



ANSI E1.9 – 2007 (R2017)
**Reporting Photometric Performance Data for
Luminaires Used in Entertainment Lighting**

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Interest category codes:

CP = custom-market producer DE = designer MP = mass-market producer
 DR = dealer rental company G = general interest U = user

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Foreword

(This foreword is not part of the standard and contains no requirements.)

The purpose of this standard is to describe a method of reporting the photometric performance of luminaires being sold for or offered for use in entertainment lighting that is both detailed and easy to understand for people in this entertainment lighting market. The document is not intended to describe the data that is required for automated lighting design and calculation software, although the reported data may be used for such purposes, nor is it intended to describe a machine-readable data reporting format.

1 Scope

This standard is intended to be used for the presentation of photometric data for luminaires used in the entertainment and performance industries. This standard defines the minimum photometric data to be presented on documents purporting to accurately describe the photometric performance of these luminaires. It does not prohibit the presentation of information in addition to that required by this standard.

2 Definitions

For the purposes of this standard the following terms shall be defined as:

2.1 cutoff field area: The area on a plane illuminated by a luminaire in which the level of illumination is 3% of the maximum or above.

2.2 cutoff illuminance angle: The angle on a plane perpendicular to an illuminated surface with the center of a luminaire's exit aperture at the apex, and the rays of the angle passing through the iso-illuminance line where the illumination is 3% of the maximum illuminance. The plane is defined by the center of the luminaire's exit aperture and a line on the illuminated surface passing through the center of the illuminated area.

2.3 exit aperture: The luminous opening of a luminaire through which the light beam is emitted. With multiple lamp or multiple compartment luminaires, the exit aperture shall be taken as the entire array of lamps or compartments.

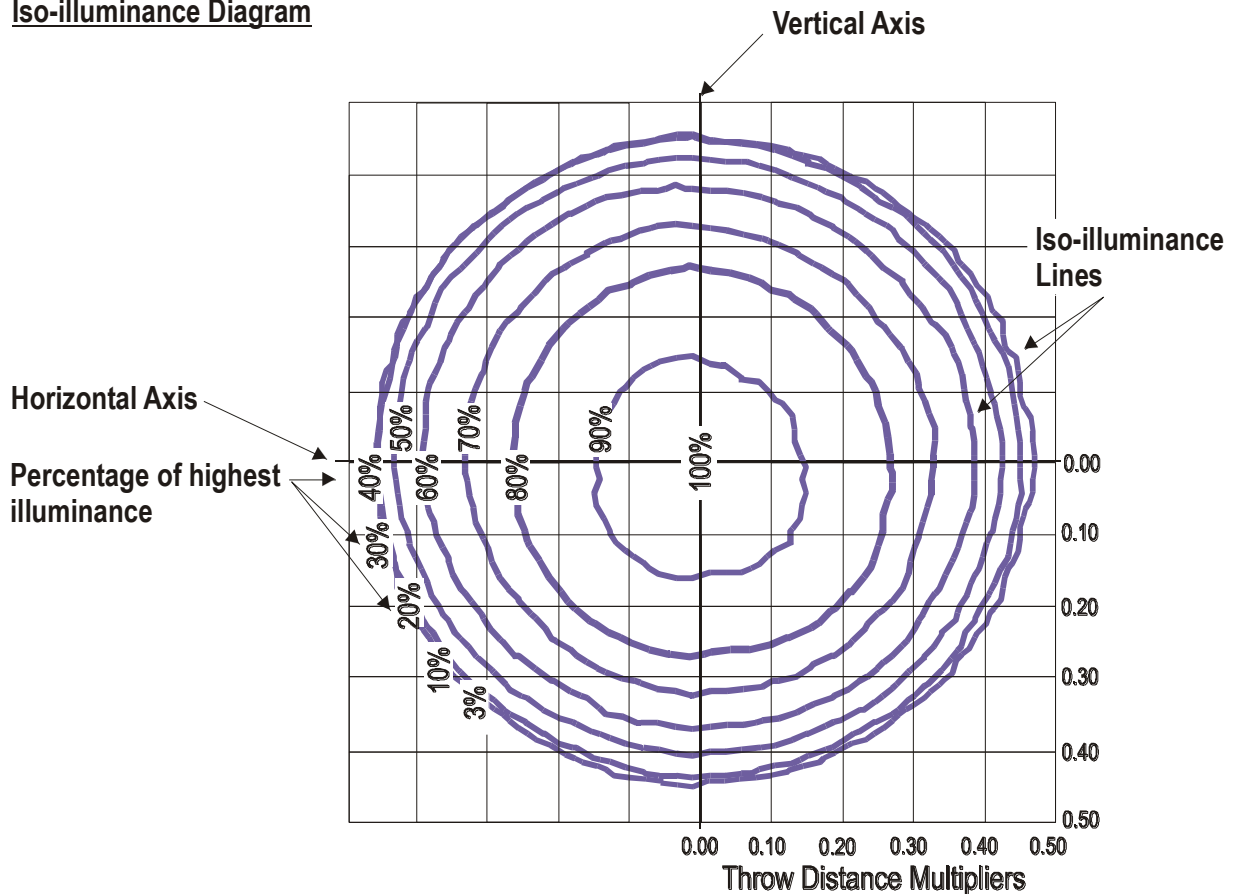
2.4 far-field luminaire: A luminaire whose intended operating distance from the subject is greater or equal to the distance at which the inverse-square law can be used to predict an illumination level.

2.5 half-peak illuminance angle: The angle on a plane perpendicular to an illuminated surface with the center of a luminaire's exit aperture at the apex, and the rays of the angle passing through the iso-illuminance line where the illumination is 50% of the maximum illuminance. The plane is defined by the center of the luminaire's exit aperture and a line on the illuminated surface passing through the center of the illuminated area.

2.6 half-peak lumens: The lumens falling within the area of an iso-illuminance diagram in which the level of illumination is 50% of the peak illuminance level or more.

2.7 hard focus: A focus position that achieves the most clearly defined edge to the illuminated area.

2.8 illuminance: The areal density of the luminous flux incident at a point on a surface.

Iso-illuminance Diagram

2.9 iso-illuminance diagram: A series of iso-illuminance lines for various illuminance values plotted on a common graph.

2.10 iso-illuminance line: A line plotted on a set of coordinates to show all the points on an illuminated surface where illuminance is the same.

2.11 light beam: The light emitted from the exit aperture of a luminaire.

2.12 luminaire efficacy: The ratio of a luminaire's total lumen output divided by the power consumed, expressed in terms of "lumens per watt."

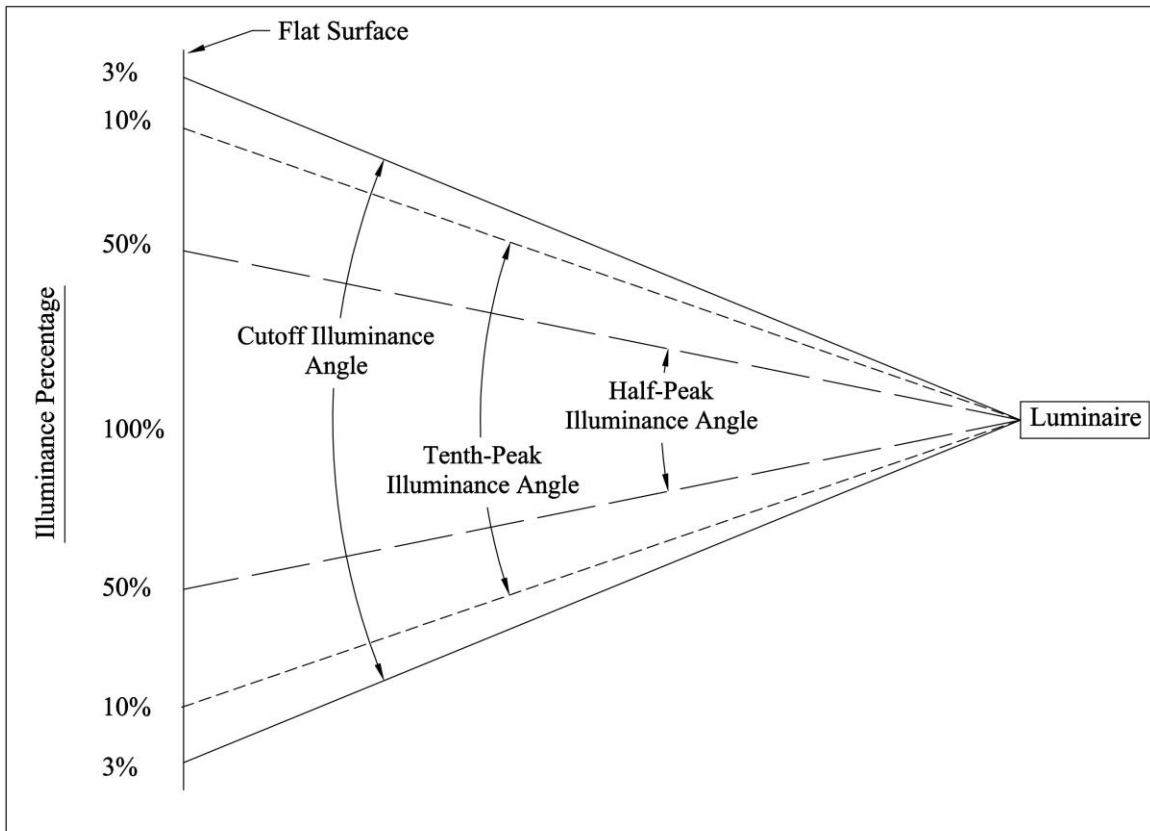
2.13 luminaire: A complete lighting unit, consisting of a lamp or lamps, together with all the parts that are needed to position and protect the lamp or lamps, distribute the light, and connect the lamp or lamps to the power supply.

2.14 near-field luminaire: A luminaire whose intended operating distance from the subject is shorter than the minimum distance at which the inverse-square law can be used to predict an illumination level.

2.15 one-tenth-peak illuminance angle: The angle on a plane perpendicular to an illuminated surface with the center of a luminaire's exit aperture at the apex, and the rays of the angle passing through the iso-illuminance line where the illumination is 10% of the maximum illuminance. The plane is defined by the center of the luminaire's exit aperture and a line on the illuminated surface passing through the center of the illuminated area.

2.16 one-tenth-peak lumens: The lumens falling within the area of an iso-illuminance diagram that is illuminated to a level of 10% and above of the peak illumination level.

2.17 throw distance: The distance between the exit aperture of the luminaire and the surface being illuminated.



2.18 throw distance multiplier: a number that when multiplied by the throw distance yields the distance of a point in the cutoff field area from the origin.

2.19 total lumen output: The lumens falling within the area of an iso-illuminance diagram that is illuminated to a level of 3% of the peak illumination level and above.

2.20 variable angle luminaire: A luminaire that has optical elements designed to be adjusted to vary the total area illuminated at a given throw distance.

3 Requirements

Photometric data reports for all types of instruments shall include the following information.

Numerical values shall be expressed with sufficient numbers of significant digits to accurately represent the information without implying a greater precision than was present in the original photometric data.

3.1 General requirements

3.1.1 Organization responsible for the product

The manufacturer's name, trademark, or other descriptive marking identifying the name of the organization that is responsible for the product shall be provided.

3.1.2 Catalog number, model number, or name of luminaire

The catalog number, model number, name, or other unambiguous identifier for the luminaire shall be noted.

3.1.3 Lamp used for gathering photometric data

The lamp or lamps used to gather the reported performance data shall be specified in an unambiguous manner. The lamp manufacturer's rated wattage, life, color temperature, voltage and lumens (if available) shall be included. If the luminaire is designed to use the lamp in any way that will raise the output, such as operation at a higher than rated voltage or at a higher than normal ambient temperature, such information shall be noted in boldface. In such cases, the nominal lumen output of the lamp as tested shall be reported.

3.1.4 Ballast factor

Where applicable, reported data shall be normalized to a ballast factor of one.

3.1.5 Photometric procedure

A brief statement shall be provided to describe how the data was gathered. If any nationally or internationally recognized standard or recommended practice for measuring luminaire performance was used, it shall be cited. The date and laboratory where the tests were performed shall be noted.

3.1.6 Lumen output

The total lumen output, shall be reported and labeled "Total Lumen Output." The half-peak lumens shall be reported and labeled "Half-Peak Lumens." The one-tenth-peak lumens shall be reported and labeled "One-Tenth-Peak Lumens."

3.1.7 Marking of conformance with this standard

Luminaire performance data sheets that conform to this standard shall be marked "Data sheet conforms to American National Standard E1.9 -XXXX" with XXXX being replaced by the year of the edition of the E1.9 standard used.

3.2 Requirements for illuminance distribution diagrams

3.2.1 General diagram requirements

Iso-illuminance diagrams plotted on Cartesian coordinate graphs shall be provided. The origin of the graph shall be located at the point of the illuminated area closest to the center of the exit aperture of the luminaire and with the plane of that graph perpendicular to the line from the origin to the center of the exit aperture. All quadrants shall be shown. The iso-illuminance lines labeled in percentages shall be drawn in 10% increments from 100% to 10%, with the highest illumination level taken as 100%. In addition, the iso-illuminance line or lines showing the 3% illumination level shall be shown. All the required iso-illuminance lines shall be shown and labeled, even if the lines coincide. Distances from the origin shall be linear and continuous, and be marked in units that are decimal fractions of the throw distance at which the iso-illuminance data was measured. The X and Y axis showing units from the origin shall be labeled "Throw Distance Multiplier."

A vertical Y axis, a horizontal X axis, and grid lines marking each of the throw distance multipliers shall be shown. The lines marking the throw distance multipliers shall be sufficiently numerous to facilitate reading the iso-illuminance lines, but in no case fewer than four. The throw distance multipliers shall be rounded off so there are no more than two digits to the right of the decimal point.

No portion of the diagram shall be drawn at a different scale than any other portion. No portion of the diagram may be omitted if there is data in that section that can be reported.

The maximum level of illumination at a specified throw distance shall be given. This statement may take the form of "100%=5,000 lux (465 fc) at 10m (33 ft.)," for example.

The iso-illuminance diagram shall have the following formula clearly displayed near it:

$$(distance\ from\ origin) = (throw\ distance) \times (throw\ distance\ multiplier)$$

3.2.2 Requirements for specific luminaire types

The general requirements described in 3.2.1 are modified or supplemented for specific luminaire types, as described below.

3.2.2.1 Far-field luminaires

The throw distance used to gather the illumination data presented and the intended operating distance shall be indicated.

3.2.2.2 Near-field luminaires

Iso-illuminance diagrams for throw distances at the farthest, closest, and middle of the intended range shall be included. The relevant throw distances shall be clearly indicated. The levels of illumination shall be noted. It shall be noted that the luminaire is designed for near-field use.

3.2.2.3 Variable angle luminaires

Iso-illuminance diagrams shall be provided for two optical settings. The suggested settings would be for the maximum, and minimum cutoff illuminance angles, but the median cutoff illuminance angle is also acceptable, either in addition to the other cutoff angles or as a substitute for one of them. The diagrams shall be labeled "Maximum Spread," "Median Spread," or "Minimum Spread," or other title, as appropriate.

3.2.2.4 Multiple-lamp luminaires

Units with multiple lamps that are intended to be used together on a circuit shall include iso-illuminance diagrams showing the luminaire's performance with these lamps used in concert. It shall not be permissible to show the performance of a single lamp, unless the unit is designed to be used in that fashion. If a luminaire is available in different configurations, for example, with different numbers of lamps or different types of lamps, and these different configurations have different lumen outputs or illumination distributions, then the exact testing configuration shall be reported. Luminaires with multiple tilting, swiveling, or similarly adjustable lamps shall also comply with the provisions in section 3.2.2.7.

3.2.2.5 Luminaires with adjustable candlepower distribution

Luminaires with adjustments intended to change the candlepower distribution in their light beam without modifying the size of the cutoff field area shall include iso-illuminance diagrams for the unit when it is adjusted to produce the candlepower distribution the luminaire manufacturer anticipates will be most often used by the end-user. In all cases, the luminaire shall be adjusted for a hard focus. The required hard focus shall be noted clearly with the words "Hard Focus."

Each iso-illuminance diagram shall be clearly labeled to indicate the distribution shown. Suggested labels include:

"Flat distribution" for a luminaire adjusted to produce a cutoff field area of the greatest uniformity.

"Peak distribution" for a luminaire adjusted to produce the maximum illuminance value somewhere in the field area.

"Blending distribution" for a luminaire adjusted to produce a light beam that will blend well with the beams from other luminaires to create an even illumination over a large area.

If a blending distribution is shown, it shall be characterized by giving the percentage of light beam overlap needed to achieve blending illumination with this distribution. The range of illumination fluctuation with that overlap shall be reported in terms of percent deviation, plus or minus, from the mean level of illumination.

3.2.2.6 Luminaires with conical light beams

Far-field luminaires whose light beams are essentially conical shall have the half-peak illuminance angle, one-tenth-peak illuminance angle, and cutoff illuminance angle noted. The angles shall be expressed in degrees and labeled, "Half-Peak Illuminance Angle," "One-Tenth-Peak Illuminance Angle," and "Cutoff Illuminance Angle".

3.2.2.7 Luminaires with tilting, swiveling, or similarly adjustable optical systems

Instruments with optical systems that tilt or swivel within the housing, or that are similarly adjustable, shall have the setting of the optical system used for generating the presented data reported.

3.2.2.8 Luminaires designed to illuminate a flat surface at an oblique angle

In the case of a luminaire designed to illuminate a surface at an oblique angle such as a cyclorama luminaire, the iso-illuminance diagram shall be representative of the illumination produced at one or more angles that are within the range at which the luminaire is intended to be used. The angle of the luminaire in relation to the surface that was used for generating the presented data shall be reported.

4 Optional information

It is suggested the data sheet carrying photometric performance data also include the following information:

4.1 Alternate lamps

4.1.1 Description of alternate lamps that may be used with the luminaire

A lamp or selection of lamps that may be used in the luminaire in lieu of the lamps reported per 3.1.3 of this standard should be listed. This lamp or lamps shall be specified in an unambiguous manner. This specification should be by ANSI lamp designation, by lamp code, by manufacturer's brand name, by manufacturer's ordering code or part number, by a complete description of the relevant physical parameters, or by any combination of the above methods. The relevant physical parameters may include, but are not limited to, base type, maximum overall length, light center length, envelope type and size, voltage rating, and maximum wattage.

4.1.2 Photometric performance with alternate lamps

The total lumen output with an alternate lamp may be listed. If this data is provided, it shall be derived from actual luminaire test data. The luminaire performance data presented shall not be derived from calculations that compare the alternate lamp's total lumen with the total lumen output of the tested lamp. It shall be clearly noted that the illumination distribution produced with the alternate lamp may not be the same as the illumination distribution produced with the tested lamp or lamps.

If presenting more detailed photometric performance data is desired for the luminaire than this subsection provides, then the reporting of the performance data shall meet all the requirements of Section 3 and its subsections in this standard.

4.2 Luminaire efficacy

The efficacy of the luminaire and lamp combination used to generate the data reported shall be in terms of "lumens per watt."

4.3 Focusing range

The range of throw distances in which a well-defined image or hard edge can be projected by the luminaire, if applicable, may be included, and shall be labeled as "Focusing Range."

4.4 Working angles

The recommended angular range of luminaire operating position may be noted, and labeled as "Working Angles."

4.5 Ambient temperatures

The recommended maximum and minimum ambient temperatures for operation of the luminaire may be noted, and labeled as "Ambient Temperature Limits."

4.6 Overall dimensions and weight

The physical dimensions and weight of the luminaire should be noted.

4.7 Color frame and color media cut size

The color media holder size and color media cut size should be noted.

4.8 Pattern or gobo size and media

The size of the pattern (gobo), if used, should be noted. The maximum thickness of the pattern as well as the width and height should be noted, as well as any restrictions on the type of material that may be used for the pattern.

4.9 Ballast data

If a ballast is used, ballast specifications in addition to the ballast factor should be included.

4.10 Ratings, listings, and approvals

Any performance and safety ratings, listings, or approvals carried by the luminaire should be included.

4.11 Candlepower distribution diagrams

A candlepower diagram plotted on a Cartesian coordinate graph may be provided, but only for far-field luminaires. Two curves may be plotted on one graph.

If two curves are plotted on one graph, one curve shall be a representation of the candlepower distribution on a plane on which the center of the beam lies. The other curve then shall be a representation of the candlepower distribution on a plane cutting through the center of the beam and perpendicular to the first plane. The vertical axis of the graph shall show the candlepower, and the horizontal axis shall show the angular displacement from the center of the beam. If the light beam is substantially radially symmetrical, only one quadrant need be shown.