

## **White LED life**

A traditional light bulb has reached the end of its life when the filament breaks. As we all know, the light output goes to zero when this event occurs. The white LED life behaves much differently! As it ages, the light output slowly and continuously decreases as the LED lamp loses efficiency. The light emitting diode has reached the end of its life when its light output reaches 50% of the rated luminous output, not when it reaches zero. This is the industry standard used for determining white LED lifespan, as well as other colors. The disadvantage of this standard is that the average person cannot judge when the LED light has reached the end of its life. The luminous output will diminish so gradually, most people do not even realize a loss has occurred. Furthermore, a person exposed to a particular LED light on a regular basis becomes less susceptible to its continuously decreasing output. Fortunately, the life of LED light bulb will last long enough that many will even outlive their applications.

## **Life of LED Light Bulb**

It seems that recently, manufacturers have improved the accuracy of their LED datasheets. Some manufacturers mention specifics about lumen maintenance within a specific period of operation. Lumen maintenance simply defines the expected luminous output after a specified period of continuous use. For example, a manufacturer may claim 60% lumen maintenance at 45,000 hours. Of course, this information is subject to conditions such as die temperature and ambient temperature. On occasion, life expectancy data depicted as a line graph is available upon special request. This form of white LED life data offers greater resolution. Rather than defining luminous output during a single point in time, the line graph offers a luminous output for nearly any point within the LED lights lifespan. Life expectancy data is a critical aspect to every custom LED lighting design. Lunar Accents Design Corporation does not recommend purchasing LED lights from a manufacturer who does not offer LED life lifespan data. Most of the time, a manufacturer will conduct a physical test over a shorter period, in order to gain the initial life of LED light bulb expectancy data. However, since an LED lamp can actually produce light up to or exceeding ten years, engineers rely on extrapolated data to determine the luminous output beyond physical lifespan test results.

## **LED Lifespan**

White LED life span can vary according to environmental and design related items. White LED lifespan is ultimately determined during the engineering phase of a specific custom LED lighting design. In some cases, design engineers may intentionally limit LED lifespan in lighting applications where longevity is non-critical. One case includes an application designed to operate only for a specified period. Perhaps more common is the application where light output is more important than the life of LED light bulb. Overdriving an LED lights will increase the luminous output, but dramatically decrease lifespan if thermal management is not considered. It is possible that budgetary restrictions will not allow for advanced forms thermal management. Poor thermal management can expose LED lights to unnecessary heat, and heat can lead to a dramatic reduction in lifespan. In addition to LED lifespan data, LED manufactures need to provide test data pertaining to the specific die temperature during the lifespan test period. Although many LED manufactures do not publish such data, it is important to inquire before attempting to calculate longevity for your custom LED product.

## **LED Environmental Factors**

Although die temperature plays the most critical role in LED lifespan, numerous other variables also play a part. Yet another consideration includes the environment in which the lighting application will operate. Ambient temperature is always a factor, primarily in applications exposed to fluctuating environmental factors. High ambient temperatures and humidity can potentially lead to a reduction in lifespan. For example, consider an LED lighting application designed to produce a 200-lumen output. Twenty surface mount LEDs will meet this criterion, but only while operating at or below the specified ambient temperature of 25 degrees Celsius. When employed within an environment as hot as 40 degree ambient, thermal stresses may dramatically reduce LED life and reliability. Increased ambient temperatures will also adversely affect luminous output. The solution is to reduce the drive current and increase the total number of LEDs within the array.