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REDLINE VERSION

INTERNATIONAL STANDARD

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

IEC 62442-3:2018-05 RLV(en)

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FOREWORD

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International Standard IEC 62442-3 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 2014. This edition constitutes a technical revision and has been harmonized with IEC 62442-1 and IEC 62442-2.

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

CDV	Report on voting
34C/1344/CDV	34C/1378/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- withdrawn,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 3: Controlgear for tungsten-halogen lamps and LED ~~modules~~ light sources – Method of measurement to determine the efficiency of controlgear

1 Scope

This part of IEC 62442 defines a measurement method for the power losses of electromagnetic transformers as well as the power losses ~~with~~ and the standby power of electronic convertors for tungsten-halogen lamps and for LED ~~modules~~ light source(s).

It is applicable for controlgear that are designed 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.

A calculation method of the efficiency of the mentioned controlgear for tungsten-halogen lamps and LED ~~modules~~ light source(s) is also defined.

This document applies to electrical controlgear-lamp circuits comprised solely of the controlgear and of the lamp(s) (LED light sources).

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

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

This document 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 tungsten-halogen lamps and LED ~~modules~~ light source(s). The term "LED light sources" includes LED modules and LED lamps.

This document does not apply to:

– controlgear which form an integral part of lamps (LED light sources);
– controlgear circuits with capacitors connected in series;
– controllable ~~wire-wound~~ electromagnetic 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 61047:2004, *DC or AC supplied electronic step-down convertors for filament lamps – Performance requirements*

IEC 61347-1:~~2007~~ 2015, *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 DC or AC supplied electronic step-down convertors for filament lamps*

IEC 61347-2-13, *Lamp controlgear – Part 2-13: Particular requirements for DC or AC supplied electronic controlgear for LED modules*

IEC 61558-1, *Safety of ~~power~~ transformers~~, power supplies~~, reactors, power supply units and ~~similar products~~ combinations thereof – 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 62301:2011, *Household electrical appliances – Measurement of standby power*

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

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

[SOURCE: IEC 62442-1:~~2011~~ 2018, 3.1]

3.2
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.

[SOURCE: IEC 62442-1:~~2011~~ 2018, 3.3, modified – Note 2 has been ~~removed~~ deleted.]

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

[SOURCE: IEC 62442-1:~~2011~~ 2018, 3.4, modified – "provide starting voltage and preheating current, prevent cold starting" has been deleted and "(LED light source(s))" has been added.]

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 lamp(s) (LED light source(s)) to the required value and operates the lamp(s) at the same frequency as the supply frequency

~~Frequency of the lamp controlgear is the same as supply frequency~~

[SOURCE: IEC 62442-1:~~2011~~ 2018, 3.5, modified – "(LED light source(s))" has been added.]

3.5
electromagnetic transformer
magnetic transformer
transformer
electromagnetic controlgear which transform the supply voltage to operate lamp(s) (LED light source(s)) with the same frequency as the supply frequency at the lamps (light sources) rated voltage

3.6
electronic controlgear
<filament lamp(s) or LED ~~module(s)~~ light sources> AC and/or DC supplied electronic circuit including stabilizing elements for operating one or more filament lamp(s) or one or more LED ~~module(s)~~ light sources

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
controlgear for LED light sources

3.8.1
electronic controlgear for LED ~~modules~~ light sources
convertor
unit inserted between the supply and one or more LED ~~modules~~ light sources which serves to supply the LED ~~module(s)~~ light source(s) with its (their) rated voltage or rated current

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, and further control functions

Note 2 to entry: The controlgear consists of a power supply and a control unit.

Note 3 to entry: The controlgear may be partly or totally integrated in the LED module.

Note 4 to entry: When there is no risk of confusion, as in a LED standard for example, “controlgear” may also be used. Both terms “controlgear” or “control gear” are acceptable.

[SOURCE: IEC 61347-2-13:2014, 3.1, modified – “LED modules” has been replaced with “LED light sources” and Note 4 has been added.]

3.8.2
power supply of the controlgear
electronic device, being part of the controlgear, capable of controlling current, voltage or power within design limits and containing no additional LED control capabilities

Note 1 to entry: For LEDsi modules, the power supply of the controlgear is separate from the LED module on a distant location.

Note 2 to entry: The energy source of a power supply can be either a battery or the electrical supply system.

3.8.3
control unit of the controlgear
electronic device, being part of the controlgear, responsible for controlling the electrical energy to the LED light sources as well as colour mixing, response to depreciating luminous flux and further performance features

Note 1 to entry: In LEDsi modules, the control unit of the controlgear is on board the LED module and separate from the power supply of the controlgear.

~~**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~~

3.9
controlgear ~~– lamp~~ -light source circuit
electrical circuit, or part thereof, normally built in a luminaire, consisting of the controlgear and ~~lamp(s)~~ light source(s)

[SOURCE: ~~IEC 62242-1:2011~~ IEC 62442-1:2018, 3.8, modified – "lamp" has been replaced with "light source".]

3.10
standby power
average power consumption of a controlgear when subjected to 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.

3.11
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)~~
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 not including failed lamp(s) or light source(s)

Note 1 to entry: Failed light source(s) could lead to incorrect measurements.

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

3.12
~~off~~ no-load mode
mode relevant for those controlgear which are permanently connected to the mains, where the lamp(s) or light source(s) are switched off via a switch on the output circuit of the controlgear~~, not including failed lamp(s)~~

3.13
total input power
total power ~~supplied to~~ consumed by the controlgear-lamp (light source) 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.~~ IEC 62442-1:2018, 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
η_{CG}
<filament lamp(s) or LED ~~module(s)~~ light source(s)>
~~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~~
ratio of the output power to lamp(s) (light source) and the 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 or other auxiliaries are disconnected or, if not possible, otherwise, eliminated from the result.

4 General

4.1 Applicability

The measurement and calculation methods in this document shall only be used for magnetic transformers which conform~~s~~ to IEC 61558-1 and IEC 61558-2-6 or for electronic convertors which conform~~s~~ 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 tests

The measurement conditions ~~are~~ specified in IEC 61347-1:~~2010~~ 2015, Clauses H.1, H.2, H.4, H.8 and H.11 shall be applied; unless otherwise specified in this document. The device under test (DUT) shall be placed according to IEC 61347-1:~~2010~~ 2015, Figure H.1.

An AC ~~reference~~ or DC voltage 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~~ should be capable of delivering at least three times the input power of the DUT.

4.3 Controllable controlgear

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

In case a controlgear has multiple channels, each channel shall be set at the same power level. The sum of the power per channel shall be equal to the maximum allowed output power of the controlgear.

Requirements ~~of~~ relevant for 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 IEC Guide 115:2007, 4.4.3.

4.5 Sampling of controlgear for testing

~~Tests in this part of IEC 62442 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.

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

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

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 / Region	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 (RMS) summation of the individual components using the fundament as 100 %.

The ratio of peak value to RMS 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) (light source(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.~~

During the test, R_{load} shall be within 1% of the calculated resistance.

For electronic controlgear for LED ~~lamps/modules~~ light sources, 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~~ light source shall be used~~, which should~~ to 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 the case of controlgear with an output frequency higher than 70 Hz for tungsten-halogen lamps, the load shall always be a lamp as indicated in IEC 61047:2004, 4.2.

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

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 electromagnetic transformers, calibrated and traceable AC power meters, power analysers or digital power meters shall be used. For measurement uncertainty and traceability see ISO/IEC Guide 98-3:2008 and IEC Guide 115.

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

The power measuring instrument shall be capable of measuring DC and AC 10 Hz to 2 000 Hz components.

For measurements made under the scope of this document, measurement instruments with the following minimum accuracies ~~are to~~ shall 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 %

The power consumption shall be measured by applying the procedure of IEC 62301:2011, 5.3 excluding 5.3.4.

Stability of the measurement values (V, A or W) is given if the data does not ~~differ by~~ deviate from more than 1 % in a time frame of 15 min. If any of these values vary with time, the power is determined as the arithmetic mean value over a sufficient period.

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

When the controlgear has supplementary connections to the output circuit or sensors (e.g. to detect fault or temperatures for example to ensure a safe function of the controlgear), all these sensors and circuits ~~have to~~ shall be connected as in normal use; sensors or networks which are not involved in power conversion shall be disconnected (see 4.15).

4.13 Multi-rated voltage controlgear

If a controlgear is designed for more than one rated voltage, 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.

4.15 Sensor and network connections

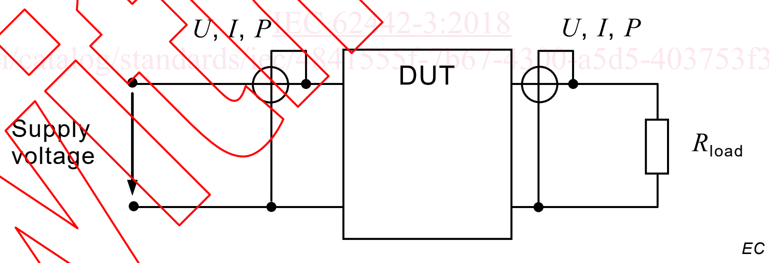
For the measurement of all kinds of controlgear power (also standby) the power consumed by all circuits (internal or external) which are not involved in power conversion for the controlgear operation (e.g. communication devices, external sensors, auxiliary load, battery charging circuits) shall be excluded 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 the efficiency of controlgear (transformer, convertor) for tungsten-halogen lamps and for LED ~~modules~~ light sources

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~~ electromagnetic 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 electromagnetic 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 (light source) power) of the DUT.