IEC 62442-1

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REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62442-1:2018. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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.

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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:

– ~~linear~~ double-capped fluorescent lamps (IEC 60081);
– ~~single-ended (compact)~~ 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.
– ~~luminaires, which rely on additional optical performance aspects.~~

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 61347-2-3, *Lamp control gear – Part 2-3: Particular requirements for AC and/or DC supplied electronic control gear for fluorescent lamps*~~

~~IEC 61347-2-8, *Lamp controlgear – Part 2-8: Particular requirements for ballasts for fluorescent lamps*~~

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

IEC TS 63105, *Lighting systems and related equipment – Vocabulary*

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**~~
~~**limiting value**~~
~~greatest or smallest admissible value of one of the quantities~~

3.2
rated value
~~quantity value for specified operating conditions of a component, device or equipment~~
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: ~~The value and conditions are specified in the relevant standard or assigned by the manufacturer or responsible vendor.~~ 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 ~~may~~ 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) ~~to the required value and operates the lamp(s) at the same frequency as the supply frequency~~

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

3.5
electronic controlgear
AC invertor 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

~~Note 1 to entry: This note applies to the French language only.~~

3.12
total input power
total power consumed by the controlgear-~~lamp (~~light source~~)~~ circuit measured at rated input voltage

~~[SOURCE: IEC 62442-1: , 3.13, modified "supplied to" has been replaced with "consumed by", "(light source)" has been added and the note has been deleted.]~~

3.13
controlgear efficiency
~~$\eta_{controlgear}$~~ η_{CG}
ratio of the output power to the lamp(s) and the total input power of the controlgear

~~Note 1 to entry: Detailed measurement method and conditions are given in Clause 5.~~

Note ~~2~~ 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
~~average power consumption of a controlgear in the standby mode~~

~~Note 1 to entry: Power supplied by controlgear to sensors, network connections and other auxiliaries is not included in the standby power.~~

~~Note 2 to entry: Standby power is expressed in W.~~

<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

~~Note 1 to entry: Power supplied by controlgear to sensors, network connections and other auxiliaries is not included in the standby power.~~

~~Note 2 to entry: Standby power is expressed in W.~~

3.19
networked standby power
<of controlgear> average power consumption in the networked standby mode

4 General

~~4.1 Applicability~~

~~The measurement and calculation methods in this document shall only be used for controlgear which conforms to IEC 61347-2-3 or IEC 61347-2-8.~~

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:

$$BLF = \frac{\text{Light}_{test}}{\text{Light}_{ref}} \quad (1)$$

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) which are not involved in power conversion for the controlgear operation (e.g. communication devices, external sensors, auxiliary load, battery charging circuits) shall be excluded from the measurements. If the auxiliary cannot be disconnected, its effect shall be otherwise eliminated from the result.~~

~~NOTE Power consumed by circuits necessary for the proper operation of power conversion is considered in the measurement (e.g. cooling fan, signalling lighting).~~

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 ~~are to~~ shall be made with the rated supply voltage. The value P_{Lrated} 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 ~~from~~ 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):

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

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_{lref}~~ $P_{\text{Lref meas}}$ 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):

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

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 ~~from~~ 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.

Measurement in the Ulbricht sphere is accepted as an alternative to the ones specified in Figure A.3. The diameter of the sphere should be at least A + 200 mm. For parameter A, see Figure A.4 In case of doubt, the measurement using the photocell (Figure A.2) should serve as reference.

NOTE With electronic controlgear, measurements of power losses of the controlgear itself cannot be measured accurately. Therefore, only the total input power method (measuring whole ballast-lamp circuits) can be carried out.

The high frequency lamp current should be obtained with a tolerance of ±1 % to that specified for the rated current in the lamp standard. At the end of this procedure, the measured high frequency lamp power (~~P_{lref}~~ $P_{\text{Lref meas}}$) shall be within ±2,5 % of the rated power of the lamp (see electrical characteristics on lamp data sheets).

After reaching stable conditions (controlgear temperature and lamp current stabilized), the measured value with the photocell is set at 100 %.

Under the same test conditions (positioning of the lamp and photocell unchanged), the controlgear under test is connected to the lamp circuit and operated until stable conditions again are reached.

The ratio of the light output of the lamp measured via the photocell, when connected to the controlgear under test, to the light output of the lamp, when connected to the reference ballast, shall be at least 92,5 %.

The total input power ($P_{\text{tot meas}}$) at the supply input of the controlgear under test is then measured.

The measured total input power ($P_{\text{tot meas}}$) into the controlgear-lamp circuit under test is corrected to a BLF of 1,00 ($\text{Light}_{\text{ref}}/\text{Light}_{\text{test}}$) and to minimize the error caused by the variation of the characteristics of the reference lamp used (~~$P_{\text{lrated}}/P_{\text{lref}}$~~ $P_{\text{Lrated}}/P_{\text{Lref meas}}$). The total input power corrected ($P_{\text{tot ref}}$) of the controlgear-lamp circuit is calculated using the following Equation (4):

$$P_{\text{tot ref}} = P_{\text{tot meas}} \times \frac{P_{\text{Lrated}}}{P_{\text{Lref meas}}} \times \frac{\text{Light}_{\text{ref}}}{\text{Light}_{\text{test}}} \quad (4)$$

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_{Lrated} is the rated lamp or typical HF power of the relevant reference lamp according to the lamp data sheet (in W);

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

$\text{Light}_{\text{ref}}$ is the light output of the reference lamp connected to the reference ballast measured by photocell meter reading;

$\text{Light}_{\text{test}}$ is the light output of the reference lamp connected to the controlgear under test measured by photocell meter reading.

5.6 Calculation of the efficiency of electronic controlgear

For the calculation of the efficiency of electronic controlgear, Equation (5) should be used:

$$\eta_{\text{controlgear}} = \left(\frac{P_{\text{Lrated}}}{P_{\text{tot ref}}} \right) = \left(\frac{P_{\text{Lref meas}}}{P_{\text{tot meas}}} \times \frac{\text{Light}_{\text{test}}}{\text{Light}_{\text{ref}}} \right) \quad (5)$$

5.7 Measuring the standby power

~~Standby power is measured for those controlgear which are permanently connected to the mains where the lamps are switched off via a control signal. Other controlgear do not have to be tested. The measurement setup is described in Figure A.3.~~

The measurement of standby power of electronic controlgear shall be performed according to IEC 63103. For multi-number-lamp controlgear, all lamps shall be connected. The standby power shall be measured at the rated supply voltage.

5.8 Measuring the networked standby power

The measurement of networked standby power of electronic controlgear shall be performed according to IEC 63103. For multi-number-lamp controlgear, all lamps shall be connected. The networked standby power shall be measured at the rated supply voltage.

5.9 Reporting of power measurements

Power measurements shall be reported in W with the minimum following resolution:

- ≥ 10 W: whole number;
- > 1 W and < 10 W: first decimal digit;
- ≤ 1 W: two decimal digits.

Annex A
(normative)

Energy performance measurement set-up

A.1 Measurement set-up for electromagnetic controlgear

For the measurement of the total input power of electromagnetic controlgear and the measurement of the lamp power, the measurement set-up of Figure A.1 should be used.

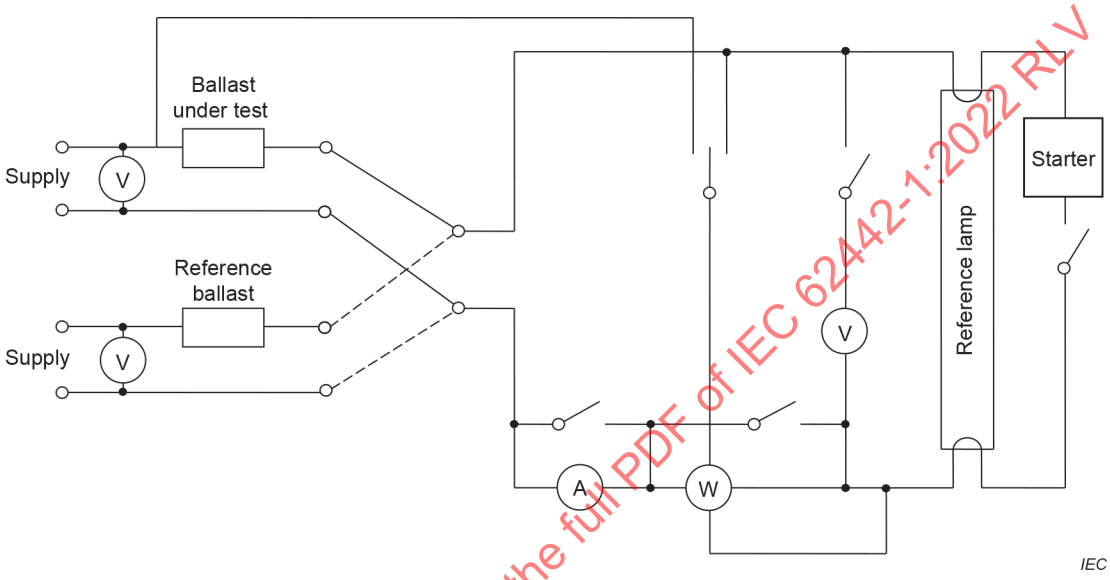


Figure A.1 – Measurement of electromagnetic controlgear-lamp circuits

A.2 Measurement set-up for electronic controlgear

A.2.1 Measurement of the total input power

For the measurement of the total input power of electronic controlgear, the measurement of the lamp power and the light output, the measurement set-up of Figure A.2 should be used.

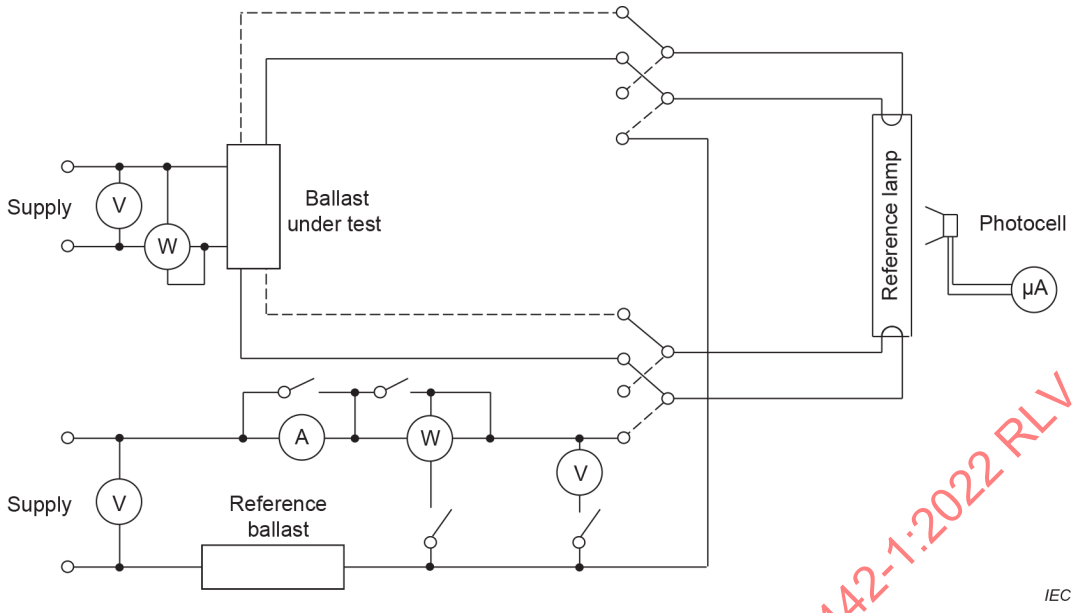
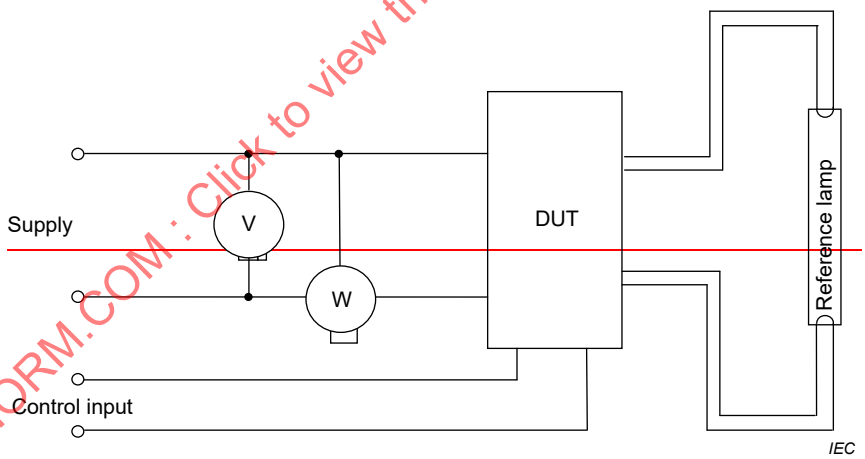


Figure A.2 – Measurement of AC supplied electronic controlgear-lamp circuits

~~**A.2.2 Measuring method of standby power**~~

~~The controlgear is connected as shown in Figure A.3; for multi-number-lamp controlgear, all lamps are connected. Via the control input, a signal is given to switch the lamps off. After visually checking whether the lamps are switched off, the input power is measured at the rated supply voltage.~~



~~**Figure A.3 – Test setup for measuring standby power**~~

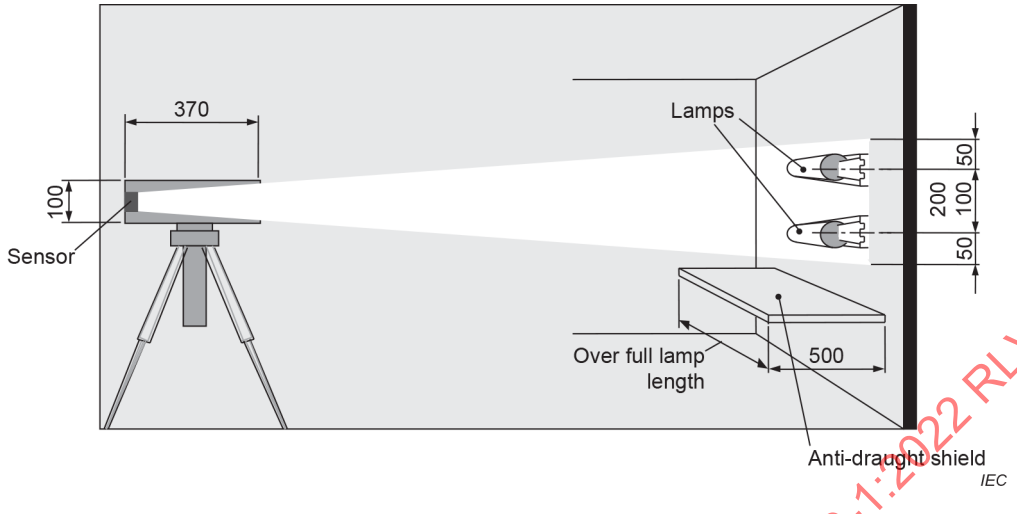
A.2.2 Light output measurement

Figure A.3 and Figure A.4 show an example for the light output measurement of fluorescent lamps.

The sensor view angle shall be large enough to measure the total illuminance of the lamp(s) including the cathodes.

The distance of the sensor to the lamp(s) shall be at least twice the lamp length in order to ensure that the error, due to the different contributions of light from the centre of the lamp end, is a maximum of 0,3 %.

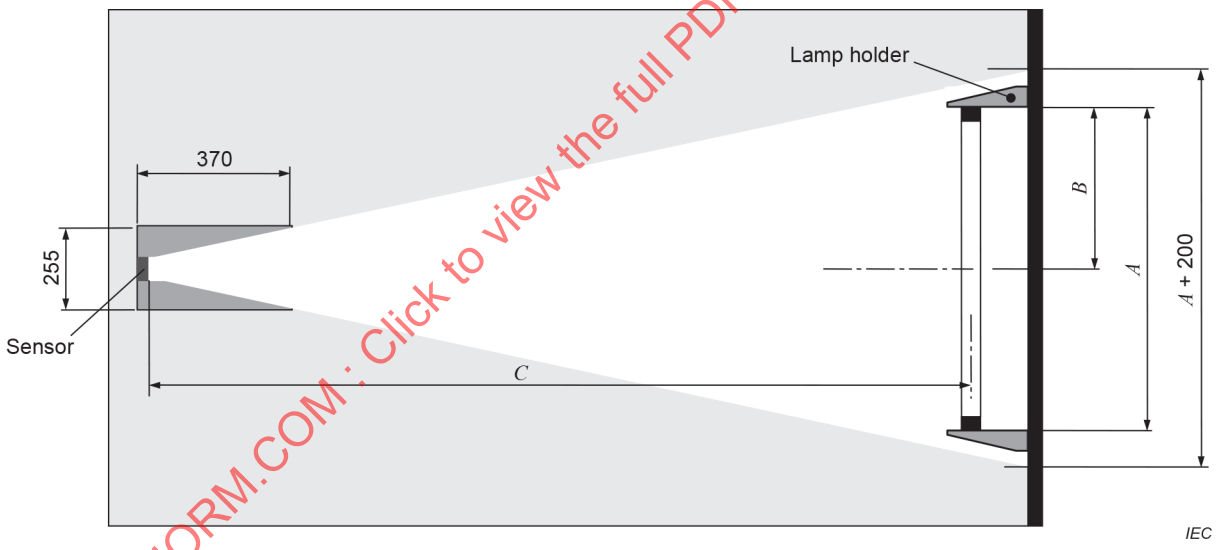
Dimensions in millimetres



NOTE The sensors are in a box painted matt black internally to avoid reflected light. Lamps are placed horizontally for linear double capped fluorescent lamps. For other lamps, the test position according to the relevant lamp data sheet applies.

Figure A.3 – Side view of light output measurement system

Dimensions in millimetres



Key

A = lamp length

B = 1/2 lamp length

C = 2 × lamp length

Figure A.4 – Top view of light output measurement system

Requirements for positioning in Figure A.3 and Figure A.4 are as follows:

a) Figure A.3 and Figure A.4 are used both for single and two-lamp controlgear.

b) The same figures are used also for multi-number-lamp controlgear (three or four lamps) with the following provisions.

   – The measuring position of the lamps is for four lamps: two lamps next to each other and two lamps above each other.

– For three-lamp controlgear, the measuring position is in the upper position, two lamps next to each other, and in the lower position, one lamp in the centre.

The minimum distance from the light sensor to the lamp is set at least at 1 m. However, the sensor shall cover at least the lamp length plus 20 % of the lamp length.

For an amalgam lamp, the reference measurements and test measurements shall always be taken in the same position.

A.2.3 Distance to lamp related to lamp length: explanations

For comparison of the light output measurement with the reference ballast and the light output measurement with the controlgear under test, the light output measurement shall cover the entire lamp surface. HF operation lamps ~~may~~ can be operated with 'hot' or with 'cold' electrodes. This will lead to a different light contribution from the lamp ends. It is therefore important that the light from the lamp ends and the light from the middle part of the lamp is weighed equally. The necessary condition is that the sensor is placed at the correct distance from the lamp. This can be achieved by placing the sensor as shown in Figure A.5.

The test position of the lamps shall be in accordance with the given position in the relevant lamp standard IEC 60081 or IEC 60901.

The sensor signal X results from the luminosity Φx from the middle of the lamp, the sensor signal X' results from the luminosity Φx′ from the end of the lamp. The sensor signal resulting from the luminosity of the lamp is proportional to the inverted square of the distance between the sensor and the lamp:

$X = \Phi x / R^2$

$X' = \Phi x' / R'^2$ $\qquad R' = R / \cos \alpha$

The difference between X and X' resulting from the difference between R and R' shall be minimized. When a lamp is operated with 'cold' electrodes the light contribution from the lamp end will be significantly lower compared with a lamp operated with 'hot' electrodes over a distance of about 2 cm.

This leads to the following result:

$X' = (\Phi x' / R^2) \cos^2 \alpha$

$\cos^2 \alpha > 0{,}95$

$\cos \alpha > 0{,}975$ $\qquad \alpha < 13°,$ $\qquad \tan \alpha < 0{,}23$

α is 13° ($R = 2L$).

For the sensor, the angle of the incident radiation has no effect on the sensor signal strength (within the 13°), therefore no cos α correction is used for the sensor.

When $R = 2L$, the error due to different contribution in light from the centre of the lamp and the lamp end is maximum 0,3 %.

Figure A.5 shows the relation between X, X', R, R', Φx and Φx′.

NOTE Light output measurements can be done without assistance of an accredited laboratory.

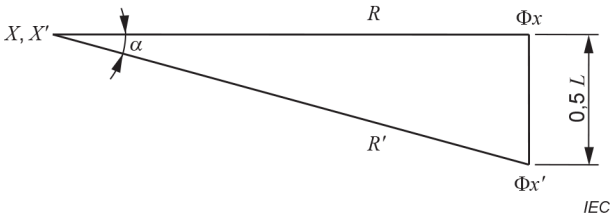


Figure A.5 – Configuration of lamp and photocell sensor

Annex B
(informative)

Application of the reference ballast when assessing lamps in electronic operation

B.1 Calculation of the reference ballast impedance

The characteristics of the high frequency reference ballast for lamps in electronic operation are deduced from the rated lamp voltage and rated lamp current of the relevant lamp data sheet. In order to achieve the rated values of the reference ballast, twice the rated lamp voltage is adjusted to the high frequency power supply. The rated current value, if not given on the lamp data sheet, should be provided by the lamp manufacturer. The value of the low inductance serial resistor is calculated from the rated lamp voltage and the rated lamp current. Definition 3.2 should be taken into consideration in this respect.

B.2 Method of adjusting the lamp power

The reference ballast is represented with a low inductive resistor, which is calculated according to Clause B.1 by taking into consideration definition 3.2.

After stabilization, the HF supply voltage is adjusted until the high frequency lamp current is within a tolerance of ±1 % to that specified in the lamp standard. At the end of this procedure, the measured high frequency lamp power (P_{lref} $P_{\text{Lref meas}}$) shall be within ±2,5 % of the rated or typical value.

Bibliography

IEC 62442-2, *Energy performance of lamp controlgear – Part 2: Controlgear for ~~high intensity~~ discharge lamps (excluding low-pressure mercury fluorescent lamps) – Method of measurement to determine the efficiency of controlgear*

IEC 62442-3, *Energy performance of lamp controlgear – Part 3: Controlgear for tungsten-halogen lamps and LED light sources – Method of measurement to determine the efficiency of controlgear*

ISO/IEC Guide 98-3~~:2008~~, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM: 1995)*

IEC Guide 115~~:2007~~, *Application of uncertainty of measurement to conformity assessment activities in the electrotechnical sector*

IEC 62442-1

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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

IEC 62442-1:2022-02(en-fr)

CONTENTS

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*

IEC TS 63105, *Lighting systems and related equipment – Vocabulary*

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 invertor 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_{Lrated} 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):

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

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.

Measurement in the Ulbricht sphere is accepted as an alternative to the ones specified in Figure A.3. The diameter of the sphere should be at least A + 200 mm. For parameter A, see Figure A.4 In case of doubt, the measurement using the photocell (Figure A.2) should serve as reference.

NOTE With electronic controlgear, measurements of power losses of the controlgear itself cannot be measured accurately. Therefore, only the total input power method (measuring whole ballast-lamp circuits) can be carried out.

The high frequency lamp current should be obtained with a tolerance of ±1 % to that specified for the rated current in the lamp standard. At the end of this procedure, the measured high frequency lamp power ($P_{\text{Lref meas}}$) shall be within ±2,5 % of the rated power of the lamp (see electrical characteristics on lamp data sheets).

After reaching stable conditions (controlgear temperature and lamp current stabilized), the measured value with the photocell is set at 100 %.

Under the same test conditions (positioning of the lamp and photocell unchanged), the controlgear under test is connected to the lamp circuit and operated until stable conditions again are reached.

The ratio of the light output of the lamp measured via the photocell, when connected to the controlgear under test, to the light output of the lamp, when connected to the reference ballast, shall be at least 92,5 %.

The total input power ($P_{\text{tot meas}}$) at the supply input of the controlgear under test is then measured.

The measured total input power ($P_{\text{tot meas}}$) into the controlgear-lamp circuit under test is corrected to a BLF of 1,00 ($\text{Light}_{\text{ref}}/\text{Light}_{\text{test}}$) and to minimize the error caused by the variation of the characteristics of the reference lamp used ($P_{\text{Lrated}}/P_{\text{Lref meas}}$). The total input power corrected ($P_{\text{tot ref}}$) of the controlgear-lamp circuit is calculated using the following Equation (4):

$$P_{\text{tot ref}} = P_{\text{tot meas}} \times \frac{P_{\text{Lrated}}}{P_{\text{Lref meas}}} \times \frac{\text{Light}_{\text{ref}}}{\text{Light}_{\text{test}}} \quad (4)$$

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_{Lrated} is the rated lamp or typical HF power of the relevant reference lamp according to the lamp data sheet (in W);

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

$\text{Light}_{\text{ref}}$ is the light output of the reference lamp connected to the reference ballast measured by photocell meter reading;

$\text{Light}_{\text{test}}$ is the light output of the reference lamp connected to the controlgear under test measured by photocell meter reading.

5.6 Calculation of the efficiency of electronic controlgear

For the calculation of the efficiency of electronic controlgear, Equation (5) should be used:

$$\eta_{\text{controlgear}} = \left(\frac{P_{\text{Lrated}}}{P_{\text{tot ref}}} \right) = \left(\frac{P_{\text{Lref meas}}}{P_{\text{tot meas}}} \times \frac{\text{Light}_{\text{test}}}{\text{Light}_{\text{ref}}} \right) \quad (5)$$

5.7 Measuring the standby power

The measurement of standby power of electronic controlgear shall be performed according to IEC 63103. For multi-number-lamp controlgear, all lamps shall be connected. The standby power shall be measured at the rated supply voltage.

5.8 Measuring the networked standby power

The measurement of networked standby power of electronic controlgear shall be performed according to IEC 63103. For multi-number-lamp controlgear, all lamps shall be connected. The networked standby power shall be measured at the rated supply voltage.

5.9 Reporting of power measurements

Power measurements shall be reported in W with the minimum following resolution:

– ≥ 10 W: whole number;
– > 1 W and < 10 W: first decimal digit;
– ≤ 1 W: two decimal digits.

Annex A
(normative)

Energy performance measurement set-up

A.1 Measurement set-up for electromagnetic controlgear

For the measurement of the total input power of electromagnetic controlgear and the measurement of the lamp power, the measurement set-up of Figure A.1 should be used.

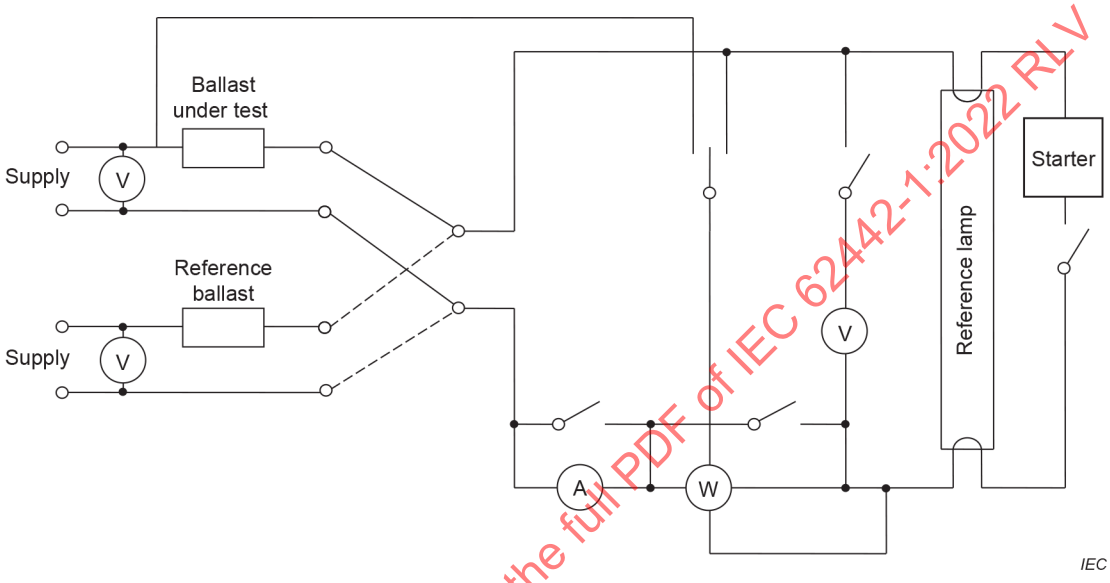


Figure A.1 – Measurement of electromagnetic controlgear-lamp circuits

A.2 Measurement set-up for electronic controlgear

A.2.1 Measurement of the total input power

For the measurement of the total input power of electronic controlgear, the measurement of the lamp power and the light output, the measurement set-up of Figure A.2 should be used.

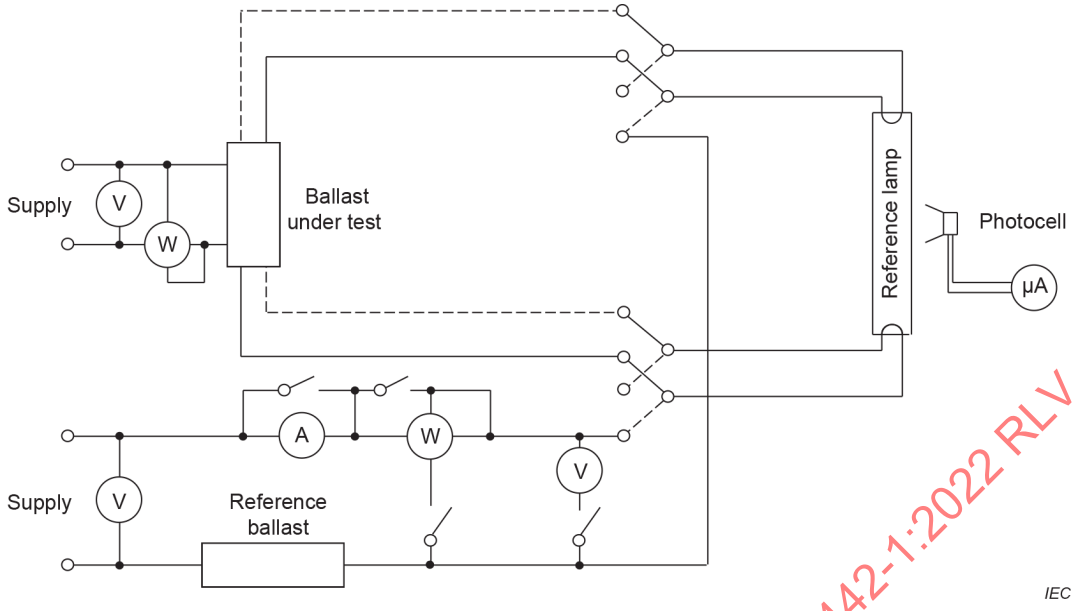


Figure A.2 – Measurement of AC supplied electronic controlgear-lamp circuits

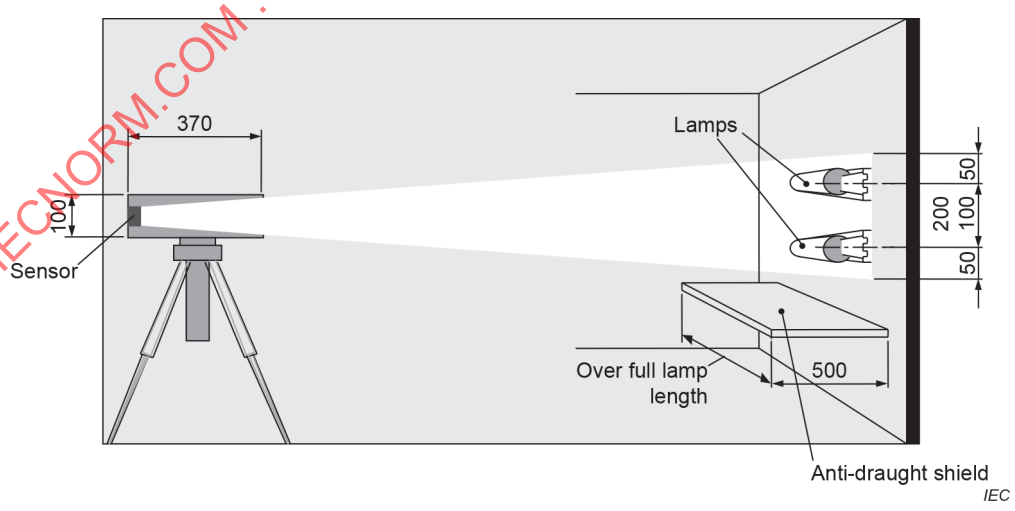
A.2.2 Light output measurement

Figure A.3 and Figure A.4 show an example for the light output measurement of fluorescent lamps.

The sensor view angle shall be large enough to measure the total illuminance of the lamp(s) including the cathodes.

The distance of the sensor to the lamp(s) shall be at least twice the lamp length in order to ensure that the error, due to the different contributions of light from the centre of the lamp end, is a maximum of 0,3 %.

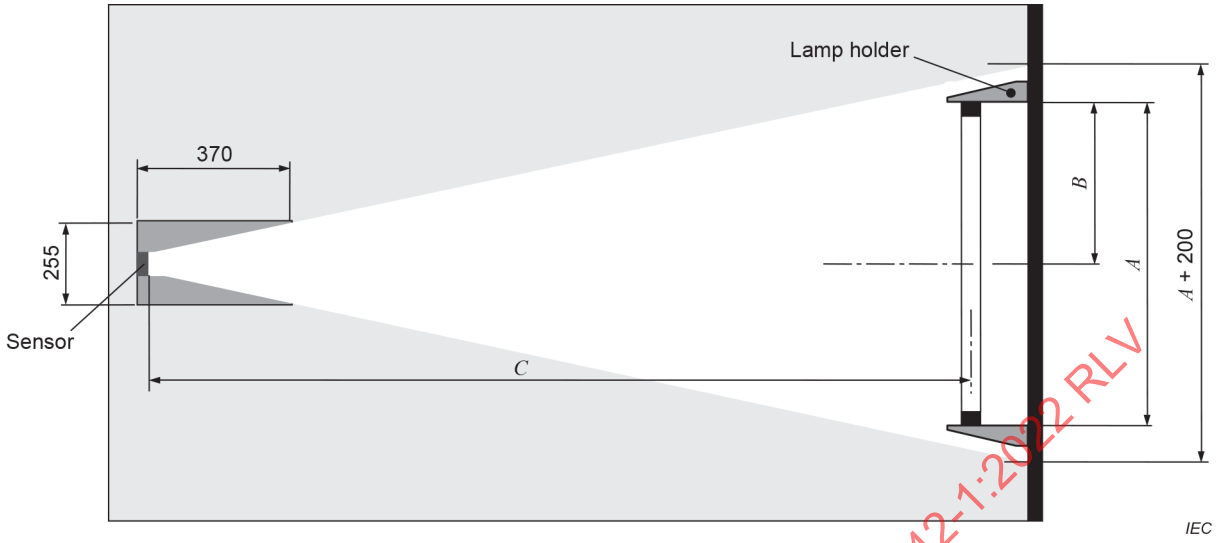
Dimensions in millimetres



NOTE The sensors are in a box painted matt black internally to avoid reflected light. Lamps are placed horizontally for linear double capped fluorescent lamps. For other lamps, the test position according to the relevant lamp data sheet applies.

Figure A.3 – Side view of light output measurement system

Dimensions in millimetres



Key

A = lamp length

B = 1/2 lamp length

C = 2 × lamp length

Figure A.4 – Top view of light output measurement system

Requirements for positioning in Figure A.3 and Figure A.4 are as follows:

a) Figure A.3 and Figure A.4 are used both for single and two-lamp controlgear.

b) The same figures are used also for multi-number-lamp controlgear (three or four lamps) with the following provisions.

   – The measuring position of the lamps is for four lamps: two lamps next to each other and two lamps above each other.

   – For three-lamp controlgear, the measuring position is in the upper position, two lamps next to each other, and in the lower position, one lamp in the centre.

The minimum distance from the light sensor to the lamp is set at least at 1 m. However, the sensor shall cover at least the lamp length plus 20 % of the lamp length.

For an amalgam lamp, the reference measurements and test measurements shall always be taken in the same position.

A.2.3 Distance to lamp related to lamp length: explanations

For comparison of the light output measurement with the reference ballast and the light output measurement with the controlgear under test, the light output measurement shall cover the entire lamp surface. HF operation lamps can be operated with 'hot' or with 'cold' electrodes. This will lead to a different light contribution from the lamp ends. It is therefore important that the light from the lamp ends and the light from the middle part of the lamp is weighed equally. The necessary condition is that the sensor is placed at the correct distance from the lamp. This can be achieved by placing the sensor as shown in Figure A.5.

The test position of the lamps shall be in accordance with the given position in the relevant lamp standard IEC 60081 or IEC 60901.

The sensor signal X results from the luminosity Φx from the middle of the lamp, the sensor signal X' results from the luminosity Φx′ from the end of the lamp. The sensor signal resulting from the luminosity of the lamp is proportional to the inverted square of the distance between the sensor and the lamp:

$X = \Phi x/R^2$

$X' = \Phi x'/R'^2$ $\qquad R' = R/\cos\alpha$

The difference between X and X' resulting from the difference between R and R' shall be minimized. When a lamp is operated with 'cold' electrodes the light contribution from the lamp end will be significantly lower compared with a lamp operated with 'hot' electrodes over a distance of about 2 cm.

This leads to the following result:

$X' = (\Phi x'/R^2)\cos^2\alpha$

$\cos^2\alpha > 0{,}95$

$\cos\alpha > 0{,}975$ $\qquad \alpha < 13°, \qquad \tan\alpha < 0{,}23$

α is 13° ($R = 2L$).

For the sensor, the angle of the incident radiation has no effect on the sensor signal strength (within the 13°), therefore no cos α correction is used for the sensor.

When $R = 2L$, the error due to different contribution in light from the centre of the lamp and the lamp end is maximum 0,3 %.

Figure A.5 shows the relation between X, X', R, R', Φx and Φx′.

NOTE Light output measurements can be done without assistance of an accredited laboratory.

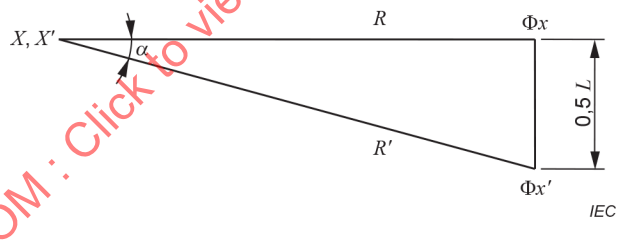


Figure A.5 – Configuration of lamp and photocell sensor

Annex B
(informative)

Application of the reference ballast when assessing lamps in electronic operation

B.1 Calculation of the reference ballast impedance

The characteristics of the high frequency reference ballast for lamps in electronic operation are deduced from the rated lamp voltage and rated lamp current of the relevant lamp data sheet. In order to achieve the rated values of the reference ballast, twice the rated lamp voltage is adjusted to the high frequency power supply. The rated current value, if not given on the lamp data sheet, should be provided by the lamp manufacturer. The value of the low inductance serial resistor is calculated from the rated lamp voltage and the rated lamp current. Definition 3.2 should be taken into consideration in this respect.

B.2 Method of adjusting the lamp power

The reference ballast is represented with a low inductive resistor, which is calculated according to Clause B.1 by taking into consideration definition 3.2.

After stabilization, the HF supply voltage is adjusted until the high frequency lamp current is within a tolerance of ±1 % to that specified in the lamp standard. At the end of this procedure, the measured high frequency lamp power ($P_{\text{Lref meas}}$) shall be within ±2,5 % of the rated or typical value.

Bibliography

IEC 62442-2, *Energy performance of lamp controlgear – Part 2: Controlgear for discharge lamps (excluding low-pressure mercury fluorescent lamps) – Method of measurement to determine the efficiency of controlgear*

IEC 62442-3, *Energy performance of lamp controlgear – Part 3: Controlgear for tungsten-halogen lamps and LED light sources – Method of measurement to determine the efficiency of controlgear*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM: 1995)*

IEC Guide 115, *Application of uncertainty of measurement to conformity assessment activities in the electrotechnical sector*

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SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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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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Cette troisième édition annule et remplace la deuxième édition parue en 2018. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) cette édition a été harmonisée avec l'IEC 62442-2 et l'IEC 62442-3;

b) des références à l'IEC 63103 ont été ajoutées afin d'appliquer les méthodes de mesurage de la consommation de puissance en mode non actif.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
34C/1545/FDIS	34C/1548/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La version française de cette norme n'a pas été soumise au vote.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

Une liste de toutes les parties de la série IEC 62442, publiées sous le titre général *Performance énergétique des appareillages de lampes*, se trouve sur le site web de l'IEC.

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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

1 Domaine d'application

La présente partie de l'IEC 62442 définit une méthode de mesurage et de calcul de la puissance d'entrée totale pour les circuits appareillage-lampe qui fonctionnent avec la ou les lampes à fluorescence qui leur sont associées. La méthode de calcul du rendement des appareillages de lampes est également définie. Le présent document s'applique aux circuits appareillage-lampe électriques constitués exclusivement de l'appareillage et de la ou des lampes. Il s'applique aux alimentations en courant continu jusqu'à 1 000 V et/ou aux alimentations en courant alternatif jusqu'à 1 000 V à 50 Hz ou 60 Hz.

NOTE Les exigences pour les essais des appareillages individuels pendant la production ne sont pas incluses.

Le présent document spécifie la méthode de mesurage de la puissance d'entrée totale et la méthode de calcul du rendement pour l'ensemble des appareillages à usage domestique et usage commercial normal, qui fonctionnent avec les lampes à fluorescence suivantes:

– lampes à fluorescence à deux culots (IEC 60081);
– lampes à fluorescence à culot unique (IEC 60901);
– autres lampes à fluorescence à vapeur de mercure à basse pression destinées à un usage général.

Le présent document ne s'applique pas aux:

– appareillages qui font partie intégrante de la lampe;
– appareillages de commande magnétiques bobinés gradables.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60050-845, *Vocabulaire électrotechnique international (IEV) – Partie 845: Eclairage* (disponible à l'adresse http://www.electropedia.org)

IEC 60081:1997, *Lampes à fluorescence à deux culots – Prescriptions de performance*
IEC 60081:1997/AMD4:2010

IEC 60901:1996, *Lampes à fluorescence à culot unique – Prescriptions de performances*
IEC 60901:1996/AMD5:2011

IEC 60921:2004, *Ballasts pour lampes tubulaires à fluorescence – Exigences de performances*

IEC 60929:2011, *Appareillages électroniques alimentés en courant alternatif et/ou continu pour lampes tubulaires à fluorescence – Exigences de performances*

IEC 63103:2020, *Appareils d'éclairage – Mesure de puissance en mode non actif*

IEC TS 63105, *Lighting systems and related equipment – Vocabulary* (disponible en anglais seulement)

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions de l'IEC 60050-845 et de l'IEC TS 63105 ainsi que les suivants s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1
valeur nominale
valeur approchée appropriée d'une grandeur, utilisée pour dénommer ou identifier un composant, un dispositif ou un matériel

Note 1 à l'article: Pour exprimer la "valeur nominale" d'une grandeur particulière, le terme "valeur" est remplacé par le nom de la grandeur; par exemple, puissance nominale, tension nominale et courant nominal.

3.2
valeur assignée
valeur d'une grandeur, utilisée à des fins de spécification, établie dans des conditions normales d'essai et telle que déclarée par le fabricant ou le fournisseur responsable

Note 1 à l'article: Pour exprimer la "valeur assignée" d'une grandeur particulière, le terme "valeur' est remplacé par nom de la grandeur; par exemple, puissance assignée, tension assignée, courant assigné et température assignée.

Note 2 à l'article: Selon le type de fonctionnement, les valeurs électriques assignées sont spécifiées dans les feuilles de caractéristiques de la lampe comme suit:

- valeurs électriques assignées sous "caractéristiques électriques", si la lampe est définie pour un fonctionnement à 50 Hz/60 Hz uniquement;
- valeurs électriques assignées sous "caractéristiques électriques", si la lampe est définie pour un fonctionnement à haute fréquence (≥ 20 kHz) uniquement;
- valeurs électriques assignées et valeurs électriques types, si la lampe est définie simultanément pour un fonctionnement à 50 Hz/60 Hz et pour un fonctionnement à haute fréquence:
  - pour un fonctionnement à 50 Hz/60 Hz: valeurs électriques assignées sous "caractéristiques électriques", et
  - pour un fonctionnement à haute fréquence: valeurs électriques assignées sous "caractéristiques représentatives d'une lampe".

[SOURCE: IEC 60050-845:2020, 845-27-100, modifié – La Note 2 à l'article a été remplacée par une nouvelle Note 2 à l'article.]

3.3
appareillage de commande
composant unique ou ensemble de composants insérés entre l'alimentation et une ou plusieurs lampes, qui peuvent servir à transformer la tension d'alimentation, limiter le courant de la ou des lampes à la valeur exigée, fournir la tension d'amorçage et le courant de préchauffage, empêcher le démarrage à froid, corriger le facteur de puissance, ou réduire les perturbations radioélectriques

3.4
appareillage de commande électromagnétique
appareillage de commande magnétique
appareillage de commande qui, via l'inductance, ou une combinaison de l'inductance et de la capacité, sert principalement à limiter le courant de la ou des lampes électriques

[SOURCE: IEC 60050-845:2020, 845-28-052, modifié – Le second terme privilégié a été ajouté.]

3.5
appareillage électronique
onduleur en courant alternatif alimenté en courant alternatif et/ou continu, qui comprend des éléments de stabilisation pour l'amorçage et le fonctionnement d'une ou de plusieurs lampes tubulaires à fluorescence, généralement à haute fréquence

3.6
lampe à fluorescence
lampe à décharge à vapeur de mercure à basse pression dans laquelle la majeure partie de la lumière est émise par une ou plusieurs couches de substances luminescentes excitées par le rayonnement ultraviolet de la décharge

3.7
circuit appareillage-lampe
circuit électrique, ou partie de celui-ci, généralement intégré à un luminaire, qui comporte l'appareillage et la ou les lampes

3.8
ballast de référence
ballast spécial, qui est soit inductif pour les lampes destinées à un fonctionnement aux fréquences du réseau en courant alternatif, soit résistif pour les lampes destinées à un fonctionnement à haute fréquence

Note 1 à l'article: Un ballast de référence est destiné à servir de norme de comparaison pour les essais de ballasts, pour le choix des lampes de référence et pour les essais de lampes de production normales sous des conditions normalisées. Il est caractérisé essentiellement, à sa fréquence assignée, par un rapport tension/courant stable qui n'est relativement pas influencé par les variations de courant, de température et de l'environnement magnétique, comme cela est indiqué dans l'IEC 60929 et l'IEC 60921.

Note 2 à l'article: L'Annexe B fournit les informations nécessaires au calcul des caractéristiques du ballast de référence et à la méthode de fonctionnement avec le ballast de référence.

3.9
lampe de référence
lampe retenue pour les essais de l'appareillage qui, lorsqu'elle est associée à un appareillage de référence, présente des caractéristiques électriques proches des valeurs assignées ou des caractéristiques types de la lampe spécifiées dans la norme applicable à la lampe

Note 1 à l'article: Pour plus d'informations sur les tolérances, voir l'Article B.2.

3.10
puissance assignée d'une lampe
$P_{\text{Lassignée}}$
puissance d'un type de lampe donné, spécifié par le fabricant ou fournisseur lorsque celle-ci fonctionne dans les conditions spécifiées

Note 1 à l'article: La puissance assignée d'une lampe est exprimée en W.

3.11
facteur de flux lumineux d'un ballast
BLF
rapport du flux lumineux de la lampe de référence lorsque le ballast soumis à l'essai fonctionne à sa tension assignée, comparé au flux lumineux de la même lampe qui fonctionne avec le ballast de référence approprié, alimenté à sa tension et sa fréquence assignées

Note 1 à l'article: L'abréviation "BLF" est dérivée du terme anglais développé correspondant "ballast lumen factor".

3.12
puissance d'entrée totale
puissance totale consommée par le circuit appareillage-source lumineuse mesurée à la tension d'entrée assignée

3.13
rendement de l'appareillage
$\eta_{\text{appareillage}}$
rapport de la puissance de sortie de la ou des lampes et de la puissance d'entrée totale de l'appareillage

Note 1 à l'article: Les charges relatives aux capteurs, aux raccordements au réseau ou aux autres appareils auxiliaires sont déconnectées. Si cela n'est pas possible, celles-ci sont éliminées du résultat d'une autre manière.

3.14
appareillage multipuissance
appareillage conçu pour faire fonctionner une ou plusieurs lampes avec différentes puissances assignées

3.15
appareillage multilampe
appareillage conçu pour faire fonctionner simultanément plus d'une lampe de type similaire

3.16
mode veille
<d'un appareillage de commande> mode dans lequel, lorsque l'appareil est relié à une tension d'alimentation, la fonction éclairante est désactivée, mais peut être activée par un déclencheur externe qui n'est pas un déclencheur provenant d'un réseau

Note 1 à l'article: La détection ou la temporisation sont des exemples de déclencheurs externes.

[SOURCE: IEC 63103:2020, 3.10, modifié – Le domaine "<d'un appareil d'éclairage>" a été remplacé par "<d'un appareillage de commande>".]

3.17
mode veille en réseau
<d'un appareillage de commande> mode dans lequel, lorsque l'appareil est relié à une tension d'alimentation, la fonction éclairante est désactivée, mais peut être activée par un déclencheur externe qui est un déclencheur provenant d'un réseau

[SOURCE: IEC 63103:2020, 3.11, modifié – Le domaine "<d'un appareil d'éclairage>" a été remplacé par "<d'un appareillage de commande>".]

3.18
puissance de veille
<d'un appareillage de commande> consommation d'énergie moyenne en mode veille

3.19
puissance de veille en réseau
<d'un appareillage de commande> consommation d'énergie moyenne en mode veille en réseau

4 Généralités

4.1 Facteur de flux lumineux du ballast

Pour chaque combinaison appareillage-lampe soumise à l'essai, le facteur de flux lumineux du ballast doit être mesuré. Le facteur de flux lumineux du ballast est défini en 3.11 et exprimé comme suit:

$$BLF = \frac{\text{Lumière}_{essai}}{\text{Lumière}_{réf}} \quad (1)$$

où:

$\text{Lumière}_{réf}$ est le flux lumineux de la lampe de référence branchée au ballast de référence, mesuré par la cellule photoélectrique;

Lumière_{essai} est le flux lumineux de la lampe de référence branchée à l'appareillage soumis à l'essai, mesuré par la cellule photoélectrique.

Le facteur de flux lumineux du ballast doit être compris entre 0,925 et 1,075. Les appareillages avec un facteur de flux lumineux du ballast inférieur ne sont pas appropriés pour les essais. La limite supérieure de 1,075 peut être dépassée si la valeur maximale du courant de fonctionnement de la lampe et la valeur maximale du courant qui passe dans n'importe quel conducteur relié aux cathodes sont conformes à la valeur assignée spécifiée dans l'IEC 60081 et l'IEC 60901.

4.2 Appareillages à intensité variable

Une température de cathode suffisante doit être délivrée par le circuit de chauffage à toutes les gradations d'intensité possibles dans la plage de gradation disponible de l'appareillage, selon les valeurs spécifiées dans la feuille de caractéristiques applicable de l'IEC 60081 et l'IEC 60901.

Les appareillages à intensité variable doivent être mesurés à des flux lumineux de 100 % et de 25 % de la ou des lampes en fonctionnement.

4.3 Appareillages multipuissances et/ou multilampes

Les appareillages multipuissances et multilampes doivent être mesurés avec toutes les combinaisons possibles de puissance et de nombre de lampes. Le fabricant doit déclarer le facteur de flux lumineux de ballast applicable à chaque combinaison.

4.4 Généralités sur les essais

Sauf spécification contraire dans le présent document, les conditions de mesurage indiquées dans l'IEC 60921:2004 ou l'IEC 60929:2011, Annexe A doivent être appliquées.

Pour l'incertitude et la traçabilité des mesures, se reporter au Guide ISO/IEC 98-3 et au Guide IEC 115.

4.5 Echantillonnage des appareillages pour les essais

Les exigences et tolérances spécifiées dans le présent document s'appliquent aux essais effectués sur un échantillon d'essai de type fourni par le fabricant pour les besoins de ces essais. Il convient que cet échantillon soit constitué d'unités qui présentent des caractéristiques typiques de la production du fabricant, et qu'il soit aussi proche que possible des valeurs médianes de la production.