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Solid State Lighting for Incandescent Replacement—Dimming

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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.”
4.5 MAXIMUM LIGHT OUTPUT WHEN OPERATED ON A DIMMER

When operated on a dimmer, the maximum light output of the integrated LED lamp may be no less than 95% of the corresponding relative light output for an incandescent lamp at the maximum phase angle.

4.6 LIGHT OUTPUT AT MINIMUM DIMMING LEVEL OF THE LED LAMP

In the on state, the LED lamp shall dim to 25% or less of the maximum light output level of the LED lamp at a phase angle of the applied voltage of 40 degrees or less.

4.7 ADJUSTING BETWEEN MAXIMUM LIGHT AND MINIMUM LIGHT

Between maximum dimmer setting and minimum dimmer setting, phase angle and relative light output shall vary according to:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Incandescent Dimmer</th>
<th>Dimmable Integrated LED Lamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instantaneous Current (mA) required by triac to stay on</td>
<td>(Informative—Most 600W triac-based dimmers have less than 50 mA holding current; most 1000W triac-based dimmers have less than 75 mA holding current)</td>
<td></td>
</tr>
<tr>
<td>Maximum time to change light level (ms)</td>
<td></td>
<td>250</td>
</tr>
<tr>
<td>Dead Travel within 120-40 deg phase angle (deg)</td>
<td>Smooth, continuous across entire dimming range, Monotonic</td>
<td>20 deg max</td>
</tr>
</tbody>
</table>

The maximum relative light output change for a corresponding change in phase angle shall be less than 1.84% per degree of phase angle for relative light outputs of less than 25% and less than 3.67% per degree of phase angle for relative light outputs of greater than 25%.

The result of the interaction between Sections 4.5 through 4.7 is that the dimming curve of the LED lamp must fall within upper and lower bounds illustrated in Figure 3 and the associated table below. In Figure 3, the incandescent dimming curve has been included for illustrative purposes.