U.S. Department of Transportation

Federal Aviation Administration

Advisory Circular

Subject:	SPECIFICATION FOR AIRPORT AND HELIPORT BEACONS	**Date:** 09/24/10 **Initiated by:** AAS-100	**AC No.:** 150/5345-12F **Change:**

1. PURPOSE. This advisory circular (AC) contains equipment specifications for light beacons that are used to locate and identify civil airports, military airports, seaplane bases, and heliports.

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

3. CANCELLATION. This AC cancels AC 150/5345-12E, Specification for Airport and Heliport Beacons, dated November 17, 2005.

4. PRINCIPAL CHANGES.

a. Chapter 2 is updated to include Engineering Brief #67 and updated MIL-C-7989B.

b. Paragraph 3.4.3 is updated to include a reference to Engineering Brief #67.

c. Paragraph 4.2.2.4 is updated to include reference to Engineering Brief #67.

5. APPLICATION. The Federal Aviation Administration (FAA) recommends the specifications contained in this AC for all applications involving development of this nature. In general, use of this AC is not mandatory. However, use of the 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 Assurance No. 34, "Policies, Standards, and Specifications," and PRC Assurance No. 9, "Standards and Specifications."

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

Michael J. O'Donnell
Director of Airport Safety and Standards

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CHAPTER 1. SCOPE AND CLASSIFICATION.

1.1 Scope.

This specification details Federal Aviation Administration requirements for airport light beacons at civil airports, military airports, seaplane bases, and heliports.

NOTE: *See the following documents for airport/heliport beacon installation and siting criteria:*

AC 150/5340-30, Design and Installation Details for Airport Visual Aids
AC 150/5390-2, Heliport Design

1.2 Classification.

1.2.1 Types.

L-801A	Medium intensity airport beacon
L-801H	Medium intensity heliport beacon
L-801S	Medium intensity seaplane base beacon
L-802A	High intensity airport beacon
L-802M	High intensity military airport beacon.
L-802H	High intensity heliport beacon
L-802S	High intensity seaplane base beacon

1.2.2 Classes.

Class 1: For operation over the range -22 to 131 degrees Fahrenheit (F) (-30 to 55 degrees Celsius (C)).

Class 2: For operation over the range -67 to 131 degrees F (-55 to +55 degrees C).

1.2.3 Options.

Lamp Monitor.

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CHAPTER 2. APPLICABLE DOCUMENTS.

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

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

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.

Standard 595	Colors Used in Government Procurement

2.4 Military Standard.

MIL-STD-810F 1 January 2000	Environmental Engineering Considerations and Laboratory Tests

2.5 Military Specification.

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

2.6 Federal Regulations.

Code of Federal Regulations (CFR)	Title 47, Telecommunications, Part 15, Radio Frequency Devices

2.7 American Society for Testing and Materials (ASTM)

B766-86 (2003)	Specification for Electrodeposited Coatings of Cadmium
B633-98e1	Specification for Electrodeposited Coatings of Zinc on Iron and Steel

2.8 Society of Automotive Engineers (SAE).

SAE AS25050	Color, Aeronautical Lights and Lighting Equipment, General Requirements for

2.9 Institute of Electrical and Electronics Engineers (IEEE)

IEEE C62.41-1991	IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
IEEE C62.45	IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

2.10 Powder Coating Institute (PCI)

PCI	Powder Coating - The Complete Finisher's Handbook, 3rd edition

2.11 Illuminating Engineering Society North America (IESNA) Publication.

LM-35-02	Photometric Testing of Floodlights Using High Intensity Discharge or Incandescent Filament Lamps
Illuminating Engineering	November 1964, Volume LXIX, page 747.

Copies of FAA advisory circulars may be obtained from:

U.S. Department of Transportation
Subsequent Distribution
Office Ardmore East Business Center
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Website: www.faa.gov/regulations_policies/advisory_circulars

Copies of military documents may be obtained from:

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Philadelphia, PA 19111-5094

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Website: dodssp.daps.dla.mil

Copies of Federal specifications and standards may be obtained from:

Federal Supply Services
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470 L'Enfant Plaza East
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Washington, D.C. 20407

Phone: (202) 619-8925
FAX: (202) 619-8985
Website: www.dsp.dla.mil

Copies of Federal Regulations may be obtained from:

Website: www.gpoaccess.gov/cfr/index.html

Copies of SAE standards may be obtained from:

Society of Automotive Engineers, Inc.
400 Commonwealth Drive
Warrendale, Pennsylvania 15096

Phone: (724)776-4841
FAX: (724)776-0790
Website: www.sae.org

Copies of IEEE Standards may be obtained from:

IEEE Customer Service
445 Hoes Lane
PO Box.1331
Piscataway, NJ 08855-1331

FAX: (732)981-9667
E-mail: onlineproducts@ieee.org
Website: www.ieee.org

Illuminating Engineering Society of North America (IESNA) documents may be obtained from:

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

Phone: (212) 248-5000
FAX: (212) 248-5017/18
Website: www.iesna.org

Copies of ASTM standards may be obtained from:

ASTM
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

Phone: (610) 832-9585
FAX: (610) 832-9555
Website: www.astm.org

Copies of Powder Coating Institute documents may be obtained from:

PCI Publications
2121 Eisenhower Avenue
Suite 401
Alexandria, VA 22314

Phone: (800) 988-COAT
FAX: (703) 684-1711
Website: www.powdercoating.org

CHAPTER 3. REQUIREMENTS.

3.1 General.
This specification details the requirements for light beacons intended for use in locating lighted civil airports, military airports, seaplane bases, and heliports.

3.2 Environmental Requirements.
Light beacons must be designed to operate in the following environmental conditions:

a. Temperature: Any temperature from -22 degrees to 131 degrees F (-30 degrees to +55 degrees C) without auxiliary heater(s) for Class 1, and -67 degrees to 131 degrees F (-55 degrees to +55 degrees C) with auxiliary heater(s) (if so equipped) for Class 2.

b. Wind: wind velocities to 100 miles per hour (161 kilometers per hour).

c. Rain and Snow: exposure to wind driven rain and snow.

d. Ice: an accumulation of a 0.5 inch (12.7 millimeters) coating of ice.

e. Solar radiation (if any plastic parts or thermoplastic lenses are used): Non-metallic and non-glass exterior parts must not degrade when exposed to solar radiation.

3.3 Photometric Requirements.
The beacons must appear, at any point throughout 360 degrees in azimuth, as a light source emitting flashes of white and/or colored light at the specified rates, colors, and intensities per this Advisory Circular.

3.3.1 Flash Rate.
The frequency of flashes must be:

L-801A	22 to 26 flashes per minute (fpm)
L-801S	" " " " " "
L-802A	" " " " " "
L-802S	" " " " " "
L-801H	33 to 39 fpm
L-802H	" " "
L-802M	16 to 20 fpm

3.3.2 Flash Duration.
a. The duration of individual flashes must be from 75 to 300 milliseconds (ms).

b. The requirement above may be met in capacitor discharge-type beacons by a series of rapid successive flashes which appear to the viewer to be one uninterrupted flash.

3.3.3 Signal Format.
a. Airport beacons must provide the following signal colors:

L-801A & L-802A	Alternate white and green

L-801S & L-802S	Alternate white and yellow
L-801H & L-802H	Alternate white, green, and yellow
L-802M	Alternate white, white, and green

b. For L-802M beacons, the time between successive white flashes must be 305 ± 56 ms, measured between the center points of maximum intensity.

(1) The intensity of the white beam must be less than 100,000 candelas (cd) for a minimum of 55 ms between white flashes. This specification is not in effective candelas.

(2) The time between the second white flash and the green flash must be between 4.3 and 5.4 seconds, measured center to center between the flashes.

3.3.4 Light Intensity.
The effective light intensity must be per Table 1 for omni-directional and rotating beacons:

NOTE: *The effective intensity of a flashing light is equal to the intensity of a steady-burning (fixed) light of the same color that produces the same visual range under identical conditions of observation.*

Table 1. Light Intensity and Elevations

Beacon Type (Note 1)	Elevation Angle in degrees	Minimum Effective Intensity of Flash in candelas
L-801A & L-801S	1 and 2	25,000 (Note 2)
	3 to 7	50,000 (Note 2)
	8 to 10	25,000 (Note 2)
L-801H	1 and 2	12,500 (Note 2)
	3 to 7	25,000 (Note 2)
	8 to 10	12,500 (Note 2)
L-802A & L-802S	1 and 2	37,500 (Note 2)
	3 to 7	75,000 (Note 2)
	8 to 10	37,500 (Note 2)
L-802H	1 and 2	18,750 (Note 2)
	3 to 7	37,500 (Note 2)
	8 to 10	18,750 (Note 2)
L-802M	1, 9, and 10	30,000 (Note 2)
	2 and 8	50,000 (Note 2)
	3 to 7	95,000 (Note 2)
	1 to 2	10,000 (Note 3)
	3 to 7	20,000 (Note 3)
	8 to 10	10,000 (Note 3)

Notes:

1. *The light beam center must be set at 5 degrees above the horizontal plane (0 degrees) for these parameters.*
2. *The intensities are expressed in white light.*
3. *The intensities are expressed in colored light.*

The effective intensity of colored lights must not be less than the values specified for white light multiplied by the following factors: yellow - 0.40, and green - 0.15.

3.4 Design Requirements.

3.4.1. General.
Beacons may be designed as a rotating type using steady-burning lamps, or a non-rotating type using flashing lamps. The total input power, size, and weight of the beacon must be the minimum necessary to meet the requirements of this advisory circular.

3.4.2 Input Voltage.
The airport beacons must be designed to operate from a standard line voltage below 600 volts, at a tolerance of ±10 percent, 60 Hertz line frequency, alternating current.

3.4.3 Lamps.

a. The airport beacon must use lamps with a minimum rated life of at least 4,000 hours at rated voltage.

b. See Engineering Brief #67, Light Sources Other Than Incandescent and Xenon for Airport and Obstruction Lighting Fixtures, for additional requirements unique to alternative light sources (example: light emitting diodes (LEDs), cold cathode emitters).

3.4.4 Light Transmitting Materials.

a. Glass for the light cover, lenses, and color screen(s) must meet the requirements of MIL-C-7989B paragraph 1.2, Class B, heat resistant glass.

b. Plastic materials used for light covers, lenses, and color screens must meet the requirements of MIL-DTC-7989C, paragraph 1.2, Class D, plastic.

3.4.5 Drive Motor.

a. Drive motors used on rotating-type beacons must have sufficient torque capacity to both start and operate the beacon under the environmental conditions per paragraph 3.2. Universal type motors are not acceptable.

b. The motor and turntable drive must not induce premature failure of lamps because of excessive vibration.

3.4.6 Vertical Adjustment.

a. The light beam center of all airport beacons must be field adjustable through vertical angles from 2 to 10 degrees above the horizontal plane using common hand tools.

b. A scale marked in one degree increments must be provided to indicate the vertical beam center setting.

3.4.7 Interlock Switches.
Interlock switches must be incorporated into capacitor-discharge beacons so that, upon opening the access door or cover, incoming power is disconnected and capacitors discharged to a maximum of 50 volts within 30 seconds.

3.4.8 Equipment Mounting.
The airport beacon must be designed for mounting on a flat, horizontal surface, and must be provided with easily accessible leveling points for leveling during installation and maintenance.

3.4.9 Surge Suppression.
Properly rated surge arresting devices must be used to protect the equipment per IEEE C62.41, Medium System Exposure, Location Category C2, Table 4.

NOTE: *See IEEE C62.41- 1991, IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits, Section 9, Definition of Standard Surge Testing Waveforms, for detailed explanations of surge/transient waveforms.*

3.4.10 Electromagnetic Interference.
The airport beacon must not cause harmful interference (radiated or conducted electromagnetic interference (EMI)) to other airport and FAA equipment (e.g., computers, radars, instrument landing systems, radio receivers, VHF Omni directional Range, etc.) that may be located on or near an airport.

NOTE: *An airport beacon is classified as an incidental radiator (47 CFR Part 15 Section 15.13). This applies to equipment that does not intentionally generate any radio frequency energy, but may create such energy as an incidental part of its intended operations.*

3.4.11 Corrosion Protection.
a. All airport beacon metallic surfaces must be protected from corrosion.

b. Exterior surfaces must be painted with a primer coat and two finish coats of paint that will protect the equipment per the environmental requirements in paragraph 3.2.

c. The beacon exterior color must be either international orange, color number 12197, or aviation yellow, color number 13538, per FED-STD-595.

d. Painted surfaces must be free of blotches, scratches, and runs.

e. If corrosion resistance is provided by galvanizing, it must be per ASTM B-633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

f. If cadmium plating is used it must be per ASTM B766-86 (2003), Standard Specification for Electrodeposited Coatings of Cadmium.

NOTE: *Polymer powder coatings may be substituted for paint if equivalent corrosion resistance is maintained. See Powder Coating Institute publication: Powder Coating - The Complete Finisher's Handbook, 3rd edition, for guidance about selection, application, and corrosion resistance.*

3.4.12 Parts Rating.
a. All parts must be of adequate rating for the application and must not be operated in excess of the part manufacturer's recommended ratings throughout the environmental range per paragraph 3.2.

b. Components must be de-rated by the interior temperature rise above the maximum outside ambient temperature at an altitude of 6,000 feet (2,000 meters) above sea level.

3.4.13 Nameplate.
A permanent nameplate with the following minimum information must be affixed to the beacon:

Light Beacon
Identification: FAA L-_____
Voltage_____Wattage_____
Manufacturer's Part No._____
Manufacturer's Name or Trademark_____

3.5 Equipment Options.
The following option is not required for certification. However, if provided, it must be tested to Chapter 4.

3.5.1 Lamp Monitor.
A circuit, if provided, must permit connection to a remote warning lamp and/or buzzer to indicate failure of the service lamp(s).

3.6 Instruction Book.
An instruction book must be provided with each airport beacon and contain the following information:

a. Safety requirements for equipment maintenance.

b. Description of circuit operation.

c. Circuit schematics and wiring diagrams.

d. Photographs or mechanical drawings of each component showing all parts.

e. Parts list with each circuit component keyed to the reference designation assigned on schematics or wiring diagrams.

f. The original equipment manufacturer's part number, name, and description must be given for each part in the parts list.

g. Recommended preventive maintenance schedule and procedures.

h. Troubleshooting information.

i. Equipment physical characteristics (weight, height, mounting dimensions).

j. Installation instructions.

k. Operating instructions.

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CHAPTER 4. EQUIPMENT CERTIFICATION REQUIREMENTS.

4.1. Certification Request.
Procedures for obtaining certification approval are contained in the current edition of AC 150/5345-53, Airport Lighting Equipment Certification Program.

4.2 Certification Tests.
Each type, class, and option of airport beacons to be certified must be tested.

4.2.1 Visual Examination.
Airport beacons must be inspected for quality of workmanship, fabrication, finish, and adequacy of the design to suit the intended purpose.

4.2.2 Photometric Tests.

a. Testing must be conducted to show conformance to all photometric requirements.

b. See Illuminating Engineering Society publication, Guide for Calculating the Effective Intensity of Flashing Signal Lights, contained in Illuminating Engineering, November 1964, Volume LXIX, page 747 for guidance about determining the effective intensity of a flashing light.

4.2.2.1 Procedures.

a. Before testing the equipment, the photometric equipment must be calibrated per IESNA LM-35-02, paragraph 5.0, Calibration Procedure and Methods (General).

(1) The photometric axes must be in relation to properly installed and aimed airport beacon.

(2) See IESNA LM-35-02, paragraph 6 for a set of standard angles for beam spreads.

b. Lamp must be stabilized prior to conducting measurements per IESNA LM-35-02, paragraph 3.4, Test Lamp Operation.

c. Confirm that high intensity discharge (metal halide) lamps, if position sensitive, have the correct coordinate system applied for the lamp operating position per IESNA LM-35-02, paragraph 3.8.2, Coordinate Systems.

d. Five production-run lamps must be randomly selected for testing.

4.2.2.2 Beam-Type Beacons.

a. For beacons with a horizontal beam width less than 180 degrees, one horizontal "cut" must be recorded at each one degree vertical interval, over the required angles of elevation per Table 1.

b. At least ten readings must be taken at each horizontal "cut." All five lamps must be measured with a minimum of one "cut" through the beam center.

4.2.2.3 Omni-directional Beacons.

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

b. The vertical readings must range over the required angles of elevation per Table 1, measured at one degree vertical intervals.

4.2.2.4 Chromaticity.

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

NOTE: *All testing must be conducted after 15 minutes of operation in ambient conditions at 77 degrees F (25 degrees C). See SAE AS25050 for definitions of colors (paragraph 3.1), chromaticity (paragraph 3.3.1). See also EB #67 for additional requirements for alternative light sources.*

b. Alternatively, the chromaticity and transmission for color filters may be certified by the manufacturer to meet FAA requirements and the documentation used to calculate the color photometric effective output based upon measurements taken with the beacon white lens.

4.2.2.5 Test Report.

A test report must be prepared per paragraph 8.0 of LM-35-02, except that "floodlight" shall be read as "airport beacon."

4.2.3 High Temperature Test.

a. The airport beacon must be placed in a test chamber at ambient temperature, then operated to determine readiness for testing.

b. After successful readiness testing, the temperature of the test chamber must be raised to 131 degrees F (55 degrees C) with the airport beacon power off. The equipment must be temperature soaked for 12 hours with any optional equipment attached.

c. At the conclusion of the 12 hour temperature soak, the airport beacon must be continuously operated at 131 degrees F (55 degrees C) for 36 hours. Any optional equipment must be demonstrated to operate at the end of 36 hours. Failure of the equipment to operate properly or deterioration of any component is considered cause for rejection.

4.2.4 Low Temperature Test.

a. The airport beacon must be placed in a test chamber at ambient temperature, then operated to determine readiness for testing. Auxiliary heater(s), if so equipped, must be operating.

b. After successful readiness testing, the temperature of the test chamber must be lowered to:

(1) For Class 1 equipment: -22 degrees F (-30 degrees C) with the AC power off.

(2) For Class 2 equipment: -67 degrees F (-55 degrees C) with the AC power off.

c. The equipment must be temperature soaked for 12 hours with any optional equipment operating.

d. At the conclusion of the 12 hour cold temperature soak, the equipment must be energized and operated in the test chamber at the soak temperature for 1 hour. Optional equipment must be demonstrated at the end of the 1 hour test.

e. If the airport beacon fails to rotate at its normal operating speed within 30 seconds or if an omni-directional design fails to flash within 30 seconds, it must be considered cause for rejection.

f. Failure of the airport beacon lamps to start and operate at their rated intensities is considered cause for rejection.

g. Any deterioration or failure of components will be considered cause for rejection.

4.2.5 Ice Load Test.
NOTE: *This test may be combined with the low temperature test.*

a. An ice test must be conducted by building up a 0.5 inch (12.7 millimeters) coating of ice on the beacon while it is inoperative in a cold test chamber maintained at the temperatures in paragraph 4.2.4.

b. The test chamber temperature must be maintained for 4 hours after the required ice load has been built up.

c. Apply power to the airport beacon. The beacon must operate after applying the power and rotate at its normal operating speed (if not omni-directional) within 30 seconds.

4.2.6 Rain Test.
a. The rain test must be conducted per MIL-STD-810F (1 January 2000), Part 2, Laboratory Test Methods, Method 506.4, Procedure I, paragraph 4.4.2, Procedure I.

(1) A simulated rainfall rate of 4 inches per hour or 1.7 millimeters per minute must be used.

(2) Wind velocity must be 40 miles per hour or 18 meters per second.

(3) The airport beacon equipment must be at ambient temperature for this test.

b. Perform an operability test of the equipment in the test chamber prior to the rain test.

c. At the conclusion of rain testing and after a preliminary inspection for water intrusion, operate the equipment.

CAUTION: *Perform a preliminary inspection before energizing the equipment to remove any accumulated water and prevent a potential shock hazard to test personnel.*

d. If water has penetrated the lamp housings or pedestal, it must be considered cause for rejection.

e. If the airport beacon does not rotate at the correct speed or flash at the correct rate, it must be considered cause for rejection.

4.2.7 Solar Radiation Test
a. A sunshine test must be conducted in accordance with MIL-STD-810F (1 January 2000), Part 2, Laboratory Test Methods, Method 505.4, paragraph 4.4.3, Procedure II for all airport beacons with nonmetallic exterior parts.

b. The airport beacon must be subjected to a minimum of 56 cycles.

c. The test unit must operate and perform all specified functions after this test.

d. Any evidence of deterioration of plastic parts: chalking, bleaching, cracking, hazing, or color changes (yellowing) to the thermoplastic lenses of the test unit must be causes for rejection.

e. For thermoplastic optical lenses or covers, the photometric performance must be measured after this test.

4.2.8 Electromagnetic Interference Tests.

a. Beacons must be tested for and not exceed the conducted power line emission limits per 47 CFR Part 15 Section 15.107b:

Frequency of Emission (MHz)	Quasi-peak Emissions: Decibels per microvolt (dB/μV)	Average Emissions: Decibels per microvolt (dB/μV)
0.15 – 0.5	79	66
0.5 -30.0	73	60

b. Beacons must be tested for and not exceed the radiated emission limits per 47 CFR Part 15.109b for the following limits at 33 feet (10 meters):

Frequency of Emission (MHz)	Field Strength microvolts per meter, (μV/m)
30-88	90
88-216	150
216-960	210
Above 960	300

4.2.9 Surge Suppression Test.

a. Subject the beacon (optional equipment connected) to 2 pulses at 15 second intervals to a combination wave 1.2μS/50μS and 8μS/20μS (10,000 volt, 5,000 amp) test pulse per the descriptions in IEEE C62.41, Table 4, Location Category C2.

b. See IEEE C62.41-1991 Section 9.3 for test condition and test generator information.

c. See IEEE C62.41-1991 Section 9.4 for a detailed combination pulse generation and parameters discussion.

d. See also IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits, for guidance about equipment test methods.

e. The equipment under test must operate normally at the conclusion of the test.

CHAPTER 5. PRODUCTION TESTS.

5.1 Production Tests.

a. All production airport beacons must be inspected for compliance to the requirements of this AC for:

(1) materials,
(2) finish,
(3) quality of workmanship.

b. Each unit must be operated for one hour (including any optional equipment) with the following checks:

(1) Rotation speed (if not an omni-directional type).
(2) Check lamp intensity per Table 1. and elevation.
(3) Proper operation of any optional equipment to be shipped with unit.

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