BS EN 62442-1:2011

BSI Standards Publication

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

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 62442-1:2011, incorporating CENELEC corrigendum May 2012. It is identical to IEC 62442-1:2011. It supersedes BS EN 50294:1998, which will be withdrawn on 16 November 2014.

CENELEC corrigendum May 2012 adds supersession information to the CENELEC foreword and title page.

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 subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2012

ISBN 978 0 580 55708 8

ICS 29.140.99;17.220.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2012.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62442-1

November 2011

ICS 29.140.99

Supersedes EN 50294:1998 + A1:2001 + A2:2003

English version

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 62442-1:2011)

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

(CEI 62442-1:2011)

Energieeffizienz von Lampenbetriebsgeräten - Teil 1: Betriebsgeräte für Leuchtstofflampen - Messverfahren zur Bestimmung der Gesamteingangsleistung von Betriebsgeräteschaltungen und des Wirkungsgrades von Betriebsgeräten

(IEC 62442-1:2011)

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 62442-1:2011 E

Foreword

The text of document 34C/987/FDIS, future edition 1 of IEC 62442-1, 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 62442-1:2011.

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)	2012-08-16
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2014-11-16

This document supersedes EN 50294:1998 + A1:2001 + A2:2003.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 62442-1:2011 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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.

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

Publication	Year	Title	EN/HD	Year
IEC 60081	-	Double-capped fluorescent lamps - Performance specifications	EN 60081	-
IEC 60901	-	Single-capped fluorescent lamps - Performance specifications	EN 60901	-
IEC 60921	2004	Ballasts for tubular fluorescent lamps - Performance requirements	EN 60921	2004
IEC 60929 + corr. September	2011 2011	AC and/or DC-supplied electronic control gear for tubular fluorescent lamps - Performance requirements	EN 60929	2011
IEC 61347-2-3	-	Lamp controlgear - Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps	EN 61347-2-3	-
IEC 61347-2-8	-	Lamp controlgear - Part 2-8: Particular requirements for ballasts for fluorescent lamps	EN 61347-2-8	-

CONTENTS

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

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 International Standard applies to electrical controlgear lamp circuits consisting only of the controlgear and the lamp(s). It is intended for use on a.c. supplies up to 1 000 V at 50 Hz or 60 Hz.

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

It 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 International Standard 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 referenced documents are indispensable for the application 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, *Double-capped fluorescent lamps – Performance specifications*

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

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 a.c. and/or d.c. 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.

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

3.2
limiting value
the 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

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

NOTE 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
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

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

3.6
electronic controlgear
a.c. and/or d.c. supplied to a.c. invertor 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 a.c. mains frequencies, or resistive for lamps for operation on high frequency

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.

NOTE Annex B provides details of 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

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

3.12
rated power of a lamp
P_{Lrated}
power, expressed in watts, of a given lamp type specified by the manufacturer or the supplier, the lamp being operated under specified conditions

3.13
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

3.14
total input power
total power supplied to the controlgear – lamp circuit measured at rated input voltage

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

3.15
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

3.16
multi-lamp-power controlgear
controlgear designed for the operation of one lamp which could have different lamp power

3.17
multi-number-lamp controlgear
controlgear designed for the operation of more than one lamp

4 General

4.1 Applicability

The measurement and calculation methods of this standard 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. The ballast lumen factor is defined in 3.13.

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

where

$\text{Light}_{\text{ref}}$ is the light output of reference lamp connected to 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 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

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 by 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 and/or multi-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.

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.

4.6 Sampling of controlgear for testing

Tests in this standard are type tests. The requirements and tolerances specified in this standard 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 of samples

One specimen shall be tested.

4.8 Conditioning of lamps

Lamps shall be handled and stabilized as described in B.1.1 of IEC 60081 and B.1.1 of IEC 60901.

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, 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.

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 controlgear – lamp circuits:

  the conditions specified in A.6.1 of IEC 60921:2004 and the test circuit of Figure A.1;

– for a.c. supplied electronic controlgear – lamp circuits:

  the conditions specified in A.6.2 of IEC 60921:2004, as far as applicable, and the test circuit of Figure A.2.

The value of the total input power ($P_{tot.meas.}$) 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 a reference lamp (or the number of reference lamps the controlgear is designed to operate). The reference lamps shall conform to Annex D of IEC 60921:2004, in addition the lamp current shall not deviate 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 watts);

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

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

$P_{\text{Lmeas.}}$ is the measured lamp power in the circuit with test controlgear (in watts);

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

5.4 Calculation of the efficiency of magnetic wire wound controlgear

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

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

5.5 Measurement and calculation of the total input power of electronic 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 Annex C of IEC 60929:2011, in addition the lamp current shall not deviate more than 1 % of the rated lamp current.

The comparison between the controlgear circuit with the controlgear under test and the controlgear – lamp circuit with reference ballast in accordance with A.6.1 or A.6.2, as far as applicable, of IEC 60921:2004 is made with the same reference lamp using a photocell positioned as shown in Figures A.4 and Figure A.5for measuring the light output of the lamp. The measurements are carried out using the test circuit specified in Figure A.1.

NOTE 1 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.

NOTE 2 Measurement in the Ulbricht sphere is accepted as an alternative to the ones prescribed in Figure A.3 and Figure A.4. 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 photocell (Figure A.3 and Figure A.4) should serve as reference.

The high frequency lamp current should be obtained with a tolerance of ± 1 % to that specified to 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 watts);

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

$P_{\text{Lrated.}}$ is the rated lamp or typical HF power of relevant reference lamp according to the lamp data sheet (in watts);

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

$\text{Light}_{\text{ref.}}$ is the light output of reference lamp connected to 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.

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 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 1.

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 $\Phi x'$ 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:

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

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

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

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 centre of the lamp and lamp end is maximum 0,3 %.

Figure 1 shows the relation between X, X', R, R', Φx and $\Phi x'$.

NOTE 3 Light output measurements can be done without assistance of an accredited laboratory.

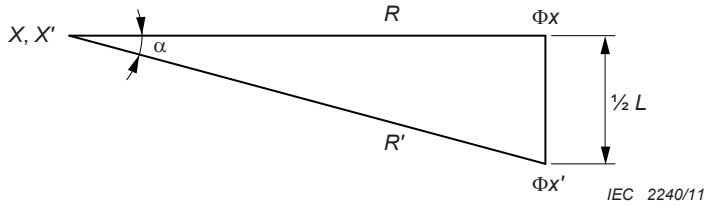


Figure 1 – Configuration of lamp and photocell sensor

5.6 Calculation of the efficiency of electronic controlgear

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

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

5.7 Measuring the standby power

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

Annex A
(normative)

Energy performance measurement setup

A.1 Measurement setup for magnetic wire wound controlgear

For the measurement of the total input power of magnetic controlgear and the measurement of the lamp power, the measurement setup of Figure A.1 should be used.

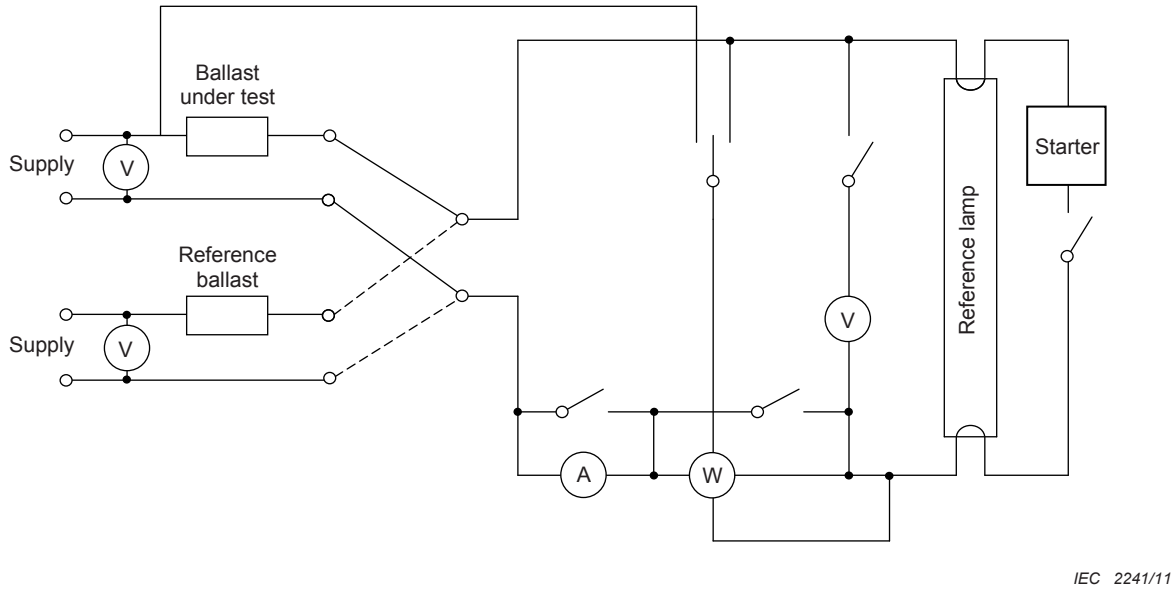


Figure A.1 – Measurement of magnetic wire wound controlgear – lamp circuits

A.2 Measurement setup 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 setup of Figure A.2 should be used.

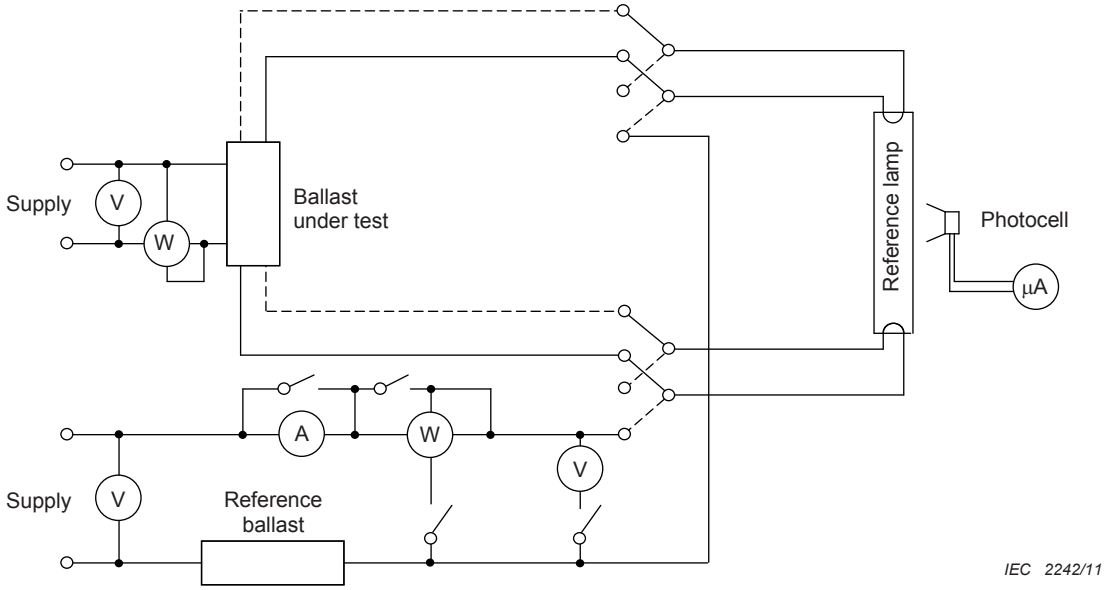


Figure A.2 – Measurement of a.c. supplied electronic controlgear – lamp circuits

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.

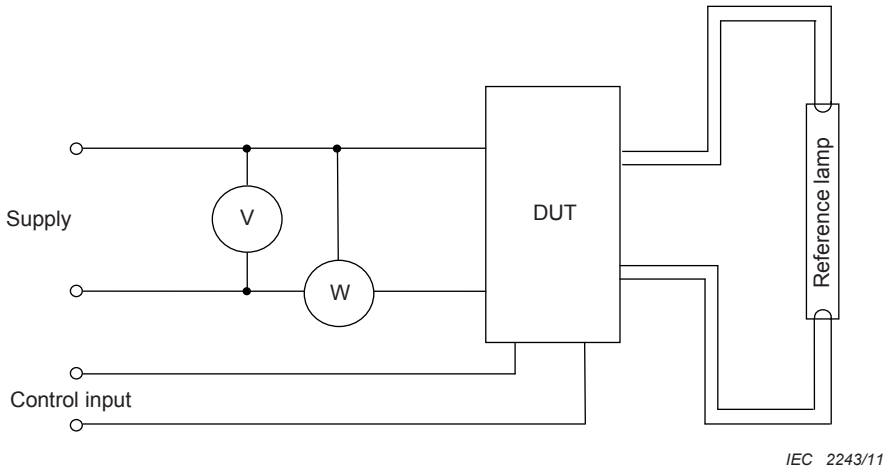
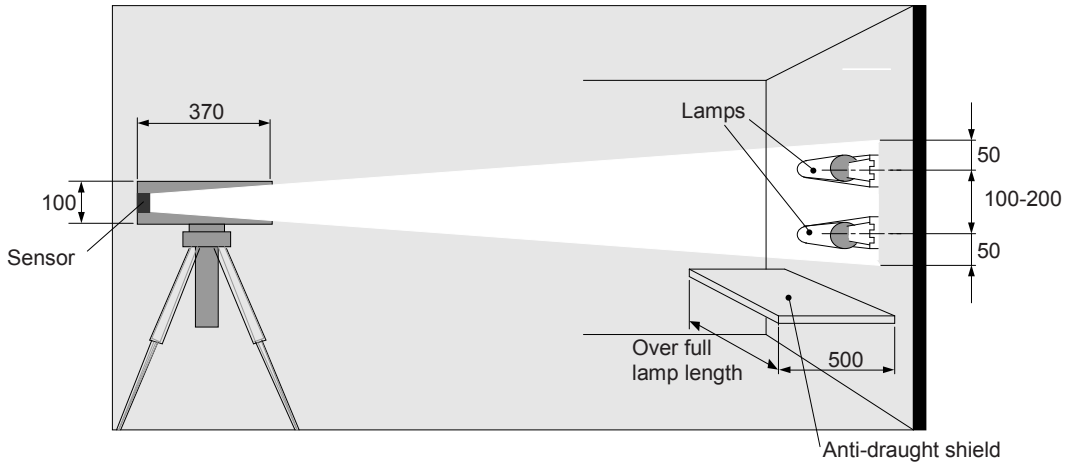


Figure A.3 – Test setup for measuring standby power

A.2.3 Light output measurement

Figure A.4 and Figure A.5 show an example for the light output measurement of fluorescent lamps.



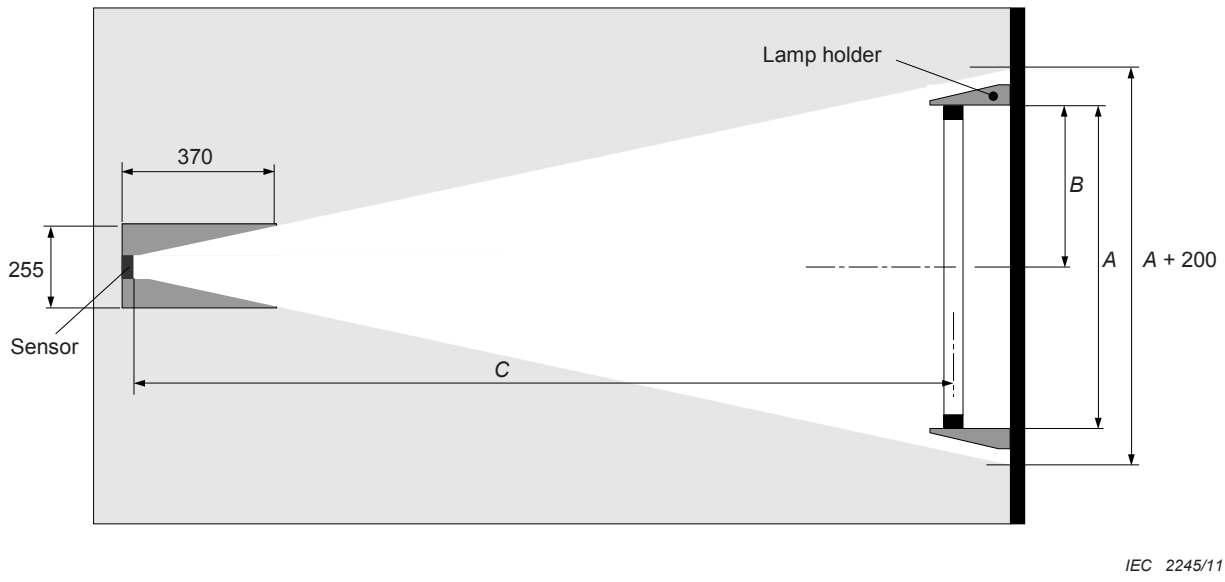
Dimensions in millimetres

NOTE 1 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.

NOTE 2 The sensor view angle should be large enough to measure the total illuminance of the lamp(s) including the cathodes.

NOTE 3 The distance of the sensor to the lamp(s) should 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 %.

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



Dimensions in millimetres

A = Lamp length

B = 1/2 lamp length

C = 2x lamp length

Figure A.5 – Top view of light output measurement system

Requirements for positioning in Figures A.4 and A.5:

a) Figures A.4 and Figure A.5 are used both for single and two lamp controlgear.
b) The same figures are used also for multi-number-lamp controlgear (3 or 4 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, care shall be taken that the reference measurements and test measurements are always taken in the same position.

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 3.3 should be regarded 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 Clause B.1 by taking into consideration definition 3.3.

After stabilization 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 high intensity discharge lamps (excluding fluorescent lamps) – Method of measurement to determine the efficiency of controlgear*[1]

_____

1 Under consideration.

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™