# IEC 61347-2-10

Edition 2.0 2024-05
REDLINE VERSION

# INTERNATIONAL STANDARD

colour inside



~~Lamp controlgear –~~
Controlgear for electric light sources – Safety –
Part 2-10: ~~Particular requirements for electronic invertors and convertors for high-frequency operation of cold start tubulardischarge lamps (neon tubes)~~ Particular requirements – Electronic controlgear for high-frequency operation of tubular cold-cathode discharge lamps (neon tubes)

IEC 61347-2-10:2024-05 RLV(en)

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**This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61347-2-10:2000+AMD1:2008 CSV. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.**

IEC 61347-2-10 has been prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lighting. It is an International Standard.

This second edition cancels and replaces the first edition published in 2000 and Amendment 1:2008. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) introduction of dated references as appropriate;

b) clarification of sample item numbers.

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

| Draft | Report on voting |
|---|---|
| 34C/1584/CDV | 34C/1592/RVC |

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This document is intended to be used in conjunction with IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017. Where the requirements of any of the clauses of IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017 are referred to in this document by the phrase "IEC 61347-1:2015, Clause n and IEC 61347-1:2015/AMD1:2017, Clause n apply", this phrase is interpreted as meaning that all the requirements of the clause in question of IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017 apply, except any which are clearly inapplicable to the specific type of controlgear covered by this document.

NOTE In this document, the following print type is used:

– *compliance statements: in italic type*.

A list of all parts in the IEC 61347 series, published under the general title *Controlgear for electric light sources – Safety,* can be found on the IEC website.

Future documents in this series will carry the new general title as cited above. Titles of existing documents in this series will be updated at the time of the next edition.

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

- reconfirmed,
- withdrawn, or
- revised.

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# INTRODUCTION

~~This part of IEC 61347, 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 self-contained and, therefore, do not include references to each other.~~

~~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 controlgear covered by this particular part of IEC 61347-2.~~

The technical requirements in this document compared to IEC 61347-2-10:2000 and IEC 61347-2-10:2000/AMD1:2008 are essentially unchanged. Nevertheless, a new edition of this document could not be avoided, as without the introduction of dated references to IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, the fourth edition of IEC 61347-1:—[1] would have been implicitly applicable due to the undated nature of the references to IEC 61347-1 in IEC 61347-2-10:2000 and IEC 61347-2-10:2000/AMD1:2008.

This document, in referring to any of the clauses of IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, specifies the extent to which such a clause is applicable. Additional requirements are also included, as necessary.

In order to check the safety of controlgear, it is necessary to check their performance. However, since no standardization of the characteristics of neon tubes exists, reference loads are specified in this document to ensure reproducible test results.



[1] Fourth edition under preparation. Stage at the time of publication IEC FDIS 61347-1:2024.

# ~~LAMP CONTROLGEAR –~~
# CONTROLGEAR FOR ELECTRIC LIGHT SOURCES – SAFETY –

## Part 2-10: ~~Particular requirements for electronic invertors and convertors for high-frequency operation of cold start tubulardischarge lamps (neon tubes)~~
## Particular requirements – Electronic controlgear for high-frequency operation of tubular cold-cathode discharge lamps (neon tubes)



## 1 Scope

This part of IEC 61347 specifies ~~particular~~ safety requirements for electronic ~~invertors and convertors~~ controlgear for high-frequency operation of tubular cold-cathode discharge lamps used in signs and luminous discharge tube installations and operating with an output voltage exceeding 1 000 V but not exceeding 10 000 V for direct connection to DC or AC supply voltages not exceeding 1 000 V (at 50 Hz or 60 Hz ~~or 1 000 V d.c~~ in case of alternating current).

NOTE 1 Historically, such types of controlgear were referred to as invertors or convertors.

NOTE ~~1~~2 In Japan, the ~~output~~ voltage limit for the application of this document is set to 15 000 V ~~is acceptable~~.

~~The requirements for two types of invertors and convertors, types A and B, are specified as follows:~~

~~– Type A unit: an invertor or convertor operating within the frequency range 20 kHz to 50 kHz, and having an output voltage (between terminals) not exceeding 5 000 V peak, a maximum output current limited to 35 mA (r.m.s.) and 50 mA (peak value). The supply voltage does not exceed 250 V at 50 Hz or 60 Hz or 250 V d.c.~~

~~NOTE 2 The output current of a type A unit may be considered as not presenting an electric shock hazard due to the limits on the current and frequency range.~~

~~NOTE 3 In Japan, the output voltage of 15 000 V is acceptable.~~

~~– Type B unit: an invertor or convertor having a no-load output voltage not exceeding 5 000 V to earth or 10 000 V between terminals, operating within the frequency range 10 kHz to 100 kHz with a maximum output current limited to 200 mA (r.m.s.) and 400 mA (peak value).~~

~~NOTE 4 Type B units require additional protection in the output circuit.~~

~~NOTE 5 In Japan, a type B unit exceeding 50 mA and/or the secondary grounded is not acceptable.~~

~~In order to check the safety of invertors or convertors, it is necessary to check their performance. However, since no standardization of the characteristics of neon tubes exists, reference loads are specified in this standard to ensure reproducible test results.~~

~~The rated maximum operating temperature of the winding, $t_w$, is not applicable to this standard.~~

This document applies for controlgear of type A and controlgear of type B, which are specified as follows:

– Type A: controlgear operating within the frequency range 20 kHz to 50 kHz, and having an output voltage not exceeding 5 000 V peak between terminals, with a maximum output current limited to 35 mA (RMS) and 50 mA (peak value) and a supply voltage not exceeding 250 V.

NOTE 3 The output current of a type A unit can be considered as not presenting an electric shock hazard due to the limits on the current and frequency range.

NOTE 4 In Japan, the output voltage of 15 000 V is acceptable.

– Type B: controlgear operating within the frequency range 10 kHz to 100 kHz and having a no-load output voltage not exceeding 10 000 V between terminals or not exceeding 5 000 V to earth, with a maximum output current limited to 200 mA (RMS) and 400 mA (peak value).

NOTE 5 In Japan, a type B controlgear providing an output current exceeding 50 mA is not acceptable.

## 2 Normative references

~~For the purpose of this part of IEC 61347, the normative references given in clause 2 of IEC 61347-1 which are mentioned in this standard apply, together with the following normative references:~~

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60417, *Graphical symbols for use on equipment,* available at https://www.graphical-symbols.info/equipment

IEC 60598-1:2020, *Luminaires – Part 1: General requirements and tests*

IEC 61347-1:2015, *Lamp controlgear – Part 1: General and safety requirements*
IEC 61347-1:2015/AMD1:2017

~~ISO 3864:1984, *Safety colours and safety signs*~~

ISO 3864-1:2011, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings*

## 3 Terms and definitions

~~For the purpose of this part of IEC 61347, the definitions given in clause 3 of IEC 61347-1, with the exception of definitions 3.14, 3.16 and 3.17 apply, together with the following:~~

For the purposes of this document, the terms and definitions given in IEC 61347-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

**3.1**
**tubular cold-cathode discharge lamp**
**neon tube**
~~discharge tube having cathodes which may be coated with an electron emitting material and which, during the starting process without external heating, emits electrons by field emission.~~
tubular discharge lamp in which the light is produced by the positive column of a glow discharge

Note 1 to entry: These lamps have a low-pressure filling of a rare gas (or a mixture of rare gases) and possibly mercury vapour. They can have an inside coating of fluorescent materials.

**3.2**
**rated no-load ~~rated~~ output voltage**
$U_o$
rated maximum ~~rated~~ voltage between the output terminals or the ends of the integral connecting leads of the invertor or convertor connected to the rated supply voltage at rated frequency with no load on the output circuit

Note 1 to entry: For sinusoidal wave forms, the rated no-load output voltage is the RMS value or the peak value divided by square root of 2. For other waveforms, it is the RMS value or the equivalent value deduced from the peak value, obtained by mathematical calculation.

Note 2 to entry: For the purposes of this document this definition overrules the one given in IEC 61347-1.

[SOURCE: IEC 61347-1:2015, 3.9, modified – The definition has been adapted for the purposes of this document and the Notes to entry have been added.]

**3.3**
**invertor**
electric energy transducer that converts direct current to alternating current

**3.4**
**convertor**
unit for the electronic conversion of AC supply at one frequency to an AC supply at another frequency

**3.5**
**earth-leakage protective device**
device which removes the output power from ~~an invertor or convertor~~ the controlgear in the event of an earth fault current flowing between any part of the output high-voltage circuit and earth

**3.6**
**open-circuit protective device**
device which removes the output power from ~~an invertor or convertor~~ the controlgear in the event of non-operation of the tube load or an interruption in the output high-voltage circuit

Note 1 to entry: An open-circuit protective device may operate by detecting an increase in the output voltage or by other suitable means.

**3.7**
**upper shut-down limit**
output voltage of ~~an invertor or convertor~~ the controlgear at which an open-circuit protective device operates

**3.8**
**output high-voltage circuit**
that part of the circuit consisting of

a) cables between the output terminals of the ~~convertor or invertor~~ controlgear and the discharge tubes,

b) discharge tubes,

c) any series connections between the discharge tubes,

~~It does not include any internal components or wiring of the invertor or convertor.~~ but not including any internal components or wiring of the controlgear

**3.9**
**sample**
one or more sampling items intended to provide information on the population or on the material provided by the manufacturer or responsible vendor

[SOURCE: IEC 60050-151:2001, 151-16-19, modified – "provided by the manufacturer or responsible vendor" has been added.]

**3.10**
**sample item**
one of the individual items in a population of similar items, or a portion of material forming a cohesive entity and taken from one place and at one time

[SOURCE: IEC 60050-151:2001, 151-16-18]

## 4 General requirements

IEC 61347-1:2015, Clause 4 applies.

For electronic lamp controlgear with means of protection against overheating, additionally IEC 61347-1:2015, Annex C applies.

Provisions for the rated maximum temperature of the winding $t_w$, are not applicable.

## 5 General notes on tests

IEC 61347-1:2015, Clause 5, applies, together with the following:

– IEC 61347-1:2015, Annex H applies.

– One sample item shall be used for all tests, unless otherwise specified in the corresponding clause.

  To allow for parallel testing and reduced test times, additional sample items may be used except where the outcome of the test can be affected by preceding tests, for example the tests of Clause 11 and Clause 12.

  Specially prepared sample items may be used where required.

For information on requalification of products compliant with the previous edition of this document, i.e. IEC 61347-2-10:2000 and IEC 61347-2-10:2000/AMD1:2008, refer to Annex B.

## 6 Classification

IEC 61347-1:2015, Clause 6 applies, together with the following:

~~Invertors and convertors~~ Additionally, controlgear shall be classified according to their rated no-load output voltage, the rating of the operating frequency and output current range, as one of the following:

a) type A ~~inverter or converter~~ controlgear;

b) type B ~~inverter or converter~~ controlgear.

Type B ~~inverters or convertors~~ controlgear may have more than one output. In this case, each output shall comply with the above.

# 7 Marking

## 7.1 Marking and information

### 7.1.1 ~~Items to be marked~~ Mandatory marking

~~Electronic invertors and convertors for high-frequency operation of cold start tubular discharge lamps shall be clearly and durably marked, in accordance with the requirements of 7.2 of IEC 61347-1, with the following markings:~~

Controlgear, other than integral controlgear, shall be marked with the following:

– items a), b), c), d), e) and f) of IEC 61347-1:2015, 7.1 and IEC 61347-1:2015/AMD1:2017, 7.1;

– on independent ~~electronic invertors and convertors~~ controlgear, a warning notice for high voltage, e.g. "HIGH VOLTAGE" and a symbol in the form of an arrow in accordance with IEC 60417-6042:2010-11 and ~~figure 1 of ISO 3864~~ ISO 3864-1:2011, Figure 3.

This marking shall be placed on the outside of the enclosure of the ~~electronic invertor or convertor~~ controlgear so that it is clearly visible.

~~NOTE It is not necessary to mark integral invertors or convertors separately as their marking is the subject of relevant sign or luminaire standards.~~

– type A or type B as applicable.

If the electronic invertor or convertor consists of more than one separate unit, the units providing the output shall be marked with the necessary information about other associated units such as DC power supplies or capacitors.

### 7.1.2 ~~Durability and legibility of marking~~ Information to be provided

~~In addition to the above mandatory marking,~~ The following information, if applicable, shall be given on the ~~electronic invertor or convertor~~ controlgear, or be made available in the manufacturer's catalogue or similar:

– items h), k), m), n) and o) of IEC 61347-1:2015, 7.1;

~~– if the electronic invertor or convertor consists of more than one separate unit, the units providing the output shall be marked with necessary information about other associated units such as d.c power supplies or capacitors;~~

– the range and number of tube types, diameters and lengths recommended for the ~~invertor or convertor~~ controlgear;

– where the ~~invertor or convertor~~ controlgear is not supplied with integral leads (tails), details of the recommended cable types and maximum cable lengths;

– details of suitable types of mounting surfaces and recommended mounting arrangements;

– details of earthing arrangements, including connections to the ~~invertor or convertor~~ controlgear output winding, where appropriate;

– details of any protective circuits incorporated in the ~~invertor or convertor~~ controlgear;

– the following ~~nominal~~ electrical characteristics:

1) ~~output~~ rated no-load output voltage. This marking shall be in the following terms:

- if the output terminal is not connected to an earthing terminal:
  "...kV" (e.g. 4 kV),
- if one output terminal is connected to an earthing terminal:
  "E -...kV" (e.g. E – 4 kV),
- if the centre point of the output winding is referred to an earthing terminal:
  "... - E -...kV" (e.g. 3 – E – 3 kV);

NOTE In Japan, E -..kV and - E - kV are not used.

For type A units, this ~~will be~~ is equivalent to the peak value. For type B units~~, it will be~~ this is equivalent to the RMS value or 0,5 times the peak value, whichever is ~~the greater~~ larger.

2) rated output current with rated load;

3) rated output frequency.

Where appropriate, the details in items 1) and 2) above shall be marked for each independent output circuit of ~~an inverter or convertor~~ a controlgear.

### 7.2 Durability and legibility

IEC 61347-1:2015, 7.2 applies.

### 7.3 Built-in controlgear

For controlgear without an enclosure and classified as built-in (e.g. open printed circuit board assembly), only items a) and b) according to IEC 61347-1:2015, 7.1 shall be marked on the controlgear.

Other mandatory markings shall be provided as information to be given either on the controlgear or made available in the manufacturer's catalogue or similar.

## 8 Terminals

IEC 61347-1:2015, Clause 8 and IEC 61347-1:2015/AMD1:2017, Clause 8 apply, together with the following:

~~Invertors or convertors~~ Controlgear provided with tails shall comply with the relevant requirements of IEC 60598-1:2020.

## 9 ~~Provisions for~~ Earthing

IEC 61347-1:2015, Clause 9 applies, together with the following:

For type B ~~invertors or convertors~~ controlgear, the earthing terminal shall be connected to a part of the output circuit except where

– the earthing terminal is connected to a part of the output circuit through means to detect earth-fault currents, or

– there is no direct connection between any part of the output circuit and the earth terminal, and for example, part(s) of that output circuit are referenced to earth potential by means of the internal circuits.

*Compliance is checked by inspection.*

~~NOTE In Japan, this clause is not applicable.~~

## 10 Protection against accidental contact with live parts

IEC 61347-1:2015, Clause 10 and IEC 61347-1:2015/AMD1:2017, Clause 10 apply, together with the following:

The remaining charge between terminals in the output circuit of ~~an inverter or convertor~~ a controlgear following a worst case of disconnection shall not exceed 45 µC.

*Compliance is checked by measurement.*

Where part(s) of the output circuit of ~~an invertor or convertor~~ a controlgear is(are) not connected to earth, or is(are) not referenced to earth by means of internal circuits, the insulation barrier between the input and output circuits shall consist of double or reinforced insulation (see test voltages in Clause 12).

*Compliance is checked by the test of Clause 12 (see test voltages).*

## 11 Moisture resistance and insulation

IEC 61347-1:2015, Clause 11 and IEC 61347-1:2015/AMD1:2017, Clause 11 apply, together with the following:

For type A ~~units~~ controlgear, the capacitance between the output terminals and the metal foil of not less than 100 $cm^2$ area placed anywhere on the surface of the enclosure of the ~~invertor or convertor~~ controlgear shall not exceed 50 pF. During the test the convertor shall not operate.

*Compliance is checked by measurement.*

## 12 Electric strength

IEC 61347-1:2015, Clause 12 applies, together with the following:

~~Test voltages~~

The test voltages for all ~~invertors and convertors~~ controlgear are:

– twice the rated input voltage plus 1 000 V on the input side, with the output circuits connected to external metal parts;

– twice the no-load rated output voltage on the output side, the input circuits being connected to external metal parts.

NOTE In Japan, 1,5 times the test voltage is approved.

IEC 60598-1:2020, Table 10.2 applies for independent ~~invertors or convertors~~ controlgear.

## 13 Thermal endurance test for windings

~~An invertor or convertor~~ Controlgear or its support shall not, under normal or abnormal conditions, have too high a temperature or impair safety.

*Compliance is checked by the tests specified in Clause 14, Clause 15 and Clause 16.*

## 14 Normal conditions

The ~~invertor or convertor~~ controlgear shall be installed in its normal operating position arranged in accordance with the manufacturer's instructions and mounted as shown in IEC 61347-1:2015, Figure H.1. The test shall be carried out in a draught-free enclosure as specified in IEC 61347-1:2015, Annex F.

The ~~invertor or convertor~~ controlgear shall be operated with the tube load replaced by the specified load resistor $R_1$ (see Annex ~~I~~A) and with nominal supply voltage.

– In the case of ~~invertors or convertors~~ controlgear which provide near constant current output, the supply voltage shall be maintained at the nominal value until steady-state temperatures are obtained.

– In the case of ~~invertors or convertors~~ controlgear which do not provide near constant current output, adjustments shall be made to the supply voltage until the output current is the same as the nominal value specified on the label of the ~~inverter or convertor~~ controlgear. The output current is then maintained at this value until steady-state temperatures are obtained. If the ~~inverter or convertor~~ controlgear has more than one output, the appropriate load resistors ($R_1$) shall be connected to each pair of output terminals.

*During the test, the temperature on the relevant parts shall not exceed the values specified in IEC 60598-1:2020, Table 12.1 and Table 12.2.*

## 15 Abnormal conditions

The ~~inverter or convertor~~ controlgear shall be operated ~~under the test conditions specified in 15.2, and~~ according to the manufacturer's instructions (including heatsinks and spacers, if specified) at the most onerous voltage between 90 % and 110 % of the rated supply voltage for a period of 1 h. The test shall be carried out in a draught-free enclosure as specified in IEC 61347-1:2015, Annex F.

The test shall be carried out with one of the following combination of conditions, whichever is the most onerous. The time interval between tests shall not exceed 15 min.

a) Conditions 1) to 3) applied sequentially.

b) Conditions 2) and 3) applied simultaneously.

1) The output circuit(s) shall be short-circuited.

   If there is more than one output circuit, all circuits shall be short-circuited at the same time.

   NOTE 1 If the ~~inverter or convertor~~ controlgear includes means to ~~remove the~~ shut off output power in the event of a short-circuit of the output load, this test may be omitted.

2) The abnormal load resistor $R_2$ (see Annex ~~I~~A) shall be connected across the output terminals. If the ~~inverter or convertor~~ controlgear has more than one output, the appropriate abnormal resistors $R_2$ shall be connected to each pair of output terminals at the same time.

3) The ~~inverter or convertor~~ controlgear shall be mounted on a 1 mm thick metal sheet, whose material shall be specified by the manufacturer.

   If not specified, then either steel or aluminium (whichever provides the worst condition) shall be used.

~~NOTE 2 In addition, other materials may be taken into consideration.~~

*During and at the end of the tests ~~specified in 15.2,~~ the ~~inverter or convertor~~ controlgear shall show no defect impairing safety, nor shall any smoke be produced.*

*The temperature of any part of the outer surface of an independent ~~inverter or convertor~~ controlgear shall not exceed 90 °C. In addition, the output current and voltage shall not exceed the values specified in Clause 23.*

## 16 Fault conditions

IEC 61347-1:2015, Clause 14 and IEC 61347-1:2015/AMD1:2017, Clause 14 apply, together with the following:

a) the output shall be short-circuited, or in the case of ~~an inverter or convertor~~ a controlgear having short-circuit protection, the output shall be connected to resistor $R_3$ as described in Annex ~~I~~A;

b) an earth fault of negligible impedance shall be applied on one or both of the output terminals.

*The output current shall not exceed 1,5 times the value specified by the manufacturer in both cases a) and b).*

~~NOTE~~ The test of b) ~~need~~ is not ~~be applied~~ applicable if there is no earth connection to any part of the output circuit; or if the ~~inverter or convertor~~ controlgear includes means to ~~remove the~~ shut off output power in the event of a short-circuit between one of the output terminals and earth, in accordance with Clause 19.

## 17 Construction

IEC 61347-1:2015, Clause 15 applies, together with following:

Independent ~~inverters or convertors of~~ class II controlgear construction shall be provided with an enclosure of insulating material only.

*Compliance is checked by inspection.*

The cable between the output terminals of ~~an inverter or convertor~~ a controlgear and the discharge tube shall be of a type specified by the manufacturer of the ~~inverter or convertor~~ controlgear and shall satisfy the following requirements:

a) be suitable for operation at high frequency;

b) be suitable for operation at the output voltage of the ~~inverter or convertor~~ controlgear.

## 18 Creepage distances and clearances

IEC 61347-1:2015, Clause 16 and IEC 61347-1:2015/AMD1:2017, Clause 16 apply, together with the following:

Creepage distances and clearances in the output circuit, whether the ~~inverter or convertor~~ controlgear is installed in dry or damp situations, shall be not less than the following, expressed in millimetres:

– minimum creepage distance $d = 12 + 6\ U_o$

– minimum clearance $c = 9 + 4{,}5\ U_o$

where

$U_o$ is the rated no-load ~~rated~~ output voltage of the ~~inverter or convertor~~ controlgear supplying the circuit in kilovolts.

The distance through insulation shall be dimensioned according to the application of the insulation and the working voltage (exceeding 50 V RMS or 71 V peak or DC) and in accordance with the following:

– supplementary insulation shall have a minimum thickness of 0,4 mm;

– reinforced insulation shall have a minimum thickness of 0,4 mm when not subjected to any mechanical stress which, at nominal operating temperature, would be likely to lead to deformation or deterioration of the insulating material.

NOTE Under mechanical stress conditions, it ~~may~~ can be necessary to increase the thickness.

*Compliance is checked by measurement and, where specified, by electric strength tests.*

## 19 Protective circuits

~~Protective circuits in type B invertors and convertors shall comply with the requirements of 19.1, 19.2 and 19.3.~~

### 19.1 General

Type A controlgear may, and type B ~~invertors or convertors~~ controlgear shall include earth-leakage protection to ~~remove the~~ shut off output power in the event of an earth fault occurring in the output circuits. ~~Protection shall comply with 19.5.~~ If provided, 19.2 applies.

Open circuit protection may be provided. If provided, 19.3 applies.

~~**19.2** If provided, the open-circuit protection of the type B invertors or convertors shall remove the output power in the event of a disconnection or tube failure occurring in the output circuits. Protection shall comply with 19.6.~~

~~**19.3** After an earth fault or open circuit has caused the protective device in an invertor or convertor to operate, it shall remain as it is until the mains supply is also switched off. When the mains supply is switched on again, the protective device to remove the output power shall automatically reset. If the earth-leakage or open-circuit fault is still present at the time of the reset, the protective device shall operate in accordance with 19.5.3 or 19.6.3.~~

~~NOTE Special arrangements may be required in circuits with animation to ensure that any protective device does not continue to reset.~~

~~***19.4 Compliance is checked by carrying out the relevant tests in accordance with 19.5 and 19.6.***~~

### 19.2 Earth-leakage protection

The earth-leakage current shall be measured in accordance with Annex A.

~~If provided, an earth-leakage protective device shall comply with the requirements of 19.5.1 to 19.5.3.~~

~~**19.5.1 Earth leakage current**~~

~~The earth leakage current shall be measured in accordance with Annex I.~~

~~**19.5.2 Accidental contact**~~

~~In the event of accidental contact between the high-voltage circuit and earth, the earth-leakage protective device shall remove the output power of the invertor or convertor.~~

~~**19.5.3 Earth-leakage protective device**~~

The earth-leakage protective device shall comply with the following requirements:

a) If any part of the sensor ~~and/~~or of the protective switch or of the device to ~~remove the~~ shut off output power, or more than one of these, are mounted within the case of the ~~invertor or~~

~~convertor~~ controlgear, the device shall operate correctly over the temperature range as specified by the manufacturer.

b) If the sensor ~~and/~~or the protective device to ~~remove the~~ shut off output power, or both, are mounted in a position not within the case of the ~~inverter or convertor~~ controlgear, the device shall operate correctly over a temperature range of –25 °C to +65 °C.

c) The rated operating current of the protective device shall be less than the rated output current of the ~~inverter or convertor~~ controlgear to be protected and shall not exceed 25 mA.

NOTE 1 The actual current which flows through the sensor circuit during an earth fault is determined by the impedance of that fault path and the output characteristics of the ~~inverter or convertor~~ controlgear feeding the fault. It does not depend on the operating current of the protection device.

d) The time to operate, at rated fault current, shall not exceed 200 ms.

After an earth fault or open circuit has caused the protective device in a controlgear to operate, it shall remain as it is until the mains supply is also switched off. When the mains supply is switched on again, the protective device to shut off output power shall automatically reset. If the earth-leakage or open-circuit fault is still present at the time of the reset, the protective device shall operate in accordance with a) to d).

NOTE 2 Special arrangements can be necessary in circuits with animation to ensure that any protective device does not continue to reset.

In the event of accidental contact between the high-voltage circuit and earth, the earth-leakage protective device shall shut off the output power of the controlgear.

### 19.3 Open-circuit protection

~~If an open-circuit protective device is provided, its performance shall comply with the requirements of 19.6.1 to 19.6.3.~~

~~**19.6.1 Open-circuit voltage**~~

~~The open-circuit voltage shall be measured in accordance with annex I.~~

~~**19.6.2 Upper shut-down limit**~~

~~In the event of the upper shut-down limit being exceeded, the open-circuit protective device shall remove the output power of the invertor or convertor. Detection of a fault condition shall be by means of sensor(s) connected in the output circuit(s), or other suitable means.~~

~~**19.6.3 Open-circuit protective device**~~

For open circuit protection the following requirements apply:

The open-circuit voltage shall be measured in accordance with Annex A.

In the event of the upper shut-down limit being exceeded, the open-circuit protective device shall shut off the output power of the controlgear. Detection of a fault condition shall be by means of sensor(s) connected in the output circuit(s), or other suitable means.

The open-circuit protective device shall comply with the following requirements:

a) If any part of the sensor ~~and/~~or of the protective switch or of the device to ~~remove the~~ shut off output power, or more than one of these, are mounted within the case of the ~~inverter or convertor~~ controlgear, the device shall operate correctly over the temperature range as specified by the manufacturer.

b) If the sensor ~~, and/~~or the protective device to ~~remove the~~ shut off output power, or both, are mounted in a position not within the case of the ~~invertor or convertor~~ controlgear, the device shall operate correctly over a temperature range of –25 °C to +65 °C.

c) If the ~~invertor or convertor~~ controlgear is switched on with an open-circuit condition as described in ~~I~~A.3.1, the protective device shall operate in not more than 5 s.

d) If an open circuit occurs, as described in ~~I~~A.3.1, whilst the installation is switched on, the protective device shall operate in a time not exceeding 200 ms. If the mains supply is then switched off and switched on again, with the open-circuit condition still persisting, the device shall operate in not more than 5 s.

NOTE Special arrangements ~~may~~ can be ~~required~~ necessary in circuits with animation to ensure that any protective device does not continue to reset.

*After an open circuit has caused the protective device in a controlgear to operate, it shall remain as it is until the mains supply is also switched off. When the mains supply is switched on again, the protective device to shut off output power shall automatically reset. If the open-circuit fault is still present at the time of the reset, the protective device shall operate in accordance with a) to d).*

## 20 Screws, current-carrying parts and connections

IEC 61347-1:2015, Clause 17 applies.

## 21 Resistance to heat, fire and tracking

IEC 61347-1:2015, Clause 18 applies.

## 22 Resistance to corrosion

IEC 61347-1:2015, Clause 19 applies.

## 23 No-load rated output voltage and rated output current

### ~~23.1 No-load rated output voltage~~

The rated no-load ~~rated~~ output voltage of type A ~~invertors or convertors~~ controlgear shall not exceed 5 000 V peak either between terminals or to earth.

The rated no-load ~~rated~~ output voltage of type B ~~invertors or convertors~~ controlgear shall not exceed 5 000 V to earth or 10 000 V between terminals.

*Compliance of the rated no-load output voltage is checked by measurement.*

### ~~23.2 Rated output current~~

The rated output current of type A ~~invertors or convertors~~ controlgear, measured in accordance with Annex ~~I~~A, shall not exceed either 35 mA (RMS) or 50 mA peak, whichever is ~~the greater~~ larger.

The rated output current of type B ~~invertors or convertors~~ controlgear, measured in accordance with Annex ~~I~~A, shall not exceed 200 mA (RMS) or 400 mA peak value, whichever is ~~the greater~~ larger.

### ~~23.3 Compliance~~

*Compliance of the rated output current is checked by measurement.*

## 24 Applicable annexes of IEC 61347-1

The following annexes of IEC 61347-1:2015 apply:

– Annex A (normative) Test to establish whether a conductive part is a live part which may cause an electric shock;

– Annex C (normative) Particular requirements for electronic lamp controlgear with means of protection against overheating;

– Annex D (normative) Requirements for carrying out the heating tests of thermally protected lamp controlgear;

– Annex F (normative) Draught-proof enclosure;

– Annex H (normative) Tests.

## Annex A
(normative)

## Test to establish whether a conductive part is a live part which may cause an electric shock

The requirements of annex A of IEC 61347-1 apply.

## Annex B
(normative)

## Particular requirements for thermally protected lamp controlgear

The requirements of Annex B of IEC 61347-1 are not applicable.

## Annex C
(normative)

## Particular requirements for electronic lamp controlgear with means of protection against overheating

The requirements of annex C of IEC 61347-1 apply.

## Annex D
(normative)

## Requirements for carrying out the heating tests of thermally protected lamp controlgear

The requirements of annex D of IEC 61347-1 apply.

## Annex E
(normative)

## Use of constant *S* other than 4 500 in $t_w$ tests

The requirements of annex E of IEC 61347-1 are not applicable.

## Annex F
(normative)

## Draught-proof enclosure

The requirements of annex F of IEC 61347-1 apply.

~~**Annex G**~~
~~(normative)~~

~~**Explanation of the derivation of the values of pulse voltages**~~

~~The requirements of annex G of IEC 61347-1 are not applicable.~~

~~**Annex H**~~
~~(normative)~~

~~**Tests**~~

~~The requirements of annex H of IEC 61347-1 apply.~~

# Annex A~~Annex I~~
(normative)

# Measurement of current and voltages in the output circuits of electronic ~~invertors or convertors~~ controlgear for neon tubes

## ~~I~~A.1 General

### ~~I~~A.1.1 Information to be provided by manufacturers

For test purposes, the manufacturer shall provide details of the following equivalent load resistors having low self-inductance and self-capacitance:

– load resistor $R_1$: resistor designed to provide rated output current of the ~~inverter or convertor~~ controlgear;

– load resistor $R_2$: resistor designed to provide the maximum output power of the ~~inverter or convertor~~ controlgear within its upper and lower shut-down limits;

– load resistor $R_3$: resistor designed to provide the output current of the ~~inverter or convertor~~ controlgear at the minimum declared tube load;

– load resistor $R_4$: resistor designed to provide the output current of the ~~inverter or convertor~~ controlgear at the maximum declared tube load.

The manufacturer of the ~~inverter or convertor~~ controlgear shall declare the value of these resistors for an average sample of each ~~inverter or convertor~~ controlgear operating at nominal supply voltage frequency. The manufacturer shall also specify the construction of the resistors to achieve the necessary low self-inductance and capacitance.

For ~~invertors or convertors~~ controlgear having more than one output, and where the outputs are designed to supply different loads, the values of load resistors shall be separately specified for each output.

~~NOTE 1~~ When used with ~~invertors or convertors~~ controlgear having outputs balanced about earth potential, it is recommended that each of the resistors is specified as two half resistors to be connected in series. This will enable current measurements to be carried out at earth potential.

NOTE ~~2~~ 1 Since the customer ~~may~~ can operate the ~~invertor or convertor~~ controlgear with tube loads outside the range specified by the manufacturer, resistor $R_2$ ~~may~~ can provide an operating point outside the range limited by $R_3$ and $R_4$.

NOTE ~~3~~ 2 Under certain conditions, one or more of the resistors ~~may~~ can have the same value as others in the set for a particular ~~invertor or convertor~~ controlgear.

NOTE ~~4~~ 3 Because of the different characteristics between invertors of different manufacture but with the same current and voltage rating, the values of the resistors are likely to be specific to particular units.

### ~~I~~A.1.2 Measurement of output voltage and current

Measurement of output voltage or current shall be carried out in a precise manner in accordance with this Annex A.

NOTE ~~A precise set of measurements is required~~ This requirement was established since the outputs of ~~invertors or convertors~~ controlgear can have a wide range and the output current and voltage waveforms ~~may~~ can include spikes and thereby contain components of higher frequencies.

### ~~I~~A.1.3 Amplitude modulations

If the circuit of the ~~inverter or converter~~ controlgear allows the output waveform to become amplitude modulated, the following precautions shall be taken:

a) voltage measurements shall be carried out during the period of peak modulation;

b) current measurements shall be averaged over complete cycles of the modulation period.

### ~~I~~A.1.4 Spikes and high-frequency harmonics

To ensure accommodation of spikes and high-frequency harmonics, the measuring equipment shall either have:

a) a maximum time constant of 250 ns; or

b) a minimum sampling rate of 10 megasamples per second.

Where the output frequency exceeds 50 kHz, the time constant or sampling rate shall comply with the following:

– time constant $< 1/(f \times 80)$ s;

– sample rate $> f \times 200$ samples per second

where

$f$ is the maximum output frequency of the ~~inverter or converter~~ controlgear in hertz.

The manufacturer of the ~~inverter or converter~~ controlgear shall specify the conditions under which the output voltage or current shall be measured. The manufacturer shall also specify all relevant parameters, including operating conditions, mounting position and cable arrangements.

### ~~I~~A.1.5 Test conditions

Where the test conditions cause protective circuits within the ~~inverter or converter~~ controlgear to operate, voltage and current measurements shall be made in the brief period before the protection operates.

## ~~I~~A.2 Instrumentation

To ensure that all transient waveforms, including both peak and RMS values, are correctly recorded, measurements shall be made by using a digitizing oscilloscope or equivalent means. Where measurements are made on ~~inverters or converters~~ controlgear having two separate outputs, the oscilloscope shall have two input channels in order that the voltages or currents of both outputs may be captured simultaneously.

Oscilloscopes shall have a sampling rate consistent with that specified in ~~I~~A.1.4.

Voltage probes for oscilloscopes shall have

a) an input capacitance of not more than 4 pF;

b) a voltage capability exceeding the output voltage of the ~~inverter or converter~~ controlgear to be measured;

c) a time constant consistent with that specified in ~~I~~A.1.4.

Current probes for oscilloscopes shall have

a) an upper frequency response consistent with that specified in ~~I~~A.1.4;

b) a lower frequency response adequate to accommodate the fundamental frequency of operation of the ~~inverter or convertor~~ controlgear without significant error.

The peak-to-peak amplitude of the sampled waveform shall exceed 7 bits in resolved amplitude (typically half-scale deflection on the oscilloscope). RMS values shall be derived using software processing of the sampled waveform.

The four resistive loads $R_1$, $R_2$, $R_3$, and $R_4$ (see ~~I~~A.1.1) shall have the following characteristics:

a) their measured resistance shall lie within ±2 % of their nominal value over a temperature range from 10 °C up to and including their maximum operating temperature;

b) the series reactive impedance caused by self-inductance shall be less than 2 % of the nominal value of the resistive load;

c) the parallel reactive impedance caused by self-capacitance shall not be less than 50 times the nominal value of the resistive load.

## ~~I~~A.3 Measurements

### ~~I~~A.3.1 Measurement of no-load output voltage

#### ~~I~~A.3.1.1 Load on output terminals

Both output terminals of the ~~inverter or convertor~~ controlgear shall be loaded simultaneously with the same length of high-voltage cable, simulating capacitance to earth as required in ~~I~~A.3.1.2. The type of cable shall be either:

a) that specified by the manufacturer of the ~~inverter or convertor~~ controlgear; or

b) a cable without an overall sheath or metal screen and having insulation appropriate to the output voltage of the ~~inverter or convertor~~ controlgear.

To ensure consistent capacitance to earth, the cables shall be laid on a sheet of earthed metal with a second sheet of earthed metal laid on top of the cables. ~~Care shall be taken to ensure that there is~~ No voltage breakdown between any cable conductor and earth shall occur.

#### ~~I~~A.3.1.2 Capacitance between the output terminals and earth

The capacitance between the output terminals and earth shall be adjusted by altering the length of the cable until the maximum no-load output voltage of the ~~inverter or convertor~~ controlgear is achieved. The length of cable shall be adjusted by either of the following methods:

a) where no maximum length of cable is specified by the manufacturer of the ~~inverter or convertor~~ controlgear, the length of cable shall be increased in suitable steps up to the point where the maximum no-load output voltage is achieved;

b) where a maximum length of cable is specified by the manufacturer of the ~~inverter or convertor~~ controlgear, the length of cable shall be decreased in suitable steps down to the point where the maximum no-load output voltage is achieved.

NOTE The maximum no-load output voltage need not necessarily occur with maximum capacitance.

#### ~~I~~A.3.1.3 Additional outputs

Where ~~inverters or convertors~~ controlgear have more than one output, each pair of output terminals shall be loaded with varying lengths of cable as described in ~~I~~A.3.1.1 and ~~I~~A.3.1.2.

NOTE The type of cable to be used ~~should be the~~ is subject to agreement between the test house and the manufacturer.

### ~~I~~A.3.2 Measurement of output current

Output currents into the appropriate load resistor shall be measured by using a current probe, as specified in Clause ~~I~~A.2 or equivalent means. Where possible, the probe or equivalent means shall be used at a voltage as near as possible to earth potential to reduce capacitive loading effects.

~~NOTE 1~~ In the case of ~~inverters and converters~~ controlgear having outputs balanced about earth potential, it is recommended that the current probe be used at the mid-point of the equivalent load resistor so that the current measurements can be carried out at earth potential.

NOTE ~~2 It should be noted that,~~ Even at low voltages to earth, stray capacitance can reduce the current reading. ~~Care should be taken to ensure that~~ This effect can be reduced by minimizing this capacitance ~~is reduced~~ as much as possible.

### ~~I~~A.3.3 Measurement of earth fault currents

Earth fault currents shall be measured by either:

a) a current probe as specified in Clause ~~I~~A.2~~.3~~; or

b) a suitable non-inductive resistor connected into the fault path in such a way that one end of the resistor is at earth potential; or

c) equivalent means.

Earth fault currents shall be introduced at each output terminal in turn using suitable non-inductive resistors. The value of the resistor shall be reduced in small, equal value steps, increasing the fault current by not more than 5 % per step, until the earth-leakage protection of the ~~inverter or convertor~~ controlgear operates. The last measured current plus the last incremental change in current shall be taken as the fault current trip level.

The measurements shall be carried out with the output of the ~~inverter or convertor~~ controlgear also connected, in turn, to load resistors $R_1$, $R_3$ and $R_4$. The fault current trip level shall comply with the requirements of Clause 19 under all load conditions.

# Annex B
(informative)

## Schedule of more onerous requirements

Products found compliant with the previous edition of this document do not necessarily require complete requalification for demonstrating compliance with this document. Depending on the nature of the changes introduced, partial retesting or even no retesting may be appropriate, as the case may be.

For this document, no more onerous requirements have been introduced with respect to the previous edition, i.e. IEC 61347-2-10:2000 and IEC 61347-2-10:2000/AMD1:2008.

## Bibliography

IEC 60050-151, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices,* available at https://www.electropedia.org

IEC 61347-2-10:2000, *Lamp controlgear – Part 2-10: Particular requirements for electronic invertors and convertors for high-frequency operation of cold start tubular discharge lamps (neon tubes)*
IEC 61347-2-10:2000/AMD1:2008

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# IEC 61347-2-10

Edition 2.0 2024-05

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Controlgear for electric light sources – Safety –**
**Part 2-10: Particular requirements – Electronic controlgear for high-frequency operation of tubular cold-cathode discharge lamps (neon tubes)**

**Appareillages de commande pour les sources de lumière électriques – Sécurité –**
**Partie 2-10: Exigences particulières – Appareillages électroniques destinés à l'alimentation en haute fréquence des lampes à décharge tubulaires à cathode froide (tubes néon)**

IEC 61347-2-10:2024-05(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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# CONTROLGEAR FOR ELECTRIC LIGHT SOURCES – SAFETY –

## Part 2-10: Particular requirements – Electronic controlgear for high-frequency operation of tubular cold-cathode discharge lamps (neon tubes)

## FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.



IEC 61347-2-10 has been prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lighting. It is an International Standard.

This second edition cancels and replaces the first edition published in 2000 and Amendment 1:2008. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) introduction of dated references as appropriate;
b) clarification of sample item numbers.

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

| Draft | Report on voting |
|---|---|
| 34C/1584/CDV | 34C/1592/RVC |

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This document is intended to be used in conjunction with IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017. Where the requirements of any of the clauses of IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017 are referred to in this document by the phrase "IEC 61347-1:2015, Clause n and IEC 61347-1:2015/AMD1:2017, Clause n apply", this phrase is interpreted as meaning that all the requirements of the clause in question of IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017 apply, except any which are clearly inapplicable to the specific type of controlgear covered by this document.

NOTE In this document, the following print type is used:

– *compliance statements: in italic type*.

A list of all parts in the IEC 61347 series, published under the general title *Controlgear for electric light sources – Safety,* can be found on the IEC website.

Future documents in this series will carry the new general title as cited above. Titles of existing documents in this series will be updated at the time of the next edition.

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

- reconfirmed,
- withdrawn, or
- revised.

# INTRODUCTION

The technical requirements in this document compared to IEC 61347-2-10:2000 and IEC 61347-2-10:2000/AMD1:2008 are essentially unchanged. Nevertheless, a new edition of this document could not be avoided, as without the introduction of dated references to IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, the fourth edition of IEC 61347-1:—[1] would have been implicitly applicable due to the undated nature of the references to IEC 61347-1 in IEC 61347-2-10:2000 and IEC 61347-2-10:2000/AMD1:2008.

This document, in referring to any of the clauses of IEC 61347-1:2015 and IEC 61347-1:2015/AMD1:2017, specifies the extent to which such a clause is applicable. Additional requirements are also included, as necessary.

In order to check the safety of controlgear, it is necessary to check their performance. However, since no standardization of the characteristics of neon tubes exists, reference loads are specified in this document to ensure reproducible test results.



[1] Fourth edition under preparation. Stage at the time of publication IEC FDIS 61347-1:2024.

# CONTROLGEAR FOR ELECTRIC LIGHT SOURCES – SAFETY –

## Part 2-10: Particular requirements – Electronic controlgear for high-frequency operation of tubular cold-cathode discharge lamps (neon tubes)

## 1 Scope

This part of IEC 61347 specifies safety requirements for electronic controlgear for high-frequency operation of tubular cold-cathode discharge lamps used in signs and luminous discharge tube installations and operating with an output voltage exceeding 1 000 V but not exceeding 10 000 V for direct connection to DC or AC supply voltages not exceeding 1 000 V (at 50 Hz or 60 Hz in case of alternating current).

NOTE 1 Historically, such types of controlgear were referred to as invertors or convertors.

NOTE 2 In Japan, the voltage limit for the application of this document is set to 15 000 V.

This document applies for controlgear of type A and controlgear of type B, which are specified as follows:

– Type A: controlgear operating within the frequency range 20 kHz to 50 kHz, and having an output voltage not exceeding 5 000 V peak between terminals, with a maximum output current limited to 35 mA (RMS) and 50 mA (peak value) and a supply voltage not exceeding 250 V.

  NOTE 3 The output current of a type A unit can be considered as not presenting an electric shock hazard due to the limits on the current and frequency range.

  NOTE 4 In Japan, the output voltage of 15 000 V is acceptable.

– Type B: controlgear operating within the frequency range 10 kHz to 100 kHz and having a no-load output voltage not exceeding 10 000 V between terminals or not exceeding 5 000 V to earth, with a maximum output current limited to 200 mA (RMS) and 400 mA (peak value).

  NOTE 5 In Japan, a type B controlgear providing an output current exceeding 50 mA is not acceptable.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60417, *Graphical symbols for use on equipment,* available at https://www.graphical-symbols.info/equipment

IEC 60598-1:2020, *Luminaires – Part 1: General requirements and tests*

IEC 61347-1:2015, *Lamp controlgear – Part 1: General and safety requirements*
IEC 61347-1:2015/AMD1:2017

ISO 3864-1:2011, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61347-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

**3.1**
**tubular cold-cathode discharge lamp**
**neon tube**
tubular discharge lamp in which the light is produced by the positive column of a glow discharge

Note 1 to entry: These lamps have a low-pressure filling of a rare gas (or a mixture of rare gases) and possibly mercury vapour. They can have an inside coating of fluorescent materials.

**3.2**
**rated no-load output voltage**
$U_o$
rated maximum voltage between the output terminals or the ends of the integral connecting leads of the invertor or convertor connected to the rated supply voltage at rated frequency with no load on the output circuit

Note 1 to entry: For sinusoidal wave forms, the rated no-load output voltage is the RMS value or the peak value divided by square root of 2. For other waveforms, it is the RMS value or the equivalent value deduced from the peak value, obtained by mathematical calculation.

Note 2 to entry: For the purposes of this document this definition overrules the one given in IEC 61347-1.

[SOURCE: IEC 61347-1:2015, 3.9, modified – The definition has been adapted for the purposes of this document and the Notes to entry have been added.]

**3.3**
**invertor**
electric energy transducer that converts direct current to alternating current

**3.4**
**convertor**
unit for the electronic conversion of AC supply at one frequency to an AC supply at another frequency

**3.5**
**earth-leakage protective device**
device which removes the output power from the controlgear in the event of an earth fault current flowing between any part of the output high-voltage circuit and earth

**3.6**
**open-circuit protective device**
device which removes the output power from the controlgear in the event of non-operation of the tube load or an interruption in the output high-voltage circuit

Note 1 to entry: An open-circuit protective device may operate by detecting an increase in the output voltage or by other suitable means.

**3.7**
**upper shut-down limit**
output voltage of the controlgear at which an open-circuit protective device operates

**3.8**
**output high-voltage circuit**
that part of the circuit consisting of

a) cables between the output terminals of the controlgear and the discharge tubes,

b) discharge tubes,

c) any series connections between the discharge tubes,

but not including any internal components or wiring of the controlgear

**3.9**
**sample**
one or more sampling items intended to provide information on the population or on the material provided by the manufacturer or responsible vendor

[SOURCE: IEC 60050-151:2001, 151-16-19, modified – "provided by the manufacturer or responsible vendor" has been added.]

**3.10**
**sample item**
one of the individual items in a population of similar items, or a portion of material forming a cohesive entity and taken from one place and at one time

[SOURCE: IEC 60050-151:2001, 151-16-18]

## 4 General requirements

IEC 61347-1:2015, Clause 4 applies.

For electronic lamp controlgear with means of protection against overheating, additionally IEC 61347-1:2015, Annex C applies.

Provisions for the rated maximum temperature of the winding $t_w$, are not applicable.

## 5 General notes on tests

IEC 61347-1:2015, Clause 5, applies, together with the following:

– IEC 61347-1:2015, Annex H applies.

– One sample item shall be used for all tests, unless otherwise specified in the corresponding clause.

  To allow for parallel testing and reduced test times, additional sample items may be used except where the outcome of the test can be affected by preceding tests, for example the tests of Clause 11 and Clause 12.

  Specially prepared sample items may be used where required.

For information on requalification of products compliant with the previous edition of this document, i.e. IEC 61347-2-10:2000 and IEC 61347-2-10:2000/AMD1:2008, refer to Annex B.

## 6 Classification

IEC 61347-1:2015, Clause 6 applies, together with the following:

Additionally, controlgear shall be classified according to their rated no-load output voltage, the rating of the operating frequency and output current range, as one of the following:

a) type A controlgear;

b) type B controlgear.

Type B controlgear may have more than one output. In this case, each output shall comply with the above.

## 7 Marking

### 7.1 Marking and information

#### 7.1.1 Mandatory marking

Controlgear, other than integral controlgear, shall be marked with the following:

– items a), b), c), d), e) and f) of IEC 61347-1:2015, 7.1 and IEC 61347-1:2015/AMD1:2017, 7.1;

– on independent controlgear, a warning notice for high voltage, e.g. "HIGH VOLTAGE" and a symbol in the form of an arrow in accordance with IEC 60417-6042:2010-11 and ISO 3864-1:2011, Figure 3.

This marking shall be placed on the outside of the enclosure of the controlgear so that it is clearly visible.

– type A or type B as applicable.

If the electronic invertor or convertor consists of more than one separate unit, the units providing the output shall be marked with the necessary information about other associated units such as DC power supplies or capacitors.

#### 7.1.2 Information to be provided

The following information, if applicable, shall be given on the controlgear, or be made available in the manufacturer's catalogue or similar:

– items h), k), m), n) and o) of IEC 61347-1:2015, 7.1;

– the range and number of tube types, diameters and lengths recommended for the controlgear;

– where the controlgear is not supplied with integral leads (tails), details of the recommended cable types and maximum cable lengths;

– details of suitable types of mounting surfaces and recommended mounting arrangements;

– details of earthing arrangements, including connections to the controlgear output winding, where appropriate;

– details of any protective circuits incorporated in the controlgear;

– the following electrical characteristics:

1) rated no-load output voltage. This marking shall be in the following terms:

- if the output terminal is not connected to an earthing terminal:
  "...kV" (e.g. 4 kV),
- if one output terminal is connected to an earthing terminal:
  "E -...kV" (e.g. E – 4 kV),

- if the centre point of the output winding is referred to an earthing terminal: "... - E -...kV" (e.g. 3 – E – 3 kV);

NOTE In Japan, E -..kV and - E - kV are not used.

For type A units, this is equivalent to the peak value. For type B units this is equivalent to the RMS value or 0,5 times the peak value, whichever is larger.

2) rated output current with rated load;

3) rated output frequency.

Where appropriate, the details in items 1) and 2) above shall be marked for each independent output circuit of a controlgear.

### 7.2 Durability and legibility

IEC 61347-1:2015, 7.2 applies.

### 7.3 Built-in controlgear

For controlgear without an enclosure and classified as built-in (e.g. open printed circuit board assembly), only items a) and b) according to IEC 61347-1:2015, 7.1 shall be marked on the controlgear.

Other mandatory markings shall be provided as information to be given either on the controlgear or made available in the manufacturer's catalogue or similar.

## 8 Terminals

IEC 61347-1:2015, Clause 8 and IEC 61347-1:2015/AMD1:2017, Clause 8 apply, together with the following:

Controlgear provided with tails shall comply with the relevant requirements of IEC 60598-1:2020.

## 9 Earthing

IEC 61347-1:2015, Clause 9 applies, together with the following:

For type B controlgear, the earthing terminal shall be connected to a part of the output circuit except where

– the earthing terminal is connected to a part of the output circuit through means to detect earth-fault currents, or

– there is no direct connection between any part of the output circuit and the earth terminal, and for example, part(s) of that output circuit are referenced to earth potential by means of the internal circuits.

*Compliance is checked by inspection.*

## 10 Protection against accidental contact with live parts

IEC 61347-1:2015, Clause 10 and IEC 61347-1:2015/AMD1:2017, Clause 10 apply, together with the following:

The remaining charge between terminals in the output circuit of a controlgear following a worst case of disconnection shall not exceed 45 µC.

*Compliance is checked by measurement.*

Where part(s) of the output circuit of a controlgear is(are) not connected to earth, or is(are) not referenced to earth by means of internal circuits, the insulation barrier between the input and output circuits shall consist of double or reinforced insulation (see test voltages in Clause 12).

*Compliance is checked by the test of Clause 12 (see test voltages).*

## 11 Moisture resistance and insulation

IEC 61347-1:2015, Clause 11 and IEC 61347-1:2015/AMD1:2017, Clause 11 apply, together with the following:

For type A controlgear, the capacitance between the output terminals and the metal foil of not less than 100 $cm^2$ area placed anywhere on the surface of the enclosure of the controlgear shall not exceed 50 pF. During the test the convertor shall not operate.

*Compliance is checked by measurement.*

## 12 Electric strength

IEC 61347-1:2015, Clause 12 applies, together with the following:

The test voltages for all controlgear are:

– twice the rated input voltage plus 1 000 V on the input side, with the output circuits connected to external metal parts;

– twice the no-load rated output voltage on the output side, the input circuits being connected to external metal parts.

NOTE In Japan, 1,5 times the test voltage is approved.

IEC 60598-1:2020, Table 10.2 applies for independent controlgear.

## 13 Thermal endurance test for windings

Controlgear or its support shall not, under normal or abnormal conditions, have too high a temperature or impair safety.

*Compliance is checked by the tests specified in Clause 14, Clause 15 and Clause 16.*

## 14 Normal conditions

The controlgear shall be installed in its normal operating position arranged in accordance with the manufacturer's instructions and mounted as shown in IEC 61347-1:2015, Figure H.1. The test shall be carried out in a draught-free enclosure as specified in IEC 61347-1:2015, Annex F.

The controlgear shall be operated with the tube load replaced by the specified load resistor $R_1$ (see Annex A) and with nominal supply voltage.

– In the case of controlgear which provide near constant current output, the supply voltage shall be maintained at the nominal value until steady-state temperatures are obtained.

– In the case of controlgear which do not provide near constant current output, adjustments shall be made to the supply voltage until the output current is the same as the nominal value specified on the label of the controlgear. The output current is then maintained at this value until steady-state temperatures are obtained. If the controlgear has more than one output, the appropriate load resistors ($R_1$) shall be connected to each pair of output terminals.

*During the test, the temperature on the relevant parts shall not exceed the values specified in IEC 60598-1:2020, Table 12.1 and Table 12.2.*

## 15 Abnormal conditions

The controlgear shall be operated according to the manufacturer's instructions (including heatsinks and spacers, if specified) at the most onerous voltage between 90 % and 110 % of the rated supply voltage for a period of 1 h. The test shall be carried out in a draught-free enclosure as specified in IEC 61347-1:2015, Annex F.

The test shall be carried out with one of the following combination of conditions, whichever is the most onerous. The time interval between tests shall not exceed 15 min.

a) Conditions 1) to 3) applied sequentially.

b) Conditions 2) and 3) applied simultaneously.

1) The output circuit(s) shall be short-circuited.

   If there is more than one output circuit, all circuits shall be short-circuited at the same time.

   If the controlgear includes means to shut off output power in the event of a short-circuit of the output load, this test may be omitted.

2) The abnormal load resistor $R_2$ (see Annex A) shall be connected across the output terminals. If the controlgear has more than one output, the appropriate abnormal resistors $R_2$ shall be connected to each pair of output terminals at the same time.

3) The controlgear shall be mounted on a 1 mm thick metal sheet, whose material shall be specified by the manufacturer.

   If not specified, then either steel or aluminium (whichever provides the worst condition) shall be used.

*During and at the end of the tests the controlgear shall show no defect impairing safety, nor shall any smoke be produced.*

*The temperature of any part of the outer surface of an independent controlgear shall not exceed 90 °C. In addition, the output current and voltage shall not exceed the values specified in Clause 23.*



## 16 Fault conditions

IEC 61347-1:2015, Clause 14 and IEC 61347-1:2015/AMD1:2017, Clause 14 apply, together with the following:

a) the output shall be short-circuited, or in the case of a controlgear having short-circuit protection, the output shall be connected to resistor $R_3$ as described in Annex A;

b) an earth fault of negligible impedance shall be applied on one or both of the output terminals.

*The output current shall not exceed 1,5 times the value specified by the manufacturer in both cases a) and b).*

The test of b) is not applicable if there is no earth connection to any part of the output circuit; or if the controlgear includes means to shut off output power in the event of a short-circuit between one of the output terminals and earth, in accordance with Clause 19.

## 17 Construction

IEC 61347-1:2015, Clause 15 applies, together with following:

Independent class II controlgear construction shall be provided with an enclosure of insulating material only.

*Compliance is checked by inspection.*

The cable between the output terminals of a controlgear and the discharge tube shall be of a type specified by the manufacturer of the controlgear and shall satisfy the following requirements:

a) be suitable for operation at high frequency;

b) be suitable for operation at the output voltage of the controlgear.

## 18 Creepage distances and clearances

IEC 61347-1:2015, Clause 16 and IEC 61347-1:2015/AMD1:2017, Clause 16 apply, together with the following:

Creepage distances and clearances in the output circuit, whether the controlgear is installed in dry or damp situations, shall be not less than the following, expressed in millimetres:

– minimum creepage distance $d = 12 + 6\ U_o$

– minimum clearance $c = 9 + 4{,}5\ U_o$

where

$U_o$ is the rated no-load output voltage of the controlgear supplying the circuit in kilovolts.

The distance through insulation shall be dimensioned according to the application of the insulation and the working voltage (exceeding 50 V RMS or 71 V peak or DC) and in accordance with the following:

– supplementary insulation shall have a minimum thickness of 0,4 mm;

– reinforced insulation shall have a minimum thickness of 0,4 mm when not subjected to any mechanical stress which, at nominal operating temperature, would be likely to lead to deformation or deterioration of the insulating material.

NOTE Under mechanical stress conditions, it can be necessary to increase the thickness.

*Compliance is checked by measurement and, where specified, by electric strength tests.*

## 19 Protective circuits

### 19.1 General

Type A controlgear may, and type B controlgear shall include earth-leakage protection to shut off output power in the event of an earth fault occurring in the output circuits. If provided, 19.2 applies.

Open circuit protection may be provided. If provided, 19.3 applies.

### 19.2 Earth-leakage protection

The earth-leakage current shall be measured in accordance with Annex A.

The earth-leakage protective device shall comply with the following requirements:

a) If any part of the sensor or of the protective switch or of the device to shut off output power, or more than one of these, are mounted within the case of the controlgear, the device shall operate correctly over the temperature range as specified by the manufacturer.

b) If the sensor or the protective device to shut off output power, or both, are mounted in a position not within the case of the controlgear, the device shall operate correctly over a temperature range of –25 °C to +65 °C.

c) The rated operating current of the protective device shall be less than the rated output current of the controlgear to be protected and shall not exceed 25 mA.

NOTE 1 The actual current which flows through the sensor circuit during an earth fault is determined by the impedance of that fault path and the output characteristics of the controlgear feeding the fault. It does not depend on the operating current of the protection device.

d) The time to operate, at rated fault current, shall not exceed 200 ms.

After an earth fault or open circuit has caused the protective device in a controlgear to operate, it shall remain as it is until the mains supply is also switched off. When the mains supply is switched on again, the protective device to shut off output power shall automatically reset. If the earth-leakage or open-circuit fault is still present at the time of the reset, the protective device shall operate in accordance with a) to d).

NOTE 2 Special arrangements can be necessary in circuits with animation to ensure that any protective device does not continue to reset.

In the event of accidental contact between the high-voltage circuit and earth, the earth-leakage protective device shall shut off the output power of the controlgear.

### 19.3 Open-circuit protection

For open circuit protection the following requirements apply:

The open-circuit voltage shall be measured in accordance with Annex A.

In the event of the upper shut-down limit being exceeded, the open-circuit protective device shall shut off the output power of the controlgear. Detection of a fault condition shall be by means of sensor(s) connected in the output circuit(s), or other suitable means.

The open-circuit protective device shall comply with the following requirements:

a) If any part of the sensor or of the protective switch or of the device to shut off output power, or more than one of these, are mounted within the case of the controlgear, the device shall operate correctly over the temperature range as specified by the manufacturer.

b) If the sensor or the protective device to shut off output power, or both, are mounted in a position not within the case of the controlgear, the device shall operate correctly over a temperature range of –25 °C to +65 °C.

c) If the controlgear is switched on with an open-circuit condition as described in A.3.1, the protective device shall operate in not more than 5 s.

d) If an open circuit occurs, as described in A.3.1, whilst the installation is switched on, the protective device shall operate in a time not exceeding 200 ms. If the mains supply is then switched off and switched on again, with the open-circuit condition still persisting, the device shall operate in not more than 5 s.

NOTE Special arrangements can be necessary in circuits with animation to ensure that any protective device does not continue to reset.

*After an open circuit has caused the protective device in a controlgear to operate, it shall remain as it is until the mains supply is also switched off. When the mains supply is switched on again, the protective device to shut off output power shall automatically reset. If the open-circuit fault is still present at the time of the reset, the protective device shall operate in accordance with a) to d).*

## 20 Screws, current-carrying parts and connections

IEC 61347-1:2015, Clause 17 applies.

## 21 Resistance to heat, fire and tracking

IEC 61347-1:2015, Clause 18 applies.

## 22 Resistance to corrosion

IEC 61347-1:2015, Clause 19 applies.

## 23 No-load rated output voltage and rated output current

The rated no-load output voltage of type A controlgear shall not exceed 5 000 V peak either between terminals or to earth.

The rated no-load output voltage of type B controlgear shall not exceed 5 000 V to earth or 10 000 V between terminals.

*Compliance of the rated no-load output voltage is checked by measurement.*

The rated output current of type A controlgear, measured in accordance with Annex A, shall not exceed either 35 mA (RMS) or 50 mA peak, whichever is larger.

The rated output current of type B controlgear, measured in accordance with Annex A, shall not exceed 200 mA (RMS) or 400 mA peak value, whichever is larger.

*Compliance of the rated output current is checked by measurement.*

## 24 Applicable annexes of IEC 61347-1

The following annexes of IEC 61347-1:2015 apply:

– Annex A (normative) Test to establish whether a conductive part is a live part which may cause an electric shock;
– Annex C (normative) Particular requirements for electronic lamp controlgear with means of protection against overheating;
– Annex D (normative) Requirements for carrying out the heating tests of thermally protected lamp controlgear;
– Annex F (normative) Draught-proof enclosure;
– Annex H (normative) Tests.

# Annex A
(normative)

# Measurement of current and voltages in the output circuits of electronic controlgear for neon tubes

## A.1 General

### A.1.1 Information to be provided by manufacturers

For test purposes, the manufacturer shall provide details of the following equivalent load resistors having low self-inductance and self-capacitance:

– load resistor $R_1$: resistor designed to provide rated output current of the controlgear;

– load resistor $R_2$: resistor designed to provide the maximum output power of the controlgear within its upper and lower shut-down limits;

– load resistor $R_3$: resistor designed to provide the output current of the controlgear at the minimum declared tube load;

– load resistor $R_4$: resistor designed to provide the output current of the controlgear at the maximum declared tube load.

The manufacturer of the controlgear shall declare the value of these resistors for an average sample of each controlgear operating at nominal supply voltage frequency. The manufacturer shall also specify the construction of the resistors to achieve the necessary low self-inductance and capacitance.

For controlgear having more than one output, and where the outputs are designed to supply different loads, the values of load resistors shall be separately specified for each output.

When used with controlgear having outputs balanced about earth potential, it is recommended that each of the resistors is specified as two half resistors to be connected in series. This will enable current measurements to be carried out at earth potential.

NOTE 1 Since the customer can operate the controlgear with tube loads outside the range specified by the manufacturer, resistor $R_2$ can provide an operating point outside the range limited by $R_3$ and $R_4$.

NOTE 2 Under certain conditions, one or more of the resistors can have the same value as others in the set for a particular controlgear.

NOTE 3 Because of the different characteristics between invertors of different manufacture but with the same current and voltage rating, the values of the resistors are likely to be specific to particular units.

### A.1.2 Measurement of output voltage and current

Measurement of output voltage or current shall be carried out in a precise manner in accordance with this Annex A.

NOTE This requirement was established since the outputs of controlgear can have a wide range and the output current and voltage waveforms can include spikes and thereby contain components of higher frequencies.

### A.1.3 Amplitude modulations

If the circuit of the controlgear allows the output waveform to become amplitude modulated, the following precautions shall be taken:

a) voltage measurements shall be carried out during the period of peak modulation;

b) current measurements shall be averaged over complete cycles of the modulation period.

### A.1.4 Spikes and high-frequency harmonics

To ensure accommodation of spikes and high-frequency harmonics, the measuring equipment shall either have:

a) a maximum time constant of 250 ns; or

b) a minimum sampling rate of 10 megasamples per second.

Where the output frequency exceeds 50 kHz, the time constant or sampling rate shall comply with the following:

– time constant $< 1/(f \times 80)$ s;

– sample rate $> f \times 200$ samples per second.

where

$f$ is the maximum output frequency of the controlgear in hertz.

The manufacturer of the controlgear shall specify the conditions under which the output voltage or current shall be measured. The manufacturer shall also specify all relevant parameters, including operating conditions, mounting position and cable arrangements.

### A.1.5 Test conditions

Where the test conditions cause protective circuits within the controlgear to operate, voltage and current measurements shall be made in the brief period before the protection operates.

## A.2 Instrumentation

To ensure that all transient waveforms, including both peak and RMS values, are correctly recorded, measurements shall be made by using a digitizing oscilloscope or equivalent means. Where measurements are made on controlgear having two separate outputs, the oscilloscope shall have two input channels in order that the voltages or currents of both outputs may be captured simultaneously.

Oscilloscopes shall have a sampling rate consistent with that specified in A.1.4.

Voltage probes for oscilloscopes shall have

a) an input capacitance of not more than 4 pF;

b) a voltage capability exceeding the output voltage of the controlgear to be measured;

c) a time constant consistent with that specified in A.1.4.

Current probes for oscilloscopes shall have

a) an upper frequency response consistent with that specified in A.1.4;

b) a lower frequency response adequate to accommodate the fundamental frequency of operation of the controlgear without significant error.

The peak-to-peak amplitude of the sampled waveform shall exceed 7 bits in resolved amplitude (typically half-scale deflection on the oscilloscope). RMS values shall be derived using software processing of the sampled waveform.

The four resistive loads $R_1$, $R_2$, $R_3$, and $R_4$ (see A.1.1) shall have the following characteristics:

a) their measured resistance shall lie within ±2 % of their nominal value over a temperature range from 10 °C up to and including their maximum operating temperature;

b) the series reactive impedance caused by self-inductance shall be less than 2 % of the nominal value of the resistive load;

c) the parallel reactive impedance caused by self-capacitance shall not be less than 50 times the nominal value of the resistive load.

## A.3 Measurements

### A.3.1 Measurement of no-load output voltage

#### A.3.1.1 Load on output terminals

Both output terminals of the controlgear shall be loaded simultaneously with the same length of high-voltage cable, simulating capacitance to earth as required in A.3.1.2. The type of cable shall be either:

a) that specified by the manufacturer of the controlgear; or

b) a cable without an overall sheath or metal screen and having insulation appropriate to the output voltage of the controlgear.

To ensure consistent capacitance to earth, the cables shall be laid on a sheet of earthed metal with a second sheet of earthed metal laid on top of the cables. No voltage breakdown between any cable conductor and earth shall occur.

#### A.3.1.2 Capacitance between the output terminals and earth

The capacitance between the output terminals and earth shall be adjusted by altering the length of the cable until the maximum no-load output voltage of the controlgear is achieved. The length of cable shall be adjusted by either of the following methods:

a) where no maximum length of cable is specified by the manufacturer of the controlgear, the length of cable shall be increased in suitable steps up to the point where the maximum no-load output voltage is achieved;

b) where a maximum length of cable is specified by the manufacturer of the controlgear, the length of cable shall be decreased in suitable steps down to the point where the maximum no-load output voltage is achieved.

NOTE The maximum no-load output voltage need not necessarily occur with maximum capacitance.

#### A.3.1.3 Additional outputs

Where controlgear have more than one output, each pair of output terminals shall be loaded with varying lengths of cable as described in A.3.1.1 and A.3.1.2.

NOTE The type of cable to be used is subject to agreement between the test house and the manufacturer.

### A.3.2 Measurement of output current

Output currents into the appropriate load resistor shall be measured by using a current probe, as specified in Clause A.2 or equivalent means. Where possible, the probe or equivalent means shall be used at a voltage as near as possible to earth potential to reduce capacitive loading effects.

In the case of controlgear having outputs balanced about earth potential, it is recommended that the current probe be used at the mid-point of the equivalent load resistor so that the current measurements can be carried out at earth potential.

NOTE Even at low voltages to earth, stray capacitance can reduce the current reading. This effect can be reduced by minimizing this capacitance as much as possible.

### A.3.3 Measurement of earth fault currents

Earth fault currents shall be measured by either:

a) a current probe as specified in Clause A.2; or

b) a suitable non-inductive resistor connected into the fault path in such a way that one end of the resistor is at earth potential; or

c) equivalent means.

Earth fault currents shall be introduced at each output terminal in turn using suitable non-inductive resistors. The value of the resistor shall be reduced in small, equal value steps, increasing the fault current by not more than 5 % per step, until the earth-leakage protection of the controlgear operates. The last measured current plus the last incremental change in current shall be taken as the fault current trip level.

The measurements shall be carried out with the output of the controlgear also connected, in turn, to load resistors $R_1$, $R_3$ and $R_4$. The fault current trip level shall comply with the requirements of Clause 19 under all load conditions.

# Annex B
(informative)

## Schedule of more onerous requirements

Products found compliant with the previous edition of this document do not necessarily require complete requalification for demonstrating compliance with this document. Depending on the nature of the changes introduced, partial retesting or even no retesting may be appropriate, as the case may be.

For this document, no more onerous requirements have been introduced with respect to the previous edition, i.e. IEC 61347-2-10:2000 and IEC 61347-2-10:2000/AMD1:2008.

## Bibliography

IEC 60050-151, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices,* available at https://www.electropedia.org

IEC 61347-2-10:2000, *Lamp controlgear – Part 2-10: Particular requirements for electronic invertors and convertors for high-frequency operation of cold start tubular discharge lamps (neon tubes)*
IEC 61347-2-10:2000/AMD1:2008

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# SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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# APPAREILLAGES DE COMMANDE POUR LES SOURCES DE LUMIÈRE ÉLECTRIQUES – SÉCURITÉ –

## Partie 2-10: Exigences particulières – Appareillages électroniques destinés à l'alimentation en haute fréquence des lampes à décharge tubulaires à cathode froide (tubes néon)

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L'IEC 61347-2-10 a été établie par le sous-comité 34C: Appareils auxiliaires pour lampes, du comité d'études 34 de l'IEC: Éclairage. Il s'agit d'une Norme internationale.

Cette seconde édition annule et remplace la première édition parue en 2000 et l'Amendement 1:2008. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) ajout de références datées le cas échéant;

b) clarification des numéros d'entités d'échantillonnage.

Le texte de cette Norme internationale est issu des documents suivants:

| Projet | Rapport de vote |
|---|---|
| 34C/1584/CDV | 34C/1592/RVC |

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/publications/.

Le présent document est destiné à être utilisé conjointement avec l'IEC 61347-1:2015 et l'IEC 61347-1:2015/AMD1:2017. Lorsque les exigences de l'un des articles de l'IEC 61347-1:2015 et de l'IEC 61347-1:2015/AMD1:2017 sont citées en référence dans le présent document par la phrase "L'IEC 61347-1:2015, Article n et l'IEC 61347-1:2015/AMD1:2017, Article n s'appliquent", cette phrase signifie que l'ensemble des exigences de cet article de l'IEC 61347-1:2015 et de l'IEC 61347-1:2015/AMD1:2017 s'appliquent, excepté les exigences qui ne s'appliquent explicitement pas au type particulier d'appareillage couvert par le présent document.

NOTE Dans le présent document, les caractères d'imprimerie suivants sont utilisés:

– *déclarations de conformité: caractères italiques.*

Une liste de toutes les parties de la série IEC 61347, publiées sous le titre général *Appareillages de commande pour les sources de lumière électriques – Sécurité*, se trouve sur le site web de l'IEC.

Les futurs documents de cette série porteront le nouveau titre général cité ci-dessus. Le titre des documents qui existent déjà dans cette série sera mis à jour lors de leur prochaine édition.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé, ou
- révisé.

# INTRODUCTION

Les exigences techniques spécifiées dans le présent document par rapport à l'IEC 61347-2-10:2000 et à l'IEC 61347-2-10:2000/AMD1:2008 n'ont pratiquement pas évolué. Néanmoins, l'élaboration d'une nouvelle édition du présent document était inévitable, car sans l'ajout de références datées à l'IEC 61347-1:2015 et l'IEC 61347-1:2015/AMD1:2017, l'applicabilité de la quatrième édition de l'IEC 61347-1:—[1] aurait été implicite en raison des références à l'IEC 61347-1 non datées dans l'IEC 61347-2-10:2000 et l'IEC 61347-2-10:2000/AMD1:2008.

Lorsque le présent document fait référence à l'un des articles de l'IEC 61347-1:2015 et l'IEC 61347-1:2015/AMD1:2017, celui-ci spécifie le degré d'applicabilité de cet article. Des exigences supplémentaires sont également fournies, lorsque cela est nécessaire.

Dans le but de vérifier la sécurité des appareillages, il est nécessaire de vérifier leurs performances. Cependant, comme il n'existe aucune normalisation pour les caractéristiques des tubes néon, des charges de référence sont spécifiées dans le présent document afin d'obtenir des résultats d'essai reproductibles.



[1] Quatrième édition en cours d'élaboration. Stade à la date de publication IEC FDIS 61347-1:2024.

# APPAREILLAGES DE COMMANDE POUR LES SOURCES DE LUMIÈRE ÉLECTRIQUES – SÉCURITÉ –

## Partie 2-10: Exigences particulières – Appareillages électroniques destinés à l'alimentation en haute fréquence des lampes à décharge tubulaires à cathode froide (tubes néon)

## 1 Domaine d'application

La présente partie de l'IEC 61347 spécifie les exigences de sécurité des appareillages électroniques destinés à l'alimentation en haute fréquence des lampes à décharge tubulaires à cathode froide utilisées dans les enseignes et les installations à tubes à décharge lumineux et qui fonctionnent à une tension de sortie supérieure à 1 000 V, mais ne dépassant pas 10 000 V, pour la connexion directe à des tensions d'alimentation inférieures ou égales à 1 000 V en courant continu ou courant alternatif (à 50 Hz ou 60 Hz en courant alternatif).

NOTE 1 Par le passé, ce type d'appareillage était désigné par le terme "onduleur" ou "convertisseur".

NOTE 2 Au Japon, la limite de courant pour l'application du présent document est de 15 000 V.

Le présent document s'applique aux appareillages de types A et B, qui sont spécifiés comme suit:

– Type A: appareillages fonctionnant dans la plage de fréquences de 20 kHz à 50 kHz et dont la tension de sortie est inférieure ou égale à 5 000 V (valeur de crête) entre les bornes, avec un courant de sortie maximal limité à 35 mA (valeur efficace) et à 50 mA (valeur de crête) et une tension d'alimentation inférieure ou égale à 250 V.

  NOTE 3 Le courant de sortie d'une unité de type A peut être considéré comme ne présentant pas de danger de choc électrique en raison des limites appliquées sur le courant et la plage de fréquences.

  NOTE 4 Au Japon, une tension de sortie de 15 000 V est acceptable.

– Type B: appareillages fonctionnant dans la plage de fréquences de 10 kHz à 100 kHz et dont la tension de sortie à vide est inférieure ou égale à 10 000 V entre les bornes ou inférieure ou égale à 5 000 V entre les bornes et la terre, avec un courant de sortie maximal limité à 200 mA (valeur efficace) et à 400 mA (valeur de crête).

  NOTE 5 Au Japon, les appareillages de type B qui fournissent un courant de sortie supérieur à 50 mA ne sont pas acceptables.

## 2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60417, *Symboles graphiques utilisables sur le matériel,* disponible à l'adresse https://www.graphical-symbols.info/equipment

IEC 60598-1:2020, *Luminaires – Partie 1: Exigences générales et essais*

IEC 61347-1:2015, *Appareillages de lampes – Partie 1: Exigences générales et exigences de sécurité*
IEC 61347-1:2015/AMD1:2017

ISO 3864-1:2011, *Symboles graphiques – Couleurs de sécurité et signaux de sécurité – Partie 1: Principes de conception pour les signaux de sécurité et les marquages de sécurité*

## 3 Termes et définitions

Pour les besoins du présent document, les termes et les définitions de l'IEC 61347-1 ainsi que les suivants s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse https://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse https://www.iso.org/obp

**3.1**
**lampe à décharge tubulaire à cathode froide**
**tube néon**
lampe à décharge tubulaire dans laquelle la lumière est produite par la colonne positive d'une décharge lumineuse

Note 1 à l'article: Ces lampes ont un remplissage à basse pression d'un gaz rare (ou d'un mélange de gaz rares) voire de vapeur de mercure. Elles peuvent comporter un revêtement intérieur constitué de matériaux fluorescents.

**3.2**
**tension de sortie assignée à vide**
$U_o$
tension maximale assignée entre les bornes de sortie ou les extrémités des fils de sortie intégrés de l'onduleur ou du convertisseur connecté à la tension d'alimentation assignée et à la fréquence assignée, sans charge sur le circuit de sortie

Note 1 à l'article: Pour les formes d'onde sinusoïdales, la tension de sortie assignée à vide correspond à la valeur efficace ou à la valeur de crête, divisée par la racine carrée de 2. Pour les autres formes d'onde, cette tension correspond à la valeur efficace ou à une valeur équivalente déduite à partir de la valeur de crête, obtenue par calcul mathématique.

Note 2 à l'article: Pour les besoins du présent document, cette définition prévaut sur celle fournie dans l'IEC 61347-1.

[SOURCE: IEC 61347-1:2015, 3.9, modifié – La définition a été adaptée pour les besoins du présent document et les Notes à l'article ont été ajoutées.]

**3.3**
**onduleur**
convertisseur d'énergie qui convertit le courant continu en courant alternatif

**3.4**
**convertisseur**
unité destinée à la conversion électronique du courant alternatif à une fréquence donnée en une alimentation en courant alternatif à une autre fréquence

**3.5**
**dispositif de protection contre les défauts de fuite à la terre**
dispositif qui supprime la puissance de sortie de l'appareillage lorsqu'un courant de défaut à la terre circule entre toute partie du circuit de sortie à haute tension et la terre

**3.6**
**dispositif de protection contre les défauts de circuit ouvert**
dispositif qui supprime la puissance de sortie de l'appareillage dans l'éventualité d'un non-fonctionnement de la charge du tube ou d'une interruption dans le circuit de sortie à haute tension

Note 1 à l'article: Un dispositif de protection contre les défauts de circuit ouvert peut se déclencher en détectant une augmentation de la tension de sortie ou par d'autres moyens appropriés.

**3.7**
**limite supérieure de déclenchement**
tension de sortie de l'appareillage pour laquelle un dispositif de protection contre les défauts de circuit ouvert fonctionne

**3.8**
**circuit de sortie à haute tension**
partie du circuit constituée des éléments suivants:

a) câbles entre les bornes de sortie de l'appareillage et les tubes à décharge,

b) tubes à décharge,

c) éventuelles connexions en série entre les tubes de décharge,

mais qui n'inclut pas les éventuels composants internes ou les conducteurs de l'appareillage

**3.9**
**échantillon**
une ou plusieurs entités d'échantillonnage destinées à fournir des informations sur la population ou la matière, fournies par le fabricant ou le fournisseur responsable

[SOURCE: IEC 60050-151:2001, 151-16-19, modifié – "fournies par le fabricant ou le fournisseur responsable" a été ajouté.]

**3.10**
**entité d'échantillonnage**
l'une des entités individuelles dans une population d'entités semblables, ou une portion de matière formant une entité cohérente et prélevée en un lieu et en un moment

[SOURCE: IEC 60050-151:2001, 151-16-18]

## 4 Exigences générales

L'IEC 61347-1:2015, Article 4 s'applique.

Pour les appareillages de lampes électroniques équipés de moyens de protection contre la surchauffe, l'IEC 61347-1:2015, Annexe C s'applique également.

Les dispositions spécifiques à la température maximale assignée de l'enroulement $t_w$ ne s'appliquent pas.

## 5 Généralités sur les essais

L'IEC 61347-1:2015, Article 5 s'applique, ainsi que ce qui suit:

– L'IEC 61347-1:2015, Annexe H s'applique.

– Une entité d'échantillonnage doit être utilisée pour l'ensemble des essais, sauf spécification contraire dans l'article correspondant.

  Pour permettre la réalisation des essais en parallèle et réduire la durée des essais, des entités d'échantillonnage supplémentaires peuvent être utilisées, sauf lorsque le résultat de l'essai peut être influencé par les essais précédents, par exemple les essais de l'Article 11 et de l'Article 12.

  Des entités d'échantillonnage spécialement confectionnées peuvent être utilisées, si cela est exigé.

Pour plus d'informations sur la requalification des produits conformes à l'édition précédente du présent document, c'est-à-dire l'IEC 61347-2-10:2000 et l'IEC 61347-2-10:2000/AMD1:2008, voir l'Annexe B.

## 6 Classification

L'IEC 61347-1:2015, Article 6 s'applique, ainsi que ce qui suit:

En outre, les appareillages doivent être classés en fonction de leur tension de sortie assignée à vide, des caractéristiques assignées de leur fréquence de fonctionnement et de leur plage de courants de sortie, comme suit:

a) appareillages de type A;

b) appareillages de type B.

Les appareillages de type B peuvent comporter plus d'une sortie. Dans ce cas, chaque sortie doit être conforme à ce qui précède.

## 7 Marquage

### 7.1 Marquages et informations

#### 7.1.1 Marquages obligatoires

Les appareillages, autres que les appareillages intégrés, doivent porter les marquages suivants:

– les marquages a), b), c), d), e) et f) indiqués dans l'IEC 61347-1:2015, 7.1 et l'IEC 61347-1:2015/AMD1:2017, 7.1;

– pour les appareillages indépendants, une notice d'avertissement pour la haute tension ("HAUTE TENSION", par exemple) et un symbole en forme de flèche conformément à l'IEC 60417-6042:2010-11 et à la Figure 3 de l'ISO 3864-1:2011.

Ce marquage doit être placé à l'extérieur de l'enveloppe de l'appareillage pour qu'il soit clairement visible.

– type A ou type B, selon le cas.

Si l'onduleur ou le convertisseur électronique comporte plus d'une unité séparée, les informations nécessaires relatives aux autres unités associées (comme les alimentations en courant continu ou les condensateurs) doivent être apposées par marquage sur les unités qui fournissent les sorties.