

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Energy performance of lamp controlgear –
Part 1: Controlgear for fluorescent lamps – Method of measurement to determine
the total input power of controlgear circuits and the efficiency of controlgear**

**Performance énergétique des appareillages de lampes –
Partie 1: Appareillages des lampes à fluorescence – Méthode de mesurage pour
la détermination de la puissance d'entrée totale des circuits d'appareillage et du
rendement des appareillages**



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.140.99

ISBN 978-2-8322-1077-0

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENERGY PERFORMANCE OF LAMP CONTROLGEAR –**Part 1: Controlgear for fluorescent lamps –
Method of measurement to determine the total input power
of controlgear circuits and the efficiency of controlgear**

FOREWORD

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IEC 62442-1 has been prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lighting. It is an International Standard.

This third edition cancels and replaces the second edition published in 2018. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) this edition has been harmonized with IEC 62442-2 and IEC 62442-3;
- b) the reference to and use of the measurement methods for non-active power consumption in accordance with IEC 63103 have been added.

The text of this International Standard is based on the following documents:

Draft	Report on voting
34C/1545/FDIS	34C/1548/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 62442 series, published under the general title *Energy performance of lamp controlgear*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

ENERGY PERFORMANCE OF LAMP CONTROLGEAR –

Part 1: Controlgear for fluorescent lamps – Method of measurement to determine the total input power of controlgear circuits and the efficiency of controlgear

1 Scope

This part of IEC 62442 defines a measurement and calculation method of the total input power for controlgear-lamp circuits when operating with their associated fluorescent lamp(s). The calculation method for the efficiency of the lamp controlgear is also defined. This document applies to electrical controlgear-lamp circuits consisting only of the controlgear and the lamp(s). It is intended for use on DC supplies up to 1 000 V and/or AC supplies up to 1 000 V at 50 Hz or 60 Hz.

NOTE Requirements for testing individual controlgear during production are not included.

This document specifies the measurement method for the total input power and the calculation method of the controlgear efficiency for all controlgear used for domestic and normal commercial purposes operating with the following fluorescent lamps:

- double-capped fluorescent lamps (IEC 60081);
- single-capped fluorescent lamps (IEC 60901);
- other general purpose low-pressure mercury fluorescent lamps.

This document does not apply to:

- controlgear which form an integral part of the lamp;
- controllable wire-wound magnetic controlgear.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-845, *International Electrotechnical Vocabulary (IEV) – Part 845: Lighting* (available at <http://www.electropedia.org>)

IEC 60081:1997, *Double-capped fluorescent lamps – Performance specifications*
IEC 60081:1997/AMD4:2010

IEC 60901:1996, *Single-capped fluorescent lamps – Performance specifications*
IEC 60901:1996/AMD5:2011

IEC 60921:2004, *Ballasts for tubular fluorescent lamps – Performance requirements*

IEC 60929:2011, *AC and/or DC-supplied electronic control gear for tubular fluorescent lamps – Performance requirements*

IEC 63103:2020, *Lighting equipment – Non-active mode power measurement*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-845 and IEC TS 63105 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

nominal value

suitable approximate quantity value used to designate or identify a component, device or equipment

Note 1 to entry: To express the "nominal value" of a particular quantity, the term "value" is replaced by the quantity name; for example, nominal power, nominal voltage, and nominal current.

3.2

rated value

value of a quantity, used for specification purposes, declared by the manufacturer or responsible vendor and established under standard test conditions

Note 1 to entry: To express the "rated value" of a particular quantity, the term "value" is replaced by the quantity name; for example, rated power, rated voltage, rated current, and rated temperature.

Note 2 to entry: For the different kinds of operation, rated electrical values are given on the lamp data sheets as:

- rated electrical values under "electrical characteristics", if the lamp is defined for 50 Hz/60 Hz operation only;
- rated electrical values under "electrical characteristics", if the lamp is defined for high frequency (≥ 20 kHz) operation only;
- rated electrical values and typical electrical values, if the lamp is defined simultaneously for 50 Hz/60 Hz operation and high frequency operation:
 - for 50 Hz/60 Hz operation: rated electrical values under "electrical characteristics", and
 - for high frequency operation: rated electrical values under "typical lamp characteristics".

[SOURCE: IEC 60050-845:2020, 845-27-100, modified – The note 2 to entry has been replaced by a new Note 2 to entry.]

3.3

controlgear

one or more components between the supply and one or more lamps which can serve to transform the supply voltage, limit the current of the lamp(s) to the required value, provide starting voltage and preheating current, prevent cold starting, correct power factor or reduce radio interference

3.4

electromagnetic controlgear

magnetic controlgear

controlgear which by means of inductance, or a combination of inductance and capacitance, serves mainly to limit the current of the electric lamp(s)

[SOURCE: IEC 60050-845:2020, 845-28-052, modified – The second preferred term has been added.]

3.5

electronic controlgear

AC inverter supplied with alternating current and/or direct current and including stabilizing elements for starting and operating one or more tubular fluorescent lamps, generally at high frequency

3.6

fluorescent lamp

discharge lamp of the low pressure mercury type, in which most of the light is emitted by one or several layers of phosphors excited by the ultra-violet radiation from the discharge

3.7

controlgear-lamp circuit

electrical circuit, or part thereof, normally built in a luminaire, consisting of the controlgear and lamp(s)

3.8

reference ballast

special ballast, either inductive for lamps for operation on AC mains frequencies, or resistive for lamps for operation on high frequency

Note 1 to entry: A reference ballast 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 IEC 60929 and IEC 60921.

Note 2 to entry: Annex B provides details for calculating the reference ballast characteristics and the method of operation with the reference ballast.

3.9

reference lamp

lamp selected for testing controlgear which, when associated with a reference controlgear, has electrical characteristics which are close to the rated values or typical lamp characteristics as stated in the relevant lamp standard

Note 1 to entry: For details regarding the tolerances, see Clause B.2.

3.10

lamp rated power

P_{Lrated}

power of a given lamp type specified by the manufacturer or the supplier, the lamp being operated under specified conditions

Note 1 to entry: The rated power of a lamp is expressed in W.

3.11

ballast lumen factor

BLF

ratio of the light output of the reference lamp when the ballast under test is operated at its rated voltage, compared with the light output of the same lamp operated with the appropriate reference ballast supplied at its rated voltage and frequency

3.12

total input power

total power consumed by the controlgear-light source circuit measured at rated input voltage

3.13 controlgear efficiency

 η_{CG}

ratio of the output power to the lamp(s) and the total input power of the controlgear

Note 1 to entry: Loads from sensors, network connections and other auxiliary are disconnected or, if not possible, otherwise eliminated from the result.

3.14 multi-power-lamp controlgear

controlgear designed to operate one or more lamp(s) with different rated powers

3.15 multi-number-lamp controlgear

controlgear designed to operate simultaneously more than one similar lamp

3.16 standby mode

<of controlgear> mode when the equipment is connected to a supply voltage with the illumination function off, while capable of being activated by an external trigger not being a trigger from a network

Note 1 to entry: Examples of external triggers are sensing or timing.

[SOURCE: IEC 63103:2020, 3.10, modified – The domain "<of lighting equipment>" has been replaced with "<of controlgear>".]

3.17 networked standby mode

<of controlgear> mode when the equipment is connected to a supply voltage with the illumination function off, while capable of being activated by an external trigger being a trigger from a network

[SOURCE: IEC 63103:2020, 3.11, modified – The domain "<of lighting equipment>" has been replaced with "<of controlgear>".]

3.18 standby power

<of controlgear> average power consumption in the standby mode

3.19 networked standby power

<of controlgear> average power consumption in the networked standby mode

4 General

4.1 Ballast lumen factor

For every controlgear-lamp combination submitted for the test, the ballast lumen factor shall be measured. The ballast lumen factor is defined in 3.11 and expressed as:

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

where

Light_{ref} is the light output of the reference lamp connected to the reference ballast measured by photocell meter reading;

Light_{test} is the light output of the reference lamp connected to the controlgear under test measured by photocell meter reading.

The ballast lumen factor shall be in the range of 0,925 to 1,075. A controlgear with a lower ballast lumen factor is not suitable for testing. The upper limit of 1,075 may be exceeded, if the value for maximum lamp operation current and maximum current in any lead to cathodes comply with the rated value in IEC 60081 and IEC 60901.

4.2 Dimmable controlgear

A sufficient cathode temperature shall be produced by the heating circuit at any possible dimming position within the available dimming range of the controlgear as specified in the relevant data sheet in IEC 60081 and IEC 60901.

Dimmable controlgear shall be measured at 100 % and 25 % lumen output of the operated lamp(s).

4.3 Multi-power and/or multi-number-lamp controlgear

Multi-power and multi-number-lamp controlgear shall be measured with all the possible lamp power and number of lamp combinations. The manufacturer shall declare the relevant BLF for each combination.

4.4 General notes on tests

The measurement conditions specified in IEC 60921:2004 or IEC 60929:2011, Annex A shall be applied, unless otherwise specified in this document.

For measurement uncertainty and traceability see ISO/IEC Guide 98-3 and IEC Guide 115.

4.5 Sampling of controlgear for testing

The requirements and tolerances specified in this document are based on the testing of a type test sample submitted by the manufacturer for that purpose. This sample should consist of units having characteristics typical of the manufacturer's production and be as close to the production centre point values as possible.

4.6 Size of the test sample

Tests are carried out with one test specimen.

4.7 Conditioning of lamps

Lamps shall be handled and stabilized as described in IEC 60081:1997, B.1.1 and IEC 60081:1997/AMD4:2010, B.1.1 and in IEC 60901:1996, B.1.1 and IEC 60901:1996/AMD5:2011, B.1.1.

4.8 Test voltages and frequencies

Where the test voltage and frequency are not defined by national or regional requirements, the test voltage and the test frequency shall be the nominal voltage and the nominal frequency of the country or region for which the measurement is being determined (refer to Table 1).

Table 1 – Typical nominal electricity supply details for some regions

Country or region	Rated voltage and frequency ^{a, c}
Europe	230 V, 50 Hz
North America	120 V, 277 V, 60 Hz
Japan ^b	100 V, 200 V, 50/60 Hz
China	220 V, 50 Hz
Australia and New Zealand	230 V, 50 Hz
South Africa	230 V, 50 Hz
^a Values are for single phase only. Some single phase supply voltages can be double the nominal voltage above (centre transformer tap). The voltage between two phases of a three-phase system is 1,73 times single phase values (e.g. 400 V for Europe). ^b 50 Hz is applicable for the Eastern part and 60 Hz for the Western part. ^c If the manufacturer advises that for a marked voltage range a discrete value shall be used for measurement, this should be observed.	

The above table can require test voltages additional to those required in IEC 63103.

4.9 Sensor and network connections

For the measurement of all kinds of controlgear power (also standby) the power consumed by all circuits (internal or external) shall be considered as indicated in IEC 63103.

NOTE Although the scope of IEC 63103 is limited to non-active mode power, the principle is also suitable for other power measurements.

5 Method of measurement and calculation of total input power of controlgear-lamp circuits and the efficiency of controlgear

5.1 Correction for ballast lumen factor

The total input power measured is corrected to a BLF of 0,95 for wire-wound magnetic controlgear and of 1,00 for high frequency (HF) electronic controlgear. Additionally, tolerances of reference lamps are compensated.

5.2 Method of measurement

The measurements are carried out with the power meter connected to measure the total input power into the controlgear-lamp circuit, using:

- for electromagnetic controlgear-lamp circuits:
the conditions specified in IEC 60921:2004, A.6.1 and the test circuit of Figure A.1;
- for AC supplied electronic controlgear-lamp circuits:
the conditions specified in IEC 60921:2004, A.6.2, as far as applicable, and the test circuit of Figure A.2.

The value of the total input power ($P_{\text{tot meas}}$) is recorded when a steady state has been reached (controlgear temperature and lamp current stabilized).

The measurements with the controlgear under test in the controlgear-lamp circuit shall be made with the rated supply voltage. The value $P_{\text{L rated}}$ of a reference lamp, in some cases, may deviate from the nominal value of the lamp.

5.3 Measurement and calculation of the total input power of magnetic controlgear-lamp circuits

The total input power ($P_{\text{tot meas}}$) of a controlgear-lamp circuit is measured with one controlgear and one reference lamp (or the number of reference lamps the controlgear is designed to operate). The reference lamps shall conform to IEC 60921:2004, Annex D; in addition the lamp current shall not deviate by more than 1 % of the rated lamp current.

The measured total input power ($P_{\text{tot meas}}$) is corrected to a BLF of 0,95 and corresponds to that value that would be given by the reference lamp with rated setting in order to minimize the error caused by the variation of the characteristics of the reference lamps used.

The corrected total input power of the ballast-lamp circuit ($P_{\text{tot ref}}$) is calculated using the following Equation (2):

$$P_{\text{tot ref}} = P_{\text{tot meas}} \left(\frac{P_{\text{Lref meas}}}{P_{\text{Lmeas}}} 0,95 \right) - (P_{\text{Lref meas}} - P_{\text{Lrated}}) \quad (2)$$

where

$P_{\text{tot ref}}$ is the total input power of the controlgear-lamp circuit under test corrected to comparable reference conditions (in W);

$P_{\text{tot meas}}$ is the measured total input power into the controlgear-lamp circuit under test (in W);

$P_{\text{Lref meas}}$ is the measured lamp power in the circuit with the reference ballast (in W);

P_{Lmeas} is the measured lamp power in the circuit with the test controlgear (in W);

P_{Lrated} is the rated lamp power of the relevant reference lamp according to the lamp data sheet (in W).

5.4 Calculation of the efficiency of electromagnetic controlgear

The ballast lumen factor of 0,95 for the light output of lamps operated with electromagnetic controlgear requires the calculation of the efficiency of the magnetic controlgear using Equation (3):

$$\eta_{\text{controlgear}} = \frac{P_{\text{Lrated}}}{P_{\text{tot ref}}} 0,95 \quad (3)$$

5.5 Measurement and calculation of the total input power of electronic controlgear-lamp circuits

The total input power ($P_{\text{tot meas}}$) of a controlgear-lamp circuit is measured with one controlgear and one reference lamp (or the number of reference lamps the controlgear is designed to operate). The reference lamps shall conform to IEC 60929:2011, Annex C; in addition the lamp current shall not deviate by more than 1 % of the rated lamp current. The measurement set-up is described in Annex A.

The comparison between the controlgear circuit with the controlgear under test and the controlgear-lamp circuit with reference ballast in accordance with, as far as applicable, IEC 60921:2004, A.6.1 or A.6.2 is made with the same reference lamp using a photocell positioned as shown in Figure A.3 and Figure A.4 for measuring the light output of the lamp. The measurements are carried out using the test circuit specified in Figure A.1.