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Projecting Long Term Lumen Maintenance of LED Light Sources

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Publication of this Committee Report has been approved by IES. Suggestions for revision should be directed to IES.

Prepared by:
The Subcommittee on Solid State Lighting of the IES Testing Procedures Committee

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Projecting Long Term Lumen Maintenance of LED Packages

INTRODUCTION

One of the benefits that LED light sources can provide is very long usable life. Unlike other lighting technologies, LEDs typically do not fail catastrophically during use. However, over time the light output will gradually depreciate. At some point in time, the light emitted from an LED depreciates to a level where it is no longer considered adequate for a specific application. It is important in lighting design to understand when this "useful lifetime" of an LED source is reached.

IES LM-80-08 is the Approved Method for Measuring Lumen Maintenance of LED Light Sources. It defines the setup, conditions, and procedures for performing lumen maintenance testing of LED packages, arrays, and modules. LM-80-08 is the IES recommendation that is used widely to characterize the lumen depreciation behavior of LEDs. LED device manufacturers routinely provide LM-80-08 reports for their products with data collected during testing for 6000 hours or more. However, how the data collected from LM-80-08 testing are actually used to best determine the useful lifetime of the tested product is not well defined.

The rated Lumen Maintenance life of an LED is the elapsed operating time over which an LED light source maintains a given percentage of its initial light output. It is defined as L_p, where p is the percentage value. For example, L_{70} is the time (in hours) when the light output from the LED has dropped to 70% of its initial output. The time when the rated lumen maintenance life of an LED light source is reached is dependent upon many variables, including the operating temperature, drive current, and the technology and materials used to construct the products. As such, the lumen maintenance of LEDs can vary not only from manufacturer to manufacturer, but also between different LED package types produced by a single manufacturer.

This Technical Memorandum recommends a method of projecting the Lumen Maintenance of LED Light Sources from the data obtained by LM-80-08 testing.

This document was developed by a dedicated TM-21 Working Group of LED industry professionals. The analyses of the LM-80-08 test data provided by major LED manufacturers are used to rationalize and support this document. Much of this LM-80-08 data were from testing that extended to 10000 hours and beyond.

1.0 SCOPE

This document provides recommendations for projecting long term lumen maintenance of LED light sources using data obtained when testing them per IES LM-80-08, "IES Approved Method for Measuring Lumen Maintenance of LED Light Sources."

2.0 NORMATIVE REFERENCES

IES LM-80-08, *Approved Method for Measuring Lumen Maintenance of LED Light Sources*.

3.0 DEFINITIONS

3.1 LED Light Source (IES LM-80-08)

LED package, array, or module that is operated via an auxiliary driver.

3.2 DUT

Device under testing (DUT) is the LED light source defined in **Section 3.1**.

3.3 Rated Lumen Maintenance Life, L_p (IES LM-80-08)

The elapsed operating time over which the LED light source will maintain the percentage, p, of its initial light output, e.g.:

L_{70} (hours): Time to 70% lumen maintenance
L_{50} (hours): Time to 50% lumen maintenance

4.0 TEST DATA AND SAMPLE SIZE

4.1 Data to be Used

The data to be used in this projection method shall be collected according to the methods described in IES LM-80-08.

4.2 Sample Size Recommendation

All data from the sample set at a given case temperature and drive current from the LM-80-08 test report for a specific product model should be used for lumen maintenance life projection. The recommended number of the sample set is a minimum of 20 units to be able to use a multiplication factor of 6