IEC 61347-2-3

Edition 2.0 2011-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Lamp control gear –
Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps

Appareillages de lampes –
Partie 2-3: Exigences particulières pour les appareillages électroniques alimentés en courant alternatif et/ou en courant continu pour lampes fluorescentes

IEC 61347-2-3:2011

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CONTENTS

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LAMP CONTROL GEAR –

Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps

FOREWORD

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International Standard IEC 61347-2-3 has been prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lamps and related equipment.

This standard shall be used in conjunction with IEC 61347-1 (2007) and its Amendment 1 (2010).

This second edition cancels and replaces the first edition published in 2000, its Amendment 1 (2004) and its Amendment 2 (2006)), IEC 61347-2-4 published in 2000, IEC 61347-2-5 published in 2000 and IEC 61347-2-6 published in 2000. This second edition constitutes a technical revision.

The significant revisions with respect to the first edition are:

– rectifying test conditions when dimming;
– construction requirements;
– measurement circuits and limits for HF leakage currents;
– modification of the structure to become a standard exclusively for a.c. and d.c. central supplied electronic control gear for general lighting and Annex J cover centrally-supplied emergency control gear.

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

FDIS	Report on voting
34C/955/FDIS	34C/968/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.

This part 2 supplements or modifies the corresponding clauses in IEC 61347-1 so as to convert that publication into the IEC standard: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps.

NOTE In this standard, the following print types are used:

– Requirements proper: in roman type.
– *Test specifications: in italic type.*
– Explanatory matter: in smaller roman type.

A list of all parts of the IEC 61347 series, published under the general title: *Lamp control gear*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site 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.

The contents of the corrigendum of September 2011 have been included in this copy.

INTRODUCTION

This second edition of IEC 61347-2-3, published in conjunction with IEC 61347-1, represents an review of the first edition of IEC 61347-2-3. The formatting into separately published parts provides for ease of future amendments and revisions. Additional requirements will be added as and when a need for them is recognized.

This standard, and the parts which make up IEC 61347-2, in referring to any of the clauses of IEC 61347-1, specify the extent to which such a clause is applicable and the order in which the tests are to be performed; they also include additional requirements, as necessary. All parts which make up IEC 61347-2 are intended to be self-contained and, therefore, do not include references to each other. However, for the case of emergency lighting lamp control gear, some cross-referencing has been necessary.

Where the requirements of any of the clauses of IEC 61347-1 are referred to in this standard by the phrase ”The requirements of clause n of IEC 61347-1 apply”, this phrase is interpreted as meaning that all requirements of the clause in question of part 1 apply, except any which are clearly inapplicable to the specific type of lamp control gear covered by this particular part of IEC 61347-2.

LAMP CONTROL GEAR –

Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps

1 Scope

This part of IEC 61347 specifies particular safety requirements for electronic control gear for use on a.c. and d.c. supplies up to 1 000 V at 50 Hz or 60 Hz with operating frequencies deviating from the supply frequency, associated with fluorescent lamps as specified in IEC 60081 and IEC 60901, and other fluorescent lamps for high-frequency operation.

Performance requirements are the subject of IEC 60929.

Particular requirements for electronic control gear with means protection against overheating are given in Annex C.

For emergency lighting operation, particular requirements for control gear operated from a central supply are given in Annex J. Performance requirements appropriate to the safe operation of emergency lighting are also contained in Annex J.

Requirements for emergency lighting control gear operating from non-centralised power supplies are given in IEC 61347-2-7.

NOTE Performance requirements detailed by Annex J are those considered to be safety-related with respect to reliable emergency operation.

2 Normative references

For the purposes of this document, the normative references given in Clause 2 of IEC 61347-1 which are mentioned in this standard apply, together with the following normative references.

IEC 60929: 2011, *AC and/or DC-supplied electronic control gear for tubular fluorescent lamps – Performance requirements*

IEC 61347-1:2007, *Lamp control gear – Part 1: General and safety requirements* Amendment 1(2010)

IEC 61347-2-7,___ *Lamp control gear – Part 2-7: Particular requirements for battery supplied electronic control gear for emergency lighting (self-contained)*[1]

IEC 61547, *Equipment for general lighting purposes – EMC immunity requirements*

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1 To be published

3 Terms and definitions

For the purposes of this document, the terms and definitions of Clause 3 of IEC 61347-1 apply, together with the following.

3.1
a.c. supplied electronic control gear
mains-supplied a.c. to a.c. invertor including stabilizing elements for starting and operating one or more fluorescent lamps, generally at high frequency

3.2
maximum value of lamp power (of a controllable control gear)
lamp power (light output) which complies with 8.1 of IEC 60929, unless otherwise declared by the manufacturer or responsible vendor

3.3
maximum allowed peak voltage
highest permitted peak voltage across any insulation under open-circuit condition and any normal and abnormal operating conditions

The maximum peak voltage is related to the declared r.m.s. working voltage; see Table 1.

3.4
minimum value of lamp power (of a controllable control gear)
lowest percentage of the lamp power defined in 3.2 declared by the manufacturer or responsible vendor

3.5
a.c./d.c. supplied electronic control gear for maintained emergency lighting
mains/battery-supplied a.c./d.c. to a.c. invertor including stabilizing elements for starting and operating one or more fluorescent lamps, generally at high frequency for emergency lighting

3.6
cathode dummy resistor
cathode substitution resistor as specified on the relevant lamp data sheet of IEC 60081 or IEC 60901 or as declared by the relevant lamp manufacturer or by the responsible vendor

3.7
d.c. supplied electronic control gear
d.c. supplied electronic control gear or invertor includes stabilisation elements for starting and operating one or more tubular fluorescent lamps, generally at high frequency

4 General requirements

The requirements of Clause 4 of IEC 61347-1 apply, together with the following additional requirement:

AC/d.c. electronic control gear for emergency lighting shall comply with the requirements of Annex J.

5 General notes on tests

The requirements of Clause 5 of 61347-1 apply together with the following additional requirement:

The following number of specimens shall be submitted for testing:

– one unit for the tests of Clause 6 to 12 and 15 to 22;
– one unit for the test of Clause 14 (additional units or components, where necessary, may be required in consultation with the manufacturer).

Tests to meet the safety requirements for a.c./d.c. supplied electronic control gear for emergency lighting are made under the conditions specified in Annex J.

6 Classification

The requirements of Clause 6 of IEC 61347-1 apply.

7 Marking

Control gear which forms an integral part of the luminaire need not be marked.

7.1 Mandatory markings

In accordance with the requirements of 7.2 of IEC 61347-1, control gear, other than integral control gear, shall be clearly and durably marked with the following mandatory markings:

– items a), b), c), d), e), k) and l) of 7.1 of IEC 61347-1, together with

– the symbol for earthing, as applicable;

– for controllable control gear, the control terminals shall be identified;

– a declaration of the maximum working voltage (r.m.s.) according to 12.2 between

- output terminals;
- any output terminal and earth.

Marking for each of these two values shall be in steps of 10 V when the working voltage is equal to, or less than, 500 V, and in steps of 50 V when the working voltage is higher than 500 V. The marking of maximum working voltage is referenced in two situations, the maximum between output terminals and the maximum between any output terminal and earth. It is acceptable for only the higher of these two voltages to be marked.

Marking shall be U-OUT=...V.

7.2 Information to be provided, if applicable

In addition to the above mandatory markings, the following information, if applicable, shall be given either on the control gear, or be made available in the manufacturer's catalogue or similar:

– items h), i), and j) given in 7.1 of IEC 61347-1;
– information regarding voltage polarity reversal protection for d.c. supplied control gear only.

8 Protection against accidental contact with live parts

The requirements of Clause 10 of IEC 61347-1 apply.

9 Terminals

The requirements of Clause 8 of IEC 61347-1 apply.

10 Provisions for earthing

The requirements of Clause 9 of IEC 61347-1 apply.

11 Moisture resistance and insulation

The requirements of Clause 11 of IEC 61347-1 apply together with the following additional requirements:

The leakage current that may occur from contact with fluorescent lamps operated at high frequency from a.c. supplied electronic control gear shall not exceed the values in Figure 5 when measured in accordance with Annex I. The values are in r.m.s. values.

The limits of leakage current values for frequencies between the values shown in Figure 5 should be obtained by calculation according to the formula in the figure (under consideration).

NOTE Limits of leakage current values for frequencies above 50 kHz are under consideration.

Compliance with these requirements is checked in accordance with Annex I.

12 Electric strength

The requirements of Clause 12 of IEC 61347-1 apply.

13 Thermal endurance test for windings

The requirements of Clause 13 of IEC 61347-1 do not apply.

14 Fault conditions

The requirements of Clause 14 of IEC 61347-1 apply.

An additional fault condition to be applied to d.c. supplied control gear is the supply voltage polarity shall be reversed.

15 Protection of associated components

15.1 Maximum peak voltage under normal operation conditions

Under conditions of normal operation, verified with dummy cathode resistors inserted and conditions of abnormal operation, as specified in Clause 16, the voltage at the output terminals shall at no time exceed the maximum permitted peak value specified in Table 1.

Table 1 – Relation between r.m.s. working voltage and maximum peak voltage

Voltage at output terminals	
RMS working voltage V	**Maximum permitted peak voltage** V
250	2 200
500	2 900
750	3 100
1 000	3 200
NOTE Linear interpolation between the given voltage steps is allowed.	

15.2 Maximum working voltage under normal and abnormal operating conditions

Under normal operating conditions and abnormal operating conditions as specified in Clause 16, except for the rectifying effect, and from 5 s after the switch on or beginning of the starting process, the voltage at the output terminals shall not exceed the maximum working voltage for which the control gear is declared.

15.3 Maximum working voltage and rectifying effect

In the case of a rectifying effect, i.e. abnormal operating condition according to 16.1 d), the r.m.s. voltage at the output terminal shall not exceed the maximum permitted value for which the control gear is designed for a period longer than 30 s after switch-on, or beginning of the starting process.

For control gear which makes more than one attempt to start a failed lamp, the combined duration of voltages above the maximum working voltage for which the ballast is declared shall not exceed 30 s.

Circuit for testing the rectifying effect and the information regarding the recovery time t_{rr} of the diode are given Figure 4 (4a, 4b and 4c).

15.4 Output voltage and abnormal conditions

For the tests of 15.1 and 15.2, the output voltages measured shall be those between any output terminal and earth. Additionally, voltages that appear between output terminals shall be measured in cases where the voltage is present across insulation barriers within associated components.

15.5 Isolation of input terminals of controllable electronic control gear

For controllable electronic control gear, the control input shall be isolated from the mains circuit by insulation at least equal to basic insulation.

NOTE This requirement does not apply to those control gear where control signals are injected via the supply terminals or where the control signals are completely isolated from the ballast by being transmitted remotely from infra-red or radio wave transmitters.

If SELV is to be used, then double or reinforced insulation is required.

16 Abnormal conditions

16.1 Abnormal conditions for a.c. and d.c. control gears

The control gear shall not impair safety when operated under abnormal conditions at any voltage between 90 % and 110 % of the rated supply voltage.

Compliance is checked by the following test.

Each of the following conditions shall be applied with the control gear operating according to the manufacturer's instructions (including a heat sink, if specified) for 1 h:

a) the lamp or one of the lamps is not inserted;

b) the lamp does not start because one of the cathodes is broken;

c) the lamp does not start although the cathode circuits are intact (de-activated lamp);

d) the lamp operates, but one of the cathodes is de-activated or broken (rectifying effect);

e) short circuit of the starter switch, if any.

For the test simulating operation with a de-activated lamp, a resistor is connected in place of each lamp cathode. The resistor value is derived from the value of the nominal running current of the lamp prescribed in the relevant lamp data sheet of IEC 60081 and IEC 60901 and substituted in the following equation:

$$R = \frac{11{,}0}{2{,}1 \times I_n} \ \Omega$$

where

I_n is the rated lamp current of the lamp.

For lamps not covered by IEC 60081 and IEC 60901, the values declared by the lamp manufacturer shall be used.

When testing electronic ballasts for the rectifying effect, the circuit shown in Figure 1 is used. The anode of the rectifier is connected to the midpoints of appropriate equivalent resistors; the cathode of the rectifier is connected to the short circuited lamp electrode. The direction of the rectifying effect is chosen so as to give the most unfavourable conditions. If necessary, the lamp is started using a suitable device.

During and at the end of the tests specified under items a) to e), the control gear shall show no defect impairing safety nor shall any smoke be produced.

16.2 Additional abnormal conditions for d.c. supplied electronic control gear

If the d.c. supplied electronic control gear declared by the manufacturer as a protected control gear against the reversal polarity of the supply voltage, then the following test is applied:

The d.c. supplied electronic control gear shall be connected for 1 h with the reversal supply voltage at the maximum value of the rated voltage with the maximum lamp power declared by the manufacturer.

During and at the end of the test the electronic control gear shall operate the lamp(s) normally without any defects.

17 Behaviour of the control gear at end of lamp life

17.1 End of lamp life effects

At the end of lamp life, the control gear shall behave in such a way that no overheating of lamp cap(s) occurs at any voltage between 90 % and 110 % of the rated supply voltage.

For the test simulating end of lamp life effects, three tests are described:

a) asymmetric pulse test (described in 17.2);

b) asymmetric power dissipation test (described in 17.3);

c) open filament test (described in 17.4).

Any of the three tests may be used to qualify electronic control gear. The control gear manufacturer shall determine which of the three tests will be used to test a given control gear based on the design of that particular control gear circuit. The chosen test method shall be indicated in the control gear manufacturer's literature.

NOTE 1 Checking control gear against their capability to cope with the partial rectifying effect is recommended by IEC 61195, Annex E, and IEC 61199, Annex H.

NOTE 2 In Japan, only the requirements of 17.1 b) are applied for electronic control gear.

Lamps used in the ballast test circuits shall be new lamps seasoned for 100 h.

17.2 Asymmetric pulse test

The ballast shall have adequate protection to prevent lamp cap overheating at the end of the lamp life cycle. Compliance is checked by the following test.

The following values of maximum cathode power P_{max} apply:

– for 13 mm (T4) lamps, P_{max} = 5,0 W;

– for 16 mm (T5) lamps, P_{max} = 7,5 W.

(Other diameters are under study.)

Test procedure:

Refer to the schematic diagram in Figure 1.

If only one connection per electrode is available at the control gear and/or lamp, T1 shall be removed and then the control gear shall be connected to J2 and the lamp to J4. The control gear manufacturer should be asked which of the output terminals has to be connected to J4 and, in case two output terminals per electrode exist, whether they can be short-circuited or be bridged with a resistor.

(1) Close switches S1 and S4, and set switch S2 to position A.

(2) Turn on the control gear under test and allow lamp(s) to warm up for 5 min.

(3) Close S3, open S1, and wait for 15 s. Open S4 and wait for 15 s.

(4) Measure the sum of the average power dissipated in the power resistors, R1A to R1C and R2A and R2B, and the Zener diodes, D5 to D8.

NOTE The power should be measured as the average value of the product of the voltage between terminals J5 and J6 times the current flowing from J8 to J7. The voltage should be measured with a differential voltage probe, and the current should be measured with a d.c. current probe. A digital oscilloscope can be used for the multiplication and averaging functions. If the control gear operates in a cycling mode, the averaging interval should be set to cover an integer number of cycles. (Each cycle is typically greater than 1 s.) The sampling rate and number of samples included in the calculations should be sufficient to avoid aliasing errors.

The power dissipation shall be below P_{max}.

If the power dissipation is greater than P_{max}, the control gear has failed and the test is discontinued.

(5) Close S1 and S4.

(6) Set S2 to position B.