

ANSI/NEMA LED Binning Standard

Introduction

Daylighting, Lighting-class LEDs are driven by application requirements and industry standards. In 2008, ANSI and NEMA collaborated to establish a binning standard for LED manufacturers called ANSI/NEMA C78 377A, also known as “Specifications for the Chromaticity of Solid-State Lighting Products.”

This Technical Bulletin briefly explains the binning process, which is the focus of ANSI/NEMA C78 377A and illustrates why this standard should be important to both manufacturers and lighting engineers.

Definitions

The technique that manufacturers have developed to classify their LEDs is called LED binning. LEDs are placed into similar categories, or bins, with each category defined by similarity in lumens, colors, and forward biased voltages. LED binning according to colors is based on the CIE 1931 Chromaticity Diagram (from the International Commission on Illumination) and a series of quadrilaterals that are imposed upon the Chromaticity Diagram (see Figure 1). Those quadrilaterals identify regions of noticeable differences in color. Within each of these individual quadrilaterals, the human eye cannot perceive any color difference. Therefore, LED manufacturers indicate the coordinates of their LED on the chromaticity diagram, and end-users can reliably use this information to select the correct color light for specific applications.

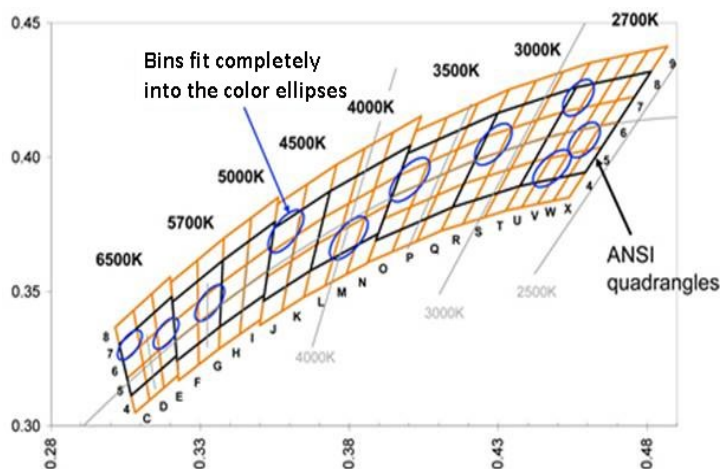


Figure 1: Chromaticity Diagram

LED Production

To understand binning, it is helpful to review the production of LEDs. Manufacturers receive LED chips known as blue chips, which are groups of similar LED chips packed and glued to blue discs. LEDs are first unpacked manually, then picked and placed automatically onto plastic packages. After alignment, a gold wire is attached between every chip, at which point phosphor is applied on top of the LED chips to convert the blue light emitted from the chip to white light. Each LED is then scanned and verified for the appropriate color temperature, and phosphor is manually added or removed as needed so that the color matches the specification. Protective polycarbonate casing is then attached on top of the underlying chips. The product is tested for air voids, and silicon will be manually added to fill these voids as necessary. Finally, heat is applied to cure the silicon material within the LED. When the quality control is finished, the binning process begins.

Binning Process

LEDs are first introduced into the hopper of a sorting machine and then lined up to enter into a spectral radiometer. Each LED product is then individually measured and sorted by lumen output and color into prescribed ranges. LED suppliers create their own standard sets of lumen bins and provide clear information on the expected lumen performance of each of their bin ranges. This way, luminaire manufacturers can easily select the bin (or set of bins) that best meets their needs using the lumen coordinates based on the Chromaticity Diagram. Smaller bin sizes maintain a tighter control of color variation and are consequently more desirable.

Conclusion

Binning is important for luminaire manufacturers to specify and control LED color output, since these factors have significant impact on performance, cost, and lead-time. Lighting engineers and designers are also encouraged to familiarize themselves with the manufacturer’s binning process and applicable engineering standards like ANSI/NEMA C78 377A to ensure quality LED products are installed.

