

Australian/New Zealand Standard™

Lamp controlgear

**Part 2.3: Particular requirements for a.c.
and/or d.c. supplied electronic
controlgear for fluorescent lamps
(IEC 61347-2-3, Ed.2.0 (2011) MOD)**



AS/NZS 61347.2.3:2016

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-041, Lamps and Related Equipment. It was approved on behalf of the Council of Standards Australia on 19 November 2015 and on behalf of the Council of Standards New Zealand on 11 December 2015. This Standard was published on 9 March 2016.

The following are represented on Committee EL-041:

Australian Industry Group
Consumers' Federation of Australia
Department of Industry
Electrical Compliance Testing Association
Electrical Contractors Association of New Zealand
Electrical Regulatory Authorities Council
Energy Efficiency and Conservation Authority of New Zealand
Fair Trading NSW
IES: The Lighting Society
Independent Pricing and Regulatory Tribunal
Institution of Professional Engineers New Zealand
Joint Accreditation System of Australia and New Zealand
Lighting Council Australia
Lighting Council New Zealand
Masters Electricians
Ministry of Business, Innovation and Employment, New Zealand

Additional Interests:

Australasian Fire and Emergency Service Authorities Council

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.saiglobal.com.au or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

This Standard was issued in draft form for comment as DR AS/NZS 61347.2.3:2015.

Australian/New Zealand Standard™

Lamp controlgear

Part 2.3: Particular requirements for a.c. and/or d.c. supplied electronic controlgear for fluorescent lamps (IEC 61347-2-3, Ed.2.0 (2011) MOD)

Originated in Australia as AS 3134(Int)—1991.
Originated in New Zealand as AS/NZS 60928:2000.
Previous edition AS/NZS 61347.2.3:2004.
Fourth edition 2016.

COPYRIGHT

© Standards Australia Limited/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, Private Bag 2439, Wellington 6140.

ISBN 978 1 76035 421 3

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-041, Lamps and Related Equipment, to supersede on publication, AS/NZS 61347.2.3:2004, *Lamp controlgear, Part 2.3 Particular requirements for a.c. supplied electronic ballasts for fluorescent lamps (IEC 61347-2-3:2000, MOD)*.

The significant revisions with respect to the first edition are as follows:

- (a) Rectifying test conditions when dimming.
- (b) Construction requirements.
- (c) Measurement circuits and limits for HF leakage currents.
- (d) Modification of the structure to become a Standard exclusively for a.c. and d.c. central supplied electronic controlgear for general lighting and Annex J cover centrally-supplied emergency controlgear.

The objective of this Standard is to specify particular minimum safety requirements for electronic controlgear to reduce the risk of electric shock and the fire hazard of such devices having given due consideration to requirements within International Standards and those specific to the Australian and New Zealand environmental and regulatory framework.

This Standard is an adoption with national modifications. It has been reproduced from IEC 61347-2-3, Ed. 2.0 (2011), *Lamp control gear, Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps*, and has been varied as indicated to take account of Australian/New Zealand conditions.

The variations made to IEC 61347-2-3 Ed 2.0 (2011) are specified in Appendix ZZ. These form the Australian and New Zealand variations for the purpose of the IECEE CB Scheme for recognition of testing to standards for safety of electrical equipment.

This Standard is to be read in conjunction with AS/NZS 61347.1, *Lamp controlgear, Part 1: General and safety requirements (IEC 61347-1:20XX, MOD)*.

This Standard covers the essential safety requirements in AS/NZS 3820, *Essential safety requirements for electrical equipment*, that could be applicable to lamp controlgear, taken in conjunction with any other relevant requirements affecting safety.

This Standard is structured in the following layout:

- (i) Preface (including Australian and New Zealand references).
- (ii) IEC 61347-2-3, Ed. 2.0 (2011) (unedited from the contents page to the final Clause of the IEC Standard).
- (iii) Appendix ZZ—Australian/New Zealand variations to the IEC Standard.

Appendix ZZ introduces marking requirements for Australia/New Zealand voltages.

In this standard, the following print types are used:

- (A) Requirements proper: in roman type.
- (B) Test specifications: in italic type.
- (C) Explanatory matter: in smaller roman type.

As this Standard is reproduced from an International Standard, the following applies:

- (1) In the source text ‘this part of IEC 61347’ should read ‘this Australian/New Zealand Standard’.
- (2) A full point substitutes for a comma when referring to a decimal marker.

Unless otherwise indicated in Appendix ZZ, references to International Standards in this Standard should be replaced by references to Australian or Australian/New Zealand Standards, as follows:

<i>Reference to International Standard</i>	<i>Australian/New Zealand Standard</i>
IEC	AS/NZS
61347 Lamp controlgear	61347 Lamp controlgear
61347-1 Part 1: General and safety requirements	61347.1 Part 1: General and safety requirements (IEC 61347-1:2000, MOD)

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the annex or appendix to which they apply. A ‘normative’ annex or appendix is an integral part of a Standard, whereas an ‘informative’ annex or appendix is for information and guidance only.

CONTENTS

1	Scope.....	7
2	Normative references	7
3	Terms and definitions	8
4	General requirements	8
5	General notes on tests	9
6	Classification.....	9
7	Marking	9
8	Protection against accidental contact with live parts	10
9	Terminals	10
10	Provisions for earthing.....	10
11	Moisture resistance and insulation.....	10
12	Electric strength	10
13	Thermal endurance test for windings	10
14	Fault conditions	10
15	Protection of associated components	10
16	Abnormal conditions	11
17	Behaviour of the control gear at end of lamp life.....	12
18	Construction.....	19
19	Creepage distances and clearances	19
20	Screws, current-carrying parts and connections.....	19
21	Resistance to heat, fire and tracking.....	19
22	Resistance to corrosion	19
	Annex A (normative) Test to establish whether a conductive part is a live part which may cause an electric shock	24
	Annex B (normative) Particular requirements for thermally protected lamp control gear	25
	Annex C (normative) Particular requirements for electronic lamp control gear with means of protection against overheating.....	26
	Annex D (normative) Requirements for carrying out the heating tests of thermally protected lamp control gear	27
	Annex E (normative) Use of constant S other than 4 500 in t_w tests.....	28
	Annex F (normative) Draught-proof enclosure.....	29
	Annex G (normative) Explanation of the derivation of the values of pulse voltages	30
	Annex H (normative) Tests	31
	Annex I (normative) Measurement of high-frequency leakage current	32
	Annex J (normative) Particular additional safety requirements for a.c., a.c./d.c. or d.c. supplied electronic control gear for emergency lighting	37
	Annex K (informative) Components used in the asymmetric pulse test circuit (see Figure 1).....	41
	Annex L (normative) Information for control gear design (from Annex E of IEC 61195).....	42
	Bibliography.....	43

Figure 1 – Asymmetric pulse test circuit.....	14
Figure 2 – Asymmetric power detection circuit	16
Figure 3 – Open filament test circuits.....	19
Figure 4 – Circuit for testing rectifying effect.....	20
Figure 5 – Nomographs for the capacitive leakage current limits of HF-operated fluorescent lamps	23
Figure I.1 – Leakage current test arrangement for various fluorescent lamps	36
Table 1 – Relation between r.m.s. working voltage and maximum peak voltage	11
Table J.1 – Pulse voltages.....	40
Table K.1 – Material specification	41
Table K.2 – Transformer specification.....	41

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.

AUSTRALIAN/NEW ZEALAND STANDARD

Lamp controlgear**Part 2.3:**

Particular requirements for a.c. and/or d.c. supplied electronic controlgear for fluorescent lamps (IEC 61347-2-3, Ed.2.0 (2011) MOD)

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*

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. inverter 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. inverter 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 inverter 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 $U_{OUT} = \dots V$.

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, $P_{\max} = 5,0 \text{ W}$;
- for 16 mm (T5) lamps, $P_{\max} = 7,5 \text{ W}$.

(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.