

ELI Technical Documents for Certification

First Edition
2007-02-01

ELI Voluntary Technical Specification for Ballasts for Double-Capped Fluorescent Lamps



ELI Quality Certification Institute

Document No.: ELI-T03

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ELI Voluntary Technical Specification for Ballasts for Double-Capped Fluorescent Lamps

This specification is a high performance specification for developing and transition economies. It becomes valid on February 1, 2007. The ELI Quality Certification Institute (ELI Institute) welcomes applications for ballasts for double-capped fluorescent lamps certification starting on February 1, 2007. 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 (ELI 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 needs of developing and transition economies. It provides an endorsement of the quality and efficiency of lighting products that have passed the ELI certification process.

Double-capped fluorescent lamps are an important lighting product used worldwide. The ELI Voluntary Technical Specification for Double-capped Fluorescent Lamps was formally launched by the ELI Institute on 1 August, 2006 to assist government agencies, international organizations, testing laboratories, lighting associations, retailers and other market aggregators in identifying high quality, high efficiency Double-capped Fluorescent Lamps. To further support this process, the ELI Institute has now developed this specification for ballasts for double-capped fluorescent lamps to improve the fluorescent system efficiency.

2. Scope

The ballasts covered by this specification are of magnetic or electronic type, that are used with double-capped fluorescent lamps having preheated cathodes with a rated lamp power from 14W to 80W, for 50Hz, 60Hz or high frequency alternating power supply.

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 Ballast

A device connected between the supply and one or more discharge lamps which serves mainly to limit the current of the lamp(s) to the required value. It may include means for transforming the supply voltage and/or frequency, correcting the power factor and, either alone or in combination with a starting device, provide the necessary conditions for starting the lamp(s).

3.3 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.

3.4 Reference Lamp

A Lamp selected for testing ballasts which, when associated with a reference ballast, has electrical characteristics that are close to the objective values as given in the relevant lamp standard.

3.5 Supply Voltage

Voltage applied to the complete circuit of lamp(s) and lamp controlgear, in volts (V).

3.6 Voltage Range

Range of supply voltage over which the ballast is intended to be operated

3.7 Energy Efficiency Index (EEI) Classification

An alphanumeric indicator (dimensionless) related to the corrected total input power of a ballast-lamp circuit under test, ranging A1, A and B.

3.8 Minimum Energy Performance Standards (MEPS)

The MEPS level for a particular ballast-lamp combination is the maximum permitted corrected total input power of a ballast-lamp circuit specified in this specification.

3.9 Ballast Lumen Factor (BLF)

The BLF is defined as the ratio of the light output of the test system (test ballast/ reference lamp combination) to the light output of the reference system (reference ballast/ reference lamp combination).

$$BLF = \frac{L_{test}}{L_{ref.}} \quad (1)$$

where

L_{test} is the measured light output of the reference lamp when connected to the test ballast, expressed in lumens (lm).

$L_{ref.}$ is the measured light output of the reference lamp when connected to the reference ballast, expressed in lumens (lm).

L_{test} and $L_{ref.}$ shall be measured according to EN 50294.

3.10 Total Input Power

The total power supplied (in watts) to the ballast-lamp circuit measured at the test voltage.

3.11 Corrected total input power

The total input power in watts of the ballast-lamp circuit under test corrected to comparable reference conditions.

Note: The determined values of corrected total input power shall be averaged and the average shall not be rounded.

a) The corrected total input power of a ballast-lamp circuit (excluding mains frequency magnetic ballasts with two-wire connection and with an external starter) shall be determined from Equation 2.

$$P_{tot.cor.} = P_{tot.test} \times \frac{P_{rated}}{P_{ref.}} \times \frac{1}{BLF} \quad (2)$$

where

P_{rated} is the rated lamp or typical HF power in watts of the relevant reference lamp according to lamp data



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sheet.

$P_{ref.}$ is the measured lamp power in watts with the reference ballast.

$P_{tot.test}$ is the total input power in watts of the ballast-lamp circuit with reference lamp and test ballast.

$P_{tot.cor.}$ is the total input power in watts of the ballast-lamp circuit under test corrected to comparable reference conditions.

$P_{ref.}$ and $P_{tot.test}$ shall be measured according to EN50294.

b) The corrected total input power of a ballast-lamp circuit with mains frequency magnetic ballasts, two-wire connection and with an external starter shall be determined from Equation 3.

$$P_{tot.cor.} = P_{tot.test} \left[\frac{P_{ref.}}{P_{test}} \times 0.95 \right] - (P_{ref.} - P_{rated}) \quad (3)$$

where

P_{rated} is the rated lamp or typical HF power in watts of relevant reference lamp according to the lamp data sheet.

$P_{ref.}$ is the measured lamp power in watts with the reference ballast.

P_{test} is the measured lamp power in watts with the test ballast.

$P_{tot.test}$ is the measured total input power in watts into the ballast-lamp circuit under test.

$P_{tot.cor.}$ is the total input power in watts of the ballast-lamp circuit under test corrected to comparable reference conditions.

$P_{ref.}$, P_{test} and $P_{tot.test}$, shall be measured according to EN50294.

Note: For magnetic ballast-lamp circuit, the measured total input power is corrected to a BLF of 0.95 to harmonize with the European Standard EN 50294.

4. Technical Requirements

For ELI certification, ballasts for double-capped fluorescent lamps shall meet the following technical requirements.

4.1 Performance Specifications

Items that must be clearly indicated on the product package, enclosed literature, or product specification sheet 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	Tests shall be made in a draught-free room and at an ambient temperature within the range of 20°C to 27°C. For those tests which require constant lamp performance, the ambient temperature around the lamp shall be the range of 23°C to 27°C and shall not vary by more than 1°C during the test.
Position and Initial aging	Measurements should be recorded from reference lamp(s) in a horizontal position, 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 must be issued by testing laboratories which meet the conditions described above. Test data must be from the model for which qualification is sought. For magnetic ballast, 12 specimens (including 3 specimens for performance tests ⁱ)



	and energy efficiency tests, 9 specimens for safety tests and EMC tests) shall be submitted for tests. For electronic ballast, 9 specimens (including 3 specimens for performance tests ⁱⁱ and energy efficiency tests, and 6 specimens for safety tests and EMC tests) shall be submitted for tests.
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 and supply voltage range. The range of nominal voltage shall not be less than ±10%.</i>
Endurance	Thermal endurance for windings of magnetic ballasts shall comply with IEC 61347-1 (13th chapter) requirements. Endurance for electronic ballasts shall comply with IEC 60929 (15th chapter) requirements.
Safety	For magnetic ballast, it must comply with IEC 61347-1, IEC 61347-2-8 and relevant regulations in the country of production or country of sale. For electronic ballast, it must comply with IEC 61347-1, IEC 61347-2-3 and relevant regulations in the country of production or country of sale.
Noise	Should be less than 35dB.

Electrical Characteristics	Performance Specifications
Frequency	Power frequency: 50Hz or 60Hz; High frequency: 20kHz to 33kHz or more than 40kHz.
Current Crest Factor	Should be less than 1.7.
Electromagnetic and Radio Frequency Interference	Comply with CISPR 15 and relevant regulations in the country of production or country of sale.
Harmonic	Comply with harmonic current limits set by IEC 61000-3-2.
Power Factor	The difference between measured power factor and rated power factor shall be less than 0.05.
Electromagnetic Compatibility Immunity	Comply with IEC 61547 and relevant regulations in the country of production or country of sale if available.
Transient Protection	Comply with IEC 61547.

4.2 Energy Efficiency Index

a) For ballasts with a minimum rated voltage $\geq 220V$, corrected total input power shall be less than or equal to the EEI values as specified in the tables below.
For magnetic ballasts, corrected total input power shall be less than or equal to the EEI value for B.
For electronic ballasts, corrected total input power shall be less than or equal to the EEI value for A.
For dimmable ballasts, corrected total input power shall be less than or equal to the EEI value for A1. In addition, for dimmable ballasts, when the ballasts are dimmed at 25% light output, the total input power shall be equal to or less than 50% of A1, and the ballasts must be able to reduce the light output to 10% or less of the maximum light output.



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b) For ballasts with a maximum rated voltage $\leq 127V$, corrected total input power shall be less than 1.01 of EEI values specified in the tables below.

Diameter of lamp	Length of tube (mm)	Rated power of lamp (W)		A1	A	B
		50/60Hz	HF			
$\geq T8$	450	15	13.5	9	18	21
	600	18	16	10.5	21	24
	895	30	24	16.5	33	36
	1200	36	32	19	38	41
	1047	38	32	20	40	43
	1500	58	50	29.5	59	64

Diameter of lamp	Length of tube (mm)	Rated power of lamp (W)	A1	A
T5	550	14	9.5	19
	850	21	13	26
	550	24	14	28
	1150	28	17	34
	1450	35	21	42
	850	39	23	46
	1450	49	29	58
	1150	54	31.5	63
	1150	80	47.5	92

Note: In the above tables, A1 is equivalent to the A1 specified in CELMA Ballast Guide, A is equivalent to the A3 specified in CELMA Ballast Guide, and B is equivalent to the B1 specified in CELMA Ballast Guide.

4.3 Other Specifications

Requirements	Specifications
Label	Product packaging, enclosed literature, or product specification sheet shall list <i>the mark of origin (trade mark, manufacturer's name or name of the responsible vendor/supplier), model number, rated supply current, rated supply voltage range, rated power factor and ballast lumen factor.</i> For magnetic ballast, <i>Product packaging, enclosed literature, or product specification sheet shall also list t_w (rated maximum operating temperature of winding) and earth terminals.</i> For electronic ballast, <i>Product packaging, enclosed literature, or product specification sheet shall also list replaceable and interchangeable parts, t_c (rated maximum temperature), wiring diagram and starting in-rush current.</i>
Materials	<i>Lamp and lamp package must comply with any regulations in the country of production or country of sale 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 language used in the country of sale on how to select compatible components to create a highly efficient lighting system.</i>



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Warranty	The purchaser of a defective ELI-certified ballast shall be able to obtain a replacement ballast 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 language used in the country of sale and an address in the country of sale for consumer contacts and complaints must be included with product when purchased.</i>
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References

ELI qualified ballasts for 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;
CELMA Ballast Guide: Guide for the application of Directive 2000/55/EC on energy efficiency requirements for ballasts for fluorescent lighting;
EN 50294-1998: Measurement method of total input power of ballast-lamp circuits;
IEC 61000-3-2, Edition 3.0: Electromagnetic compatibility (EMC) – Part 3-2: Limits- Limits for harmonic current emissions (equipment input current ≤ 16 A per phase). 2005-11;
IEC 61000-3-3, Edition 1.2: Electromagnetic compatibility (EMC) – Part 3-3: Limits-Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection. 2005-10;
IEC 61347-1, Edition 1.1: Lamp controgear – Part 1: General and safety requirements. 2003-11;
IEC 61347-2-3, Edition 1.1: Lamp control gear – Part 2-3: Particular requirements for a.c. supplied electronic ballasts for fluorescent lamps. 2004-09; Amendment 2. 2006-01;
IEC 61347-2-8, Edition 1.1: Lamp control gear - Part 2-8: Particular requirements for ballasts for fluorescent lamps. 2006-03;
IEC 61547, First edition: Equipment for general lighting purposes- EMC immunity requirements. 1995-09; Amendment 1. 2000-08;
IEC 60921, Edition 2.1: Ballast for tubular fluorescent lamps-Performance requirements. 2006-06;
IEC 60929, Edition 3.0: AC-supplied electronic ballasts for tubular fluorescent lamps-Performance requirements. 2006-01;
ISO/IEC 17025, Edition 2.0: General requirements for the competence of testing and calibration laboratories. 2005-05;
ISO 9001:2000, Edition 3: Quality Management System—Requirements. 2004-12-31.

Enquiries

For application forms and more information about ELI, please 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 In accordance with ISO 2859-1 to examine the samples: no failure will pass; one failure or more will fail.

ii In accordance with ISO 2859-1 to examine the samples: no failure will pass; one failure or more will fail.