

LM-79

Light emitting diodes (LED's) are a new and exciting light source of the future. LED's are an electronic device and require specific equipment and specific system designs to ensure the high lumen output and the very long life are attained and maintained. Real thermal management is very important to maintain the high lumen output, long life and chromaticity consistency. In order to ensure specification integrity the entire lighting system must be tested. This means that the LED must be mounted to its electronic board, the electronic board mounted to its substrate, the solid-state driver installed and the optics mounted. All of the system components must then be enclosed in a light fixture for its intended use. The Illuminating Engineering Society of North America developed testing standards **LM79-08 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products** that allows for the testing of what B-K Lighting and TEKA Illumination call **BKSSL™ Technology**. The LM79 test data allows the specifier or end user to evaluate the suitability of the SSL lighting system for its use in a particular application or to compare SSL lighting systems against one another. LM79 provides for the total luminous flux, electrical power, efficacy and chromaticity.

Why is this important with LED's? We have used relative photometry for years to design our lighting systems. Why a new system?

Relative photometry utilizes a lighting manufacturers standard product, photometric testing is accomplished using a reference lamp and a reference ballast or transformer if required. Therefore relative photometry does not provide electrical power information. It also does not take into account heat characteristics of the system regarding efficacy or chromaticity. In fact it does not provide chromaticity characteristics at all. All of these issues are very important when evaluating SSL systems.

Absolute photometry requires the lighting manufacture to submit the complete SSL lighting system for measurement so that the resulting data reflects the actual flux, colorimetric performance and the electrical power measurements of the lighting fixture packaged for its intended use.

The importance of absolute photometry and the **IESNA LM79** testing standard is that an LED is an electronic device. While an LED has no IR or UV in its beam it does create heat. The LED directly converts electrons to photons unlike the traditional lamps that convert electrons into heat or exciting an internal gas. The point at which the LED converts the electrons into photons is the P/N junction. This point is measured for heat as the junction temperature or T_j . This heat must be conducted away as fast as possible. This is known as heat sinking. The better the system is at moving this heat quickly will allow the LED to operate cooler and will provide for a higher efficacy, better lumen maintenance and a more consistent color output over time.

Several things within the system can affect the T_j . The driver within the system will determine the forward current at which the LED's are driven. This will determine the lumens produced by the LED's with a diminishing return for higher drive current due to increased T_j . Of equal importance is how well the LED design handles heat dissipation to the electronic board, how well the electronic board dissipates heat to the substrate and how well the substrate dissipates heat to the heat sink. And then, how well the fixture manufacturer dissipates this heat away from the fixture.

B-K Lighting and TEKA Illumination have been designing and moving heat away from its fixtures for a long time. **We are experts at it.** With many years of design experience our sealed fixtures will provide the lowest operating temperatures for the outdoor environment. B-K Lighting and TEKA Illumination will provide IESNA LM79 testing reports for all of our **BKSSL™ Technology** so that the designer can determine the suitability of our fixtures for their application and be assured of a quality SSL lighting system **"To Last a Lifetime"**.

LM-80

"My LED's will last for 50,000 hours." "My LED's will last for 100,000 hours." We have all heard these claims. The truth is that an LED being an electronic device with no moving parts could theoretically last forever. Three things can kill a LED. Heat, dirty power and moisture will all have detrimental effects on LED life. In reality, even if LED's could last forever, their lumen output will diminish over time to a point where they would no longer function as a useful lighting source. We call this "lumen maintenance." The industry has determined that the LED ceases to be a useful light source when lumen output reduces to 70% of its initial lumens. This is called L70.

How do we determine how long this will be?

LED manufacturers measure LED's in pulse mode operation with no heat sink. The pulse is a short 10 to 20 millisecond duration. This does not allow the LED to heat up and the T_j is ambient temperature. This allows the LED manufacturer to compare one LED to another with all things being equal. Thus the LED manufacturers data sheets gives you lumen output at T_j at 25°C. Because of this testing method we used to hear that the LED manufacturers were "cheating." This type of testing is not cheating, but it also is not very helpful to the lighting manufacturer who must test the entire system or the designer who must determine if the system is suitable for the application.

This is why the Illuminating Engineering Society of North America developed **LM80-08 Approved Method: Measuring Lumen Maintenance of LED Light Sources**. LM80 covers lumen maintenance measurement for LED packages, arrays and modules. It does not cover any other aspects of LED performance and must be supplied to the lighting manufacturer by the LED manufacturer. This is why B-K Lighting and Teka Illumination will only use LED's from manufacturers that have tested their LED's to this standard.

IESNA LM80 sets the standards for uniform test methods for LED manufacturers under controlled conditions for measuring LED lumen maintenance while controlling the LED's case temperature, the forward voltage and forward current to the LED. It also requires the LED manufacturer to measure at a 55°C, 85°C and one other case temperature chosen by the manufacturer, typically at 110°C. It also requires the lumen maintenance data for at least 6,000 hours of constant DC mode operation. The preferred method is 10,000 hours.

How do we use this information?

LM80 does not speak to this issue, but LED manufacturers then extrapolate this data to provide lumen maintenance out to L70 or useful lumens life. At this time IESNA is working on TM21 that will standardize this extrapolation method for all LED manufacturers.

What is L70 and why is it important?

Traditional lamps have a lamp life expressed in a 50% mortality rate. In other words half of the lamps will have ceased to operate at X hours. While traditional lamps experience lumen depreciation over their life, this is usually taken into consideration during the calculation phase of the design. Since LED's could theoretically operate forever the industry has established the L70 standard or where the lumen output of the LED system will have depreciated to 70% of initial lumens. This is the theoretical extrapolation that is done using the LM80 information and the lighting manufacturers tested T_j . These numbers are usually in the range of 30,000 to 50,000 hours and beyond.

What does this mean in real life?

The designer must ensure the SSL lighting system "being considered for specification" has been tested to the LM79 standards and that the SSL lighting system manufacturer can provide the LM80 data from the LED manufacturer. A typical halogen MR16 lamp has a lamp life of 4,000 to 5,000 hours with lumen maintenance of 70% at end of life. A typical pulse start metal halide lamp has a lamp life of 12,000 to 15,000 hours with lumen maintenance of 50% at end of life. B-K Lighting and TEKA Illumination fixtures, utilizing the **BKSSL™ Technology**, will provide a 30,000 to 50,000+ L70 life depending on the system chosen.