



IFC/GEF Efficient Lighting Initiative Voluntary Technical Specification Compact Fluorescent Lamps

Background

Developing countries often share common market barriers to the use of energy-efficient lighting. Barriers include inadequate information about the energy, economic and environmental benefits of efficient lighting, and a lack of credible sources of such information.

To address these barriers, ELI develops and promotes voluntary technical specifications that include rigorous technical and quality criteria. ELI has a labeling system that helps consumers identify energy efficient lighting products that meet the ELI specifications. ELI programs include marketing, educational, market building, and financing activities. Each participating country tailors its activities to meet the needs of the local market. These activities are supported by US\$15 million in Global Environment Facility funding, and by additional local and international funding. Lighting manufacturers whose products meet the ELI specifications are invited to launch product promotions and advertising campaigns in cooperation with ELI's local marketing programs.

Manufacturers interested in ELI should review the ELI voluntary technical specifications to determine whether or not their products could comply. They should then review the ELI qualification protocol for guidance on how their lighting products could receive the ELI label.

Compact Fluorescent Lamps

Compact fluorescent lamps (CFLs) are an important energy efficient lighting technology that is promoted through ELI. ELI-labeled CFLs are available in a wide variety of lamp dimensions, with various wattages, lumen outputs, efficiency levels and prices. For a current list of ELI-labeled products, see <www.efficientlighting.net>

Definitions for this Specification

Ballast

Refers to an electrical device used with an electric-discharge lamp to obtain the necessary circuit conditions (voltage, current and waveform) for starting and operating the lamp.

Compact Fluorescent Lamp (CFL)

Refers to any compact fluorescent lamp/ballast combination designed for applications furnished with a socket originally intended to operate standard incandescent bulbs. CFLs may be either unitary (a single, non-separable unit containing lamp and ballast, also often referred to as self-ballasted), or, modular (designed so that the lamp may be removed from the ballast and replaced by the consumer).

Dimmability

Unless otherwise indicated, the requirements set forth in this specification apply to non-dimmable CFLs, and also to dimmable CFLs that are operating at maximum power.

Efficiency

Calculated as initial lumens measured with the CFL in optimal operating position divided by the measured input power and expressed as lumens per watt (lm/W).

Fluorescent Lamp

Refers to an electric discharge lamp that generates visible light through fluorescence when attached to and operated by an appropriate ballast.

Input Power

Power drawn by the CFL in stable operation after an initial burn-in period of 100 hours. Input power shall be the power drawn measured in watts (W) by the specific lamp and ballast combination being tested during stable operation at maximum power.

Luminous Flux

Lumens generated by the CFL in stable operation after an initial aging period of 100 hours. Luminous flux shall be measured as the lumens generated by the specific lamp and ballast combination included in the CFL being tested during stable operation at maximum power in the vertical base up (VBU) position.

Normal Operation

These specifications require that measurements be taken from CFLs operating at rated voltage and temperature. Measurements shall be taken from CFLs in the vertical base up (VBU) position after an initial burn-in period of 100 hours, with stable light output and power supply, unless otherwise noted.

Standard References

- IEC International Electrotechnical Commission
- EN European Norm (European Union Standard)
- IESNA Illuminating Engineering Society of North America
- CIE Commission Internationale d'Eclairage (International Illumination Commission)
- ANSI American National Standards Institute
- ISO International Standards Organization

Compact Fluorescent Lamp (CFL) shall meet the following ELI performance specifications. *Items that must be clearly indicated on the CFL product package are indicated in italics.*

Laboratory and Test Requirements	Performance Specifications
Laboratory Facility	Must be accredited according to ISO 17025, or equivalent standard. Accreditation document must be provided to ELI.
Testing Conditions	Performed at 25 C in an atmosphere with maximum relative humidity of 65%.
Position and Initial Burn-in	Measurements should be recorded from products in the VBU position, after an initial burn-in period of 100 hours at stabilized light output and current.
Test Data and Sample Size	Test data must be from the model for which qualification is sought. Values indicated on the application form shall be calculated as the average of the data from all the units tested. Measurements of electrical characteristics must be submitted for at least 10 units of the same CFL model. Measurements of photometric characteristics must be submitted for at least three units of the same CFL model.
Longevity of Test Results	Test results must be less than two years old, unless manufacturer can document to ELI's satisfaction that older test results accurately portray the performance of the present model.

Efficiency Specifications

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

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

Efficiency shall be calculated from luminous flux and input power for the specific lamp and ballast combination in the CFL measured at 25 °C and 220 V. To qualify, CFLs of any tube configuration shall meet the following minimums.

If CFL has either an integral or a separate ballast

- At input power of <15 W: ≥ 45 lm/W
- At input power of ≥ 15 W and >4000 CCT: ≥ 55 lm/W
- At input power of ≥ 15 W and ≤ 4000 CCT: ≥ 60 lm/W

If CFL has a translucent cover

- At input power of ≤ 14 W: ≥ 40 lm/W
- At input power of 15 to 19 W: ≥ 48 lm/W
- At input power of 20 to 24 W: ≥ 50 lm/W

At input power of ≥ 25 W: ≥ 55 lm/W

If CFL has a reflector

- At input power of <19 W: ≥ 33 lm/W
- At input power of ≥ 19 W: ≥ 40 lm/W

Power Characteristics	Performance Specifications
Electromagnetic and Radio Frequency Interference	Comply with CISPR 15 or relevant local regulations.
Power Factor	Measured in vertical base up position, and as defined in IEC 61000. CFLs for inclusion in ELI programs in Latvia, Hungary and the Czech Republic must comply with power quality limits set by IEC 61000-3-2. CFLs for other ELI countries must have a power factor of 0.5 or greater at maximum power as defined by IEC 61000.
Tolerance of Voltage Variation	Manufacturers must state in the application that CFL will perform within specified parameters at a range of nominal voltages $\pm 10\%$ of rated operating voltage without reduction in the rated life.
Transient Protection	CFLs must comply with IEC 61547.

Operating Characteristics	Performance Specifications
Lamp Start	CFL must continuously illuminate within 1.5 seconds of being switched on at minimum rated starting temperature and maximum power. Prior to measurement CFL must be switched off for at least 30 minutes.
Starting Temperature	<i>CFL 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>
Lifetime	CFLs must have a minimum rated lifetime of 6,000 hours as defined in IEC 60969. <i>Lifetime shall be clearly indicated in hours on product packaging.</i>
Safety	CFLs must meet all local safety requirements and the requirements of IEC 60968 for unitary CFLs and applicable parts of IEC 61199 and 60598 for modular CFLs.

Light Characteristics	Performance Specifications
Correlated Color Temperature	<i>Correlated color temperature (CCT) of CFL must appear on product packaging (as defined in IEC 60969 and measured in accordance with IES LM-16-1984, "Colorimetry of Light Source" and the 1993 IESNA Lighting Handbook).</i>
Color Rendering	Color Rendering Index (CRI) of at least 80 for fluorescent lamps with a diameter less than 2.0 cm. CRI of at least 70 for all other lamps (as defined in IEC 60969, measured in accordance with CIE 29/2).
Lumen Maintenance	After 2000 hours of operation the luminous flux of CFLs must be $\geq 80\%$ of initial levels (measured in accordance with IES LM-66-1991 or IEC 60969 for unitary CFLs, IEC 60901 for modular CFLs).
Stabilized Light Output	The time to 75% of stabilized light output after switch-on shall not exceed 100 seconds, or, the time to 80% of stabilized light output after switch-on shall not exceed 120 seconds (measured in accordance with IEC 60969).

Other	Performance Specifications	
Comparison of CFL to GLS on Label**	<i>Lumen output noted on package must be the luminous flux as reported to ELI for the specific lamp and ballast combination in the package. Where the packaging or other literature claims that the rated luminous flux of the CFL is equivalent to, or exceeds that, of an equivalent GLS filament lamp the lamp rating must comply with the following requirements:</i>	
	CFL Luminous Flux Claim (lm)	Rated Wattage of equivalent GLS filament lamp
	≥ 214	≤ 25 W
	≥ 386	≤ 40 W
	≥ 530	≤ 50 W
	≥ 660	≤ 60 W
	≥ 874	≤ 75 W
	≥ 1100	≤ 90 W
	≥ 1246	≤ 100 W
	≥ 2009	≤ 150 W
Warranty	In addition, manufacturers must notify ELI if the CFL exhibits ≥ 10% light output degradation due to: <ul style="list-style-type: none"> • Operation outside of rated temperature range or, • Operation in other than VBU position or, • Any other factors. 	
Quality of Production	Purchaser may return the CFL to point of purchase with no explanation necessary within 12 months from the date of purchase for a full refund. <i>Written warranty in at least one applicable local language must be included with CFL when purchased.</i> Manufacturer shall provide a local address for customer contacts and complaints.	
	CFLs must be manufactured under a Quality Assurance System in accordance with ISO 9000-2000 or equivalent (equivalency to be determined by ELI).	

Reference Specifications

- IEC - 61547 Equipment for General Lighting Purposes - EMC Immunity Requirements.
- IEC – 60969 Self-Ballasted Lamps for General Lighting Service: Performance Requirements.
- IEC – 61199 Single-Capped Fluorescent Lamps: Safety Requirements.
- IEC – 60968 Self-Ballasted Lamps for General Lighting Service: Safety Requirements.
- IEC – 60901 Single-capped Fluorescent Lamps: Performance Requirements.
- IEC - 61000-3-2 Electromagnetic Compatibility - Limits - Limits for Harmonic Current Emissions (equipment input current ≤ 16A per phase).
- EU Ecolabel Criteria for Single-Ended Lightbulbs.
- Propuesta De Norma De Eficiencia Energética Para Lamparas Fluorescentes Compactas - LFC's, Peru May 1999.
- ANSI C78.5-1997 Specifications for Performance of Self-Ballasted Compacted Fluorescent Lamps U.S.A., 1997.
- Minimum Specifications for Promotional CFLs: IFC/GEF Poland Efficient Lighting Project, Poland 1997.

Revised July 10, 2002

- Pacific Northwest National Laboratories Subcompact Fluorescent Lamp: Bulk purchase program features and specifications. U.S.A. 1998.
- ENERGY STAR® Compact Fluorescent Lamp Specification. U.S.A. 1999.
- European Wide Initiative for the Promotion of Efficient Lighting in the Residential Sector: Campaign CFLs Quality Charter.

Inquiries

Please address all questions or comments regarding this specification to:

Ms. Kathryn Conway
Technical Consultant, Efficient Lighting Initiative
P.O. Box 510
Nassau, NY 12123-0510 USA
E-mail eli@kateconway.cc