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ANSI/IES LM-79-19

Illuminating ENGINEERING SOCIETY

APPROVED METHOD:
OPTICAL AND ELECTRICAL MEASUREMENTS OF SOLID-STATE LIGHTING PRODUCTS

AN AMERICAN NATIONAL STANDARD

Approved American National Standard ANSI

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Publication of this Technical Memorandum
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Approved by the IES Standards Committee February 28, 2019, as a Transaction of the Illuminating Engineering Society.

Approved as an American National Standard May 14, 2019.

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Published by the Illuminating Engineering Society, 120 Wall Street, New York, New York 10005.

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Printed in the United States of America.

ISBN# 978-0-87995-004-0

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CONTENTS

This is a preview of "ANSI/IES LM-79-19". Click here to purchase the full version from the ANSI store.

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Foreword

This document is a revision of IES LM-79-2008, *Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products*. Changes have been made to update information and provide better guidance based on information gathered from proficiency testing associated with laboratory accreditation and independent research. The updated requirements in this test method are intended to reduce the variation of measurement results across testing laboratories, while minimizing the burden on the testing laboratories. The method is based on absolute photometry addressing the requirements for optical and electrical measurement of solid-state lighting products.

The structure of the document has been changed significantly to match the approved IES Testing Procedure Committee document structure.

1.0 Introduction and Scope

1.1 Introduction

Solid-state lighting (SSL) products as defined in this document utilize light-emitting diodes, including inorganic LEDs (simply called *LEDs*) and organic LEDs (*OLEDs*) as the optical radiation sources to generate light for illumination purposes. An overview of LEDs and lighting is available in IES TM-16-17.[1] Although constant current control is typical for individual LEDs, this document addresses integrated SSL products incorporating semiconductor device-level current control; thus, the electrical parameters of interest are the SSL product's input electrical parameters.

For special purposes, it may be useful to determine the characteristics of SSL products when they are operated at other than the standard conditions described in this approved method. Where this is done, such results are meaningful only for the conditions under which they were obtained, and these conditions shall be stated in the test report.

The photometric information typically required for SSL products includes total luminous flux (lumens), luminous efficacy (lm/W), luminous intensity (candelas) in one or more directions, chromaticity coordinates, correlated color temperature (CCT), and color rendering index (CRI). In addition, special lighting applications of SSL products may need data such as radiant intensity, photon intensity, radiant flux, photon flux, radiant efficacy, and photon efficacy. For this approved method, the determination of all these parameters will be considered *optical measurements*.

The electrical characteristics measured for AC-powered SSL products include RMS* AC voltage, RMS AC current, AC active power, power factor, total harmonic current distortion, and voltage frequency. For DC-powered SSL products, measured electrical characteristics include DC voltage, DC current, and power. For this approved method, the determination of these parameters will be considered electrical measurements.

1.2 Scope

This approved method describes the procedures to be followed and precautions to be observed in performing reproducible accurate measurements of total luminous, radiant, or photon flux; electrical power; system efficacy; luminous, radiant, or photon intensity distribution; and color quantities and/or spectrum of solid-state lighting (SSL) products for illumination purposes, under standard conditions. This approved method covers LED luminaires, OLED luminaires, integrated LED lamps, integrated OLED lamps, non-integrated LED lamps operated with a driver designated by a manufacturer's identification number or by a defined [ANSI] reference circuit, and LED light engines, all of which will be referred to as *SSL products or device under test* (DUT). SSL products, excluding non-integrated LED lamps, are intended to directly connect to AC mains power or to a DC voltage power supply to operate.

This document does not cover SSL products that require external heat sinks, nor does it cover components of

* "RMS" stands for root-mean-square and is a way of expressing an AC quantity of voltage or current in terms functional equivalence to DC. For example, 10 V AC RMS is the amount of voltage that would produce the same amount of heat dissipation across a resistor of given value as 10 V DC. RMS voltage is also referred to as the "equivalent" or "DC equivalent" value of an AC voltage or current. For a sine wave, the RMS value is approximately 0.707 of its peak value. Source: All About Circuits. (Accessed 2018 Feb 23) www.allaboutcircuits.com/textbook/alternating-current/chpt-1/measurements-ac-magnitude/