NEMA Standards Publication

NEMA SSL 6

Solid State Lighting for Incandescent Replacement - Dimming

National Electrical Manufacturers Association

NEMA SSL 6

Solid State Lighting for Incandescent Replacement— Dimming

NEMA Standards Publication SSL 6-2010

Solid State Lighting for Incandescent Replacement—Dimming

Published by

National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752
Rosslyn, Virginia 22209
Approved February 3, 2011

www.nema.org

Includes April 2011 Errata

NOTICE AND DISCLAIMER

The information in this publication was considered technically sound by the consensus of persons engaged in the development and approval of the document at the time it was developed. Consensus does not necessarily mean that there is unanimous agreement among every person participating in the development of this document.

National Electrical Manufacturers Association (NEMA) standards and guideline publications, of which the document contained herein is one, are developed through a voluntary consensus standards development process. This process brings together volunteers and/or seeks out the views of persons who have an interest in the topic covered by this publication. While NEMA administers the process and establishes rules to promote fairness in the development of consensus, it does not write the document and it does not independently test, evaluate, or verify the accuracy or completeness of any information or the soundness of any judgments contained in its standards and guideline publications.

NEMA disclaims liability for any personal injury, property, or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, application, or reliance on this document. NEMA disclaims and makes no guaranty or warranty, expressed or implied, as to the accuracy or completeness of any information published herein, and disclaims and makes no warranty that the information in this document will fulfill any of your particular purposes or needs. NEMA does not undertake to guarantee the performance of any individual manufacturer or seller's products or services by virtue of this standard or guide.

In publishing and making this document available, NEMA is not undertaking to render professional or other services for or on behalf of any person or entity, nor is NEMA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. Information and other standards on the topic covered by this publication may be available from other sources, which the user may wish to consult for additional views or information not covered by this publication.

NEMA has no power, nor does it undertake to police or enforce compliance with the contents of this document. NEMA does not certify, test, or inspect products, designs, or installations for safety or health purposes. Any certification or other statement of compliance with any health or safety–related information in this document shall not be attributable to NEMA and is solely the responsibility of the certifier or maker of the statement.

CONTENTS

Figures

Foreword

The NEMA Lighting Controls and Solid State Lighting sections have prepared this standards publication, *Solid State Lighting for Incandescent Replacement—Dimming*. This standard provides interface requirements for dimming control, focusing on integrated LED lamps intended for replacement of general service incandescent lamps. Because it addresses the installed base of incandescent dimmers, this document cannot and does not provide dimmer requirements.

In the preparation of this standards publication, input of users and other interested parties has been sought and evaluated. Inquiries, comments, and proposed or recommended revisions should be submitted to the concerned NEMA product subdivision by contacting:

Vice President, Technical Services
National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752
Rosslyn, Virginia 22209

Section approval of the standard does not necessarily imply that all section members voted for its approval or participated in its development.

At the time the standard was approved, the Solid State Lighting Section was composed of the following members:

Amerlux Global Lighting Solutions
Atlas Lighting Products, Inc.
Cooper Industries plc
Cree, Inc.
Dialight Corporation
EiKO, Ltd.
EYE Lighting International of N.A., Inc.
GE
Hatch Transformers, Inc.
Hubbell Incorporated
LEDnovation, Inc.
Leviton Manufacturing Co., Inc.
Luminus Devices, Inc.
Lutron Electronics Company, Inc.
MaxLite
Nichia America Corporation
Osram Sylvania Inc.
Philips Lighting Company
Ruud Lighting Inc.
Schneider Electric
Soraa Inc.
Technical Consumer Products, Inc.
TerraLUX Inc.
Toshiba International Corporation
Universal Lighting Technologies

At the time the standard was approved, the Lighting Controls Section was composed of the following members:

Acuity Brands Lighting
Cooper Industries plc
GE
Hubbell Incorporated
Legrand North America
Leviton Manufacturing Co., Inc.
Lutron Electronics Company, Inc.
Osram Sylvania Inc.
Philips Lighting Company
RAB Lighting
Schneider Electric
Universal Lighting Technologies

In April 2011, errata was published to the standard. In 4.6, “40 degrees or greater” was changed to “40 degrees or less.”

Section 1
GENERAL

1.1 SCOPE

This standards publication provides interface recommendations for dimming control of integrated LED lamps intended for replacement of general service incandescent lamps operating at 120 volts, i.e., for operation with the majority of installed incandescent dimmers. LED lamps intended for operation at 12 volts are not covered by this standard.

1.2 NORMATIVE REFERENCES

The following normative documents contain provisions, which through reference in this text constitute provisions of this standards publication. By reference herein these publications are adopted, in whole or in part as indicated, in this standards publication.

NEMA 410 *Performance Testing for Lighting Controls and Switching Devices with Electronic Fluorescent Ballasts*

1.3 INFORMATIVE REFERENCES

ANSI/IESNA RP-16-10 *Nomenclature and Definitions for Illuminating Engineering*

IESNA Lighting Handbook, Ninth Edition, 2000, Chapter

ENERGY STAR® Program Requirements for Integral LED Lamps, v1.1, amended March 22, 2010

UL 1472 *Solid-State Dimming Controls*

UL 8750 *Light Emitting Diode (LED) Light Sources for Use in Lighting Products*

IEEE PAR 1789 *Recommended Practices of Modulating Current in High Brightness LEDs for Mitigating Health Risks to Viewers*

1.4 DEFINITIONS

Crest factor: Ratio of peak current to rms current drawn by the lamp, over a line cycle in steady state.

Dead travel: A range of dimmer settings that produce the same light output. Refer to Figure 1.

Dimmer setting: Adjustment to the incandescent dimmer intended to achieve a value of perceived light output, and results in a particular value root-mean-square voltage phase cut of the ac signal applied to the lamp. A dimmer setting of unity corresponds to the maximum light output that can be requested. A dimmer setting of zero corresponds to the minimum non-off light output that can be requested.

Flicker: Unintended, perceivable modulation of light output.

Forward phase: Phase description of wave-form for phase-cut dimmers that apply line voltage sometime after the zero cross until the subsequent zero cross. Most commonly obtained in triac-based dimmers.

Incandescent dimmer: Phase-cut dimmer intended for incandescent lamps.