BS EN 62442-3:2014

BSI Standards Publication

# Energy performance of lamp controlgear

## Part 3: Controlgear for halogen lamps and LED modules — Method of measurement to determine the efficiency of the controlgear

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This British Standard is the UK implementation of EN 62442-3:2014. It is identical to IEC 62442-3:2014.

The UK participation in its preparation was entrusted by Technical Committee CPL/34, Lamps and Related Equipment, to Subcommittee CPL/34/3, Auxiliaries for lamps.

A list of organizations represented on this committee can be obtained on request to its secretary.

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EUROPEAN STANDARD

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**EN 62442-3**

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English Version

# Energy performance of lamp controlgear - Part 3: Controlgear for halogen lamps and LED modules - Method of measurement to determine the efficiency of the controlgear (IEC 62442-3:2014)

Performance énergétique des appareillages de lampes - Partie 3: Appareillage de lampes à halogène et modules de DEL - Méthode de mesure pour la détermination du rendement de l'appareillage (CEI 62442-3:2014)

Energieeffizienz von Lampenbetriebsgeräten - Teil 3: Betriebsgeräte für Halogenlampen und LED-Module - Messverfahren zur Bestimmung des Wirkungsgrades des Betriebsgerätes (IEC 62442-3:2014)

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Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

## Foreword

The text of document 34C/1077/FDIS, future edition 1 of IEC 62442-3, prepared by SC 34C "Auxiliaries for lamps", of IEC/TC 34 "Lamps and related equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62442-3:2014.

The following dates are fixed:

| | | |
|---|---|---|
| – latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2015-03-01 |
| – latest date by which the national standards conflicting with the document have to be withdrawn | (dow) | 2017-05-29 |

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In the official version, for Bibliography, the following notes have to be added for the standards indicated:

| | | |
|---|---|---|
| IEC 60357 | NOTE | Harmonized as EN 60357. |
| IEC 62384 | NOTE | Harmonized as EN 62384. |
| IEC 62442-1:2011 | NOTE | Harmonized as EN 62442-1:2011 (not modified). |
| IEC 62442-2:— | NOTE | Harmonized as EN 62442-2:2014 (not modified). |

# Annex ZA
(normative)

## Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

| Publication | Year | Title | EN/HD | Year |
|---|---|---|---|---|
| IEC 61047 | 2004 | DC or AC supplied electronic step-down convertors for filament lamps - Performance requirements | EN 61047 | 2004 |
| IEC 61347-1 (mod) | 2007 | Lamp controlgear - Part 1: General and safety requirements | EN 61347-1 | 2008 |
| +A1 | 2010 | | +A1 | 2011 |
| +A2 | 2012 | | +A2 | 2013 |
| IEC 61347-2-2 | - | Lamp controlgear - Part 2-2: Particular requirements for d.c. or a.c. supplied electronic step-down convertors for filament lamps | EN 61347-2-2 | - |
| IEC 61347-2-13 | - | Lamp controlgear - Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules | EN 61347-2-13 | - |
| IEC 61558-1 | - | Safety of power transformers, power supplies, reactors and similar products - Part 1: General requirements and tests | EN 61558-1 | - |
| IEC 61558-2-6 | - | Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V - Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers | EN 61558-2-6 | - |
| IEC Guide 115 | 2007 | Application of uncertainty of measurement to conformity assessment activities in the electrotechnical sector | - | - |

CONTENTS

# ENERGY PERFORMANCE OF LAMP CONTROLGEAR –

# Part 3: Controlgear for halogen lamps and LED modules – Method of measurement to determine the efficiency of the controlgear

## 1 Scope

This part of the IEC 62442 series defines a measurement method for the power losses of magnetic transformers and the power losses with the standby power of electronic convertor for halogen lamps and LED modules.

Also a calculation method of the efficiency for the mentioned controlgear for halogen lamps and LED modules is defined.

This part of IEC 62442 applies to electrical controlgear – lamp circuits comprised solely of the controlgear and of the lamp(s).

For multipurpose power supplies only the lighting part will be considered.

NOTE 1 Requirements for testing individual controlgear during production are not included.

It specifies the measurement method for the total input power, the standby power and the calculation method of the controlgear efficiency for all controlgear sold for domestic and normal commercial purposes operating with halogen lamps and LED modules.

This part of IEC 62442 does not apply to:

– controlgear which form an integral part of lamps;
– controlgear circuits with capacitors connected in series;
– controllable wire-wound electromagnetic controlgear.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61047:2004, *DC or AC. supplied electronic step-down convertors for filament lamps – Performance requirements*

IEC 61347-1:2007, *Lamp controlgear – Part 1: General and safety requirements*
Amendment 1:2010
Amendment 2:2012

IEC 61347-2-2, *Lamp controlgear – Part 2-2: Particular requirements for d.c. or a.c. supplied electronic step-down convertors for filament lamps*

IEC 61347-2-13, *Lamp controlgear – Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules*

IEC 61558-1, *Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests*

IEC 61558-2-6, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers*

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

## 3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

**3.1**
**nominal value**
suitable approximate quantity value used to designate or identify a component, device or equipment

[SOURCE: IEC 62442-1:2011, 3.1]

**3.2**
**rated value**
quantity value for specified operating conditions of a component, device or equipment

The value and conditions are specified in the relevant standard or assigned by the manufacturer or responsible vendor

[SOURCE: IEC 62442-1:2011, 3.3, modified – The note has been removed.]

**3.3**
**controlgear**
one or more component between supply and one or more lamps which may serve to transform the supply voltage, limit the current of lamp(s) to the required value, provide starting voltage and preheating current, prevent cold starting, correct power factor or reduce radio interference

[SOURCE: IEC 62442-1:2011,3.4]

**3.4**
**electromagnetic controlgear**
controlgear which by means of inductance, or a combination of inductance and capacitance, serves mainly to limit the current of lamp(s) to the required value

Frequency of the lamp controlgear is the same as supply frequency

[SOURCE: IEC 62442-1:2011, 3.5]

**3.5**
**magnetic transformer**
transformer
magnetic controlgear which transform the supply voltage to operate lamp(s) with the same frequency as supply frequency at the lamps rated voltage

**3.6**
**electronic controlgear**, <used for filament lamp(s) or LED module(s)>
A.C. and/or D.C. supplied electronic circuit including stabilizing elements for operating one or more filament lamp(s) or one or more LED module(s)

**3.7**
**electronic step-down convertor**
convertor
unit inserted between the supply and one or more tungsten-halogen or other filament lamps which serves to supply the lamp(s) with its (their) rated voltage, generally at high frequency

Note 1 to entry: The unit may consist of one or more separate components and may include means for dimming, correcting the power factor and suppressing radio interference.

[SOURCE: IEC 61347-2-2:2011, 3.1, modified – Additional information has been transferred to a note to entry.]

**3.8**
**electronic controlgear for LED modules**
convertor
unit inserted between the supply and one or more LED modules which serves to supply the LED module(s) with its (their) rated voltage or rated current. The unit may consist of one or more separate components and may include means for dimming, correcting the power factor and suppressing radio interference

**3.9**
**LED module**
unit supplied as a light source, which in addition to one or more LEDs may contain further components, e.g. optical, electrical, mechanical and/or electronic

**3.10**
**controlgear – lamp circuit**
electrical circuit, or part thereof, normally built in a luminaire, consisting of the controlgear and lamp(s)

[SOURCE: IEC 62242-1:2011,3.8]

**3.11**
**standby power**
average power consumption of a controlgear when subjected to standby mode

Note 1 to entry: Unit: W.

**3.12**
**standby mode**

mode relevant for those controlgear which are permanently connected to the mains, where the lamp(s) are switched off via a control signal, not including failed lamp(s)

[SOURCE: IEC 62242-2:—, 3.8, modified – The note has been removed.]

**3.13**
**total input power**
total power supplied to the controlgear – lamp circuit measured at rated input voltage

[SOURCE: IEC 62242-1:2011, 3.14, modified – The sentence "The rated power specified is related to a specific ballast lumen factor (BLF)." has been removed.]

**3.14**
**off mode**
mode relevant for those controlgear which are permanently connected to the mains, where the lamp(s) are switched off via a switch on the output circuit of the controlgear, not including failed lamp(s)

**3.15**
**controlgear efficiency**, <for controlgear used for filament lamp(s) or LED module(s)>
$\eta_{(CG)}$
ratio between the lamp power (controlgear output power) and the input power of the controlgear – lamp circuit with possible sensors, network connections and other auxiliary loads disconnected

## 4 General

### 4.1 Applicability

The measurement and calculation methods of this standard shall only be used for magnetic transformer which conforms to IEC 61558-1 and IEC 61558-2-6 or for electronic convertor which conforms to IEC 61347-1 and IEC 61347-2-2 or for electronic controlgear for LED modules which conforms to IEC 61347-1 and IEC 61347-2-13.

### 4.2 General notes on test

The measurement conditions are specified in IEC 61347-1:2010; Annex H: H.1, H.2, H.4, H.8 and H.11; unless otherwise specified in this standard. The device under test (DUT) shall be placed according to IEC 61347-1:2010; Figure H.1.

An A.C. reference source shall be used to provide input voltage to the DUT. During the tests, the supply voltage and the frequency shall be maintained constant within ± 0,5 % during the warm-up period. However, during the actual measurement, the voltage shall be adjusted to within ± 0,2 % of the specified testing value.

The input voltage source shall be capable of delivering at least three times the input power of the DUT.

### 4.3 Controllable controlgear

In case of controllable controlgear the test shall be carried out with the maximum output power.

Requirements of the efficiency during the dimming condition of controllable controlgear are under consideration.

### 4.4 Measurement uncertainty

Measurement uncertainty shall be managed in accordance with the accuracy method in 4.4.3 of the IEC Guide 115:2007.

### 4.5 Sampling of controlgear for testing

Tests in this part of IEC 62442 are type tests. The requirements and tolerances specified in this part of IEC 62442 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 Number of samples

One specimen shall be tested.

### 4.7 Power supply

Where the test voltage and frequency are not defined by national or regional requirements, the controlgear manufacturer shall declare the nominal voltage(s) at which the given efficiency is valid.

Test voltage(s) and test frequency(ies) shall be the nominal voltage and the nominal frequency of the country for which the measurement is being determined (refer to Table 1).

**Table 1 – Typical nominal electricity supply details for some regions**

| Country | Nominal voltage and frequency [a] |
|---|---|
| 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.

### 4.8 Supply voltage waveform

The total harmonic content of the supply voltage when supplying the DUT shall not exceed 3 %; harmonic content is defined as the root-mean-square (r.m.s.) summation of the individual components using the fundament as 100 %.

The ratio of peak value to r.m.s. value of the test voltage (i.e. crest factor) shall be between 1,34 and 1,49.

### 4.9 Substitution load

To give reproducible measurement results, a resistor ($R_{load}$) shall be used as a replacement for the lamp(s). $R_{load}$ is determined from the rated output power and the rated output voltage or rated output current of the controlgear.

The resistor $R_{load}$ shall be selected so that the value of the resistance shall not deviate by more than 1 % during the test.

For electronic controlgear for LED lamps/modules a pure resistive load may cause malfunction of the DUT. In these cases a combination of diodes and variable resistor equivalent to the LED lamp/module shall be used, which should ensure the maximum rated output current at the rated output voltage.

NOTE When a special starting procedure is used to allow the constant current controlgear to function properly, the method with the equivalent resistor can be used.

In case of controlgear with an output frequency higher than 70 Hz for halogen lamps, the load shall always be a lamp as indicated in 4.2 of IEC 61047:2004.

### 4.10 Thermocouple and temperature indicator

The resolution of the temperature indicator shall be at least 0,1 °C, when used with the appropriate thermocouple.

### 4.11 Instrument accuracy

For magnetic transformers, calibrated and traceable a.c. power meters, power analysers or digital power meters shall be used.

For electronic step-down convertors, all output power measurements shall be made with a calibrated and traceable wideband power analyser or digital power meter.

For measurements made under the scope of this standard, measurement instruments with the following minimum accuracies are to be used.

a) For frequencies up to and including 1 kHz:

- voltage: 0,5 %
- current: 0,5 %
- power: 1,0 %
- frequency: 0,1 %

b) For frequencies above 1 kHz:

- voltage: 1,0 %
- current: 1,0 %
- power: 2,0 %

Stability of the measurement values (V, A or W) is given if the data does not differ by more than 1 % in a time frame of 15 min.

Measurement shall be done in such a way that the line losses are limited (for example with a four wire measurement system).

Additional tests will be required using an oscilloscope with at least 20 MHz bandwidth or a spectrum analyser/receiver. This will be required for determination of convertor output fundamental frequency and harmonics. The power analyser or digital power meter shall have specified accuracies to within 200 kHz.

### 4.12 Measuring circuits

In case of controlgear with supplementary connection to the output circuit or sensors (e.g. to detect fault or temperatures), all sensors and circuits have to be connected as in normal use.

### 4.13 Multi-rated voltage controlgear

If a controlgear is designed for more than one rated voltages, the controlgear manufacturer shall declare the rated voltage(s) at which the given efficiency and the standby power are valid.

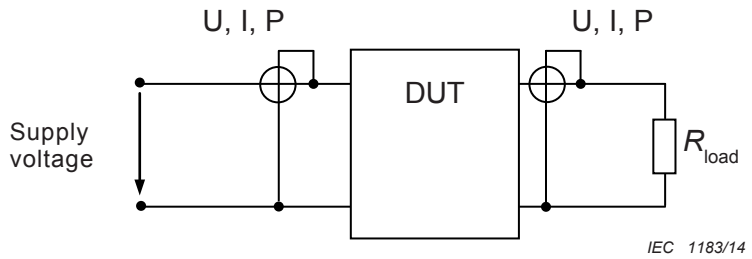
### 4.14 Multi-power controlgear

If a controlgear is designed for more than one output power the test shall be carried out with the maximum output power.

# 5 Method of measurement and calculation of the efficiency of controlgear (transformer, convertor) for tungsten halogen lamps and for LED modules

## 5.1 Measurement setup: input and output power

Figure 1 shows the measurement setup for the measurement of the power losses of magnetic wire wound controlgear and the input and output power of convertor – electronic controlgear.




**Key**

| | |
|---|---|
| DUT | Device under test |
| U | Voltage |
| I | Current |
| P | Power |
| $R_{load}$ | Substitution load |

**Figure 1 – Power losses measurement setup for magnetic controlgear (transformer) and input and output power measurement setup for convertor (electronic controlgear)**

The measurement setup circuit for constant power controlgear shall be used in suitable way also with the current defined in the data sheets of the lamp(s).

The information regarding the substitution load is given under 4.9. The measurements are carried out with power meters connected to measure the total input power into and the output power (lamp power) of the DUT.

The value of the total input power ($P_{tot.meas.}$) is recorded when a steady state has been reached (temperature of the DUT).

The supply voltage for the measurement according Figure 1 is defined in 4.7 and 4.13 of this standard.

**Measurement sequence:**

1) Connect the DUT according to Figure 1.
2) Switch on the mains voltage.
3) Await the thermal equilibrium.
4) Measure the input and the output power.

The total input power ($P_{tot.meas.}$) of a DUT is measured on one DUT.

$P_{tot.meas.}$ is the measured total input power into the DUT (in Watt)

$P_{Lamp}$ is the measured output power of the DUT (lamp power – power on the substitution resistor) in the test circuit (in Watt)

In case of multi output controlgear $P_{Lamp}$ is the sum of all the power measured in each channel.

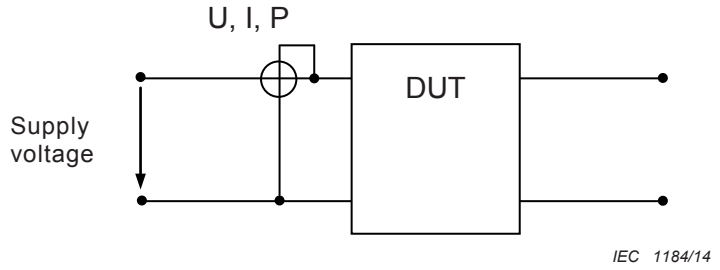
### 5.2 Efficiency calculation for magnetic (transformer) and electronic (convertor) controlgear

For the calculation of the efficiency of a DUT ($\eta_{(CG)}$), Equation (1) should be used:

$$\eta_{(CG)} = \left( \frac{P_{lamp}}{P_{tot.meas}} \right) \quad (1)$$

### 5.3 Measurement setup: input power in off mode

Figure 2 shows the measurement setup for the measurement of the input power losses in off mode for magnetic wire wound controlgear and for convertor (electronic controlgear).




**Key**

| | |
|---|---|
| DUT | Device under test |
| U | Voltage |
| I | Current |
| P | Power |

**Figure 2 – Input power measurement setup for magnetic controlgear (transformer) and for convertor (electronic controlgear)**

The measurement setup circuit for constant power controlgear shall be used in suitable way also with the current defined in the data sheets of the lamp(s).

The substitution load is disconnected from the DUT – open output circuit (see Figure 2). The measurements are carried out with a power meter connected to measure the total input power into the DUT.

The value of the total input power in off-mode ($P_{tot.meas.off}$) is recorded when a steady state has been reached (temperature of the DUT).

The supply voltage for the measurement according to Figure 2 is defined in 4.7 and 4.13 of this standard.

**Measurement sequence:**

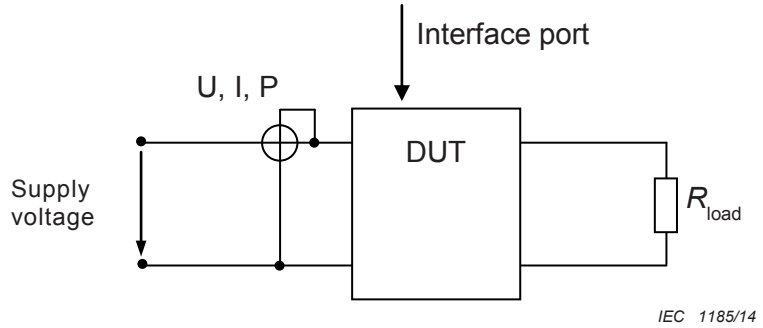
1) Connect the DUT according to Figure 2.
2) Switch on the mains voltage.
3) Await the thermal equilibrium.
4) Measure the input power.

The measured total input power in off mode ($P_{tot.meas.off}$) of a DUT is measured on one DUT.

$P_{tot.meas.off}$ is the measured total input power into the DUT (in Watt) in off mode

### 5.4 Standby power measurement of convertor – electronic controlgear

Figure 3 shows the measurement setup of the standby power of convertor – electronic controlgear.




**Key**

| | |
|---|---|
| DUT | Device under test |
| U | Voltage |
| I | Current |
| P | Power |
| $R_{load}$ | Substitution load |

**Figure 3 – Measurement setup of the standby power of convertor – electronic controlgear**

The measurement setup circuit for constant power controlgear shall be used in suitable way also with the current defined in the data sheets of the lamp(s).

Information regarding the substitution load is given under 4.9.

The measurements are carried out with power meters connected to measure the total input power into the convertor – electronic controlgear.

The value of the standby power ($P_{(CG)standby}$) (total input power) is recorded when a steady state has been reached (temperature of the convertor – electronic controlgear).

The supply voltage for the measurement according to Figure 3 is defined in 4.7 and 4.13 of this standard.

**Measurement sequence:**

1) Connect the DUT according to Figure 3.
2) Switch on the mains voltage.
3) Set the controlgear via the interface port (for example “digital addressable lighting interface”) to the standby mode.
4) Await the thermal equilibrium.
5) Measure the standby power (total input power).

The standby power ($P_{(CG)standby}$) (total input power) of a convertor – controlgear is measured with one electronic lamp controlgear.

# Bibliography

IEC 60357, *Tungsten halogen lamps (non-vehicle) – Performance specifications*

IEC 62384, *DC or AC supplied electronic control gear for LED modules – Performance requirements*

IEC 62442-1:2011, *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 the controlgear*

IEC 62442-2:—[1], *Energy performance of lamp controlgear – Part 2: Controlgear for high intensity discharge lamps (excluding fluorescent lamps) – Method of measurement to determine the efficiency of the controlgear*

[1] To be published.

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