

# **Forkoblingsenheder til lamper – Del 2-13: Særlige krav til jævnstrøms- eller vekselstrømsforsynede elektroniske forkoblingsenheder til LED-moduler**

Lamp controlgear – Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules

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EUROPEAN STANDARD

**EN 61347-2-13**

NORME EUROPÉENNE

EUROPÄISCHE NORM

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Supersedes EN 61347-2-13:2006

English Version

**Lamp controlgear - Part 2-13: Particular requirements for d.c. or  
a.c. supplied electronic controlgear for LED modules  
(IEC 61347-2-13:2014)**

Appareillages de lampes - Partie 2-13: Exigences  
particulières pour les appareillages électroniques alimentés  
en courant continu ou alternatif pour les modules de LED  
(CEI 61347-2-13:2014)

Geräte für Lampen - Teil 2-13: Besondere Anforderungen  
an gleich- oder wechselstromversorgte elektronische  
Betriebsgeräte für LED-Module  
(IEC 61347-2-13:2014)

This European Standard was approved by CENELEC on 2014-10-08. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

## Foreword

The text of document 34C/1092/FDIS, future edition 2 of IEC 61347-2-13, prepared by SC 34C, "Auxiliaries for lamps", of IEC TC 34, "Lamps and related equipment", was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61347-2-13:2014.

The following dates are fixed:

- latest date by which the document has (dop) 2015-07-08  
to be implemented at national level by  
publication of an identical national  
standard or by endorsement
- latest date by which the national (dow) 2017-10-08  
standards conflicting with the  
document have to be withdrawn

This document supersedes EN 61347-2-13:2006

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

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

## Endorsement notice

The text of the International Standard IEC 61347-2-13:2014 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60051 Series	NOTE	Harmonised in EN 60051 Series.
IEC 60085:2004	NOTE	Harmonised as EN 60085:2008.
IEC 60364-4-41:2005	NOTE	Harmonised as HD 60364-4-41:2007.
IEC 60384-14:2005	NOTE	Harmonised as EN 60384-14:2005.
IEC 60950-1:2005	NOTE	Harmonised as EN 60950-1:2006.
IEC 61558-1:2005	NOTE	Harmonised as EN 61558-1:2005.
IEC 61558-2-1:2007	NOTE	Harmonised as EN 61558-2-1:2007.
IEC 61558-2-4:2009	NOTE	Harmonised as EN 61558-2-4:2009.
IEC 61558-2-13:2009	NOTE	Harmonised as EN 61558-2-13:2009.

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61347-1 (mod)	2007	Lamp controlgear -- Part 1: General and safety requirements	EN 61347-1	2008
+A1	2010		+A1	2011
+A2	2012		+A2	2013
IEC 61347-2-7	2011	Lamp controlgear -- Part 2-7: Particular requirements for battery supplied electronic controlgear for emergency lighting (self-contained)	EN 61347-2-7	2012
IEC 61547	-	Equipment for general lighting purposes - EMC immunity requirements	EN 61547	-
IEC 61558 series	-	Safety of power transformers, power supplies, reactors and similar products -- Part 1: General requirements and tests	EN 61558 series	-
IEC 61558-2-6	2009	Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V -- Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers	EN 61558-2-6	2009
IEC 61558-2-16	2009	Safety of transformers, reactors, power supply units and similar products for voltages up to 1 100 V -- Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units	EN 61558-2-16	2009
IEC 62384	2006	D.C. or A.C. supplied electronic control gear for LED modules - Performance requirements	EN 62384	2006







IEC 61347-2-13

Edition 2.0 2014-09

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Lamp controlgear –  
Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear  
for LED modules**

**Appareillage de lampes –  
Partie 2-13: Exigences particulières pour les appareillages électroniques  
alimentés en courant continu ou alternatif pour les modules de LED**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## LAMP CONTROLGEAR –

**Part 2-13: Particular requirements for d.c. or  
a.c. supplied electronic controlgear for LED modules**

## 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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- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61347-2-13 has been prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lamps and related equipment.

This second edition cancels and replaces the first edition published in 2006. This edition constitutes a technical revision.

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

- a) Replacement of the SELV-equivalent requirements by SELV requirements and reference to the SELV requirements of Annex L in IEC 61347-1:2007/AMD2:2012.
- b) Reference to IEC 61347-1 for the protection against accidental contact with live parts, moisture resistance and insulation and electric strength.
- c) New Annex J for emergency lighting requirements.

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

FDIS	Report on voting
34C/1092/FDIS	34C/1106/RVD

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

This standard shall be used in conjunction with IEC 61347-1. 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 61347-1:2007/AMD1:2010/AMD2:2012, 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.

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

In this standard, the following print types are used:

- requirements: in roman type,
- *test specifications: in italic type,*
- notes: in small roman type.

A list of all parts in the IEC 61347, published under the general title *Lamp controlgear* can be found on the IEC website.

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

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

## INTRODUCTION

This second edition of IEC 61347-2-13 is published in conjunction with IEC 61347-1. The formatting into separately published parts provides for ease of future amendments and revisions. Additional requirements will be added as and when a need for them is recognized.

This standard and the parts which make up IEC 61347-2, in referring to any of the clauses of IEC 61347-1 specify the extent to which such a clause is applicable and the order in which the tests are to be performed; they also include additional requirements as necessary. All parts which make up IEC 61347-2 are self-contained and therefore do not include references to each other.



## LAMP CONTROLGEAR –

### Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules

#### 1 Scope

This part of IEC 61347 specifies particular safety requirements for electronic controlgear for use on d.c. or a.c. supplies up to 1 000 V (a.c. at 50 Hz or 60 Hz) and at an output frequency which can deviate from the supply frequency, associated with LED modules.

Controlgear for LED modules specified in this standard are designed to provide constant voltage or current at SELV or higher voltages. Deviations from the pure voltage and current types do not exclude the gear from this standard.

The annexes of IEC 61347-1 which are applicable according to this Part 2-13 and using the word “lamp” are understood to also comprise LED modules.

Particular requirements for SELV controlgear are given in Annex I.

Performance requirements are covered by IEC 62384.

Plug-in controlgear, being part of the luminaire, are covered as for built-in controlgear by the additional requirements of the luminaire standard.

#### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61347-1:2007, *Lamp controlgear – Part 1: General and safety requirements*  
*Amendment 1:2010*  
*Amendment 2:2012*

IEC 61347-2-7:2011, *Lamp controlgear – Part 2-7: Particular requirements for battery supplied electronic controlgear for emergency lighting (self-contained)*

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

IEC 61558 (all parts), *Safety of power transformers, power supplies, reactors and similar products*

IEC 61558-2-6:2009, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers*

IEC 61558-2-16:2009, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units*



IEC 62384:2006, *DC or AC supplied electronic controlgear for LED modules – Performance requirements*

### 3 Terms and definitions

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

#### 3.1

##### **electronic controlgear for LED modules**

unit inserted between the supply and one or more LED modules which serves to supply the LED module(s) with its (their) rated voltage or rated current

Note 1 to entry: The unit may consist of one or more separate components and may include means for dimming, correcting the power factor and suppressing radio interference, and further control functions.

Note 2 to entry: The controlgear consists of a power supply and a control unit.

Note 3 to entry: The controlgear may be partly or totally integrated in the LED module.

#### 3.2

##### **d.c. or a.c. supplied controlgear**

controlgear that includes stabilising elements for operating one or more LED module(s)

#### 3.3

##### **SELV controlgear**

controlgear providing an SELV output isolated from the supply mains by means such as a safety isolating transformer, as specified in IEC 61558-2-6 and IEC 61558-2-16

#### 3.4

##### **associated controlgear**

controlgear designed to supply specific appliance(s) or equipment, incorporated or not incorporated

EXAMPLE: An electronic controlgear within an emergency unit where it is assigned in a one-to-one relation to a battery driven ballast.

#### 3.5

##### **plug-in controlgear**

controlgear incorporated in an enclosure provided with an integral plug as the means of connection of the electrical supply

#### 3.6

##### **rated output voltage for constant voltage controlgear**

output voltage, at rated supply voltage, rated frequency and at rated output power, assigned to the controlgear

#### 3.7

##### **rated output current for constant current controlgear**

output current, at rated supply voltage, rated frequency and at rated output power, assigned to the controlgear

#### 3.8

##### **light emitting diode**

##### **LED**

solid state device embodying a p-n junction, emitting optical radiation when excited by an electric current

Note 1 to entry: This definition is independent from the existence of enclosure(s) and of terminals.

[SOURCE: IEC 60050-845:1987, 845.04.40]

### 3.9

#### **LED module**

light source having no cap, incorporating one or more LED package(s) on a printed circuit board, and possibly including one or more of the following:

electrical, optical, mechanical, and thermal components, interfaces and controlgear

Note 1 to entry: A LED module may be integrated (LEDi module, Type 1) or semi-integrated (LEDsi module, Type 2) or nonintegrated (LEDni module, Type 3).

Note 2 to entry: The LED module is usually designed to be part of a LED lamp or LED luminaire.

### 3.10

#### **maximum output voltage**

maximum voltage which can occur between the output terminals for constant current controlgear in any load condition

### 3.11

#### **emergency lighting**

lighting provided for use when the supply to the normal lighting fails; it includes escape lighting and standby lighting

### 3.12

#### **rated emergency supply voltage or voltage range**

rated voltage or voltage range claimed by the manufacturer where the controlgear will operate according specification

### 3.13

#### **emergency output factor**

##### **EOF<sub>x</sub>**

ratio of the electrical output parameter when the control gear under test is operated in emergency mode to the output electrical parameter when the control gear is operated with the normal lighting conditions

Note 1 to entry: The electrical output parameter can be current (EOF<sub>I</sub>), voltage (EOF<sub>V</sub>) or power (EOF<sub>W</sub>) at the output(s) of the control gear (depending on the module it could be constant current, constant voltage or constant power).

Note 2 to entry: The emergency output factor is the minimum of the values measured at the appropriate time after failure of the normal supply and continuously.

### 3.14

#### **emergency supply current**

rated supply current of the control gear operating in the emergency mode

## 4 General requirements

The requirements of Clause 4 of IEC 61347-1:2007/AMD2:2012 apply, together with the following additional requirements.

- Controlgear providing SELV shall comply with the requirements of Annex I. This includes insulation resistance, electric strength, creepage distances and clearance between primary and secondary circuits.
- If a separating, isolating or autotransformer is used, it shall comply with the relevant parts of IEC 61558. If, however, insulated winding wires are used for controlgear with an input voltage of up to 300 V, the dielectric strength test voltage is limited to 3 kV for raw material.

## 5 General notes on tests

The requirements of Clause 5 of IEC 61347-1:2007/AMD2:2012 apply, with the following additional requirement.

The following number of specimens shall be submitted for testing:

- one unit for the tests of Clauses 6 to 12 and 15 to 20;
- one unit for the tests of Clause 14 (additional units or components, where necessary, may be required in consultation with the manufacturer).

## 6 Classification

Controlgear are classified according to the method of installation given in Clause 6 of IEC 61347-1:2007 and according to protection against electric shock as:

- auto-wound controlgear;
- separating controlgear;
- isolating controlgear;
- SELV controlgear.

## 7 Marking

### 7.1 Mandatory marking

Controlgear, other than integral controlgear, shall be clearly and durably marked, in accordance with the requirements of 7.2 of IEC 61347-1:2007, with the following mandatory markings:

- items a), b), c), d), e), f), k), l), m), t) and u) of 7.1 of IEC 61347-1:2007/AMD2:2012 together with:
- for constant voltage types:  $P_{rated}$  rated output power and  $U_{rated}$  rated output voltage;
- for constant current types:  $P_{rated}$  rated output power and  $I_{rated}$  rated output current;
- if applicable: an indication that the controlgear is suitable for operation with LED modules only.

### 7.2 Information to be provided if applicable

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

- items h), i), j) and s) of 7.1 of IEC 61347-1:2007/AMD2:2012 together with
- a mention of whether the controlgear has mains-connected windings of transformer.

Windings do not apply to ferrite inductors and ferrite line filters.

## 8 Protection against accidental contact with live parts

The requirements of Clause 10 of IEC 61347-1:2007/AMD2:2012 apply.

## 9 Terminals

The requirements of Clause 8 of IEC 61347-1:2007 apply.

## 10 Provisions for protective earthing

The requirements of Clause 9 of IEC 61347-1:2007/AMD2:2012 apply.

## 11 Moisture resistance and insulation

The requirements of Clause 11 of IEC 61347-1:2007/AMD1:2010/AMD2:2012 apply.

## 12 Electric strength


The requirements of Clause 12 of IEC 61347-1:2007/AMD2:2012 apply.

## 13 Thermal endurance test for windings of ballasts

The requirements of Clause 13 of IEC 61347-1:2007/AMD2:2012 are not applicable.

## 14 Fault conditions

The requirements of Clause 14 of IEC 61347-1:2007/AMD1:2010/AMD2:2012 apply, together with the following additional requirements.

In the case of controlgear provided with the marking , the requirements specified in Annex C shall be fulfilled.

## 15 Transformer heating

### 15.1 General

If a controlgear contains an SELV, isolating and separating transformer, the controlgear shall be tested according to Clauses L.6 and L.7 of IEC 61347-1:2007/AMD2:2012, where the requirements for controlgear providing SELV are valid also for separating and isolating controlgear.

For SELV controlgear, the output voltage shall not exceed the limits given in 10.4 of IEC 61347-1:2007/AMD2:2012, during the tests of 15.1 and 15.2 of this standard.

### 15.2 Normal operation

The requirements of Clause L.6 of IEC 61347-1:2007/AMD2:2012 apply, together with the following additional requirement.

For built-in and integral controlgear, tests shall be made under conditions such that the convertor is brought to  $t_c$ , as reached under normal operation at rated supply voltage.

### 15.3 Abnormal operation

The requirements of Clause L.7 of IEC 61347-1:2007/AMD2:2012 apply.

In addition, the following test at any voltage between 90 % and 110 % of the rated supply voltage shall be performed if relevant, with the controlgear operating according to the manufacturer's instructions (including heatsinks, if specified) for 1 h.

Connect double the LED modules or equivalent load for which the controlgear is designed:



- in parallel to the output terminals, for constant voltage output types;
- in series to the output terminals, for the constant current output types.

During and at the end of the tests specified above, the controlgear shall show no defect impairing safety, nor shall any smoke or flammable gases be produced.

## **16 Construction**

The requirements of Clause 15 of IEC 61347-1:2007/AMD2:2012 apply.

## **17 Creepage distances and clearances**

Unless otherwise specified in Clause 14 of this standard, the requirements of Clause 16 of IEC 61347-1:2007 apply.

## **18 Screws, current-carrying parts and connections**

The requirements of Clause 17 of IEC 61347-1:2007 apply.

## **19 Resistance to heat, fire and tracking**

The requirements of Clause 18 of IEC 61347-1:2007 apply.

## **20 Resistance to corrosion**

The requirements of Clause 19 of IEC 61347-1:2007 apply.



**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 61347-1:2007/AMD2:2012 apply.



**Annex B**  
(normative)

**Particular requirements for thermally  
protected lamp controlgear**

The requirements of Annex B of IEC 61347-1:2007/AMD1:2010/AMD2:2012 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 61347-1:2007 apply.



**Annex D**  
(normative)

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

The requirements of Annex D of IEC 61347-1:2007 apply.



**Annex E**  
(normative)

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

The requirements of Annex E of IEC 61347-1:2007 apply only for windings of 50 Hz/60 Hz.





**Annex F**  
(normative)

**Draught-proof enclosure**

The requirements of Annex F of IEC 61347-1:2007 apply.



**Annex G**  
(normative)

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

The requirements of Annex G of IEC 61347-1:2007 are not applicable.



## **Annex H** (normative)

### **Tests**

The requirements of Annex H of IEC 61347-1:2007 apply.



**Annex I**  
(normative)

**Particular additional requirements for SELV d.c.  
or a.c. supplied electronic controlgear for LED modules**

The requirements of Annex L in IEC 61347-1:2007/AMD2:2012 apply.



## Annex J (normative)

### Particular additional safety requirements for a.c., a.c./d.c. or d.c. supplied electronic controlgear for emergency lighting

#### J.1 General

This annex specifies particular safety requirements of a.c., a.c./d.c. or d.c. supplied electronic controlgear for emergency lighting purposes intended for connection to a centralized emergency power supply, as, for example, central battery supply system. It does not apply to electronic controlgear used in self-contained emergency lighting luminaires as this is covered by IEC 61347-2-7.

#### J.2 Marking

##### J.2.1 Mandatory markings

The controlgear shall, in addition to the requirements of 7.1, be clearly marked with the following mandatory marking:

- a) a.c., a.c./d.c. or d.c. maintained emergency electronic controlgear shall be marked with the symbol:



[SOURCE: IEC 61347-2-7:2011]

- b) rated emergency power supply voltage or voltage range.

##### J.2.2 Information to be provided if applicable

In addition to the above mandatory markings and the requirements of 7.2, the following information shall either be given on the control gear or be made available in the manufacturer's catalogue or similar.

- a) Limits of the ambient temperature range within which an independent control gear will operate satisfactorily at the declared voltage (range).  
b) Emergency output factor ( $EOF_x$ ). In case of settable electrical output parameter, a range shall be provided.  
c) Information on whether the control gear is intended for use in luminaires for high-risk task area lighting.

#### J.3 General notes on tests

One specimen shall be submitted to all the tests.

The tests shall be carried out with the length of the output cable of both 20 cm and 200 cm unless otherwise declared by the manufacturer.

To give reproducible measurement results, one or more resistors ( $R_{load}$ ) shall be used as replacement for the LED lamps/module(s).  $R_{load}$  is determined from the rated output power and the rated output voltage or rated output current of the controlgear. The resistor ( $R_{load}$ ) shall be selected so that the value of the resistance shall not deviate by more than 1 % during the test. For electronic controlgear for LED lamps/modules a pure resistive load may cause



malfunction of the DUT. In these cases a combination of diodes and variable resistor equivalent to the LED lamp/module shall be used, which should ensure the maximum rated output current at the rated output voltage.

NOTE When a special starting procedure is used to allow the constant current controlgear to function properly, the method with the equivalent resistor can be used.

#### J.4 Starting conditions

Control gears shall start rated load(s) without adversely affecting the performance when operated in emergency mode.

*Compliance is under consideration.*

#### J.5 Operating condition

The provisions of 7.2 of IEC 62384:2006 apply at 90 % and 110 % of the rated emergency supply voltage.

*Compliance is checked by measurement.*

#### J.6 Emergency supply current

At the rated emergency supply voltage or voltage range, the emergency supply current shall not differ by more than  $\pm 15\%$  from the declared value when the control gear is operated in emergency mode with maximum load power.

The supply shall be of low impedance and low inductance.

*Compliance is checked by measurement.*

#### J.7 EMC immunity

For emergency supplied electronic controlgear the requirements of IEC 61547 apply.

#### J.8 Pulse voltage from central battery systems

The d.c. supplied emergency controlgear shall withstand, without failure, any pulses caused by switching other equipment in the same circuit.

*Compliance is checked by operating the controlgear at the maximum voltage of the rated voltage range in association with the rated load(s). The controlgear shall withstand, without failure, the number of pulse voltages given in Table J.1 superimposed, with the same polarity, on the supply voltage.*

**Table J.1 – Pulse voltages**

Number of voltage pulses	Pulse voltage		Period between each pulse
	Peak value V	Pulse width at half peak ms	
3	Equal to design	10	2

NOTE A suitable measuring circuit is shown in Figure G.2 of IEC 61347-1:2007.

## J.9 Tests for abnormal conditions

The provisions of Clause 12 of IEC 62384:2006 apply.

## J.10 Temperature cycling test and endurance test

The provisions of Clause 13 of IEC 62384:2006 apply.

## J.11 Functional safety ( $EOF_x$ )

The controlgear associated to the rated load shall provide the necessary output electric parameter in emergency mode. This is verified if the declared emergency output factor ( $EOF_x$ ) is achieved during emergency operation.

$EOF_x$  is measured 5 s and 60 s after switch on of the control gear in emergency mode at maximum emergency supply voltage and at minimum emergency supply voltage.

*Compliance is checked by the following test set-up.*

*Measurement of  $EOF_x$  shall be made using rated load(s).*

*Reference setting to measure the  $EOF_x$   
The emergency output factor ( $EOF_x$ ) is measured with the appropriate reference setting (depending on the module, it could be constant current, constant voltage or constant power).*

*Set-up to measure the  $EOF_x$  under emergency conditions  
The  $EOF_x$  is measured 5 s and 60 s after energizing the control gear. Afterwards it is measured in steady state conditions operated with the minimum supply voltage.*

*For the calculation of  $EOF_x$  the lower value of the measurements below is used:*

- a) electrical output parameter measured after 60 s at maximum voltage/electrical output parameter measured in reference setting;*
- b) electrical output parameter measured in steady state conditions at minimum supply voltage/electrical output parameter measured in reference setting.*

*After 5 s of operation with maximum emergency supply voltage at least 50 % of the declared  $EOF_x$  shall be reached).*

*The lowest value of the values measured at 60 s with maximum emergency supply voltage or in steady conditions at minimum emergency supply voltage shall be retained and compared with the one measured with the same rated load(s) operating with the appropriate reference setting. The ratio shall reach at least the declared  $EOF_x$ .*

*Replace 60 s by 0,5 s for controlgears declared suitable for high-risk task area lighting.*

In case of settable EOF, requirements are under consideration.

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