensity specification, the measured minimum may be no more than three times the specified minimum intensity. This paragraph does not apply to bidirectional, split color light fixtures if a single light source is used.

3.3.6 The light colors are the aviation colors defined in SAE-AS25050 with exceptions per Table 3-1 and Table 3-2 notes.

Table 3-1. 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	

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-850D [j]	-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-852H	See Table 3-4								
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 for Table 3-1:

(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 except for 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. See AC 150/5340-30J paragraph 5.6.1.

(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

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

(j) L-850D light fixtures are supplied as either left or right toe-in for threshold application only (green). Red light is not toed.

(k) All FAA in-pavement fixtures must have a minimum of six fixation points.

(l) See Table 3-4 for L-852H intensity requirements.

Table 3-2. Photometric Requirements for Directional Elevated Lights.

Type	Note	Minimum Beam Coverage (Degrees)				Intensity (candelas) [b]			
		Main beam [e]		10 percent [e]					
		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

Type	Note	Minimum Beam Coverage (Degrees)				Intensity (candelas) [b]			
		Main beam [e]		10 percent [e]					
		H	V	H	V	White	Yellow	Green	Red
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 omnidirectionally 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 3-3. 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-861H	See Table 3-4			
L-861	White	75	125	40
	Yellow	37	67	20
	Green	28	46	14
	Red [c]	3	5	1

Type	Color	Intensity (candelas) [a]		
		2 to 10 degrees		10 to 15 degrees
		Minimum	Minimum Average Intensity	Minimum
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.

Table 3-4. Photometric Requirements for L-861H and L-852H Heliport and Vertiport Perimeter Lights.

Color	0 to 15 degrees		16 to 90 degrees
	Minimum	Minimum Average Intensity	Minimum
Green	10	15	5

3.4 Dimensional Requirements.

The light fixtures described in this specification may be installed directly in the ground or pavement. They may also 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).

1. When not installed on an FAA Type 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.

2. The power conductors are routed to the light fixture via a saw kerf cut into the pavement.

3. The light fixture must be designed to maximize adhesion via the securing compound and to resist rotation and uplift.

4. All optical components and electrical components (except those used to provide the power) must be removable for servicing without breaking the adhesive bond.

5. A shallow base or other installation accessories must withstand the loading and environmental stress requirements in this AC.

6. 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.

7. If installation bolts are provided by the light fixture manufacturer for a Class 1 light fixture, they must be furnished with corrosion resistant two-part locking washers.

3.4.1.2 **Class 2 (Base Mounted).**

Note: Light fixture interface details and dimensions of FAA Type L-868 bases are in AC 150/5345-42. Installation standards may be found in AC 150/5340-30.

1. Critical interface areas of the light fixture are the outer diameter, top flange, bolt holes, and throat projection. For in-pavement light fixtures, 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. Alternatively, the light fixtures for L-850 C, D, and E may have an outside diameter of 17.25 inches (438 mm) ±0.09 inch (2 mm), and mate with an L-868 size C light base. Adapter rings that make light fixtures compatible with an L-868C light base must be qualified with the light fixture.

2. In-pavement light fixture types L-852T and L-852H may be installed on L-867B light bases in non-load bearing applications. The loading requirements in this specification still apply.

3. For 8-inch (203.20 mm) in-pavement light 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 that make the 8-inch (203 mm) light fixture compatible with an L-868 size B or C light base must be qualified with the light fixture.

4. The light fixture must have a projection that extends at least 1/4 inch (6.35 mm) down through the L-868 assembly.

5. Any projection of the light fixture beyond the 1/4-inch (6.35 mm) throat projection must be sized to fit through a multiple section light base (bottom/middle and bottom flange of the top section) or a light

base extension bottom flange cutout. The diameter of this projection must be at least 0.06 inch (+0.00, -0.01 inch (1.52 mm +0.0, -0.25 mm) less than the light base flange nominal cutout diameter (see AC 150/5345-42 for more information about the light base top flange and bottom flange inner diameters).

6. In-pavement light fixtures intended to be installed on L-868A or L-868B light bases must be designed to mount on the base top flange that is 0.75 inch (19 mm) below grade. Alternatively, in-pavement light fixtures intended to be installed on L-868C light bases must be designed to mount on the base top flange that is 1.25 inches (32 mm) below grade.

7. The light fixture bolt hole configuration must match the Type L-868 or L-867 for types L-852T and L-852H in non-load bearing applications base that it is sized to fit.

8. The axis between one pair of bolt holes on opposite sides of the light fixture must be perpendicular to the direction of the runway centerline.

3.4.2 Elevated Lights.

1. The standard operational 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). The height of the L-861H must be determined per AC 150/5390-2.

2. The elevated light fixture 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).

3. Installation standards for elevated light fixtures can be found in AC 150/5340-30 and AC 150/5390-2.

4. When the purchaser specifies that a mounting system be provided, it must be per paragraph 3.4.2.1. The mounting system must be provided with the light fixture and must comply with paragraph 3.4.2.1.

3.4.2.1 **Yield Device.**

1. Each elevated light fixture must have a yield point near the point or position where it attaches to the base plate or mounting stake.

   a. The yield point must be no more than 1.5 inches (38.1 mm) above the threaded interface of the elevated light cover (see AC 150/5345-42 for more information). See AC 150/5340-30 for

additional information about light fixture yield point above grade location.

b. The yield point must separate before any other part of the fixture is damaged and withstand a bending moment of 150 foot-pounds (203 Newton-meters (N-m)) without failure.

c. The yield point must separate from the mounting system before the bending moment reaches 500 foot-pounds (678 N-m).

d. The yield device must use a threaded connection to the base plate or stake, and 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.

e. 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.

2. Type L-860 light fixtures may bend instead of separating. The fixture must not sway more than 1 inch (25.4 mm) from vertical under the specified wind loading.

3. 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.

4. If the yield device is a "pop-out" design 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.

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

6. The light fixture must not sway more than 1 inch (25.4 mm) 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 NPT or NPS thread, or 1.5 inch (38.1 mm) -12 UNF thread. Thread length is 1 inch (25.4 mm) for 2 inch (50.8 mm) frangible devices and 0.75 inch (19 mm) for 1.5 inch (38.1 mm) frangible devices. 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.

3.4.2.1.1 **Yield Device for Type L-804.**

1. Each L-804 elevated light fixture must have a yield point near where the light attaches to the base plate.

2. 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).

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

4. 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.

5. 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.

6. 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.

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

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

9. 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.

3.4.3 Type L-804 Runway Guard Light.

1. The light 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.

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

3. 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.

4. 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.

    a. 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.

    b. The bottom of the visor must extend at least 0.5 inch (12.7 mm) below the center of the light source.

    c. The visor must be mounted in such a manner as to prevent light from escaping from the area where the visor attaches to the fixture.

    d. 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° while the fixture is aimed vertically at any angle between 0 and +20°.

    e. All surfaces of the visors must be a low luster black finish.

5. The center of the specified beam spread must be capable of being aimed vertically and horizontally.

    a. The fixture and/or the mounting system must be designed to permit vertical adjustment of the light beam from 0° to +20° above the horizontal.

    b. 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.

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

7. The light fixture must be designed and installed so that jet blast does not turn it either horizontally or vertically.

8. A flexible corrosion resisting steel tether must be provided to prevent the light fixture from being blown onto a neighboring runway or taxiway.

    a. The tether must have a minimum tensile strength of 6,800 pounds (3,084 kg) and be designed to anchor the fixture to the L-867 base.

    b. Approximately 6-10 inches (152.40-254.0 mm) of slack should be provided.

9. All components required for installation must be supplied and all mounting legs must have yield devices per 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.

1. In-pavement light fixtures must withstand vibration along any axis.

2. In-pavement light fixtures must withstand an inertial load of up to 15 Gs when vibrated at frequencies between 20 and 2000 Hertz (Hz).

3. If an incandescent lamp is used, the lamp (including filament, glass envelope, and glass reflector) must withstand an inertial load of 3 Gs when vibrated between 20 and 2000 Hz.

3.5.2 Static Load.

When installed per the manufacturer's recommendations, the light fixture (and its adapter ring, if required) must withstand a static loading (in pounds/kilograms) 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 fixture must withstand a shear load of 11,000 pounds (4989.51 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 fixture (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 Type L-850 lights, the light fixture must withstand the repeated impact of a steel ball with 29.5 foot-pounds (40 Joules) of energy.

3.5.6 Leakage Resistance.

The light fixture assemblies that contain the optical components, including the lamp, must be resistant to water leakage or infiltration from above or below the light fixture. 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° F (160° C) when is operating at its maximum intensity while covered by the wheel of a heavy ground vehicle or aircraft for 10 minutes.

3.6 **Drainage.**

3.6.1 Elevated Lights.

1. Elevated light fixtures must be constructed so that a tight seal is formed between the components.

2. A gasket must be used between the fixture cover and body.

3. The light fixture assembly must be constructed so that any water developed internally will drain down past the yield point.

4. The Type L-804 light fixture assembly may use a drain hole rather than drain down the mounting legs. The design must not allow water build-up around the yield point.

3.6.2 In-pavement Lights.

1. 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 light base.

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

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

4. 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.

5. If the light fixture design has 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.**

1. The Type L-804 light fixture must have monitoring capability to detect failures per paragraph 3.7.3.4.

2. All Type L-862 and in-pavement light fixtures except L-852H, must use a Mode 1 (constant current) power supply of 6.6 amperes.

3. All Type L-860 light fixtures must use a Mode 2 (constant voltage) power supply; the L-861, L-852H, and L-804 light fixtures may be either Mode 1 or Mode 2.

4. 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 (CCR) and monitors.

5. FAA Certified CCR manufacturers may be found in AC 150/5345-53 Addendum.

6. Upon request, the FAA Certified CCR manufacturer must provide oscilloscope photographs (or equivalent digital formats) of the constant current regulator's output waveform per AC 150/5345-10.

3.7.1 In-pavement Lights.

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

2. The light fixture leads must be stranded copper insulated with a material suitable for the electrical and temperature requirements.

3. Light fixture leads for Class 2 fixtures must be terminated with an L-823 plug (FAA certified to AC 150/5345-26) to mate with the socket on the secondary lead of an isolating transformer.

4. Light fixture leads for Class 1 light fixtures must be sealed at the entry to the fixture and must have the ends ready for splicing.

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

3.7.2 Elevated Light Fixtures.

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

2. A light fixture 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.

3. A clamp or similar device must prevent any strain or tugging on the light fixture lead from adversely affecting the lamp socket.

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

5. A means (such as a plug and receptacle) must be provided at the yield point of elevated light fixtures with frangible or pop-out devices to disconnect the electrical circuit and allow the light fixture to separate cleanly from the base plate in the event of a knockdown.

3.7.2.1 **Mode 1(Series-Powered) Fixtures.**

The leads must be terminated in a Type L-823 plug certified to AC 150/5345-26 on Mode 1 light fixtures. See AC 150/5345-42 for additional information about Type L-823 receptacle mounting. The elevated light fixture must be provided with the appropriate length lead to mate with the isolation transformer secondary at the yield point.

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.

1. For Type L-860 fixtures with flexible mounting systems or external wiring, the disconnect device may be at any convenient point.

2. The light fixture lead must be secured so that no strain is placed on the primary power cable when the disconnect device is pulled apart by separation at the yield point of the light fixture.

3. When the disconnect device is separated, the energized leads from the power cable must not be exposed.

3.7.3 Type L-804 Runway Guard Light Fixture.

The Type L-804 fixture may be designed to accept a Mode 1 or Mode 2 power supply.

1. The power input cable must have sufficient length to reach at least 6 inches (152.40 mm) below grade when installed and must have a provision for strain relief.

2. The power input cable must terminate in a plug; for Mode 1 circuits, this must be a Type L-823 plug.

3. Plugs and receptacles for Mode 2 circuits must be of good quality, weatherproof, and suitable for direct burial.

4. If a standard Type L-823 plug is not used, the mating receptacle for the plug must be provided for field installation.

3.7.3.1 **Type L-804 Flasher.**

The two light sources in the runway guard light fixture must be alternately illuminated 45 to 50 times a minute per lamp over all specified brightness levels.

1. The flashing mechanism used to switch the two lights must maintain the flash rate within tolerance under the environmental conditions in paragraph 3.2.

2. If required, filters must be included in the light fixture to suppress transmitted or received electromagnetic interference (EMI). See AC 150/5340-30, Appendix B, Airport Technical Advisory, for additional information about EMI effects and mitigation strategies.

3. Power must be applied alternately to each light source for 50 percent (±0.5 percent) of the total cycle.

4. When operating on the highest intensity setting, the light output for each light source must rise to at least 70 percent of the steady-burning intensity 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 **Type 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 for tolerance/limits and operating standards.

3.7.3.3 **Type L-804 Control.**

One of two methods may be used to control the brightness of the L-804:

1. Allow the lamp intensity to vary with the current delivered to the fixture via a series circuit (mode 1). Depending on the CCR used to energize the circuit, the current may vary from 4.8 to 6.6 amps (3 step CCR) or from 2.8 to 6.6 amps (5 step CCR).

2. When using 120 or 240 volts ac (mode 2), a photocell is used to switch the lamps to 30 percent intensity (±10% (27% minimum, 33% maximum)) at low light levels.

    a. The photocell must switch the Type L-804 light fixture to high intensity when the illuminance reaches 50 to 60 foot-candles (538 to 646 lux).

    b. The photocell must switch the Type L-804 light fixture to 30 percent intensity when the illuminance reaches 25 to 35 foot-candles (269 to 377 lux).

    c. (3) A time delay circuit must be incorporated to prevent intermittent mode switching due to transient light conditions.

3.7.3.4 **Mandatory Type 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.

1. An option may be provided for a Type L-804 without monitoring, however this option must only be performed by the removal of components from the fixture and/or replacement of power/control lead cabling.

2. When monitoring is provided with a single support leg for breakaway for Mode 1 circuits, using a multiple conductor pin/plug connector that is not a Type L-823 is acceptable until an appropriate Type L-823 connector is available. The mating connector must be furnished with the fixture.

3. The Type L-804 connector should meet the same environmental, electrical, and separation specifications as a Type L-823 connector. Connection to the isolation transformer must be with Type 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, and other environmental factors that will degrade performance.

1. Reflectors must have a finish of high specular reflectivity.

2. All light transmitting surfaces must meet MIL-C-7989B, Class B, C, or D.

3. Covers must resist abrasion or other damage arising from sandblasting, sunlight, and deicing chemicals.

4. A permanent label with replacement lamp identification data must be placed on the fixture near the lamp.

5. Lamps for Types L-850, L-862, L-861SE, and the L-852 E, F, S, and G light fixtures 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.

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

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

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

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

5. 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 reproduced.

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

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

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

9. L-862S light fixtures with exterior aiming mechanisms must meet the requirements in AC 150/5340-30 paragraph 4.5.3, Light Beam Orientation for In-Pavement Stop Bar Lights. For L-862S light fixtures with asymmetric light beams (where up aim is integral to the optic design like other L-861 and L-862 applications), photometric compliance must be demonstrated over the full vertical range of adjustment. Therefore, with the light beam axis adjusted to 5 degrees up (however the manufacturer specifies to do this), measure from -3 to 13 degrees vertical, and with the light beam axis adjusted to 10 degrees up, measure from 2 to 18 degrees vertical.

10. Elevated and in-pavement light fixtures must include a proper lug/connector for accommodating the ground connection. See AC 150/5340-30, paragraph 12.6, for details.

11. The fixture must be permanently marked with the manufacturer's name and the fixture type.

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

13. For in-pavement lights, a fitting must be supplied with the light fixture to allow pressurization of the sealed optical assembly. The fitting will be used to test the light fixture seals after field maintenance. The pressurization fitting may be replaced by a suitable plug when the light fixture is installed.

14. 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 fixtures that adhere to the light base upper flange.

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 more than the component manufacturer's recommended rating.

3.10.1 In-pavement Lights.

3.10.1.1 **Hardware.**

All bolts, studs, nuts, lock washers, and other similar fasteners used for the light fixture assemblies must be fabricated from 316L (equivalent to EN 1.4404), 18-8, 410, or 416 stainless steel. If 18-8, 410, or 416 stainless steel is utilized ensure it is passivated and free from any discoloration. All screw threads must be Class 2 or Class 3 per ANSI B1.1. This paragraph does not apply to current carrying components. Coatings for bolts and steel fasteners per EB 83A may be effective against corrosion. Ensure these surfaces are unbroken before and after the installation process to prevent corrosion.

Coated stainless-steel, coated carbon steel and coated stainless-steel bolts, per EB 83A, may be effective in preventing galling and seizing issues.

If uncoated bolts are used, apply a corrosion inhibiting, anti-seize compound to all screws, nuts and frangible coupling threads. If coated bolts are used per EB 83A, do not apply anti-seize compound.

Note: Paragraph 3.10.1.1 does not apply to fasteners that are used to attach the light fixture to the light base; see AC 150/5345-42 for additional information. In addition, refer to the light fixture manufacturer's installation instructions about recommended bolt torque, locking washers, and the use of anti-seize and thread-locking compounds.

3.10.1.2 **Finish.**

All surfaces of the finished top assembly must be smooth, without burrs or sharp edges.

1. Any "O" ring grooves must have a surface finish of 64 micro-inches (µin.) (1.62 micro-meters (µm)) average roughness (R_a) per ANSI B46.1.

2. In addition, all edges that project above the pavement must be rounded to not less than 1/16-inch (1.59 mm) radius.

3. The surface on the light fixture that mates with the base flange must have a smooth finish to provide good load transfer and sealing.

3.10.2 Elevated Lights.

Elevated lights must be per the following paragraphs.

3.10.2.1 **Protection of Metals.**

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

3.10.2.2 **Finishes.**

The exterior finish of non-optical surfaces must match color No. 13538, DOT Highway Yellow, ANA506, FED-STD-595C, Appendix IV, Master Color List, unless otherwise specified.

3.10.2.2.1 **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 3.10.2.2) properties are satisfied.

3.10.2.2.2 **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 per paragraph 3.2 for a suitable period.

3.11 Instruction Manual.

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

1. Diagram showing layout of parts and wiring;
2. Complete parts list with the names and addresses of the component suppliers and their part numbers;
3. Assembly and installation instructions, including dimensions of any pavement cuts, recommended manufacturer light fixture torque requirements, and special mounting requirements;
4. Maintenance instructions, including durability information on “pop-out” yield devices for elevated lights.

3.12 **Optional Items.**

3.12.1 Option 1 - Lamp Bypass.

1. The purchaser may specify an electrical bypass device for in-pavement light fixtures installed in series circuits.

2. The bypass device must close an auxiliary circuit around the lamp within 15seconds after failure of the lamp.

3. A film disc cutout or other suitable device may be used for this function.

4. A suitable holder and bypass wiring must be furnished for the device.

3.12.2 Option 3 - Shields.

1. The manufacturer may provide shields for elevated light fixtures to eliminate light in undesired directions (FAA Type L-804 is excepted).

2. Shields are attached after the fixture is in place and are oriented according to installation requirements.

3. 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, Type 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 third party certification 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.

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

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

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

4. All in-pavement fixtures tested must be mounted on a facsimile that simulates the below grade requirements per paragraph 3.4.1.2(5).

4.3.1 Procedures.

1. 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.

2. The light 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.

3. For light fixtures with a 10 percent ellipse per Table 3-1, Table 3-2, Table 3-3, and Table 3-4, at least 8 points must be measured on this ellipse. The method of measurement required to demonstrate compliance with the specification is in the following subsections:

4.3.1.1 Narrow-Beam Fixtures.

1. For light fixtures with a specified horizontal main beam width less than or equal to ±15 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.

2. The average value of each axis, per paragraph 4.3.3, must meet the minimum average intensity requirements contained in Table 3-1 and Table 3-2.

3. Each intensity reading along the outside and inside the ellipse or rectangle must be at least one-half the specified value for the minimum average intensity requirement.

4. For Type L-850E light fixtures, each reading must equal or exceed the minimum intensity in Table 3-1.

4.3.1.2 Wide-Beam Fixtures.

1. For fixtures with a horizontal beam width greater than 30 but less than 180°, horizontal "cuts" must be taken to measure the light intensity at each one degree interval throughout the required vertical beam spread.

2. At least 10 readings must be taken at each horizontal "cut." The results of these horizontal "cuts" must each be averaged per paragraph 4.3.3. These averages must then be averaged collectively and meet the minimum average intensity requirements per Table 3-1 and Table 3-2.

3. 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.

4. 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.

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

2. Each reading must meet the minimum intensity requirement, and the average of each vertical "cut" must meet the minimum average intensity requirement contained in Table 3-1 and Table 3-3.

3. For Table 1,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.

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

4.3.2 Chromaticity.

1. Each light 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.

2. Spectral transmittance measurements of the filter must be at the operating temperature of the light fixture.

3. The light 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.

Bidirectional and split color light fixtures are exempt from this requirement if a single light source is used.

1. The average measured intensity may be no more than three times the specified average intensity.

2. For light fixtures with a minimum but no average intensity requirement, the measured minimum must be no more than three times the specified minimum intensity.

1. 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.

3. 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.

4.3.4 Special Conditions - In-pavement Lights.

For in-pavement light fixtures, photometric tests must follow the shock and hydraulic impact tests to determine if the lamp filament has sustained any damage.

1. If an in-pavement light fixture 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 Table 3-1, Table 3-2, and Table 3-3.

Note: The 50% acceptance criterion applies only to the opaque tape test.

2. The center of the light beam may be shifted ±0.5° vertically, and ±1.0° horizontally, to meet the photometric curve.

3. Type L-852B, D, J and K light 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 1° horizontally and 1° 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 Type L-804 Flash Intensity Ratio Test.

1. The Type L-804 Runway Guard Light fixture must be operated while flashing for a minimum 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.

2. The flasher mechanism must then be disabled.

3. After a five minute re-warm period, a steady state reading must be recorded.

4. 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.**

1. A static load test must be performed on the complete in-pavement light fixture (and a shallow base or Type L-868 facsimile).

2. 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 (25.4 mm) less than the outside diameter of the light assembly. The rubber block must be 1 inch (25.4 mm) thick and have a Shore A hardness of from 55 to 70.

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

4. The load must be applied uniformly over the rubber at a rate not greater than 10,000 pounds (4,536 kg) per minute; full load must be applied for at least one minute.

a. The load 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.

4.5 In-pavement Light Fixture Testing.

1. The in-pavement light fixtures must be tested under simulated installed conditions unless otherwise noted.

2. Class 1 light fixtures must be tested with any shallow base or other accessories used for installation.

3. Class 2 light fixtures must be tested while attached to a Type L-868 light base or facsimile

4.5.1 Mechanical Tests.

4.5.1.1 Vibration Test.

1. 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).

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

3. For the initial test, the light fixture must be operated and continuously monitored throughout the test. The fixture must be vibrated over a frequency of 20 to 500Hz, with a maximum acceleration of 10 G for 10 minutes.

4. The light fixture must then be vibrated from 500 to 2000 Hz, with a maximum acceleration of 15 G for 10 minutes.

    a. After the vibration test is complete, the light fixture must be inspected.

    b. Mechanical failure of any component, loosening of any part or fastener, operational deterioration during testing, or any discernible movement of lamps in lamp holders during the test is cause for rejection.

    c. If the incandescent lamp is damaged (as defined in 3.5.1.c), it must be replaced, re-energized, and the test rerun, with a maximum G loading of 3 G.

    d. After the second test is performed, damage to the lamp is cause for rejection.

4.5.1.2 **Shock Test.**

1. For light fixtures that may be located on a runway (this includes taxiway light fixtures except Type L-852E, L-852F, L-852H, and L-852T), the assembled unit must be rigidly mounted on either a 1-inch thick (25.4 mm) steel plate or a 4-inch (101.6 mm) or thicker concrete base. The dimensions of the steel or concrete base must be at least 3×3 feet (0.9×0.9 m).

2. The light fixture must be turned on at full brightness for at least 2 hours prior to starting the test.

   a. With the light at full brightness, a case-hardened steel ball weighing 5 pounds (2.3 kg) must be dropped on the center of the top of the light fixture from a height of 6 feet (1.8 m), 10 times with a 5-minute interval between each drop.

   b. Upon conclusion of the test, the light fixture must be opened to determine if the optical assembly has been damaged or any component displaced.

   c. The sample must operate throughout the test without any noticeable interruption. In addition, 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.

1. 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.

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

3. 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.

4. A load of 11,000 pounds (4989.51 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.

5. 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.**

1. The light fixture must be totally immersed in water.
2. While immersed, the light fixture must be subjected to a low temperature of -40° F (-40° C) for 24 hours.
3. 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.
4. Any evidence of damage to the light fixture or leakage of water inside the light fixture is cause for rejection.

4.5.2.2 **Cycling and Thermal Shock Test.**

1. 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.
2. The light fixture must then be de-energized and immediately submerged under at least 1 foot (304.8 mm) of water for at least 4 hours.
3. The temperature of the water before submersion of the light fixture must be 41° F (5° C) or lower.
4. This cycle must be repeated three times
5. The light fixture must be immediately inspected at the completion of the third cycle.
6. Any evidence of glass breakage or lens damage, leakage of water into the optical assembly, or damage to any part of the light fixture is cause for rejection.

4.5.2.3 **Surface Temperature Test.**

1. Tests must be conducted to demonstrate that the maximum temperature on top of the inset light fixture does not exceed 320° F (160° C), when the light is covered with the tire of a heavy ground vehicle of at least 6,000 pounds (2,721 kg) gross vehicle weight (GVW) rating for a period of 10 minutes.

2. Before the 10-minute test period, the light fixture must be operated at high intensity for at least 2 hours in still air with an ambient temperature of at least 77° F (25° C).

3. The light fixture must use the lowest transmissivity filter to be qualified.

4. The thermocouple must be located between the hottest point of the light fixture and the tire to register the test temperature.

4.5.3 Water Tests.

4.5.3.1 **Hydraulic Impact Test.**

1. For in-pavement type light fixtures, the light assembly must be submerged in water to a depth of approximately 0.5 inch (13 mm).

2. The upper surfaces of the light fixture around the windows must be encased in a leak-proof metal housing with a 1.75 inch (44.5 mm) diameter steel piston.

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

4. A 5 pound (2.3 kg) steel ball must be dropped from a height of 6 feet (1.8 m) onto the piston.

5. 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.**

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

2. Prior to performing this test, the wire leads must be subjected to a 30-pound (13.6 kg) tension for 5 minutes to test the integrity of the seal where the leads enter the light fixture.

3. The entire assembly must then be submerged in water at least 3 inches (76 mm) below the surface, subjected to an internal air pressure of 20 psi (138 kPa) and maintained for 10 minutes.

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

4.5.4 Accelerated Life Test.

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

2. The light fixture must be set in dry sand and stabilized to a temperature of at least 131° F (+55° C), simulating its installation in pavement.

   a. The sand must be at least 5 inches (127 mm) thick around the sides and bottom of the light assembly.

   b. The sand must fill any openings in the light assembly that would be below pavement level.

   c. Only Class 2 fixtures must be mounted to a standard L-868 base that is buried in sand.

3. The unit must be operated for at least one-half the minimum rated lamp life at rated current.

   a. Light fixtures supplied with filters must have the lowest transmissivity filter in place during this test.

   b. After testing, all sand must be removed and the photometric performance of the light fixture must be measured per paragraph 4.3.

   c. Intensities must not be less than 80 percent of the intensities specified in Table 3-1, Table 3-2 and Table 3-3.

4. After testing is complete, the light fixture assembly must be disassembled and examined. Any deformation, blistering, evidence of heat damage, or corrosion will be cause for rejection.

4.5.5 Insulation Resistance Check.

Light fixtures must be subjected to a 500-volt DC insulation resistance test (lead-to-case).

1. The initial resistance must be at least 50 MΩ.

2. The light fixture must then be operated for one 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 MΩ.

4.5.6 Protective Plating Test.

Zinc plating on iron or steel articles must be tested by methods per ASTM B 633.

4.6 **Elevated Light Tests.**

4.6.1 High Temperature Test.

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

2. 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° F (55° C).

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

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

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

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

4.6.2 Low Temperature Test.

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

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

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

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

5. 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 light fixture 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.

1. All tests, demonstrating compliance to the requirements of paragraph 3.4.2.1 (3.4.2.1.1 for Type L-804) must be performed with the light fixture fully assembled at nominal height (14 inches (355.6 mm)) and mounted to a rigidly secured base plate.

2. The load must be applied to the light fixture body at a point just below the lens, no faster than 50 pounds (222.4 N) per minute until the minimum bending moment of paragraph 3.4.2.1 (3.4.2.1.1 for FAA Type L-804) is achieved.

3. After it has been determined that the light fixture will sustain this load without damage, the loading will continue at the same rate until yield point failure.

4. 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.

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

6. Failure of any of the frangible fittings to meet the requirements of paragraph 3.4.2.1 (3.4.2.1.1 for FAA Type L-804) or damage to any part of the light fixture before the yield point is cause for rejection.

7. For friction type devices, the manufacturer must provide data on the maximum number of "pop-outs" expected before the device falls below the minimum yield value.

4.6.6 Solar Radiation Test.

1. 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.

2. The material must be subjected to a minimum of 56 cycles.

3. At the conclusion of the test, any evidence of deterioration or alteration of the light fixture is cause for rejection.

4. For plastic optical lenses or covers, the photometric performance will 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.

1. 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 fixture, mounting system, or yield device is damaged, and the light does not sway more than 1 inch (25.4 mm)

2. FAA Type L-804 light fixtures must not sway more than 2 inches (50.8 mm).

3. If a light fixture for snow areas is offered (paragraph 3.4.2), it must also be wind tested.

4. 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 meets the requirements in paragraph 3.8.

4.6.9 Type L-804 Operational Test.

An operational test, using the appropriate electrical power mode, must be conducted on the Type L-804 light fixture to demonstrate:

1. flash rate

2. flash duration

3. intensity control

4. vertical adjustment

5. any other required operational features inclusive of visual verification of tethering device attachment.

4.6.10 Elevated Light Elevated Light Fixture Insulation Test.

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

CHAPTER 5. Production Testing

5.1 Testing.

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

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

3. A sampling of all in-pavement and elevated light fixtures must be subjected to the photometric tests in paragraph 4.3.

4. The light fixtures must meet the requirements in paragraph 3.3.

5. For conventional testing, sampling is defined by ANSI/ASQ Z1.4-1993, Inspection Level II, Acceptance Quality Level (AQL) 2.5.

6. 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.

If abbreviated photometric test methods are used for production testing, they must be approved prior to testing by the certifying agent.

5.2 Production Test Records.

Records showing the test results of all tests required in 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.

Advisory Circular Feedback

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by (1) mailing this form to Manager, Airport Engineering Division, Federal Aviation Administration ATTN: AAS-100, 800 Independence Avenue SW, Washington DC 20591 or (2) faxing it to the attention of the Office of Airport Safety and Standards at (202) 267-5383.

Subject: AC 150/5345-46F Date: _____

Please check all appropriate line items:

☐ An error (procedural or typographical) has been noted in paragraph _____ on page _____.

☐ Recommend paragraph _____ on page _____ be changed as follows:

_____
_____
_____

☐ In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

_____
_____
_____

☐ Other comments:

_____
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☐ I would like to discuss the above. Please contact me at (phone number, email address).

_____
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Submitted by: _____ Date: _____