

Information Regarding Automotive Lighting

RAW VS EFFECTIVE LUMENS

LED Lamp output values (Lumens) can vary dramatically depending on which values are being quoted. The following information may assist selecting the right product for the right application. There are inherent losses associated with any Lamp (LED, HID or Halogen). The main losses are related to 3 particular items;

1. *Thermal loss,*
2. *Optical loss*
3. *Assembly Variation*

THERMAL LOSSES

The greatest challenge is thermal management of LED's. LED Manufacturers typically measure the light produced by their LED's after 25 milliseconds (ms). That is equivalent to a flash. It gives a Lumen number that is the absolute maximum value at the peak of the flash test. However LED's produce less light as they get hotter. LED's also generate a tremendous amount of power in a relatively small area. As the LED's are powered for longer and longer periods of time, they typically get hotter and hotter depending on the thermal management system. It's not unusual for LED's to reach over 100 ° C. For vehicle or machinery applications, most specifications require that the lamp be measured at 10 minutes and 30 minutes to make sure that the LED Temperature has stabilised. This will result in the LED producing 10% -20% less light than its advertised value.

OPTICAL & ASSEMBLY LOSSES

As light travels through an object such as a lens, it loses intensity depending on the clarity of the material. This is due to inherent losses internal to the material and to losses as light travels from air through the lens back to air. These losses are present no matter the type of light. The losses associated with the lens material and optics can vary from 10% to 20%. There are also losses associated with assembly and manufacturing variation. The LED Output varies as the assembly tolerances may diminish the overall performance from theoretical maximums. Simply adding the expected values of the LED Light sources together will never result in a light that shines that amount of light on the ground.

RAW

The "**Raw Lumen Output**" is calculated by the theoretical rated output of the LED's by the number of LED's in the lamp.

Example: 8 LEDs rated at 110 Lumens per watt

RAW Lumens = $8 \times 110 = 880$ Lumen

EFFECTIVE

The "**Effective Lumen Output**" is a measured number that takes into account real world losses (e.g. thermal, optical and assembly)

Example: Raw Lumens 880

Less – Thermal, Optical & Assembly Losses = 30% (example only)

Effective Lumens = 616 Lumens (example only)

SUMMARY

The goal of any decent manufacturer is to use high quality products and first class manufacturing techniques to minimise thermal, optical and assembly losses.

LIGHTING TERMINOLOGY

The world of Lighting has undergone many changes in the last century. This means we now enjoy some of the brightest, longest lasting and efficient lighting systems the world has ever seen. The down side is this has led to an abundance of terminology that many find confusing.

WATTS & LUMENS

If you have two lights in front of you, with one being 75 watts and the other 100 watts, which will produce more light? Most would say the 100 watt light, but that's not necessarily the correct answer. Truth be told we can't know the correct answer because watts is not a measure of light output. Watts are actually a measure of total power output. Not all of the energy emitted by a light source is visible light – heat and invisible light waves (infrared light) are also emitted. Lumens, on the other hand, will tell you the total visible light output of a source. For this reason, Lumens (not watts) is the relevant measure when you're concerned about visibility.

CANDELA & CANDLEPOWER

Candlepower was once the predominant unit of measure to describe the intensity of a light source in a particular direction. However the standard unit of measure is "Candela" (which happens to be a direct equivalent to Candlepower). One Candela is close to the light intensity produced by an ordinary candle as perceived by the human eye and address how bright a light source is in a particular direction. The candela is similar to the Lumen in that both deal with light output as perceived by the human eye. The key difference is that the lumen measures the total visible light output, whereas the candela address directional intensity.

LUX

Lux is the amount of visible light that falls on a surface. To better understand Lux, imagine that you have a one candela light source located in the centre of a sphere. If the radius of that sphere is a distance of one meter, one Lux is the amount of light that falls on the inside surface of that sphere.

IN SUMMARY

- The "Watt" is a measure of the total power output
- The "Lumen" is a measure of the total visible light output of a light source
- The "Candela" is a measure of the intensity of a light source in a particular direction
- The "Lux" measures the amount of visible light falling on a surface.

