IEC 62811

Edition 1.0 2015-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

AC and/or DC-supplied electronic controlgear for discharge lamps (excluding fluorescent lamps) – Performance requirements for low frequency square wave operation

Appareillage électronique alimenté en courant alternatif et/ou continu pour lampes à décharge (à l'exclusion des lampes fluorescentes) – Exigences de performance pour le fonctionnement en onde carrée de basse fréquence

IEC 62811:2015-04(en-fr)

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AC AND/OR DC-SUPPLIED ELECTRONIC CONTROLGEAR FOR DISCHARGE LAMPS (EXCLUDING FLUORESCENT LAMPS) – PERFORMANCE REQUIREMENTS FOR LOW FREQUENCY SQUARE WAVE OPERATION

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The text of this standard is based on the following documents:

FDIS	Report on voting
34C/1132/FDIS	34C/1149/RVD

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

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

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

This International Standard covers performance requirements for electronic controlgear for use on a.c., at 50 Hz or 60 Hz and/or d.c. supplies up to 1 000 V associated with discharge lamps as specified in IEC 61167 for low frequency square wave operation.

In order to obtain satisfactory performance of discharge lamps and electronic controlgears, it is necessary that certain features of their design be properly coordinated. It is essential, therefore, that specifications for them be written in terms of measurement made against some common baseline of reference, permanent and reproducible.

These conditions may be fulfilled by reference ballasts. Moreover, the testing of controlgear for discharge lamps will, in general, be made with reference lamps and, in particular, by comparing the results obtained using these lamps on the controlgear to be tested and on the reference ballast. Whereas the reference ballast for frequencies of 50 Hz or 60 Hz is a self-inductive coil, the low frequency square wave reference ballast is a resistor because of its independence of frequency and the lack of influence of parasitic capacitance.

AC AND/OR DC-SUPPLIED ELECTRONIC CONTROLGEAR FOR DISCHARGE LAMPS (EXCLUDING FLUORESCENT LAMPS) – PERFORMANCE REQUIREMENTS FOR LOW FREQUENCY SQUARE WAVE OPERATION

1 Scope

This International Standard specifies performance requirements for electronic controlgear for use on a.c. and/or d.c. supplies up to 1 000 V and/or a.c. supplies up to 1 000 V at 50 Hz or 60 Hz, associated with discharge lamps, as specified in IEC 61167, which have information for low frequency square wave operation, where the frequency range of the low frequency is from 70 Hz to 400 Hz.

Tests in this standard are type tests. Requirements for testing individual controlgear during production are not included.

There are regional standards regarding the regulation of mains current harmonics and immunity for end products like luminaires and independent controlgear. In a luminaire, the controlgear is dominant in this respect. Controlgear, together with other components, should comply with these standards.

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 60050 (all parts), *International Electrotechnical Vocabulary*

IEC 61000-4-14:1999, *Electromagnetic compatibility (EMC) – Part 4-14: Testing and measurement techniques – Voltage fluctuation immunity* test
IEC 61000-4-14:1999/AMD1:2001
IEC 61000-4-14:1999/AMD2:2009

IEC 61167, *Metal Halide lamps – Performance specifications*

IEC 61347-1, *Lamp controlgear – Part 1: General and safety requirements*

IEC 61347-2-12, *Lamp controlgear – Part 2-12: Particular requirements for d.c. or a.c. supplied electronic ballasts for discharge lamps (excluding fluorescent lamps)*

IEC 62386 (all parts), *Digital addressable lighting interface*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-845 as well as the following apply.

3.1
reference ballast
special resistive ballast for lamps, for operation on low frequency square wave 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

Note 1 to entry: 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 this standard.

[SOURCE: IEC 60050:1987, 845-08-36, modified – Adapted for electronic operation of lamps.]

3.2
reference lamp
discharge lamp selected for the purpose of testing ballasts and which, when associated with a reference ballast under specified conditions, has electrical values which are close to the objective values given in a relevant specification

[SOURCE: IEC 60050:1987, 845-07-55]

3.3
calibration current of a reference ballast
value of the current on which are based the calibration and control of the reference ballast

Note 1 to entry: Such a current should preferably be approximately equal to the rated or typical current of the lamps for which the reference ballast is suitable.

[SOURCE: IEC 61347-1:2007, 3.4, modified – In the note to entry the words "rated running" are replaced by "rated or typical"]

3.4
total circuit power
total power dissipated by controlgear and lamp in combination, at rated voltage and frequency of the controlgear

[SOURCE: IEC 60929:2011, 3.5]

3.5
displacement factor
cosφ_1
cosine of the phase difference between the fundamental of the mains voltage and the fundamental of the mains current

3.6
run-up current
lamp current after take-over phase until the lower limit of the lamp voltage is reached

Note 1 to entry: Lower limit is given in Annex G of IEC 61167.

3.7
take-over
time between lamp being able to conduct current until electrodes are at thermionic emission

Note 1 to entry: At the end of the take-over phase, the lamp power factor is above 0,9 and the lamp voltage stabilises and ramps up from about 20 V rms.

[SOURCE: IEC 61167:2011, 3.14]

3.8
average peak current ratio
APCR
average of the absolute ratio between the peak current and the rms current

Note 1 to entry: For measurement procedure, see 7.4.2.

Note 2 to entry: This note applies to the French language only.

3.9
typical lamp voltage
steady state lamp voltage expected for a lamp operating on low frequency square wave ballast

Note 1 to entry: Typical lamp current is derived from the lamp rated power and typical lamp voltage. In practice, lamps for use on low frequency square wave ballasts may be targeted to a different voltage within the allowed range for best performance, and the lamp current will be different accordingly. Typical lamp voltages and currents have been used as a basis for assigning currents at take-over and run-up.

[SOURCE: IEC 61167:2011, 3.16, modified]

3.10
typical lamp current
steady state lamp current expected for a lamp operating on low frequency square wave ballast

Note 1 to entry: Typical lamp current is derived from the lamp rated power and typical lamp voltage. In practice, lamps for use on low frequency square wave ballasts may be targeted to a different voltage within the allowed range for best performance, and the lamp current will be different accordingly. Typical lamp voltages and currents have been used as a basis for assigning currents at take-over and run-up.

[SOURCE: IEC 61167:2011, 3.16, modified]

3.11
commutation time
fall and rise time
time which is the transition time of lamp current at half cycle polarity reversals

Note 1 to entry: It is measured using lamp current waveforms between 90 % of the rms value of one half cycle to 90 % of the rms value of the opposite half cycle.

3.12
electronic controlgear life time
declared average life time at which 90 % of the electronic controlgears are still operating

Note 1 to entry: In the context of life time, an electronic controlgear is “operating” if it still fulfils its intended functions.

Note 2 to entry: The manufacturers apply suitable methods, e.g. statistical calculation and/or reliability testing.

3.13
failure rate of electronic controlgear
expected statistical failure during operation based on a MTTF calculation by manufacturer and given in percentage per 1 000 h

Note 1 to entry: For the definition of MTTF, see IEC 60050-191:1990, 12.07.

3.14
ambient temperature range
t_a
temperature range of the air surrounding the electronic controlgear declared by the manufacturer to indicate the normal operating temperature range for the electronic controlgear

Note 1 to entry: The lifetime of the electronic controlgear is given at the ambient temperature t_a, for ease of measurement also the corresponding temperature of the t_c point is given.

Note 2 to entry: The measurement test condition for the ambient temperature assigned to the DUT should be in accordance to Annex D of IEC 61347-1 at the rated voltage.

4 General notes on tests

4.1 Tests according to this standard are type tests.

The requirements and tolerances permitted by this standard are based on the testing of a type test sample submitted by the manufacturer for that purpose. In principle this type test 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.

4.2 The tests are carried out in the order of the clauses, unless otherwise specified.

4.3 One controlgear is submitted to all tests unless otherwise stated.

4.4 In general, all tests are made on each type of controlgear or where a power range of similar controlgear is involved, for each rated power in the range or on a representative selection from the range as agreed with the manufacturer.

4.5 The tests are made under the conditions specified in Annex A. Lamp data sheets not published in an IEC publication shall be made available by the lamp manufacturer.

4.6 All controlgear specified in this standard shall comply with the requirements of IEC 613472-12.

4.7 Attention is drawn to lamp performance standards which contain information for square wave ballast design; this should be followed for proper lamp operation; however, this standard does not require the testing of lamp performance as part of the type test approval for controlgear.

5 Marking

5.1 Electronic controlgear shall be clearly marked with the following mandatory marking as applicable:

a) displacement factor e.g. $\cos\varphi_1 = 0{,}85$.

   If the displacement factor is less than $\cos\varphi_1 = 0{,}95$ capacitive, it shall be followed by the letter C, e.g. $\cos\varphi_1 = 0{,}85$ C.

   NOTE In Japan displacement factor will not be used, there power factor will be used. Power factor is power divided by the product of voltage and current.

5.2 In addition to the above mandatory markings, the following information shall either be given on the controlgear or be made available in the manufacturer's catalogue or the like:

a) type of control interface, in case of dimmable ballast.(e.g. D.C. type or PWM type, DALI),;
b) lifetime of the controlgear linked to the ambient temperature and the measured temperature on the reference point (t_c point).

For the information, the format of Table 1 has to be used. Corresponding to the fixed ambient temperature values 40 °C, 50 °C and 60 °C, the values of the temperature measured on the reference point (t_c point) and the declared life time have to be inserted by the manufacturer. The value of the temperature of the t_c point given in the table shall never exceed the t_c (IEC 61347-1), therefore in that case the column, where the temperature of t_c point exceeds t_c, will be left blank; but at least the column with ambient temperature 40 °C shall always be

filled. The measurement setup for measuring the ambient temperature shall be in accordance to Annex D of IEC 61347-1 at the rated voltage. After stabilisation of the ambient temperature the temperature of t_c shall be measured.

Table 1 – Controlgear life time information

Ambient temperature	40°C	50°C	60°C
Temperature measured on the reference point (t_c point) in °C	xx[a]	xx[a]	xx[a]
Lifetime in h	xxxxx[a]	xxxxx[a]	xxxxx[a]
[a] Values declared by the controlgear manufacturer			

Additional information from the controlgear manufacturer to the tabled ambient temperature and life time are allowed.

5.3 Non-mandatory information which may be made available by the manufacturer are:

a) rated output frequency at rated voltage, with and without lamp operating;

b) limits of the ambient temperature range within which the controlgear will operate satisfactorily at the declared voltage (range);

c) total circuit power.

6 General statement

It may be expected that controlgear complying with this standard, when associated with lamps which comply with IEC 61167 for low frequency square wave operation, will provide satisfactory starting of the lamp and operation at an ambient temperature range as given by the controlgear manufacturer at voltages within 92 % and 106 % of the rated voltage.

NOTE 1 The electrical characteristics as given on the lamp data sheets of IEC 61167 and applying to operation on a reference controlgear at rated voltage with a frequency of 50 Hz or 60 Hz, will deviate when operating on a low frequency square wave controlgear and the conditions of item b) of 5.3 above.

NOTE 2 In some regions there are laws on EMC for luminaires. The controlgear is also contributing to this EMC behavior. See Bibliography for reference.

7 Starting conditions

7.1 General

Control gear shall start lamps at any supply voltage between 92 % and 106 % of its rated value or the rated voltage range. Compliance is checked by the tests according to 7.2 to 7.4, as appropriate, with the control gear operating at supply voltage of 92 % and 106 % of the rated value or in case of a rated voltage range at 92 % of the minimum value of the range and 106 % of the maximum value of the range.

7.2 Breakdown

The breakdown is the phase where the non-conducting gas is ignited and becomes conducting plasma. This process needs a high voltage for a minimum time.

Measurement is made with an oscilloscope. The controlgear shall be measured without connecting a lamp. Capacitance (simulating the parasitic capacitance of the wires and wires towards earth) shall be added as specified by the controlgear manufacturer.

NOTE 1 Controlgear manufacturers can also define multiple capacitance values.

The absolute value of the ignition peak voltage shall comply with the value given on the relevant lamp data sheet. The measuring procedure can be found in IEC 61167, Table G.1 the section describing the breakdown.

NOTE 2 Values given in IEC 61167 are for pulse ignition, values for high frequency ignition are under consideration.

7.3 Take-over

In the take-over phase the electrodes are heated towards thermionic emission.

The take-over is measured with resistors, unless stated otherwise.

During the take-over, the controlgear shall provide power and current according to the information for ballast design of IEC 61167 (measurement method under consideration) the minimum open circuit voltage (OCV), measured at ≥1 MΩ load shall be according the values in Table 2.

Table 2 – Minimum OCV

Lamp type	Square wave or DC	Non-square wave	
		RMS	Peak
Ceramic and quartz arc tubes	280 V	235 V	332 V
Ceramic arc tubes only	250 V	235 V	332 V
These values are valid for metal halide lamps of 20 W, 35 W, 70 W and 150 W, for other lamps OCV values are given on relevant lamp data sheets.			

The time limit for the duration of the non-low frequency square wave current is maximum 10 s (under consideration), this limit is not required if the controlgear is able to detect the end of the takeover phase.

Open circuit voltage is measured according to the measuring method as described in Annex F.

7.4 Run-up

7.4.1 Run-up current

The run-up current shall be between the values given on the relevant lamp data sheet measured on resistances starting with resistance at run-up as given on the relevant lamp data sheet up to a calculated resistance at which the lamp voltage is equal to lower voltage limit as given in Annex G of IEC 61167.

7.4.2 Average peak current ratio (APCR)

The requirements of Annex G of IEC 61167 apply.

The APCR is determined by measuring the current wave form on a lamp substitution circuit representing the lamp voltage range from 20 V (under consideration) to 75 V. The substitution circuit is an ohmic variable resistor capable of regulation the lamp voltage in the required range. Determine the maximum PCR value within the measured voltage range by applying a smoothing window of 20 μs. Determine during 1 s, around the determined maximum PCR value, the PCR values for all positive half periods and average the PCR values. Determine during this same 1 s the PCR values for all negative half periods and average the PCR values.