

ELI Technical Documents for Certification

Second edition

ELI Voluntary Technical Specification for Self-Ballasted Compact Fluorescent Lamps (CFLs)



Document No.: ELI-T01-2011
Issue Date: Mar. 1st 2011
Implementation Date: June. 1st 2011

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ELI Voluntary Technical Specification for Self-Ballasted Compact Fluorescent Lamps (CFLs)

This specification is formally issued on March 1st, 2011 and implemented on June 1st, 2011, at which time all prior versions shall be retired. The ELI Quality Certification Institute (ELI Institute) welcomes applications for product certification starting on March 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.

CFLs are an important energy efficient lighting technology promoted by organizations worldwide. They are available in many shapes, sizes, wattages, lumen outputs, efficiency levels and prices. For a list of ELI-certified products see the ELI website.

2. Scope

This specification applies exclusively to **self-ballasted compact fluorescent lamps (CFLs)**—with or without an cover, and without any reflector element. These lamps have an integrated means for controlling starting and 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 100V to 250V.

3. Definitions for this Specification

3.1 Self-Ballasted Fluorescent Lamp

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

3.2 Fluorescent Lamp

Discharge lamp of the low-pressure mercury type, in which most of the light is emitted by one or several



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layers of phosphors excited by ultraviolet radiation from the discharge.

3.3 Ballast

Unit inserted between the power supply and one or more discharge lamps serves mainly to limit the current of the lamp(s) to the required value. It may also include means for transforming the supply voltage and arrangements which help provide starting voltage and pre-heating current.

3.4 Rated Voltage

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

3.5 Initial Values

The photometric, electrical and color characteristics tested at the end of the 100-hour aging period.

3.6 Luminous Flux

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

3.7 Rated Wattage

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

3.8 Luminous Efficacy

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

3.9 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.

3.10 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 conditions¹.

3.11 Average Rated Lamp Life

The number of hours when 50% of any large group of lamps have failed, in hours (h).

3.12 Starting Time

Time needed, after the supply voltage is switched on, for the lamp to start fully and remain alight.

3.13 Run Up Time

The time needed, after the supply voltage is switched on, for the lamp to reach a specified percentage of its final luminous flux.

4. Technical Requirements

For ELI certification, self-ballasted compact fluorescent lamps shall meet the following technical requirements.

4.1 Division of Certification Units

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

ELI divides self-ballasted fluorescent lamps of the same lamp-cap type and the same diameter into four ranges of rated wattage. For each range of rated wattage, the lamps are divided into six units for certification by correlated color temperature. See the table in 4.3.



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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 100 hours, at stabilized light output and current.
Test Data and Sample Size	The applicants shall submit a separate set of test reports for each individual model. 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 Compact Fluorescent 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 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	<i>The product package must declare the operating temperature conditions.</i>



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Conditions	In such conditions, with 92%~106% rated voltage, the lamp can start reliably and maintain stable operation.
Minimum Starting Temperature	<i>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.</i>
Starting Time	CFL must continuously illuminate within 1.5 second of being switched on at $25\pm 1^{\circ}\text{C}$ and 92 % of rated voltage.
Run up Time	Up to 3 minutes to reach 80% of light output
Switch Withstand	50% of lamp life as switching(ie ie 4000 switches for 8000 hour lamp life Claimed) Cycle times must be 1 minute on, 3 minutes off. Lamp will be cycled once for every two hours of rated lamp life.
Premature Failure	Not more than 10% failure within 1000 hours.
Lifetime	Must have a minimum rated lifetime of 8,000 hours as defined in 3.11. <i>Rated lifetime should be clearly indicated in hours on product packaging.</i>
Safety	Must comply with IEC 60968 and relevant local regulations.

Light Characteristics	Performance Specifications
Correlated Color Temperature	Must comply with IEC 60969 and the color tolerance shall be within 5SDCM from the target values. <i>Correlated color temperature (CCT) must appear on the product packaging.</i>
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 80% of initial levels at 40% of model's rated lifetime. Luminous flux shall be measured according to IEC 60969.

4.3 Efficiency Specifications

Lamp wattage shall be classified based on the rated wattage, but the test wattage shall be within $\pm 15\%$ of rated wattage. Initial luminous efficacy shall be calculated from initial luminous flux and input power for the specific lamps measured at $25\pm 1^{\circ}\text{C}$ 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
≥ 5 to <9	46			50		
≥ 9 to <15	52			55		
≥ 15 to <25	57			60		
≥ 25 to ≤ 60	62			65		

The minimum initial luminous efficacy of a lamp model with a cover (no reflector) shall be no less than 85% of the requirements indicated in the above table. Separate applications must be made for models offered with a cover option.

Applicants/Manufacturers may manufacture lamps of non-standardized chromaticity co-ordinates according to the requirements of customers, but the target values of the non-standardized chromaticity co-ordinates should be given at the same time, with its color tolerance within 5 SDCM. For lamps of non-standardized colors, their luminous effects should be determined as the higher rating of energy



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efficiency among the values of luminous efficacy of the neighboring standard colors.

The product packaging must clearly state the performance of the following characteristics, as defined in IEC 60969:

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

4.4 Other Specifications

Requirements	Specifications																				
Label and Comparison of Self-Ballasted Compact Fluorescent Lamps to General Lighting Service	<p>Product packaging, enclosed literature, or product specification sheet shall list the diameter of lamp tubes and the lamp-cap type, and the length, efficiency and color rendering index of the lamp.</p> <p><i>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.</i></p> <table border="1"> <thead> <tr> <th>Light output (lm)</th> <th>Power of standard GLS (W)</th> </tr> </thead> <tbody> <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> </tbody> </table>	Light output (lm)	Power of standard GLS (W)	230	25	415	40	570	50	715	60	940	75	1,227	90	1,350	100	2,180	150	3,090	200
Light output (lm)	Power of standard GLS (W)																				
230	25																				
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940	75																				
1,227	90																				
1,350	100																				
2,180	150																				
3,090	200																				
Materials	<i>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.</i>																				
Mercury Content	Mercury content should be less than 5mg, as measured in accordance with IEC62321																				
Quality Management System	Manufacturers shall have in place and implement a Quality Management System in accordance with ISO 9001-2000 or equivalent (equivalency to be determined by ELI).																				
Warranty	Purchaser may replace a defective ELI-certified lamp at point of purchase within 12 months from the date of purchase. <i>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.</i>																				

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.



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IEC 60064, Edition 6.3 : Tungsten Filament Lamps for Domestic and Similar General Lighting Purposes Performance Requirements. 2005-05.
IEC 60968 Edition 1.2 : Self-Ballasted Lamps for General Lighting Service - Safety Requirements. 1999-09.
IEC 60969, Edition 1.2 : Self-Ballasted Lamps for General Lighting Service - Performance Requirements. 2001-03.
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.
IEC62321 : Procedures for the Determination of Levels of Six Regulated Substances(Lead, Mercury, Hexavalent Chromium, Polybrominated Biphenyls, Polybrominated Biphenyl Ether) in Electrotechnical Products
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.