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LIGHTING TERMINOLOGY EXPLAINED

Comparing the performance of various lamps can be quite bewildering even when relevant figures are supplied. Moreover, there is considerable confusion about the meaning of technical terms encountered.

WAVELENGTH (nanometres)

Visible light is just a small part of the spectrum of electromagnetic radiation that includes radio waves, heat, light, microwaves etc. Each type of radiation covers a range of wavelengths that are measured in nanometres (one millionth of a millimetre).

The wavelengths perceptible by human vision are between 400 nm (violet) and 700 nm (red).

COLOUR TEMPERATURE (Kelvin)

A hot object radiates a specific range of wavelengths that appear as a particular colour depending on the object's temperature. The temperature is expressed in Kelvin (K), the scientific temperature unit. Degrees Celsius can be easily converted to Kelvin by adding 273.

The Kelvin temperature equivalent is used to describe the lamp's colour. Lamps generally vary from about 2500K, which is quite yellow through to 7000K, which is considerably bluish. The temperature of balanced white is about 5500K.

SPECTRAL CHART (RGB)

The phosphors in a lamp are made from a mixture of fluorescent powders emitting primary colours, which combine to produce white light. The lamp colour can be expressed as the individual wavelengths of these phosphor components. For example Red= 611nm, Green=544nm and Blue= 435nm.

VISUAL PERCEPTION

The human visual system has a stronger response to green than to other colours. All units indicating the illumination in terms of the human visual perception are adjusted to the equivalent brightness at 555nm, which is the wavelength of green light. All other units explained below are adjusted to compensate for the relative sensitivity of the eye to green light.

LUMINOUS INTENSITY (Candela)

Luminous intensity is a measurement the light radiating from the lamp in a particular direction, disregarding the intensity of light in other directions. The candela figures for a source need to be given for specific directions but are independent of distance from the lamp.

Manufacturers provide charts showing the luminous intensity of a lamp in every direction from the source. These charts can be used to calculate the total luminous flux and the illumination intensity surrounding the lamp.

LUMINANCE (Candela per Square Metre)

The candela does not represent the brightness looking directly at the source itself. A small point source may have the same candela measurement as a

large diffuse source that is not perceived as so intensely bright.

Rather, the intensity of a viewed light source is measured in candela per square metre of the irradiating source. Higher values indicate a concentrated source such as LEDs or halogen filaments. Diffuse sources such as fluorescent tubes have a relatively low value. Lamps with high intensity visible sources produce more glare. Sometimes luminance is expressed using the unit "Lambert" which is equivalent to $1/\pi$ Candela per square centimetre.

LUMINOUS FLUX (Lumens)

The perceived total amount of useful light from a source is the sum of the candela measurements in all directions. It is measured in lumens (lm). The figure is also independent of distance from the lamp and says nothing of the direction of the light, the intensity of the source or the brightness of an illuminated surface, just the total visible light in all directions.

ILLUMINANCE (Lux)

The perceived brightness of the light falling on a surface illuminated by the lamp and is measured in lumens per square metre or its equivalent, lux. Illumination values will decrease with distance from the lamp and are not generally useful in describing lamp performance unless a distance is quoted.

Concentrated sources such as lasers, LEDs and optically focussed lamps can provide intense illumination on a small area. They produce a high lux figure but may still have very little total light and a corresponding low lumen value.

LUMINOUS EFFICIENCY (Lumens per Watt)

This is a measure of how much total effective light in all directions (lumens) is produced per Watt of electrical power consumed.

It is important to compare overall efficiency of lamps including the losses in the associated circuitry. Luminous efficiency is typically quoted by LED manufacturers at the terminals of the LED rather than at the input of the power supply electronics, where the consumption will be considerably higher.

Some fluorescent lamp manufacturers have also resorted to this misleading figure in order to enhance their claim to high luminous efficiency. Tests conducted on 240 Volt compact fluorescent lamps by a leading Australian consumer magazine have shown that the majority do not live up to the claims of light output.

The majority of 12V/24V fluorescent lamps have never even been tested. Their promoters often claim the theoretical maximum lumens of the tube rather than measuring the output using the dedicated inverter. Rainbow Power Company believes the actual lumen output of many fluorescent lamps is considerably less than what is claimed.

LIFE EXPECTANCY (Hours)

Although a lamp may continue to function electrically, the light output and efficiency degrades over time. The life of a lamp is defined as the operating time for light output to fall to fifty percent of its original lumen figure.

Manufacturers make the tests under ideal conditions so that the life expectancy is as high as possible. Under real conditions the life of a lamp is generally considerably shorter than the quoted figure. Factors such as the ambient temperature, supply voltage variation and number of switching cycles greatly affect the actual life of the lamp.

Conventional fluorescent lamps are particularly vulnerable to accelerated degradation from frequent switching cycles and variation in supply voltage.

NOMINAL POWER (Watts)

Most suppliers provide a nominal power rating, rather than the actual power

consumption of the lamp under specific conditions. The actual power consumption at the lamp input of most extra low voltage DC lamps at normal battery voltage is typically ten to twenty percent below the nominal rating.

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Local Date|Tuesday, 13-Feb-2007 09:07:50 EST

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