



IFC/GEF Efficient Lighting Initiative Voluntary Technical Specification Lamp-ballast Circuits for Indoor Luminaires with 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.

Indoor CFL Luminaires

CFL luminaires intended for indoor use are already in wide use in the commercial sectors of Western Europe and North America. These luminaires will be broadly promoted the commercial sector in ELI countries, but also to residential customers. Indoor CFL luminaires are becoming available in a wide variety of styles, with various wattages, lumen outputs, efficiency levels and prices. Local manufacturers are adapting CFL technology in luminaires suited to local tastes. This voluntary technical specification will serve to identify indoor CFL luminaires that save energy and meet customer expectations for quality and performance, with the specific goal of encouraging penetration into residential lighting markets.

Definitions

Ballast

For the purposes of this specification, ballast shall refer to an electrical or electronic device used with an electric-discharge lamp to obtain the necessary circuit conditions (voltage, current and waveform) for starting and operating of the lamp.

Fluorescent Lamp

For the purposes of this specification, fluorescent lamp shall refer to an electric discharge lamp that generates visible light through fluorescence when attached to an appropriate ballast. The self-ballasted lamp, or CFL, is considered in IFC/GEF Efficient Lighting Initiative, Voluntary Technical Specifications, Compact Fluorescent Lamps.

Indoor Compact Fluorescent Lamp (CFL) Luminaire

A complete lighting unit consisting of a separate compact fluorescent lamp or lamps and ballasts together with other components designed to distribute the light, to position and protect the lamps and to connect them to the power supply. Ballasts shall be hardwired in the luminaire (housing). Indoor CFL luminaires include both luminaires that are permanently connected to the supply mains and portable luminaires that utilize a plug to connect to an electrical socket.

Indoor CFL luminaires are intended for interior use and will be qualified and sold with appropriate, pin-based (or "single capped") compact fluorescent lamp(s). CFL luminaires shall permit users to replace lamp(s) when they expire or fail and manufacturers shall provide information indicating which lamps will provide performance equal to or better than the lamp(s) sold with the CFL luminaire.

Normal Operation

All performance parameters assume that measurements are taken from CFL luminaires operating at rated voltage and 25 degrees C. Measurements shall be taken from CFL luminaires after an initial burn-in period of 100 hours, with stable light output and power unless otherwise noted.

Luminous Flux

Lumens generated by the lamp-ballast circuit applied in the indoor CFL luminaire in stable operation after an initial burn-in period of 100 hours. For the purposes of this specification, luminous flux shall be measured for the specific lamp and ballast combination in question only, without considering the effects of other luminaire components, as the lumens generated under stable operation at maximum power.

Input Power

Power drawn by the indoor CFL luminaire 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-ballast circuit in question when under stable operation at maximum power.

Efficiency

The total efficiency of any luminaire is a function of both the electrical efficiency of the light source in converting electricity to visible light, and the optical efficiency with which the reflectors, lenses and other components of the luminaire direct that light to its intended use. Unfortunately, it can be quite expensive to gather optical efficiency data and manufacturers generally do not provide it for residential luminaires (unlike more expensive luminaires intended for commercial applications). Many indoor luminaire manufacturers are also small businesses that purchase lamps and electrical components from third party manufacturers to install in luminaire housings. Therefore, this specification considers only the efficiency of the lamp and ballast combination used in the indoor CFL luminaire in question, and disregards the effects of the other luminaire components.

For the purposes of this specification, efficiency shall be the total rated luminous flux generated by all lamps in an indoor CFL luminaire, as published by the lamp manufacturer, multiplied by the ballast factor, as published by the ballast manufacturer, divided by the Input Power for the indoor CFL luminaire. Lamp-ballast circuit efficiency is measured in lm/W.

Dimmability

Some CFL luminaires are now available in models offering either multiple levels of light output or continuously variable dimming. Unless otherwise indicated, the requirements proposed apply to both non-dimmable and dimmable CFL luminaires operating at maximum power.

Standard References

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

Indoor CFL luminaires

Efficiency	Performance Specifications
<p>All Lamp Types¹</p> <p>Below 20W input power (all lamp types)</p> <p>20 to 29W input power (all lamp types)</p> <p>≥ 30W input power including the following lamp types: circular, pin-based CFLs, other non linear lamps and linear lamps ≤ 60 cm in length)</p>	<p>(Light source efficiency only, see definitions above)</p> <p>≥ 50 lm/W</p> <p>≥ 55 lm/W</p> <p>≥ 60 lm/W</p>

Power Characteristics	Performance Specifications
Electromagnetic and Radio Frequency Interference	Comply with CISPR 15 or relevant local regulations.
Power Factor	Lamp-ballast circuits used in indoor CFL luminaires for inclusion in ELI programs in Latvia, Hungary and the Czech Republic must comply with power quality limits set by IEC 61000-3-2. Indoor CFL luminaires for inclusion in ELI programs in 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	Indoor CFL luminaires must perform within specified parameters at a range of nominal voltages ± 10% of rated operating voltage without reduction in the rated life of lamps or ballasts.
Transient Protection	Lamps and ballast combinations supplied with CFL luminaires must comply with IEC 61547 and all equivalent local requirements.

Operating Characteristics	Performance Specifications
Lamp Start	Lamp and ballast combinations must continuously illuminate within 2.0 second of being switched on.
Safety	CFL luminaires must meet all relevant local safety regulations and the requirements of IEC 61199 and IEC 60598 Part 1 and Parts 2, where applicable.

¹ Initial lamp lumens from manufacturer's literature, multiplied by the ballast factor for the ballast used in the CFL luminaire, yielding lamp/ballast system efficiency.

Light Characteristics	Performance Specifications
Correlated Color Temperature	Correlated lamp color temperature of compact fluorescent lamps included in indoor CFL luminaire should appear on product packaging. (Measured in accordance with IEC 60901 and measured in accordance with IES LM-16-1984, Colorimetry of Light Source and the 1993 IES Lighting Handbook)
Color Rendering	Color Rendering Index (CRI) of at least 70 (as defined in IEC 60969, measured in accordance with CIE 29/2)
Lumen Maintenance	Manufacturer rating that after 2000 hours of operation the luminous flux should be not less than 80% of the initial luminous flux (measured in accordance with IEC 60901)
Stabilized Light Output	The time to 75% of stabilized light output, after switch-on shall be less than 180 seconds. (Measured in accordance with IEC 60901)

Other	Performance Specifications	
Lamp Replacement	An appropriate fluorescent lamp must be included with the luminaire at time of sale. Luminaire must allow replacement of fluorescent lamp without also requiring replacement of ballast or other components.	
Labeling, Comparison CFL/GLS**	Light output as noted on package should be luminous flux as reported to ELI for the specific lamp and ballast combination used in the product. Where the packaging or other literature claims that the luminous flux of the indoor CFL luminaire is equivalent to, or exceeds that, of equivalent GLS filament lamp(s), the luminous flux of the specific lamp and ballast combination included with the indoor CFL luminaire must comply with the following requirements:	
	Indoor CFL luminaire Luminous Flux Claim (lm)	Rated Wattage(s) of equivalent GLS filament lamp
	≥ 214	≤ 25 W
	≥ 386	≤ 40 W
	≥ 660	≤ 60 W
	≥ 874	≤ 75 W
	≥ 1246	≤ 100 W
	≥ 2009	≤ 150 W
	Also, manufacturers of indoor CFL luminaires must indicate anticipated degradation of light output ≥ 10% of rated luminous flux due to: Operation outside of rated temperature range or, Location or position of installation or, Any other environmental or installation factors.	
Longevity (ballast)	Manufacturer shall provide information stating appropriate generic lamp descriptors, including: lamp diameter, length, wattage, CRI, and base type both on the exterior packaging <i>and</i> in either included installation instructions or application information sent to specifiers. Ballasts shall be rated by the manufacturer at a minimum life of 20,000 hours until 50% failure of a sample of ≥ 20 units of a product.	
Quality of Production	Compact fluorescent lamps and ballasts used in indoor CFL luminaire must be manufactured under a quality assurance system in accordance with ISO 9002 (ISO 9000-2000 starting in 2000) or equivalent (equivalency to be determined by ELI).	

Warranty	Repair or replacement of defective parts of the indoor CFL luminaire (except lamps) for 2 years from the date of purchase. Written warranty at least one applicable local language must be included with luminaire when purchased. Manufacturer shall provide a local (in-country) mailing address for customer warranty concerns and product returns.
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Notes:

* **Power Factor:** European Union requirements for harmonics injected by electricity using consumer goods drawing ≤ 25 Watts will become quite strict in 2001. These requirements will impose costs on manufacturers and consumers and possibly have a negative impact on the reliability of indoor CFL luminaires. Therefore, only in ELI participant countries that are candidates for EU integration (Latvia, Hungary and the Czech Republic) will indoor CFL luminaires be required to comply with IEC 61000-3-2 in order to qualify for participation in ELI. Indoor CFL luminaires in the remaining four ELI countries may qualify if they meet the stated power factor requirements.

** **Labeling:** It is the intent of this specification that the efficiency measurement requirements in combination with the labeling requirements shall encourage manufacturers of indoor CFL luminaires to re-examine common current GLS equivalency claims.

Reference Specifications

- IEC – 60598 Safety Requirements of luminaires.
- IEC – 61199 Single-capped fluorescent lamps: 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 ≤ 16 A per phase).
- IEC - 61547 Equipment for general lighting purposes - EMC immunity requirements.
- US EPA/DOE ENERGY STAR® Residential Light Fixture Memorandum of Understanding, USA 1997.
- Minimum Specifications for Promotional CFLs: IFC/GEF Poland Efficient Lighting Project, Poland 1997.
- ISO 9000-2000 Manufacturing Quality Assurance.

Inquiries

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