

GLOSSARY OF TERMS

AlGaAs: One of the material systems for manufacturing LEDs that produce light in the red and amber portions of the visible light spectrum.

AlInGaP: The Light-Emitting Diode (LED) chip technology containing Aluminum, Indium, Gallium and Phosphorous to produce red, orange and amber-colors.

Alternating Current (AC): Electrical current in which the direction is reversed at regular intervals or cycles; in the U.S. the standard is 120 reversals or 60 cycles per second. (See Direct Current).

Ambient Temperature (Ta): The air temperature surrounding the device.

Ampere (Amps): The SI unit measuring the intensity of electrical current flow.

American National Standards Institute (ANSI): The organization that coordinates voluntary guidelines and standards for the electrical and other industries.

ANSI Binning: The system defined by the American National Standards Institute for the binning specifications for light emitting diodes.

Arc Gap: The distance measured between the electrodes of an arc discharge lamp (HID lamp).

Ballast: A device used to provide the starting voltage and regulate the current to discharge lamps, including Fluorescent, Metal Halide, and High Pressure Sodium.

Ballast Types for Fluorescent Lamps:

Instant Start: A type of Fluorescent lamp ballast that applies high voltage across the lamp with no preheating of the cathode.

Preheat: A Fluorescent lamp type that requires a starter, which enables the electrodes to be properly heated before allowing the ballast to supply the correct current flow.

Programmed Rapid Start: A Fluorescent lamp starting method where the cathodes are heated prior to lamp ignition, then the heat is removed or reduced once the lamp has started.

Rapid Start: A type of Fluorescent ballast that applies a low filament voltage to preheat the cathodes. Simultaneously, a starting voltage (lower than that used in instant start ballasts) is also applied to strike the arc. When the cathodes are hot enough the lamp will strike.

Ballast Factor: The percentage of rated lumens from the same lamp using a commercial ballast as compared to an ANSI reference ballast. A ballast factor of .94 means the commercial ballast produces 94% of light produced by an ANSI reference ballast operating same lamp. The ballast factor can be referred to in the catalogs from Fluorescent ballast manufacturers.

Base: The physical end of the lamp that inserts into the lamp socket or holder.

Beam Angle (Spread): The central part of the beam of light from a reflector lamp (i.e. BR, MR and PAR types) where the intensity is 50% of the maximum candle power.

Bin (Binning): The systematic dividing of distribution of performance parameters (Flux, Wavelength or CCT, and Vf) in to small finite groupings that may be selected to optimize assembly performance.

Black Body / Black Body Radiator: An object that absorbs all electromagnetic radiation falling on it. Because it reflects no light, a black body appears black. As a black body is heated to incandescence, it radiates light in a sequence of colors, from red to orange to yellow to white to blue, depending on its temperature. This color sequence describes a curve within a color space, known as the black-body curve.

Black Body Curve: A curve within a color space describing the sequence of colors emitted by a black-body radiator at different temperatures.

Burn Position: The position in which lamps are designed to be operated. Often designated by the position of the lamp base. BU = Base Up, Horiz = Horizontal.

CSA (Canadian Standards Association): The CSA International certification mark, recognized in Canada, the U.S. and around the world, provides increased assurance of quality and safety.



Candela (cd): The measuring unit of luminous intensity of a light source in a given direction. A light source may have different intensities depending upon the given direction which the measurement is taken. The old measurement equated to the amount of light produced by a standard candle.

Candlepower (cp): Luminous intensity expressed in candelas. Typically used in measuring the luminous intensity distribution of a reflector lamp or lighting fixture.

Case Temperature: The temperature measured at the LED package or case.

Center Beam Candle Power (CBCP): The intensity of light produced at the center of a reflector's beam, expressed in candelas.

CE Mark: Formerly known as the EC mark, the CE mark signifies that a product meets the conformity standards for products sold in the European Economic Area (EEA). The CE stands for "Conformité Européene," which is French for "European Conformity."



Chromaticity of a Color: The quality of color that includes its dominant or complementary wavelength, purity, hue, and saturation. Independent of luminance or brightness.

Color Rendering Index (CRI): An index from 0-100 measuring a light source's ability to render color accurately. Sodium lamps can have a CRI as low as 22, while tungsten Halogen lamps can have a CRI as high as 100. Any lamps rated above 80 CRI tend to be of good color rendering.

Conformal Phosphor Coating: Phosphor application process that uniformly coats the LED chip with phosphor.

Consortium for Energy Efficiency (CEE): The goal of this organization is to work toward lasting and verifiable energy efficiency. Develops standards to define performance in the market and verify the impact of savings.

Correlated Color Temperature (CCT) or Color Temperature: A scientific measurement of the balance of wavelengths making up any "white" light. The unit of measurement is in Kelvin(K) which determines the warm or cool appearance of a light source. The lower the color temperature, the warmer or more yellow is the appearance. The higher the color temperature, the cooler or bluer is the appearance. Typical color temperatures are 2800K for Incandescent, 3000K for Halogen, 4200K Cool White Fluorescent, and 5000K daylight Fluorescent and Metal Halide.

Compact Fluorescent Lamp (CFL): The standard term given to small diameter Fluorescent lamps, some of which have built-in ballasts and medium screw bases for replacement of Incandescent lamps.

Types of CFL Lamps:

Integrated Compact Fluorescent (CFLi): A type of Fluorescent lamp ballast that applies high voltage across the lamp with no preheating of the cathode. This lamp has an integrated ballast.

Non-Integrated Compact Fluorescent (CFLni): These non-integrated CFL lamps are without an integrated ballast.

Current: A measure of the rate of flow of electricity, expressed in amperes.

Daylight: Generally defined as having a correlated color temperature of 6000K or higher.

Direct Current (DC): A type of electrical current and distribution by which electricity flows in one direction through the conductor. Battery operated systems are typical DC applications. (See Alternating Current)

Dichroic: "Two Color"; Often referred to in lighting as the dichroic coating applied to glass filters and glass reflectors to change or control the color of light passing through the lighting fixture or lamp.

Die: Also known as Chip: the active light emitting semiconductor compound.

Digital Addressable Lighting Interface (DALI): A digital communications protocol for controlling and dimming lighting fixtures, originally developed in Europe.

Dimmable: A lamp that has varying lumen output controlled by dimming device.

Dimmer: An electronic device used to vary the lumen output of a lamp.

Directional Light Source: A light source that emits light only in the direction it is pointed or oriented.

Discharge Lamps: See High Intensity Discharge Lamp (HID).

DLC (Design Lights Consortium): The goal of this organization is to accelerate energy efficiency in the solid-state lighting commercial sector. The DLC mark signifies a quality, high efficiency LED product.



DMX: A digital communications protocol for controlling lighting fixtures, originally developed to control stage lighting.

Efficacy: The measured effectiveness at which lamps convert power (measured in watts) into light (measured in lumens). Also see Lumens Per Watt.

Ellipsoidal Reflector: A reflector designed to converge light so that the beam is focused to a single point. This often results in the reduction of light trapped within a lighting fixture.

ELV-type Dimmer: An electronic low voltage dimmer, used to dim LED lighting fixtures with electronic transformers.

Energy Independence and Security Act 2007 (EISA 2007): Section 321 establishes increased energy efficiency requirements for general service lamps. Incandescent bulbs are not banned, but rather certain familiar incandescent lamps in the market do not meet the new standard.

Energy Policy Act (EPACT): Energy legislation passed in 1992 by the U.S. Congress. The law involves a variety of different industries including lighting. The lighting section of the legislation covers lamp labeling and minimum energy efficiency standards (lumens/watt) for many commonly used lamps including incandescent and Fluorescent sources.

ENERGY STAR®: The Energy Star mark signifies that the product has met certain set standards in regards to efficiency, quality and lamp life.



ETL Listed Mark: See Intertek Testing Services (ETL).

Federal Communications Commission (FCC): The FCC mark ensures the product complies with the necessary requirement to avoid interference with radio frequencies.



Filament: A tungsten wire that when heated electrically generates radiation in the visible, infrared and ultraviolet ranges.

Fluorescent Lamp: A low-pressure mercury discharge lamp in which an electric discharge of ultraviolet energy excites a coating of phosphor on the lamp glass and transforms some of that energy to visible light. Fluorescent lamps are manufactured in many different forms including linear four foot T8 lamps, U-shaped and Coiled Compact Fluorescent lamps with integrated ballasts. Fluorescent lamps typically require a matching ballast to operate the lamp properly.

Footcandle (fc): A unit of illuminance. One footcandle is equal to one lumen per square foot (lmft²); see Lux. A lighting designer would use a measure of footcandles at the work surface to determine the proper illumination level for office lighting.

Forward voltage: LEDs are current driven devices. If an external current is passed through the device, a forward voltage will be developed across the diode.

Frequency: The number of times per second that an alternating current system reverses from positive to negative and back to positive, expressed in hertz (Hz).

Ghosting: An effect that occurs when lighting fixtures in the OFF state faintly glow as a result of residual voltage in the circuit.

Goniophotometer: A photometric device for testing the luminous intensity distribution, efficiency, and luminous flux of luminaires.

Halogen Lamp: A higher pressure, high temperature incandescent lamp containing Halogen gas that recycles tungsten back onto the filament surface. The Halogen cycle allows for higher efficacy, higher color temperature, and longer life cycles than incandescent lamps.

Heat Sink: A part of the thermal system that conducts or disperses heat away from sensitive components, such as LEDs and electronics.

Hertz (Hz): A unit of frequency equal to one cycle per second (see Frequency). The U.S. standard is 60 Hz.

High Power LED: A high power LED, sometimes referred to as a power LED, is one that is driven at a current of 350 mA or higher.

High Intensity Discharge Lamp (HID): A high pressure lamp in which high intensity light is produced by an electrical arc source. General terminology for Mercury lamps, Metal Halide lamps, High Pressure Sodium lamps, High Pressure Xenon lamps, or any other high intensity arc discharge source.

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Hot / Cold Factor: The relative light output performance at a temperature compared to the light output at a nominal or test temperature.

Hot Testing: LED performance testing and specification at an elevated temperature of 85°C.

Hue: The attribute of colors that permits them to be classified as red, yellow, green, blue or an intermediate between any contiguous pair of these colors.

Ignitor: A ballast component that produces enough voltage to cause the initial arc to form across electrodes in HID lamps.

Illuminance: The concentration of luminous flux on a surface. Measured in Lux (lx) or Footcandles (fc).

Inboard Power Integration: An approach to power management that integrates the power supply directly into a fixture's circuitry, creating an efficient power stage that consolidates line voltage conversion and LED current regulation.

InGaN LED: LED (Light-Emitting Diode) semiconductor material system containing Indium, Gallium, and Nitrogen to produce green, blue and white-colored LED light sources.

Initial Lumens: The luminous output of a new light source. Quantity of light output measured after 100 hours of operation using controlled system characteristics.

Integrating Sphere: A device used for a variety of optical, photometric, or radiometric measurements.

Incandescent Lamp: A lamp that provides light when a filament, surrounded by inert gas, is heated to incandescence by an electric current.

Inrush Current: The current generated during the initial start up of a lamp system. Inrush current can be several times higher than the operating current of a lamp.

Instant Start: See Ballast.

Intertek Testing Services (ETL): Originally a mark of Electrical Testing Services, the ETL Listed Mark now signifies that the lamp has been tested to meet North American safety standards by Intertek Testing Services.



Instant Start: A type of Fluorescent lamp ballast that applies high voltage across the lamp with no preheating of the cathode.

Junction Temperature: Junction temperature, noted as T_j , is the temperature of the LED's active region.

Kelvin: A unit of color temperature measurement. (See Correlated Color Temperature).

Kilowatt (kW): A measure of electrical power equal to 1000 watts.

Kilowatt Hour (kW/hr): 1000 watts of electricity used for one hour. A unit of measure that utility companies utilize for billing purposes.

LCL: See Light Center Length.

Leadership in Energy & Environmental Design (LEED): The U.S. Green Building Council's (USGBC) green building certification program that requires buildings to satisfy certain prerequisites to achieve different levels of certification.

Leading Edge Dimmer: A type of dimmer that regulates power to lamps by delaying the leading edge of each half-cycle of AC power. Compatible with many LED fixtures.

LED: A solid state lighting device. (See Light-Emitting Diode).

LED Array: An assembly of LED packages or dies on a printed circuit board or substrate, possibly with optical elements and additional thermal, mechanical, and electrical interfaces that are intended to connect to the load side of an LED driver.

LED Chip (Chip): The light producing semiconductor device that may or may not be incorporated into an LED.

LED Driver: An electronic circuit that converts input power into a current source — a source in which current remains constant despite fluctuations in voltage. An LED driver protects LEDs from normal voltage fluctuations, over voltages, and voltage spikes.

LED Light Engine: An integrated assembly comprised of LEDs or LED arrays, LED driver, and other optical, thermal, mechanical, and electrical components.

LED Luminaire: A complete lighting unit consisting of LED-based light emitting elements and a matched driver together with parts to distribute light, to position and protect the light emitting elements, and to connect the unit to a branch circuit. The LED based light emitting elements may take the form of LED packages, (components), LED arrays (modules) LED Light Engine, or LED lamps. The LED luminaire is intended to connect directly to a branch circuit.

Life, Average Rated: Average life is a value for life expectancy based on laboratory tests using controlled system characteristics measured in hours where 50% are still operating.

Light Center Length (LCL): The distance between the center of the filament or arc tube and the reference plane (usually the bottom of the lamp base).

Light-Emitting Diode (LED): A Light Emitting Diode (LED) is a solid-state semiconductor device that converts electrical energy directly into light. On its most basic level, the semiconductor is comprised of two regions. The p-region contains positive electrical charges while the n-region contains negative electrical charges. When voltage is applied and current begins to flow, the electrons move across the n-region into the p-region. The process of an electron moving through the p-n junction releases energy. The dispersion of this energy produces photons with visible wavelengths.

LM-79: Photometric testing report for LEDs that contains information such as lumens, color temperature, power, current, etc.

LM-80: Testing report for LEDs that contains information on the lifespan of the LED.

Lumens: The international unit of measurement for light. A measurement of total quantity of light output from an electric lamp in all directions for a given unit of time. (See Initial Lumens and Mean Lumens)

Lumens Per Watt (LPW, Lm/W): Efficacy; Lumen output divided by lamp watts consumed.

Lumen Depreciation: The decrease in lumen output of a light source over time, until failure.

Luminance: Photometric brightness, luminance is a measure of the flux emitted from, or reflected by, a relatively flat and uniform surface. Luminance may be thought of as luminous intensity per unit area. Candelas per square meter (cd/m²).

Luminous Intensity: See Candela (cd).

Lux (lx): An international metric unit of luminance. One lux is equal to 1 lumen per square meter (see footcandle). 1 lx = 1 lumen per square meter (lm/m²).

MacAdam Ellipse: A MacAdam ellipse is the region on a chromaticity diagram which contains all colors which are indistinguishable, to the average human eye, from the color at the center of the ellipse.

Material System: The material, such as aluminum indium gallium phosphide (AlInGaP) and indium gallium nitride (InGaN), used within an LED to produce light of a specific color.

Maximum Overall Length (MOL): The end-to-end measurement of a lamp.

MCPCB: A widely accepted Printed Circuit Board (PCB) material with a Metal Core (MC) for better thermal performance.

Mean Lumens: The luminous output of a light source at 40% lamp life. Average quantity of light output over the life of the lamp. High Pressure Sodium and Incandescent lamps are measured for mean lumens at 50% of lamp life. Fluorescent and Metal Halide lamps are measured for mean lumens at 40% of rated lamp life.

Metal Halide Lamp: A member of the high intensity discharge light source family. The light from this source is produced by the radiation from mercury, together with halides of metals such as sodium, scandium, indium and dysprosium. Metal Halide light sources typically require a matching ballast to operate the lamp properly. Metal Halide lamps are available in single-ended and double-ended varieties. Lamp design varies from tubular to elliptical shapes.

MOL: See Maximum Overall Length.

MR16: Mirrored reflector lamp with a 16/8 inch diameter. Most MR16 lamps are made up of a Halogen capsule surrounded by a dichroic coated reflector. Alignment of the filament within the reflector is critical to creating a precision beam. Smaller diameter lamps include MR11 and MR8.

Nanometer (nm): A unit of length equal to 10⁻⁹ meter. It is the preferred unit of measure for light in the visible and ultraviolet regions of the energy spectrum.

NTSC Color Space: The range of colors within the CIE Chromaticity Diagram included when combining phosphor based RGB sources in CRTs such as televisions and computer monitors.

NEMA: National Electrical Manufacturers Association.

Neodymium: A rare earth metal used in reflector and glass coatings to help reduce the yellow light emitted by the lamp.

Ohms Law: Volts x Amps = Watts

Onboard Power Integration: An approach to power management that integrates the power supply into a fixture's housing, eliminating the need for an external power supply.

Operating Current: Steady state current consumed by a lamp at rated watts.

Operating Position: See burn position.

Organic Light-emitting Diodes (OLED): Organic Light-Emitting Diodes (OLEDs) are based on organic (carbon based) materials. In contrast to LEDs, which are small point sources, OLEDs are made in sheets which provide a diffuse area light source. OLED technology is used in display applications such as cell phones and PDA screens.

P-N Junction: An area on an LED chip where the positively and negatively charged regions meet. When current is applied, the electrons move across the n region into the p region. The process of an electron moving through the p-n junction releases energy. The dispersion of this energy produces photons with visible wavelengths. In short, the area on a chip where light is produced.

PAR (Parabolic Aluminized Reflector): A type of Halogen lamp made up of an aluminum coated parabolic glass reflector that controls its light beam by either the reflector or front glass.

Parabolic Reflector: A smooth surfaced, curved reflector formed in the shape of a parabola which focuses all the light at the focal point to create a parallel beam.

Phosphor: An inorganic chemical compound processed into a powder and deposited on the inner glass surface of certain discharge lamps. Phosphors absorb short wavelength ultraviolet radiation, transform it and emits it as visible light.

Phosphor Conversion: This is the process by which photons from an LED chip are converted to a different color. White LEDs and some colored LEDs are made using phosphor conversion.

Picograms Per Lumen-Hour (pg/lu-hr): A measure of the amount of mercury in a lamp per unit of light delivered over the life of the lamp.

Planckian Black Body Locus: The line on the CIE Chromaticity Diagram that describes the color temperature of an object when heated from approximately 1,000K to more than 10,000K.

Power Factor (PF): A measure of the effectiveness of which an electrical device converts amperes to watts. Power factors can range from 0 to 1.0. A high power factor means that an electrical system is utilizing power efficiently. Devices with power factors of greater than 0.90 are considered "high power factor."

Preheat: See Ballast.

Programmed Rapid Start: See Ballast.

Pulse Width Modulation (PWM): A method, used by LED drivers, to regulate the amount of energy to the LEDs. PWM turns LEDs on and off at high frequency, reducing total ON time to achieve a desired dimming level.

Rapid Start: See Ballast.

REACH: Reach stands for Registration, Evaluation, Authorization and Restriction of Chemicals. This is a directive of the European Union created for the purpose of regulating chemicals that can cause harm to one's health and the environment. The REACH Compliance mark signifies that the product meets the standards of this regulation.



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Remote Phosphor: A phosphor conversion technique in which photons from a royal blue LED pass through a phosphor material that is not attached to the LED chip.

RGB Color Model: An additive color model in which red, green, and blue light are added together in different proportions to produce a broad range of colors, including white.

RGB White: A method of producing white light by combining the output from red, green, and blue LEDs.

RoHS (Restriction of Hazardous Substances) (Directive 2002/95/EC): Also known as Lead-Free, this initiative originated in the European Union. A product is considered compliant and receives the RoHS Compliant mark when the proper standards are met for restricted materials.



Remote Phosphor: A phosphor conversion technique in which photons from a royal blue LED pass through a phosphor material that is not attached to the LED chip.

SMDs: Surface-mount LEDs.

Solid-State lighting: A description of the devices that do not contain moving parts or parts that can break, rupture, shatter, leak or contaminate the environment.

Spectral Distribution: The distribution and intensity of spectral energy of a lamp. Concerning the lighting industry, the UV, visible and IR regions are most important. Visible and UV light are most often measured in nanometers while IR light is most often measured in micrometers.

Spectral Luminous Efficiency Function: A bell-shaped curve describing the sensitivity of a human eye with normal vision to the spectrum of visible light. Also known as the eye-sensitivity curve.

Standard deviation of color matching (SDCM): Describes the difference between two colors. A difference of one to three SDCM "steps" is virtually imperceptible, a difference of four SDCM steps is just noticeable, and a difference of more than four SDCM steps is readily visible.

TCLP Test: See Toxicity Characteristic Leaching Procedure (TCLP)

Thermal management: Controlling the operating temperature of the product through design, examples includes heat sinks and improved airflow.

Thermal Pad Temperature: The measured temperature of the thermal pad during testing. The thermal pad aides in the conduction of heat away from the component being cooled and into the heatsink.

Thermal Resistance (K/W): The property of a material's ability to conduct heat.

Total Harmonic Distortion (THD): A measure of the distortion of an electrical wave form. THD is expressed in percent and may refer to individual electrical loads (such as a ballast). The ANSI recommendation is for THD to be no greater than 32%.

Toxic Characteristic Leaching Procedure (TCLP): Under the Federal Resource Conservation Recovery Act, this test determines if waste is hazardous by simulating the product's effects in a landfill disposal.

Trailing Edge Dimmer: A type of dimmer that regulates power to lamps by delaying the end of each half-cycle of AC power. Compatible with many LED fixtures.

Transformer: An electrical device used to raise or lower the voltage of alternating current.

Trigger Start: A circuit used to eliminate the starter and start the preheat lamp almost instantly. In this circuit each electrode is connected to a separate winding in the ballast so the electrode is continuously heated.

Tunable White Light: White-light LED fixtures that combine channels of warm white and cool white LEDs to produce a range of color temperatures.

Tungsten: A heavy metal used in wire filaments and electrodes. Also known as Wolfram.

UL (Underwriters Laboratories): An organization that tests equipment for electrical and fire safety. Qualified products display the UL Mark.



Ultraviolet (UV): The portion of the electromagnetic spectrum in which the longest wavelength is just below the visible spectrum, extending from approximately 4nm to approximately 400nm.

Voltage: The force or the pressure of electricity. For incandescent and Halogen lamps, voltage generally refers to the line voltage of which the lamp should be connected. For HID, Fluorescent, and Low-Voltage lamps, the voltage generally refers to the operating voltage which the lamp is connected to a power supply (ballast or transformer) after it has warmed up.

Wall Plug Efficiency: This typically refers to the effectiveness of converting electrical power to light output. It is defined as the ratio of the radiant flux to the input electrical power.

Watt: A unit of electrical power used to indicate power consumption.

Wavelength: Distance between two successive points of a periodic wave. The wavelengths of light are typically expressed in nanometers (nm), or billionths of a meter.

Xenon, Low Pressure: A filament lamp in which Xenon gas is contained in a quartz capsule with a low pressure atmosphere. This includes Xenon Wedge-Base, Festoon, and Bi-pin type lamps. Xenon is a heavy, colorless, chemically inactive, monatomic gaseous element.

Xenon, High Pressure: A short-arc discharge lamp which Xenon gas is contained in a hard glass or special quartz capsule with a high pressure atmosphere. This includes lamps used for searchlight, followspots, and medical applications. Xenon is a heavy, colorless, chemically inactive, monatomic gaseous element.