IEC 62442-1

Edition 2.0 2018-05
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

IEC 62442-1:2018-05 RLV(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.140.99

ISBN 978-2-8322-5682-4

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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International Standard IEC 62442-1 has been prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lamps and related equipment.

This second edition cancels and replaces the first edition published in 2011. This edition constitutes a technical revision and has been harmonized with IEC 62442-2 and IEC 624423.

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

CDV	Report on voting
34C/1335A/CDV	34C/1376/RVC

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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 "http://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- withdrawn,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 fluorescent lamps;
– single-ended (compact) fluorescent lamps;
– other general purpose 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 60081:1997, *Double-capped fluorescent lamps – Performance specifications*
IEC 60081:1997/AMD4:2010

IEC 60901:1996, *Single-capped fluorescent lamps – Performance ~~requirements~~ 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*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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

3.2
limiting value
greatest or smallest admissible value of one of the quantities

3.3
rated value
quantity value for specified operating conditions of a component, device or equipment

Note 1 to entry: The value and conditions are specified in the relevant standard or assigned by the manufacturer or responsible vendor.

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".

3.4
controlgear
one or more components between the supply and one or more lamps which may 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

3.5
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 lamp(s) to the required value and operates the lamp(s) at the same frequency as the supply frequency

~~Frequency of the lamp operation is the same as supply frequency.~~

3.6
electronic controlgear
~~a.c. and/or d.c. supplied to~~ 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

3.7
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

3.8
controlgear-lamp circuit
electrical circuit, or part thereof, normally built in a luminaire, consisting of the controlgear and lamp(s)

3.9
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: It is designed for the purpose of providing comparison standards for use in testing ballasts, for the selection of reference lamps and for testing regular production lamps under standardized conditions. It is essentially characterized by the fact that, at its rated frequency, it has a stable voltage/current ratio which is relatively uninfluenced by variations in current, temperature and magnetic surroundings, as outlined in 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.

3.10
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.

~~**3.11**~~
~~**rated supply voltage of a controlgear**~~
~~voltage specified by the controlgear manufacturer for a given controlgear that applies to a given operation condition~~

3.11
lamp rated power ~~**of a lamp**~~
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.

3.12
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.

3.13
total input power
total power ~~supplied to~~ consumed by the controlgear-lamp (light source) circuit measured at rated input voltage

~~The rated power specified is related to a specific ballast lumen factor (BLF).~~

[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.]

3.14
controlgear efficiency
$\eta_{controlgear}$
~~ratio between the summation of the rated lamp power(s) and the corrected to reference conditions input power of the controlgear – lamp circuit with possible sensors, network connections and other auxiliary loads disconnected~~
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 to entry: Loads from sensors, network connections and other auxiliary are disconnected or, if not possible, otherwise eliminated from the result.

3.15
multi-power-lamp ~~power~~ controlgear
controlgear designed ~~for the operation of one lamp which could have different lamp power~~ to operate one or more lamp(s) with different rated powers

3.16
multi-number-lamp controlgear
controlgear designed ~~for the operation of~~ to operate simultaneously more than one similar lamp

3.17
standby mode
mode of the controlgear, in which the light source is switched off by a control signal, while the controlgear remains connected to the mains supply, failed lamp(s) not included

Note 1 to entry: The ignition phase of lamp(s) is excluded from the standby mode.

Note 2 to entry: Failed lamp(s) could lead to incorrect measurements.

3.18
standby power
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.

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.

4.2 ~~Declaration of~~ Ballast lumen factor

For every controlgear-lamp combination submitted for the test, ~~the controlgear manufacturer shall declare~~ the ~~measured~~ ballast lumen factor shall be measured. The ballast lumen factor is defined in 3.12.

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

where

$\text{Light}_{\text{ref}}$ 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.

The ~~declared~~ 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.

4.3 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 datasheet in IEC 60081 and IEC 60901.

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

4.4 Multi-~~wattage~~ power and/or multi-~~number~~-lamp controlgear

~~If a controlgear is designed for the operation of one lamp with different lamp power then the test shall be carried out for each lamp type, the manufacturer shall declare for every lamp the relevant BLF. The test for multi-lamp controlgear shall be carried out with all possible combinations.~~

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.

~~4.5 Accuracy of measurement~~

~~The accuracy of the measurements shall be in accordance with A.1.2 and A.1.7 of IEC 60929. The total accuracy of the measurement arrangement shall be within ± 1,5 % for magnetic wire-wound controlgear – lamp circuits and ± 2,5 %, for electronic controlgear – lamp circuits, including the accuracy of the photometric measurement.~~

4.5 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.

4.6 Sampling of controlgear for testing

~~Tests in this standard are type tests.~~ 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.

4.7 ~~Number~~ Size of the test sample~~s~~

~~One specimen shall be tested.~~ Tests are carried out with one test specimen.

4.8 Conditioning of lamps

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

4.9 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 ~~± 2 %~~ (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

[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~~, respectively~~.

[c] If the manufacturer advises that for a marked voltage range a discrete value shall be used for measurement, this should be observed.

4.10 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).

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 ~~magnetic wire wound~~ 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 be made with the rated supply voltage. 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 ~~wire wound~~ controlgear-lamp circuits

The ~~measured~~ 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 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).