

NEMA 410

---

# Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts



# **NEMA 410**

## **PERFORMANCE TESTING FOR LIGHTING CONTROLS AND SWITCHING DEVICES WITH ELECTRONIC DRIVERS AND DISCHARGE BALLASTS**



**NEMA Standards Publication 410-2011**

*Performance Testing for Lighting Controls and Switching Devices  
with Electronic Drivers and Discharge Ballasts*

*Published by:*

**National Electrical Manufacturers Association**

1300 North 17th Street, Suite 1752

Rosslyn, Virginia 22209

Approved April 7, 2011

[www.nema.org](http://www.nema.org)

© Copyright 2011 by the National Electrical Manufacturers Association. All rights, including translation into other languages, reserved under the Universal Copyright Convention, the Berne Convention for the Protection of Literary and Artistic Works, and the International and Pan American Copyright Conventions

## 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.

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 fulfil 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

Foreword .....	iii
Section 1 SCOPE .....	1
Section 2 DEFINITIONS .....	2
2.1 Ballast .....	2
2.2 Driver .....	2
2.3 Electronic Discharge Ballast .....	2
2.4 Inrush Current .....	2
2.5 Pulse Width .....	2
2.6 Self-Ballasted Lamp .....	2
Section 3 REFERENCED PUBLICATIONS .....	3
3.1 Normative References .....	3
3.2 Informative References .....	3
Section 4 GENERAL .....	4
4.1 Ballast Inrush Current .....	4
4.2 Source Impedance .....	4
Section 5 COMPATIBILITY TESTING .....	5

### Tables

Table 1 Bulk Energy Capacitances .....	4
Table 2 Peak Current Requirements .....	5

### Figures

Figure 1 Typical Test Circuit Diagram .....	6
Figure 2 Waveform per Synthetic Measurement of Pulse Width and Peak Current .....	7
Figure 3 Waveform per Synthetic Load of 5 A and Line Voltage 120 Vac .....	8
Figure 4 Waveform per Synthetic Load of 8 A and Line Voltage 120 Vac .....	9
Figure 5 Waveform per Synthetic Load of 10 A and Line Voltage 120 Vac .....	10
Figure 6 Waveform per Synthetic Load of 12 A and Line Voltage 120 Vac .....	11
Figure 7 Waveform per Synthetic Load of 15 A and Line Voltage 120 Vac .....	12
Figure 8 Waveform per Synthetic Load of 16 A and Line Voltage 120 Vac .....	13
Figure 9 Waveform per Synthetic Load of 5 A and Line Voltage 277 Vac .....	14
Figure 10 Waveform per Synthetic Load of 8 A and Line Voltage 277 Vac .....	15
Figure 11 Waveform per Synthetic Load of 10 A and Line Voltage 277 Vac .....	16
Figure 12 Waveform per Synthetic Load of 12 A and Line Voltage 277 Vac .....	17
Figure 13 Waveform per Synthetic Load of 15 A and Line Voltage 277 Vac .....	18
Figure 14 Waveform per Synthetic Load of 16 A and Line Voltage 277 Vac .....	19
Figure 15 Simulation of Steady State Current and Pulse Width .....	20
Figure 16 Simulation of Steady State Current and Peak Inrush Current .....	21
Figure 17 Simulation of Steady State Current and $I^2t$ (A <sup>2</sup> s) .....	22

**Annexes**

Annex A CIRCUIT DEVELOPMENT AND HISTORY (informative).....	23
Annex B PROPOSED REVISIONS TO ANSI C82.11 (normative).....	30

## Foreword

The purpose of this standard is to provide guidance for the design and testing of lighting controls and switching devices to be used with electronic drivers, discharge ballasts, and self-ballasted lamps. This document defines the worst case inrush current expected to be encountered in field installations, and establishes uniform test criteria for compatibility.

In the preparation of this standard, input of users and other interested parties has been sought and evaluated. Inquiries, comments, and proposed or recommended revisions should be submitted to the NEMA Wiring Device Section and Lighting Systems Division by contacting:

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

This is the second edition of this guide.

The standards or guidelines presented in a NEMA standards publication are considered technically sound at the time they are approved for publication. They are not a substitute for a product seller's or user's own judgment with respect to the particular product referenced in the standard or guideline, and NEMA does not undertake to guarantee the performance of any individual manufacturer's products by virtue of this standard or guide. Thus, NEMA expressly disclaims any responsibility for damages arising from the use, application, or reliance by others on the information contained in these standards or guidelines.

A NEMA working group that included representatives from the Lighting Systems Division and members of the Wiring Device Section developed this standard. Approval of this guide does not necessarily imply that all members voted for its approval or participated in its development.

< This page is intentionally left blank. >

## **Section 1**

### **SCOPE**

This standard covers the definition, measurement, and testing of characteristics relevant to the use and application of lighting controls and electronic drivers, discharge ballasts, and self-ballasted lamps.

This standard covers devices rated 120 and 277 Vac intended to control electronic drivers, discharge ballasts, and self-ballasted lamp loads up to 16 amps of steady state current.

This standard does not cover or require additional testing for 15 and 20 amp general-use ac snap switches tested and listed in accordance with UL 20/CSA C22.2 No. 111, which includes a high inrush tungsten lamp load endurance test. They have been evaluated and determined to be compatible with the electronic drivers, discharge ballasts, and self-ballasted lamps as described in this publication.