# Common LED Specs Explained

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## Understanding Common Terms When Selecting an LED Lighting Solution and Why These are Important

### Total Lumens

Total Lumens is the total light output of a given light source and is a measure of the total quantity of light given out by a light source. In an omni-directional light source, up to 78% of the light out may be redirected with a majority of the redirected light reflected back into the luminaire.

Understanding lumens will give you the best idea of how much light is produced from a lamp.

### Delivered Lumens

Delivered Lumens are the total illuminance delivered directly to the work surface. In a directed light source such as an LED, approximately 80% of the total lumen output is delivered with none of the lumens reflected back into the luminaire. Therefore, a LED light source with a lower rated lumen output may deliver the same or more useful light to a work surface and a traditional lighting luminaire with a higher rated lumen output.

Knowing delivered lumens will give you the best idea of how much light is produced from a luminaire.

### Lamp Wattage

In a light source such as an LED lamp, a Watt is a unit of measure of the amount of energy it takes per hour to produce a certain amount of light. A higher wattage may indicate a brighter light or it may indicate a light using less efficient LED components. Lamp Wattage is the watts (W) consumed by the LED lamp. In a typical LED lamp, watts are equated to lumen output:

- 40W incandescent = 9-4W LED = 380 – 460 lumens
- 60W incandescent = 31-15W LED = 500-600 lumens
- 100W incandescent = 13-7W LED = 1,700 – 1,800 lumens

Lamp Wattage is important because the lower the wattage, the lower the energy bill.

### System Wattage

LED System Watts is the total sum of LED Lamp Watts plus watts used by the LED Driver. When comparing a LED lighting source to an incumbent lighting source in a retrofit, the System Wattage may be the Wattage of the incumbent lamp plus the lamp ballast.

When planning a retrofit, understanding System Wattage will provide a more accurate metric to calculate the time for payback.

### Efficacy (LPW)

Efficacy is a measure of the efficiency of how well a light source produces visible light. For a LED light source, it is the calculated lumens output per watt input (LPW). Commonly, utility companies base rebate eligibility for LED retrofits on LPW specifications published by the DesignLights Consortium® (DLC®), a standards body defining energy efficiency lighting metrics agreed upon by utility companies and manufacturers.

For consumers, efficacy means the higher the value, the more efficient the light source. Greater efficiency may enable you to save energy by dimming lights imperceptibly, space lighting farther apart, or reduce the number of luminaries installed.

### Rated Life

The Rated Life of an LED light source is the statistically-determined estimate of median operation life and is dependent upon specific operating conditions. It's an indication of how long the LED should operate before reaching 70% of its initial brightness.

In terms of rated life, LEDs operate differently than traditional light sources. A traditional light source has a rated length of time before it burns out – for example a halogen lamp may last 4,000 hours. An LED light source doesn't burn out, it slowly dims. For an LED, rated life is the point in time when it's 30% dimmer; 50,000 hours or more depending upon use.

### Lumen Maintenance

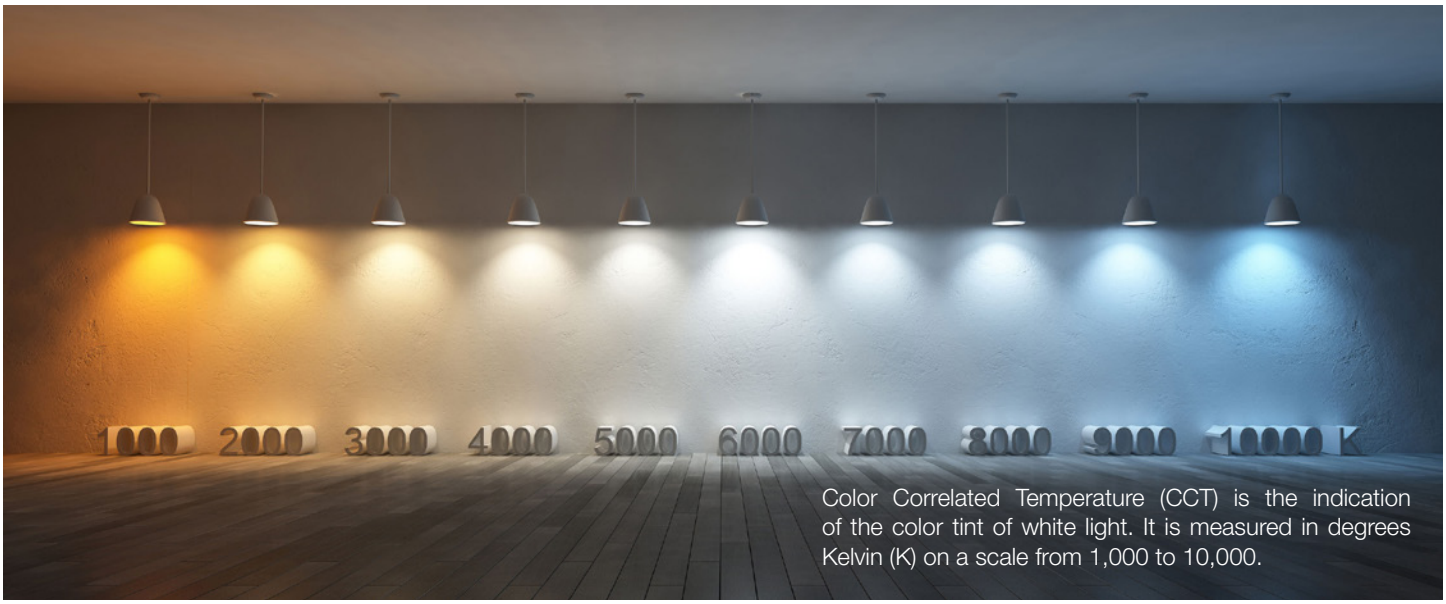
There are two common measures of lumen maintenance for LED light sources:

- LM-80 defines lumen maintenance as the elapsed operating time at which a specified percentage of the lumen depreciation or lumen output is reached, compared to its initial light output. This is done at the device level.
- L70, the point in time at which the LED light source lumen output has reached 70% of its initial light output, is the common threshold for recommended module life. A LED light source typically will not burn out. It gradually dims and when it reaches 70%, it is nominally considered to be at the end of its life.

Understanding Lumen Maintenance will help you recognize when it's time to replace the LED lamp.

### Color Temperature (CCT)

Color Correlated Temperature (CCT) is the indication of the color tint of white light. It is measured in degrees Kelvin (K) on a scale from 1,000 to 10,000. Commercial lighting color temperatures typically fall between 2000K and 6500K. Warm White, closer to a more yellow-white incandescent bulb in appearance, is typically in the 2000K – 3000K CCT range. Neutral White, similar to cool white or bright white common from a fluorescent, is in the 3100K – 4500K CCT range. And Daylight White, named for its near daylight quality, typically falls in a 4600K – 6500K range.

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Color Temperature is important when choosing the right whiteness of light for a particular space. A restaurant might want a warmer light to create a cozy space. An office might want a brighter neutral light to promote productivity. A warehouse or parking garage might want to use a cooler, more vibrant, daylight white.

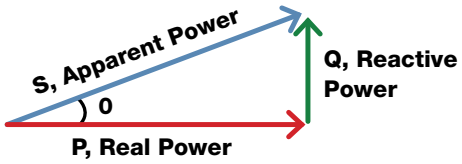
## Color Rendering Index (CRI)

A Color Rendering Index (CRI) is a quantitative measure of the ability of a light source to reveal the colors of various objects faithfully in comparison with an ideal or natural light source. The higher the CRI value of the light source, the closer colors will appear as compared to a natural light source. CRI is calculated from the differences in the chromaticities of eight standard color samples (CIE 1995) when illuminated by a light source and when illuminated at the same correlated color temperature (CCT). Commonly in commercial applications for LED light sources, a CRI of 80+ is normal. LED light sources in particular have a higher CRI value for R9, or red, color rendering making them a desirable light source for retail stores and art studio, as red is a common color in the accurate representation of many fabrics, produce, and skin tones.


In most cases, natural colors are preferred. CRI means, red apples will look red!

## Power Factor (PF)

Power factor is an expression of how effectively the LED light source is using electricity. It is the ratio between the Real Power and the Apparent Power and is shown on the Power Factor Triangle.




On the triangle, Real Power is the power actually utilized in the LED light and is expressed in Watts. Reactive Power is the unusable or unutilized power, typically created by capacitive and inductive loads caused by circuit operation. Apparent Power is sum of Real Power and Reactive Power.

A higher Real Power benefits both the user and the utility company. Commonly LED lighting specifications will indicate a PF of >90% (0.90) or greater, which when paired with a Total Harmonic Distortion of 20% or less, may qualify the LED lamp for utility rebates.

Power Factor can maximize the overall current-carrying capacity, improve voltage to the LED array and reduce power losses. In short, if you see a Power Factor over .9, you'll have improved efficiency.

## Total Harmonic Distortion (THD)

THD is important to any building. A low THD means a reduction in peak currents, less heating, and lower losses. THD could potentially shorten equipment lifespan, increase power losses on the transmission line, heat up transformers, and affect the performance of the LEDs and other electronics. It's typically related to Power Factor (PF). Commonly, LED lighting specifications will indicate a THD of <20% or greater, which when paired with a Power Factor of 0.9 or greater, may qualify the LED lamp for utility rebates.

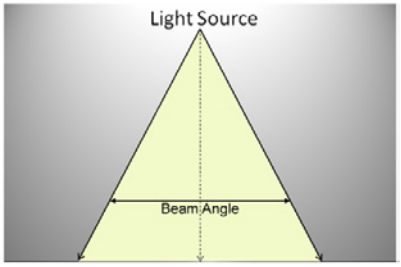
## Ballast Factor

Ballast factor (BF) is the measured ability of a particular ballast to produce light from the fluorescent lamp(s) it powers. Ballast factor is calculated by dividing the lumen output of a lamp-ballast combination by the lumen output of the same lamp(s) on a reference ballast. A ballast factor of <1 means a particular fluorescent system will produce less light (lumens) than the reference ballast and a factor of >1 means it will produce more light. Some linear LED specifications will indicate the performance of the LED lamp when driven by low, nominal, or high BF ballasts.

Ballast Factor, which applies only to installations where an LED lamp is driven by the installed ballast, affects the lumen output, watts consumed, and rated life of the LED. A lamp connected to a LBF ballast will consume less power and operate longer, but will output less light. A LED lamp connected to an HBF ballast will put out more light but will consume more power and operate for a shorter period of time.

## Beam Angle/Beam Spread

The beam angle of a LED lamp lets you know how much area it will illuminate at a given distance. The lighting industry has developed a uniform formula to determine the beam angle. The light output (lumens) is measured at the center of the beam and then light strength (intensity) is measured out from the center until it is 50% of the intensity level (as measured in the center). The beam angle is then determined in degrees (see below). The beam spread is the area the light covers with at least 10% of the maximum beam angle. This is not typically tested for, but is commonly estimated at double the beam angle.




50% Light Intensity Maximum Light Intensity 50% Light Intensity

Beam Angle helps you determine spacing in your lighting plan, avoiding dark spots (cave effects) where areas are under lit.

## Luminance (cd/m2)

Luminance is a photometric measure of the luminous intensity per unit area of light travelling in a given direction. It describes the amount of light passed through, emitted or reflected from a particular area and falling within a given solid angle. The unit for luminance is candela per square meter (cd/m2), also referred to as a nit. The luminance indicates how much brightness is perceived by an eye looking at the surface of an object from a particular angle of view.

| LUMINANCE (cd/m2) | | | |
|---|---|---|---|
| Vert Angle | At 0° Horiz | At 45° Horiz | At 90° Horiz |
| PLA14-36W840-U | | | |
| 45° | 4987 | 5374 | 5571 |
| 55° | 4416 | 5121 | 5409 |
| 65° | 3692 | 4738 | 5095 |
| 75° | 2873 | 4219 | 2929 |
| 85° | 1950 | 2016 | 1147 |

When designing a lighting project,it is important to keep luminance in mind. The brightness the eye perceives at the work surface may be less than the lamp specifies; an over-lit space uncomfortable and energy inefficient.

## Candela Plot

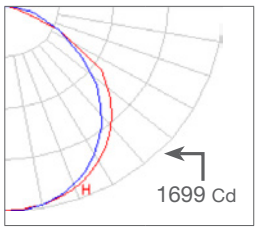
The Candela plot or chart is an analysis of a LED luminaire's distribution of light and its impact on lighting levels and potential glare conditions. IES files are commonly formatted files of data used to simulate the light performance in lighting design software. Each luminaire and lamp combination has a unique Candela plot or chart. The type of lamp installation, for example powered by a ballast, driven by a LED driver or connected directly to line voltage will also affect the specific lamp photometrics.

The Candela distribution curve is a graphical representation of relative light intensity for a single vertical plane based on candela readings across the vertical viewing angles (0–180°) for a single horizontal viewing angle. For example, in the case of an elongated pendant luminaire with two LED T8 lamps, the two curves will have a different shape.

Looking straight at the luminaire, positioned along the 0-180° axis, the upward beam is spherical (lower left). The downward beam however, is split into two spherical planes, because of the luminaire's reflector. The light is blocked by the reflector in the center.

If you look at the luminaire from the side, positioned along the 90-270° axis, a spherical plane is shown upwards and downwards. This means the luminaire distributes light evenly. The luminaire's elongated shape does not mean the curve is flat or elongated. The light distribution is measured from the central point of the luminaire.

| CANDELA PLOT | |
|---|---|
| Angles | 10° |




The Candela Plot aides designers in determining what type of luminaire to use, luminaire placement, spacing, and height in order to deliver sufficient luminance.

**To learn more about LED technology:**

- Register at the Universal University

**For specific questions about LED technology:**

- Send your questions to Technical Engineering Services at tes@unvlt.com
- Contact your local Universal Lighting representative
- Email marketing@unvlt.com