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ELI Voluntary Technical Specification for Double-Capped Fluorescent Lamps



ELI Quality Certification Institute

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ELI Voluntary Technical Specification for Double-Capped Fluorescent Lamps

This specification is a high performance specification in developing and transition economies. It becomes valid on August 1, 2006. The ELI Quality Certification Institute (ELI Institute) welcomes applications for double-capped fluorescent lamps certification starting on August 1, 2006. 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 high performance technical specifications adapted to the 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 double-capped fluorescent lamp is an important worldwide used lighting product. The definition of a performance standard guaranteeing high quality and efficiency is hence very significant for energy saving.

2. Scope

The specification is applicable to double-capped fluorescent lamps with a rated power between 14W and 65W. The lamps may have preheated cathodes and be designed for operation on AC mains frequencies with the use of a starter, or they may be of the type designed for operation at high frequency.

It shall be expected that lamps which comply with this specification will start and operate satisfactorily at voltages between 92% and 106% of rated supply voltage and at an ambient air temperature of between 10°C and 50°C, when operated with a ballast complying with IEC 60921 or IEC 60929, where relevant with a starter complying with IEC 60155 or IEC 60927, and in a luminaire complying with IEC 60598.

3. Definitions for this Specification

3.1 Double-Capped Fluorescent Lamp

Discharge lamp of the low-pressure mercury type having two separate caps and mostly of tubular form and linear shape, in which most of the light is emitted by one or several layers of phosphors excited by the



ultra-violet radiation from the discharge.

3.2 Reference Ballast

Special ballast, either inductive for lamps for operation on a.c. mains frequencies, or resistive for lamps for operation on high frequency. It is designed for the purpose of providing comparison standards for use in testing ballasts, for the selection of reference lamps and for testing regular production lamps under standardized conditions. It is essentially characterized by the fact that at its rated frequency, it has a stable voltage/current ratio which is relatively uninfluenced by variations in current, temperature and magnetic surroundings, as outlined in the relevant ballast standard. [IEV 845-08-36, modified]

3.3 Initial Values

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

3.4 Luminous Flux

Lumens generated by a lamp in rated voltage and stable operation, in lumens (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 its 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

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.

3.9 Average Rated Lamp Life

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

Note: An individual lamp shall be deemed to have reached the end of its life (failed) when it operates to burn out or to the criterion of lumen maintenance laid down in this specification.

4. Technical Requirements

For ELI certification, double-capped 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 double-capped fluorescent lamps of the same lamp-cap type and the same diameter into three 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.

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.



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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%; the light characteristics of high efficient preheated cathode double-capped T5 fluorescent lamps shall be performed at 35±1 °C.
Position and Initial aging	Measurements should be recorded from products in horizontal position, after an initial aging period of 100 hours, at stabilized light output and current.
Test Data and Sample Size	<p>The applicants shall submit a separate set of test reports for each individual model. The test reports for the lowest wattage model among the models of the same certification unit (as described in 4.1 and 4.3) that are to applying for ELI, must be from testing laboratories which meet the conditions described above, except the full lifetime test report (see requirements of the full lifetime test report below). For other rated wattages in the same certification unit, the test reports from non-accredited testing laboratories are recognized.</p> <p>Test data must be from the model for which qualification is sought. Values indicated on the Product Application Form—Double-Capped Fluorescent Lamps should be the testing data from the samples tested. Measurements of photometric and electrical characteristics must be submitted for 8 unitsⁱⁱ of the same model.</p>
Validity of Test Results	Validity 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.

Operating Characteristics	Performance Specifications
Operating Conditions	<i>The product package must declare the operating temperature conditions.</i> At 10°C-50°C, with 92%~106% rated voltage, the lamp can start reliably and maintain stable operation.
Starting time	Comply with starting characteristics limits set by IEC 60081.
Lifetime	<p>Must have a minimum rated lifetime of 12,000 hours as defined in 3.9. <i>Rated lifetime should be clearly indicated in hours on product packaging.</i></p> <p>Method of test for the life of a lamp shall be in accordance with IEC 60081. The full lifetime testing conducted by manufacturers' testing facilities or by any other non-accredited testing facilities is acceptable for ELI application. ELI, nevertheless, may request clarification and/or additional supporting documents as appropriate, and reserves the right to accept or reject the test reports submitted. Requirements of validity of test result in this specification and validity period of the test report specified in the ELI Qualification Protocol are not applicable to the full lifetime test report of double-capped fluorescent lamp.</p>
Safety	Must comply with IEC 61195 and relevant local regulations.



Light Characteristics	Performance Specifications
Correlated Color Temperature	Must comply with IEC 60081 and the color shall be within 5SDCM from the target value. <i>Correlated color temperature (CCT) must appear on the product packaging.</i>
Color Rendering Index	Color Rendering Index (CRI) should be no less than 80, as measured in accordance with CIE13.3.
Lumen Maintenance	The luminous flux of the lamp must be $\geq 85\%$ of initial levels at 40% of model's rated lifetime. Luminous flux shall be measured according to IEC 60081.

4.3 Efficiency Specifications

Lamp wattage shall be classified based on the rated wattage, but the actual measured wattage shall be within $105\% + 0.5W$ of rated wattage.

Initial luminous efficacy shall be calculated from initial luminous flux and input power for the specific lamps measured at rated voltage and specified temperature. 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)					
	2700K	3000K	3500K	4000K	5000K	6500K
≥ 14 to <22	65			60		
≥ 22 to <36	75			70		
≥ 36 to <65	85			80		

Note: This table and requirements are not applicable to high efficient preheated cathode double-capped T5 fluorescent lamps.

High efficient preheated cathode double-capped T5 fluorescent lamps that adopt high frequency should meet the following luminous efficacy requirements.

Input Power of Lamp (W)	Initial Luminous Efficacy (lm/W)					
	Correlated Color Temperature (CCT)					
	2700K	3000K	3500K	4000K	5000K	6500K
≥ 14 to <22	85			80		
≥ 22 to <36	93			88		

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

The produce packaging must clearly state the performance of the following characteristics:

- Rated Lamp power in watts, and
- Light output in lumens.

4.4 Other Specifications



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Requirements	Specifications
Label	Product packaging, enclosed literature, or product specification sheet shall list the diameter of lamp tubes (either in millimeters or as a T * number) and the lamp-cap type, and the length, efficiency and color rendering index of the lamp. <i>The packaging or enclosed literature should specify the rated luminous flux of the lamp.</i>
Materials	<i>Lamp and lamp package must comply with any local regulations regarding disclosure and disposal, including regulations regarding toxic materials such as mercury.</i> ELI encourages manufacturers to inform all purchasers about environmentally responsible options for disposal or recycling of lamps at end of the useful lamp life.
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).
Product Use Guidance	<i>The manufacturer or distributor shall offer a clear and credible guidance in the relevant local language on how to select compatible components to create a highly efficient lighting system.</i>
Warranty	The purchaser of a defective ELI-certified lamp shall be able to obtain a replacement lamp at no cost from the point of purchase within 12 months from the date of purchase. <i>A written no-questions-asked 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 double-capped 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 60081, Edition 5: Double-Capped Fluorescent Lamps-Performance Specifications. Amendment 2, 2003-03;

IEC 61195, Edition 2: Double-Capped Fluorescent Lamps-Safety Specifications. 1999-10;

ISO/IEC 17025--2005: General Requirements for the Competence of Testing and Calibration Laboratories;

ISO 9001:2000, Edition 3: Quality Management System—Requirements. 2004-12-31;

ISO 2859--1999: Sampling Procedures for Inspection by Attributes.

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.