Shedding Light on Light Output

There exists basic illumination criteria that one must understand before comparing similar LED products against each other. Until recently, the most commonly available lighting products utilized incandescent light sources. Design and manufacturing processes associated with incandescent lighting are fairly consistent from brand to brand. Therefore aesthetics play a significant role in defining differences between these products.

The rapid development of LED technology has introduced many more aspects from which consumers must carefully make comparisons from product to product. The best product for any one application is no longer the one that simply meets a style requirement. Now, power consumption, luminous flux, efficacy, illuminance, and beam angle must be scrutinized in addition to more familiar aspects such as colors, shapes, and finishes. In order to make the most informed decisions, it is important to understand some key lighting terms.

Luminous Flux

Luminous flux is defined as the power of perceived light. In other words, luminous flux is a way of describing a quantity of light. Luminous flux is measured in lumens and is often used to specify the total amount of light output from a light fixture. It is fair to say that if light A and B have the same beam angle, light A will more intensely illuminate a specific area than light B will illuminate that same area if light A has a higher luminous flux output. The luminous flux of a light is a good platform to base your decision on when it comes to light performance because it is an accurate representation of how much light you will get out of the product.

Efficacy

Another criteria you should consider when selecting a lighting product is efficacy. Like efficiency, the efficacy of a light is the amount of light it produces per unit of electrical power it consumes (lumens per watt). Obviously, a light that produces more lumens per watt is more efficient and probably a better choice providing it fulfills your lighting requirements.

It is also penny wise to consider how much light you get for your money. By dividing the luminous flux of a light by its cost, you can compare the lumens per dollar for each light you are considering. The more lumens per dollar you get, the more light you'll be getting for your money.

Illuminance

Some manufacturers will specify illuminance measures for their lighting products. Illuminance is defined as the intensity of light at one specific point of a lighted area. It is also known as visible flux density. To better understand this, recall the density of an object is equal to the quotient of its weight and its volume. Similarly, illuminance (or visible flux density) is equal to luminous flux (Φ) divided by area (A). Illuminance (E) is measured in lux and one lux is equal to one lumen per square meter.

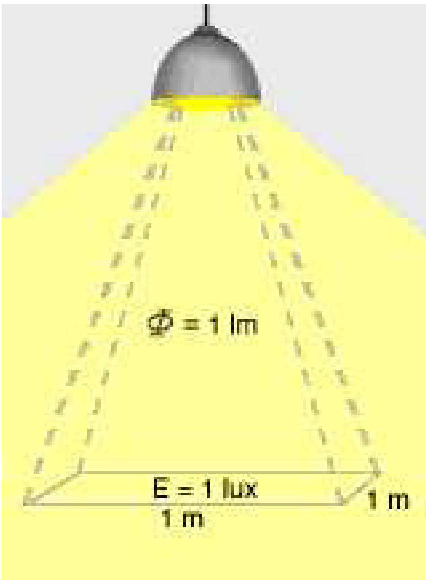

Illustration of the relationship between Luminous Flux (Φ) and Illuminance (E).

Based on the formula E = Φ / A or Φ = E x A, if you know the area (A) you are trying to light and the illuminance (E) you would like to achieve, you can determine the total number of lumens required. Divide the total lumens by the output of the product you are choosing to determine the number of fixtures required to deliver the light output you desire.

For example, If you have a room that is 10 square meters and you want an illuminance of 150 Lux, then you will require 1500 lumens [Φ = 10 x 150]. Please refer to the table to the right for typical illumination levels. If you are using lights with a luminous flux of 100 lumens, you will need 15 of them (1500 / 100 = 15).

Illuminance is determined by two variables (luminous flux and area). Therefore, it is unfair to compare illuminance measures (usually specified at 1 meter away from the light source) of two lights unless the lights have similar beam angles and the illuminance is recorded at exactly the same distance away from each. This is because as the beam angle and/or distance from the light vary, so does the lighted area. For a constant luminous flux (one light, same luminous flux), as the area increases or decreases, so will the illuminance measured at any specific point in that lighted area.

Recommended Illuminance by area of the boat.

Area	Lux
Stateroom	50-100
Passageway	50-100
Saloon	100-150
Galley	150-200
Head	150-200
Engine Room	200-250
Flybridge	50-100
Cockpit	50-100

Beam Angle

The beam angle of a light describes the angle through which its light output is distributed. The beam angle specified for a light can be deceiving because this doesn't specify the intensity of the light at that angle. A light can have a beam angle of 100o, yet at the outer perimeter of the illuminated area, the illuminance can be very low.

For this reason, light fixtures are often rated by their Full Width, Half Maximum beam angle. Imagine a single light in the overhead of your saloon and a string hanging from the light that ends right at the deck. Immediately below the light (0o), at the end of that string, will be the maximum illuminance in the area that the light shines on. Now, swing the string out from the center of the illuminated area. The distance from the light to the end of the string will remain constant, but the angle will increase. The illuminance at the end of the string will decrease as this angle increases. When the illuminance at the end of the string is half of its maximum (at 0o), you have reached half of the FWHM beam angle. Because this angle will be mirrored on the opposite side of the light, the actual FWHM beam angle will be twice that.