

USAI® Lighting

BeveLED Mini®
Complete 3"

Glossary of Lighting Terms

- Measuring Light
- Light Sources & Technologies
- Optics & Accessories
- Color Properties
- Lighting Design
- Regulations, Standards & Energy Codes
- Additional Resource

Measuring Light

Beam: A cone of light emitted by a luminaire (see beam illustration).

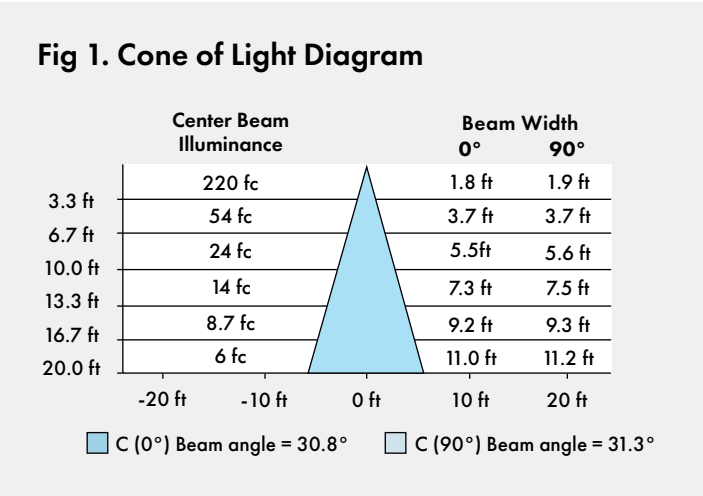
Beam Angle: The beam angle is the angle at which the light output drops to 50% of the fixture’s maximum intensity at the center of the beam (See Fig 2).

Candela (cd): The measure of luminous intensity emitted by a light source in a given direction.

Center Beam Candlepower (CBCP): The luminous intensity (in candelas) of a light source measured at the center of its beam. For symmetric beams, this is usually the maximum intensity (See Fig 2).

Circadian Lighting: Lighting that works with a persons natural circadian rhythm, a 24-hour internal clock. By following the day to night cycle of natural lighting, artificial lights can be optimized for human health and wellness (see fig 3).

Cone of Light Diagram: A reference guide for checking the amount of light that can be delivered by a source. It provides FC measurements and beam width at standard heights.

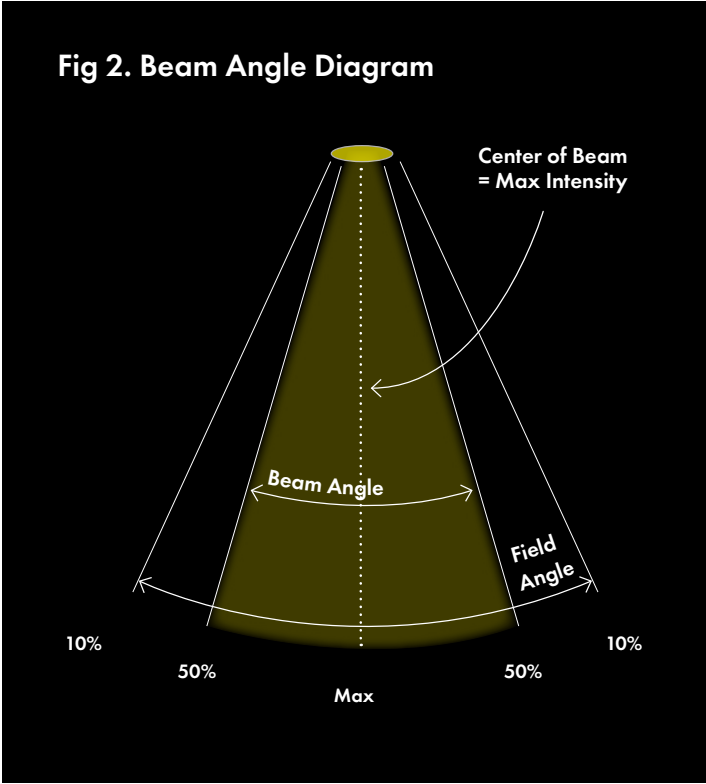


Cut Off Angle: The lowest angle from the nadir (directly below) where the light source is not visible. Smaller cutoff angles are better for glare control. (see fig 4).

Delivered Lumens: Represent the actual amount of light that reaches and illuminates the target area, accounting for losses from housing, optics, and other components.

Efficacy: A metric describing how much light is delivered from a luminaire as a result of power consumption. Luminaire efficacy is typically reported in lumens per watt (lm/W).

Field Angle: The field angle is the angle at which the light output falls to 10% of the fixture’s maximum intensity at the center of the beam (see beam illustration).



Footcandle (FC): Imperial unit of illuminance which measures the amount of light reaching a surface. Equal to one lumen per square foot (lm/ft2). 1 fc=10.76 lux.

Illuminance: The density of light incident on a surface. Two common units used to measure illuminance are footcandles (lm/ft2) and lux (lm/m2).

Light Output: Luminous flux, measured in lumens. The light output rating of a lamp is a measure of its total integrated light output. See also lumen.

Light Reflectance Value (LRV): A measurement of how much light a surface reflects versus absorbs. It’s a scale from 0 (complete Light Absorption, Black) to 100 (full light reflection, White). Lighter surfaces with higher LRV reflect more light, while darker surfaces absorb more.

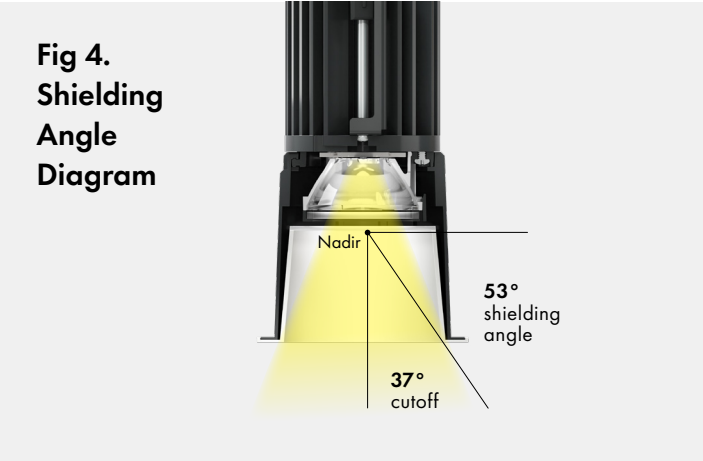
Lumen: The unit of measurement of the quantity of light produced by a source. A 60-watt incandescent lamp produces approximately 800 lumens.

Luminance: The luminous intensity of a surface of a given projected area. Luminance is closely related to the brightness of an object. Units of luminance include foot-lamberts, candelas/m2, or nits. 1 cd/m2 = 1 nit = 0.292 fl.

Lux: Standard international unit of illuminance which measures the amount of light reaching a surface. Equal to 1 lumen per square meter. 1fc=10.76 lux.

Shielding Angle: The lowest angle from the horizontal ceiling line where the light source becomes visible (see fig 4).

Fig 3. Circadian Lighting Example/Color Temperatures



Source Lumens: Measurement of the total light output from the light source (LED, Halogen, Incandescent, etc), without considering any losses from housing or optics.

Unified Glare Rating (UGR): A lighting metric used to quantify the level of potential discomfort glare experienced by an occupant in interior lighting spaces. It ranges from 5 (low glare) to 40 (high glare), with lower values indicating better visual comfort.

Watts (W): A unit of power that measures the rate of energy consumption. In lighting, it indicates how much electrical power a light source uses. Higher wattage usually means more energy use, but not necessarily more brightness, especially with LED technology.

Light Sources & Technologies

A-Lamp: Refers to the shape of the common incandescent “light bulb” used throughout homes in North America.

Chip On Board (COB): Multiple LEDS (nine or more) that are behind a phosphor coating.

Discreet LED Board: Singular high performing LED that can be arrayed on a board.

Driver: Electronic device that acts as a power supply for an LED module, converting main power to a specific current and voltage required to light a given LED. Constant current drivers maintain a constant current for the LED while varying voltage, and constant voltage drivers maintain a fixed voltage differential while allowing variable current based on load.

Heatsink: A device, usually a thermally conductive metal mass, that dissipates heat away from sensitive electronic components such as the LED and driver.

Light Emitting Diode (LED): Semiconductor that emits light when a voltage differential is applied.

Light Engine: An integrated assembly of the components necessary to make an LED luminaire work, including LED packages or modules, drivers, and other optical, thermal, mechanical, and electrical components.

Lamp Life: Also known as the average rated life, is the number of hours at which half of a large group of lamps have failed when operated under standard testing conditions.

L70 (HOURS): Used to describe the LED’s expected light output over its stated life span. “L70” predicts when the LED will reach 70% of its initial lumen output, in number of hours. Typical L70 values for LED luminaires are 50,000 hrs or more.

Tunable White Light: Lighting technology that allows the color temperature of white light to be adjusted, typically ranging from warm white 2200K to cool white 6000K. This enables users to change the mood, ambiance, or functional quality of light in a space to suit different needs or times of day.

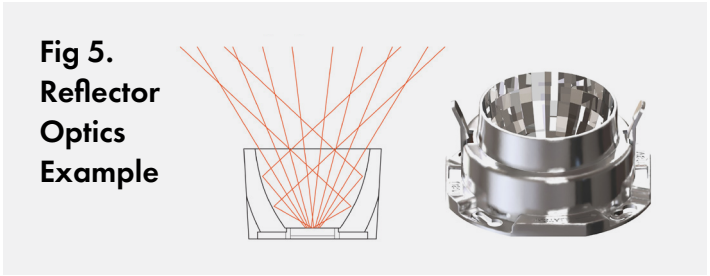
Warm Dimming: Lighting technology that mimics the behavior of traditional incandescent bulbs by gradually shifting the light color from bright white to a warmer, amber tone as it dims. This creates a cozy, natural dimming experience ideal for settings like homes, restaurants, or hospitality spaces.

WRGB: LED lighting technology that combines white, red, green, and blue LEDs in a single fixture. This allows for a wide range of color mixing, including pure and bespoke architectural white light, as well as vibrant colors and soft pastels for versatile lighting effects.

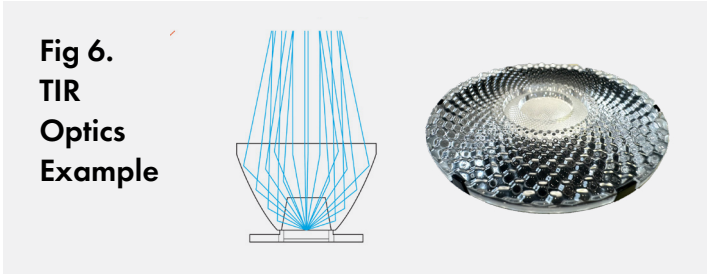
Optics & Accessories

OPTICS

Reflector Optics: The use of mirror-like surfaces to manipulate light beams in various optical systems (see fig 5).



Total Internal Reflection (TIR) Optic: A compound lens that consists of a refractive lens inside a reflector. Light is reflected back into lens instead of refracting. Used to shape and focus light beams (see fig 6).



ACCESSORIES

Color Lens (Filters): Changes light color for aesthetic or functional purposes, common in retail and stage lighting.

Diffusion: A translucent material placed in front of a light source. It can be used to soften the edge of a light and increase beam angle.

Elliptical: Creates an oval beam for artwork.

Frosted Lens: Diffuses light for a soft glow, suitable for homes or restaurants.

Hexcell Louver: Reduces glare with a honeycomb grid pattern, used in galleries or museums.

Linear Spread Lens: Creates a linear line of light.

Narrow Beam Shaping: Focuses light for highlighting specific areas.

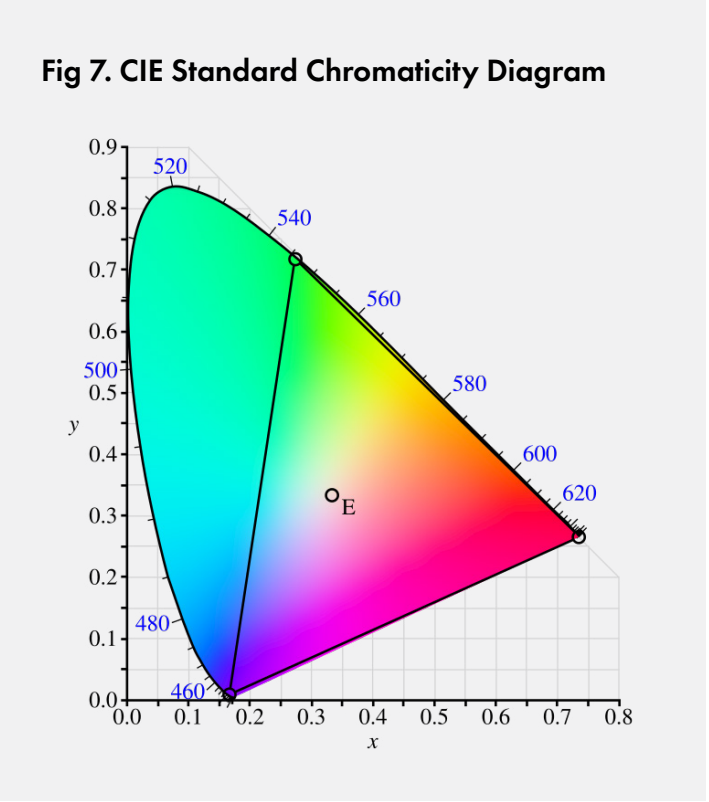
Wide Beam Shaping: Spreads light over a larger area.

Color Properties

Color Rendering Index (CRI): A standard metric used to describe the effect of a light source on the color appearance of objects being illuminated, with a CRI of 100 as the maximum CRI possible. In general, a lower CRI (less than 80) indicates that some colors may appear unnatural when illuminated by the light source.

Correlated Color Temperature (CCT): Approximately describes the color appearance of white light in terms of warm vs. cool. CCT is measured in degrees Kelvin (K). A low color temperature (3000K and lower) describes a warm source, such as a typical incandescent lamp. A high color temperature (4000K and higher) describes a cool source, such as a fluorescent lamp.

CIE Standard Chromaticity Diagram: A diagram in which the x and y chromaticity coordinates are plotted in rectangular coordinates. This diagram provides a concrete reference point with which to describe the chrominicity of a given light source. The diagram may be based on the CIE 1931 Standard Observer or the CIE 1964 Supplementary Standard Observer. The 1931 diagram is most commonly used.



Fidelity Index (Rf): Similar to the older CIE CRI (Color Rendering Index), it measures how accurately a light source renders colors compared to a reference, with a score up to 100.

Gamut Area Index (Rg): Describes the saturation of colors rendered by the light source. Values around 100 mean no change in saturation; values above 100 indicate more saturated (vivid) colors, and below 100 indicate desaturation.

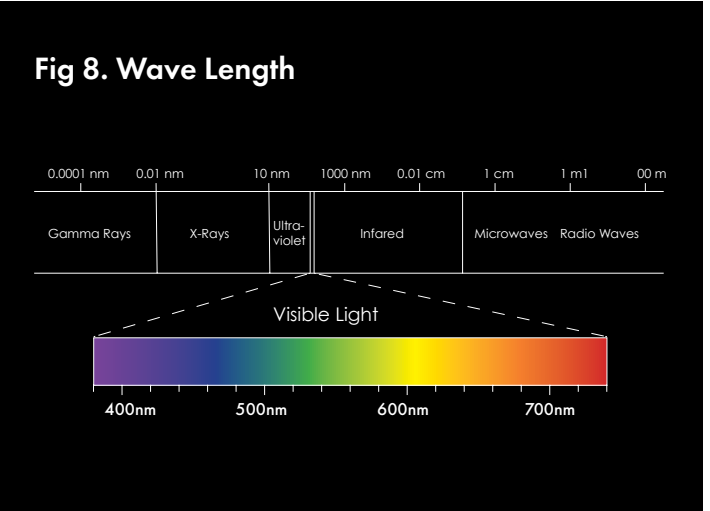
MacAdam Ellipse: A metric to convey the perceivable amount of color shift away from a target x,y chromaticity coordinate. MacAdam Ellipses are referred to in “steps” which represents 1 standard deviation from the target. ANSI standards recommend that manufactures stay within a “4-step” MacAdam Ellipse.

R9: A specific color rendering metric that measures how well a light source renders strong red tones, which are important for accurately displaying skin tones, food, and artwork. Unlike general CRI, which averages several colors, R9 focuses on saturated red and is not always included in standard CRI scores, making it a key indicator of high-quality lighting.

Spectral Power Distribution (SPD): A measurement that details the quantity of light emitted at each specific wavelength in the visible spectrum for a given light source. SPD measurements are used to calculate CCT, CRI, chromaticity coordinates and more.

TM-30: An alternative method that describes color rendering properties of light sources developed by the Illuminating Engineering Society (IES) that builds on CIE principles. It includes: Fidelity Index (Rf) and Gamut Area Index (Rg).

Wavelength: Distance from peak to peak of a waveform. For visible electromagnetic radiation (light), this is measured in nanometers. The visible light spectrum ranges from approximately 400-700 nanometers with blue & violet wavelengths at the lower end and red wavelengths at the upper end.



Application of Light

Accent Light: A lighting technique that emphasizes a particular object or draws attention to a specific area by increasing light level contrast or color contrast on the subject illuminated. Typically achieved with adjustable luminaires.

Ambient Light: Lighting that is designed to provide a uniform light level throughout an area.

Adjustable Luminaire: A luminaire with the ability to be aimed in a specific direction through tilt and rotation mechanisms.

Downlight: A luminaire that emits light in a downward direction, in an approximately symmetric cone of light. Sometimes referred to as a “Can Light”, “High-Hat”, or “Pot-Light”.

Light: Scientifically, Light is visible electromagnetic radiation. Light is the messenger for humanity’s visible interaction with the surrounding world. Light reveals the environment, conveys information, regulates sleep-wake cycles, and impacts mood.

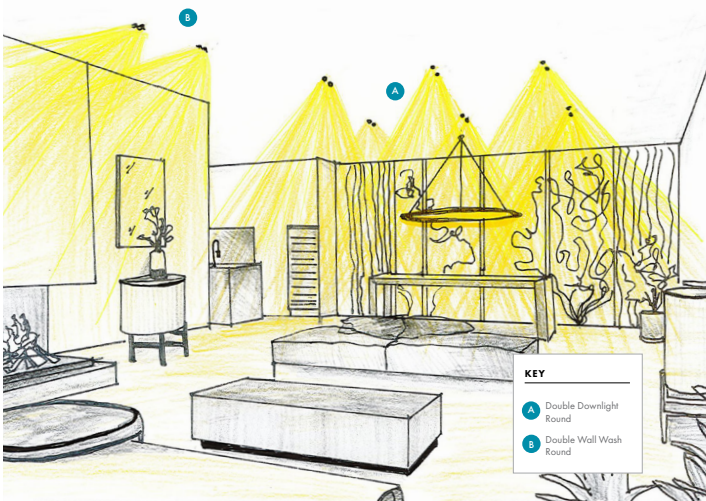
Luminaire: A complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light.

Spacing Criterion: A parameter for indoor light fixtures that is the estimated maximum ratio of fixture spacing to fixture mounting height above the work plane for a regular array of light fixtures that will result in an acceptably uniform illuminance on the work plane.

Wall Wash: A luminaire with a fixed asymmetric light distribution designed to distribute light evenly across the vertical surface of a wall.

Wall Washing: A technique that provides uniform light levels on a vertical surface that appears fairly even from top to bottom and side to side. Typically achieved with wall wash luminaires.

Fig 9: Downlight and Wall Wash Examples



Regulations, Standards & Energy Codes

ASHRAE 90.1: Published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, this standard is widely adopted throughout the US for minimum requirements for energy-efficient design. ASHRAE 90.1 is updated every three years, but adoption by different states and municipalities varies.

Ingress Protection (IP): Rating defines the level of protection a device has against solids (like dust) and liquids (like water). It’s shown as IPXX, where the first digit is for solids and the second for liquids—the higher the numbers, the greater the protection.

National Electrical Code (NEC): A regionally adoptable standard for the safe installation of electrical wiring and equipment in the UCE. It is part of the National Fire Code published by the National Fire Protection Association (NFPA). The NEC is updated every three years.

Title 24/JA8: California’s Building Energy Efficiency Standards that regulates various products and appliances. Lighting products used in residential projects must meet “high efficacy lighting” standards as outlined in Joint Appendix 8 and listed in the California Energy Commission’s on-line database as JA8 compliant.

Underwriters Laboratory (UL): A global safety consulting and certification company that wrote the safety standard for lighting fixtures. Fixtures installed in the U.S. are required to pass testing certification to UL standards. UL is also one of several Nationally Recognized Test Laboratories (NRTLs) approved to perform safety testing by the U.S. federal agency Occupational Safety and Health Administration (OSHA). Other NRTLs include ETL and CSA.

UL Dry/Damp/Wet ratings indicate where a lighting fixture can be safely installed:

- Dry: For indoor areas with no moisture (e.g., bedrooms).
- Damp: For areas with humidity or occasional moisture (e.g., bathrooms, covered patios).
- Wet: For direct exposure to water (e.g., showers, outdoor locations).

FEDERALLY FUNDED INFRASTRUCTURE PROJECTS

USAI Lighting proudly manufactures in Upstate New York and works closely with local vendors and suppliers whenever possible. We support federally funded infrastructure projects by offering solutions that meet sourcing standards under the Buy American Act (BAA), Build America, Buy America (BABA), and other agency-specific Buy America requirements. Visit usailighting.com/buy-american for more details.

Build America, Buy America (BABA): Enacted as part of the 2021 Infrastructure, Investment and Jobs Act. All iron, steel, manufactured products, and construction materials used in US infrastructure projects must be produced in the United States.



Project: Lakeside Montana Residence
Lighting Design: CED - Kalispell
Interior Design: Camp Martini
Photograph: Gibeon Photography

SUSTAINABILITY PROJECTS

Declare: The ILFI manages the Declare label platform and product approvals for LBC projects. The Declare label is the only label that screens products against the Red List, a list of the worst chemicals in terms of their toxicity to our planet and to people.

International Living Future Institute (ILFI) is a global nonprofit organization that operates the Living Building Challenge (LBC), a performance standard for healthy and sustainable buildings.

Living Building Challenge (LBC): A rigorous green building certification program that promotes sustainability by requiring buildings to be self-sufficient, environmentally regenerative, and socially responsible across categories like energy, water, materials, and health.

WELL is a building standard focused on enhancing human health and well-being through design. It evaluates factors like air, light, water, comfort, and mental health to create healthier indoor environments. WELL lighting standards promote environments that provide good visual acuity in a variety of tasks to avoid eye strain and to minimize productivity losses and headaches.

Glossary of Lighting Terms

USAI® Lighting



SOURCES

Lighting Research Center, Rensselaer Polytechnic Institute: www.lrc.rpi.edu

IES Handbook, 10th Edition.

ADDITIONAL REFERENCE SOURCES

Where to go for more information:

Illuminating Engineering Society (IES): Organization geared towards improving the lighted environment by providing recommendations and guidance on standard lighting practice. www.ies.org

International Association of Lighting Designers (IALD): Organization of Professional Lighting Designers. Website provides a search tool to identify lighting designers by geographic location and project type. www.iald.org

USAI Lighting Website: Source of the best, high performance lighting products available. www.usailighting.com

FRONT COVER

Project: Publicis Groupe, 'Le Truc' Clubhouse

Architect: A + I

Lighting Design: Lighting Workshop

Photograph: OTTO / Magda Biernat

ABOVE

Project: Oceanside Library

Architect: MDA Designgroup Architects and Planners

Photographer: Robert Lowell Photography

USAI®
Lighting

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