ELI Technical Documents

for Certification

First Edition

ELI Voluntary Technical Specification for

Self-Ballasted LED Lamps for General Lighting Services

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ELI Quality Certification Institute

ELI Voluntary Technical Specification for Self-Ballasted LED Lamps for General Lighting Services

This specification is a high performance specification in developing and transition economies. It is formally issued on March 1st, 2011 and implemented on June.1st, 2011. The ELI Quality Certification Institute (ELI Institute) welcomes applications for Self-Ballasted LED Lamps certification starting on Feb.1, 2011. Applicants should consult the ELI website (www.efficientlighting.net) for the most up-to-date version of this specification. The ELI Institute reserves the right to correct or change this specification at any time.

1. Background

ELI is the Efficient Lighting Initiative, a voluntary international program for certifying the quality and efficiency of lighting products. It is operated by a non-profit organization, the ELI Quality Certification Institute, for the benefit of end users, policymakers, and lighting suppliers worldwide. The mission of ELI is to provide a transparent and simple mechanism for certifying the quality and efficiency of lighting products sold worldwide. ELI's strategy is to develop "reach" standards for lighting efficiency in developing and transition economies. It provides an endorsement of the quality and efficiency of lighting products.

ELI was initiated in 2000 by the International Finance Corporation (IFC) and funded by the Global Environment Facility (GEF), to promote efficient lighting in Argentina, the Czech Republic, Hungary, Latvia, Peru, the Philippines, and South Africa. The original ELI program tested the quality certification and labeling concept and focused on seven countries during the period 2000 through 2003. In 2005, IFC with funding from GEF, supported an establishment of the **ELI Quality Certification Institute** (ELI Institute) to develop and expand the ELI certification and branding system globally.

The expanded ELI program aims to cooperate with government agencies, international organizations, manufacturers, testing laboratories, lighting associations, large retailers and other market aggregators to accelerate the widespread adoption of energy efficient lighting products and thereby reduce greenhouse gas emissions. The ELI Institute seeks strategic partnerships to develop a global service network, and also seeks opportunities to harmonize test methods and performance specifications with other voluntary labeling programs.

Currently, the self-ballasted LED lamp is an important worldwide used lighting product. The definition of a performance standard guaranteeing high quality and efficiency is hence very significant to energy saving.

2. Scope

This specification applies exclusively to non-directional Self-Ballasted LED Lamps. These lamps have an integrated means for stable operation and are intended for general lighting purposes. They have screw or bayonet caps, a rated power up to 60W and a rated voltage of up to 250V AC or DC.

3. Definitions for this Specification

3.1 Self-Ballasted LED Lamp

A unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a LED light source and any additional elements necessary for starting and for stable operation of the light source.

3.2 Rated Voltage

The voltage or voltage range marked on the lamp, in voltage (V).

3.3 Initial Values
The photometric, electrical and color characteristics tested at the end of the 0-hour aging period.

3.4 Luminous Flux
Lumens generated by a lamp in rated voltage and stable operation, in lumen (lm).

3.5 Rated Wattage
The power marked on the lamp, in watts (W).

3.6 Luminous Efficacy
The ratio of the initial luminous flux of a lamp to the actual measured power, in lumens per watt (lm/W).

3.7 Lumen Maintenance
The ratio is generally expressed as a percentage of the luminous flux of a lamp at given time in its life to its initial luminous flux, while the lamp is being operated under specific conditions.

3.8 Correlated Color Temperature (CCT)
For practical purposes, the color of "white light" can be expressed by *correlated color temperature (CCT)* in the unit Kelvin [K]. The CCT is defined as the temperature of the Planckian radiator whose perceived color most closely resembles that of a given stimulus at the same brightness and under specified viewing conditions[i].

3.9 Average Rated Lamp Life
The number of hours when 50% of any large group of lamps have failed, in hours (h).

4. Technical Requirements
For ELI certification, self-ballasted LED lamps shall meet the following technical requirements.

4.1 Division of Certification Units
This technical specification defines the Certificaiton Units based on the rated power ranges and color temperature.

ELI divides self-ballasted LED lamps into four ranges of rated wattage. For each range of rated wattage, the lamps are divided into six unites for certification by correlated color temperature. See the table in 4.3.

Lamps of the same model produced at different manufacturing facilities or composed with different components must be certified separately. Each ELI certificate will indicate the name and location of the manufacturing facilities for each lamp model.

4.2 Performance Specifications
Items that must be clearly indicated on the product package are shown in italics.

Laboratory and Test Requirements	**Performance Specifications**
Laboratory Facility	Must be accredited according to ISO/IEC 17025 and qualified for pertinent lighting product tests by a recognized national or regional accreditation body. (See the ELI Certification Protocol on the ELI website.) A copy of the accreditation document must be provided to ELI.
Testing Conditions	Performed at 25±1°C in an international standard atmosphere with maximum relative humidity of 65%.
Position and Initial Burn-in	Measurements should be recorded from products in vertical base-up position, after an initial burn-in period of 0 hours, at stabilized light output and current.
Test Data and	The applicants shall submit a separate set of test reports for each individual model.

Sample Size	The test reports for the lowest wattage model in each certification unit as described in 4.1 and 4.3 must be from testing laboratories which meet the conditions described above. For other rated wattages in the same certification unit, the test reports from non-accredited testing laboratories are recognized. Test data must be from the model for which qualification is sought. Values indicated on the Product Application Form—Self-ballasted LED Lamps should be the testing data from the samples tested. Measurements of photometric and electrical characteristics must be submitted for 8 units[ii] of the same model.
Longevity of Test Results	Longevity of test results is two years, unless the applicant can document to ELI's satisfaction that older test results accurately portray the performance of the present model.

Electrical Characteristics	**Performance Specifications**
Electromagnetic and Radio Frequency Interference	Comply with CISPR 15 and relevant local regulations.
Harmonic	Comply with harmonic current limits set by IEC 61000-3-2.
Power Factor	Power factor shall be $\geq$ 0.5 at maximum power.
Electromagnetic Compatibility Immunity	Comply with IEC 61547 and all relevant local regulations if available.
Transient Protection	Comply with IEC 61547.

Operating Characteristics	**Performance Specifications**
Operating Conditions	*The product package must declare the operating temperature conditions.* In such conditions, with 92%~106% rated voltage, the lamp can start reliably and maintain stable operation.
Minimum Starting Temperature	*The product package must declare the minimum starting temperature and any other conditions (such as installation in an enclosed luminaire) that would affect either reliable starting or the starting time.*
Switch Withstand	At least 12500 cycles (50% of lamp life) based on cycle of 30 seconds off and 30 seconds on.
Lifetime	Must have a minimum rated lifetime of 25,000 hours as defined in 3.9. *Rated lifetime should be clearly indicated in hours on product packaging.*
Safety	Must comply with IEC 62560 and relevant local regulations.

Light Characteristics	**Performance Specifications**
Correlated Color Temperature	Must comply with IEC/PAS62612 and the color tolerance shall be within 7 SDCM from the target values. *Correlated color temperature (CCT) must appear on the product packaging.*
Color Rendering Index	Color Rendering Index (CRI) should be at least 80, as measured in accordance with CIE13.3.
Initial Luminous Flux	The initial luminous flux measured after the ageing time shall be not less than 90% of the rated luminous flux.

Lumen Maintenance	The luminous flux of the lamp must be ≥ 96% at 3000h, the luminous flux of the lamp must be ≥ 91.8% at 6000h. Luminous flux shall be measured according to IEC/PAS62612. The test results of luminous flux at 6000h are allowed not to accompany with the Product Application Form-Self-ballasted LED lamps. However, the test results of luminous flux at 6000h shall officially be submitted upon completion of the testing. ELI reserves the right to withdraw the use of the logo if the test results do not meet the ELI specification.
Color Rendering Sustainability	The change of chromaticity over the lumen maintenance test period (6000 hours) shall be within 0.007 on the CIE1976(u',v') The test results of color rendering sustainability are allowed not to accompany with the Product Application Form-Self-ballasted LED lamps. However, the test results of color rendering sustainability shall officially be submitted upon completion of the testing. ELI reserves the right to withdraw the use of the logo if the test results do not meet the ELI specification.

4.3 Efficiency Specifications

Lamp wattage shall be classified based on the rated wattage, but the test wattage shall be within ± 15% of rated wattage. Initial luminous efficacy shall be calculated from initial luminous flux and input power for the specific lamps measured at 25±1°C and at rated voltage. Where the rated voltage is a range, then the test voltage shall be: (a) the nominal voltage of the country/region of intended use; or; (b) the mid point of the rated voltage range where the country/region of intended use is unclear. The value of initial luminous efficacy (lm/W) of the lamps applying for ELI shall not be less than the value indicated in the table.

Input Power of Lamp (W)	**Initial Luminous Efficacy (lm/W)**					
	Correlated Color Temperature (CCT)					
	6500K	5000K	4000K	3500K	3000K	2700K
1～5	50		45			
6～10	55		50			
11～25	55		50			
26～60	50		45			

The product packaging must clearly state the performance of the following characteristics, as defined in IEC/PAS62612*:*

- *Rated power in watts, and*
- *Rated operating voltage, and*
- *Light output in lumens (luminous flux).*

4.4 Other Specifications

<table>
<tr><th>Requirements</th><th>Specifications</th></tr>
<tr><td>Label and Comparison of Self-Ballasted LED Lamp for General Lighting Service</td><td>Product packaging, enclosed literature, or product specification sheet shall list the lamp-cap type, efficiency and color rendering index of the lamp.

The packaging or enclosed literature should specify the rated luminous flux of the lamps, and should note its equivalency compared to the luminous flux of an incandescent lamp for general lighting service (GLS). The equivalent GLS must be elected in accordance with IEC 60064.

<table>
<tr><th>Light output (lm)</th><th>Power of standard GLS (W)</th></tr>
<tr><td>≥230</td><td>25</td></tr>
<tr><td>≥415</td><td>40</td></tr>
<tr><td>≥570</td><td>50</td></tr>
<tr><td>≥715</td><td>60</td></tr>
<tr><td>≥940</td><td>75</td></tr>
<tr><td>≥1,227</td><td>90</td></tr>
<tr><td>≥1,350</td><td>100</td></tr>
<tr><td>≥2,180</td><td>150</td></tr>
<tr><td>≥3,090</td><td>200</td></tr>
</table>
</td></tr>
<tr><td>Materials</td><td>Lamp and lamp package must comply with any local regulations regarding disclosure and disposal, including regulations regarding toxic materials. ELI encourages manufacturers to inform all purchasers about environmentally responsible options for disposal or recycling of lamps at end of the useful lamp life.</td></tr>
<tr><td>Quality Management System</td><td>Manufacturers shall have in place and implement a Quality Management System in accordance with ISO 9001-2008 or equivalent (equivalency to be determined by ELI).</td></tr>
<tr><td>Warranty</td><td>Purchaser may replace a defective ELI-certified lamp at point of purchase within 12 months from the date of purchase.
A written warranty in at least one applicable local language and a local address for consumer contacts and complaints must be included with product when purchased.</td></tr>
</table>

References

ELI qualified self-ballasted compact fluorescent lamps shall comply with the relevant clauses of the following standards, unless the ELI requirements stated above are more restrictive.

CIE 13.3-1995: Method of Measuring and Specifying Colour Rendering Properties of Light Sources.
IEC CISPR 15, Edition 6.2: Limits and Methods of Measurement of Radio Disturbance Characteristics of Electrical Lighting and Similar Equipment. 2002-10-30.
IEC 62560：Self-Ballasted LED Lamps for General Lighting Service>50V-Requirements.
IEC/PAS 62612：Self-ballasted LED-lamps for general lighting services–Performance requirements
IEC 61000-3-2, Edition 2.2：Electromagnetic Compatibility－Limits－Limits for Harmonic Current Emissions. (Equipment Input Current ≤16 A Per Phase). 2004-11.
IEC 61547：Equipment for General Lighting Purposes－EMC Immunity Requirements.
ISO/IEC 17025--2005: General Requirements for the Competence of Testing and Calibration Laboratories.
ISO 2859--1999: Sampling Procedures for Inspection by Attributes.
ISO 9001:2008：Quality Management System－Requirements.

Inquiries

For application forms and more information about ELI, refer to the ELI web site (http://www.efficientlighting.net). Please address all questions or comments regarding this specification to:

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[i] Ohno, Yoshi. 2000. CIE Fundamentals for Color Measurements. IS&T NIP16 Conference, Vancouver, Canada, Oct. 16-20, 2000. See CIE publications for methods of calculating CCT.

[ii] The ELI Quality Certification Institute will request at least 8 units of the same model, and will examine the samples in accordance with ISO 2859-1 and the principle of acceptance quality level (AQL): two failures or fewer will pass; and three failures or more will fail.