

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Lamp controlgear –

Part 2-7: Particular requirements for ~~battery~~ electric source for safety services (ESSS) supplied electronic controlgear for emergency lighting (self-contained)

Appareillages de lampes –

Partie 2-7: ~~Règles~~ Exigences particulières relatives aux appareillages électroniques alimentés par ~~batteries~~ source électrique de sécurité (ESSS) pour l'éclairage de secours (autonome)



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2021 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC online collection - oc.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Lamp controlgear –

Part 2-7: Particular requirements for ~~battery~~ electric source for safety services (ESSS) supplied electronic controlgear for emergency lighting (self-contained)

Appareillages de lampes –

Partie 2-7: ~~Règles~~ Exigences particulières relatives aux appareillages électroniques alimentés par ~~batteries~~ source électrique de sécurité (ESSS) pour l'éclairage de secours (autonome)

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.140.99

ISBN 978-2-8322-1063-6

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

REDLINE VERSION

VERSION REDLINE



Lamp controlgear –

Part 2-7: Particular requirements for ~~battery~~ electric source for safety services (ESSS) supplied electronic controlgear for emergency lighting (self-contained)

Appareillages de lampes –

Partie 2-7: ~~Règles~~ Exigences particulières relatives aux appareillages électroniques alimentés par ~~batteries~~ source électrique de sécurité (ESSS) pour l'éclairage de secours (autonome)

CONTENTS

FOREWORD	4
INTRODUCTION	6
INTRODUCTION to Amendment 1	6
INTRODUCTION to Amendment 2	7
1 Scope	8
2 Normative references	8
3 Terms and definitions	9
4 General requirements	12
5 General notes on tests	12
6 Classification	12
7 Marking	12
8 Protection against accidental contact with live parts	15
9 Terminals	15
10 Provisions for protective earthing	15
11 Moisture resistance and insulation	15
12 Electric strength	15
13 Thermal endurance test for windings of ~~ballasts~~ controlgear	15
14 ~~Fault conditions~~ Void	15
15 Starting conditions	15
16 Lamp current	16
17 Supply current	16
18 Maximum current in any lead (with cathode preheating)	16
19 Lamp operating current waveforms	16
20 Functional safety (EBLF, EOF _x)	17
21 Changeover operation	21
22 Recharging device	21
23 Protection against excessive discharge	25
24 Indicator	26
25 Remote control, rest mode, inhibition mode	26
26 Temperature cycling test and endurance test	28
27 Polarity reversal	28
28 Fault conditions	29
29 Construction	29
30 Creepage distances and clearances	29
31 Screws, current-carrying parts and connections	29
32 Resistance to heat, fire and tracking	29
33 Resistance to corrosion	29
34 Abnormal lamp conditions	30
35 Protection of associated components	35
Annex A (normative) Test to establish whether a conductive part is a live part, which may cause an electric shock	37

Annex B (normative) Particular requirements for thermally protected lamp controlgear	37
Annex C (normative) Particular requirements for electronic lamp controlgear with means of protection against overheating.....	37
Annex D (normative) Requirements for carrying out the heating test of thermally protected lamp controlgear	37
Annex E (normative) Use of constant S other than 4 500 in t_w tests.....	37
Annex F (normative) Draught-proof enclosure.....	37
Annex G (normative) Explanation of the derivation of the values of pulse voltages	38
Annex H (normative) Tests	38
Annex I (normative) ~~Batteries~~ ESSSs for emergency lighting luminaires	38
Annex J (informative) Rest mode and inhibition mode facilities	38
Annex K (normative) ~~Ballasts~~ Controlgear incorporating an automatic testing function for emergency lighting operation.....	39
Annex L (informative) Compatibility between normal mains operation electronic controlgear and ~~battery~~ electric source for safety services (ESSS) powered emergency operation controlgear.....	42
Annex M (informative) Example of battery manufacturer's declaration of design for a Li battery	45
Bibliography.....	46
Figure 1 – Suitable circuit for the measurement of lamp current and luminous flux.....	19
Figure 2 – ~~Circuit for testing~~ rectifying effect ~~test~~	32
Figure 3 – Circuit to test whether a controlgear can withstand a leaking burner	34
Figure 4 – Circuit to test whether a ~~ballast~~ controlgear can withstand rectification	35
Figure L.1 – Timing diagram: changeover operation.....	43
Figure L.2 – Supply voltage for the function test	44
Table 1 – Voltage per cell to which the battery is discharged	22
Table 2 – Relation between ~~r.m.s.~~ RMS working voltage and maximum peak voltage.....	36
Table 3 – Voltage, current and temperature values per cell.....	25
Table K.1 – Relevant requirements of IEC 62034.....	39
Table M.1 – Example of battery manufacturer's declaration of design for a Li battery.....	45

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LAMP CONTROLGEAR –

Part 2-7: Particular requirements for ~~battery~~ electric source for safety services (ESSS) supplied electronic controlgear for emergency lighting (self-contained)

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 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.

This consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.

IEC 61347-2-7 edition 3.1 contains the third edition (2011-12) [documents 34C/995/FDIS and 34C/1002/RVD], its amendment 1 (2017-10) [documents 34C/1354/FDIS and 34C/1359/RVD] and its amendment 2 (2021-12) [documents 34C/1536/FDIS and 34C/1540/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 61347-2-7 has been prepared by subcommittee 34C: Auxiliaries for lamps, of IEC technical committee 34: Lamps and related equipment.

This third edition constitutes a technical revision.

Significant changes introduced into this third edition include:

- modification of IEC 61347-2-7 to become a standard exclusively for d.c. battery supplied electronic controlgear for emergency lighting (self-contained). IEC 61347-2-3 Annex J is intended to cover centrally supplied emergency controlgear;
- update of Clause 22 – Recharging devices;
- modification of Clause 20 battery voltage characterisation to support EBLF measurement. This to simplify and increase reproducibility of testing;
- rationalisation of requirements between IEC 61347-2-7 and IEC 60598-2-22 requirements of IEC 60598-2-22 being transferred to IEC 61347-2-7.

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

This standard shall be used in conjunction with IEC 61347-1. This part 2 supplements or modifies the corresponding clauses in IEC 61347-1.

NOTE 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 of the IEC 61347 series, published under the general title *Lamp controlgear*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability date indicated on the IEC web site under 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

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 reference 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.

INTRODUCTION to Amendment 1

EBLF is the ratio of the light output of a light source in emergency mode to the rated light output under normal conditions. EBLF is controlled by the output characteristics (current, voltage, power) of the controlgear with which the light source is operated.

For conventional lamps like fluorescent lamps, the EBLF is defined by the light output ratio of the lamp operated at 100 % and in emergency mode.

$$\text{EBLF} = \Phi_{\text{emergency}} / \Phi_{100 \%}$$

For this measurement no special lamp is required, it is expected that all lamps of the same type show a very similar light output ratio independent of its manufacturer. The measurement is done at an ambient temperature of 25 °C. Due to the same dimensions and the identical cooling system (free air) the thermal conditions are identical for all lamps. The result is fully reproducible without any additional condition.

Special requirements for LED light sources

The light output of LED light sources depends also on the temperature at which they are operated. Typically the temperature is controlled by a heat sink on which it is mounted (e.g. luminaire surface).

This amendment describes a test method to evaluate the EBLF via an output factor (EOF_X) taking into account that the ratio of the forward current of the LED controlgear is directly proportional to the LED light output. Any non-linearity due to the increased efficacy at lower operation temperature leads to an increased tolerance of the light output in the emergency mode but always positive.

Controlgear, which operates the LED light source in normal operation as well as in emergency operation can be marked directly with the output factor. Controlgear, operating the LED module in emergency mode only needs to be marked with the output value, for example the forward current $I_{\text{emergency}}$.

INTRODUCTION to Amendment 2

The following significant technical changes have been introduced in this Amendment 2:

- a) clarification of rest mode and inhibiting mode requirements;
- b) introduction of requirements for controlgear using lithium batteries;
- c) introduction of requirements for controlgear using electric double-layer capacitors (EDLCs);
- d) introduction of the term "electric source for safety services (ESSS)" to cover both batteries and EDLCs;
- e) clarification of changeover operation requirements.

LAMP CONTROLGEAR –

Part 2-7: Particular requirements for ~~battery~~ electric source for safety services (ESSS) supplied electronic controlgear for emergency lighting (self-contained)

1 Scope

This part of IEC 61347 specifies particular safety requirements for ~~battery~~ electric source for safety services (ESSS) supplied electronic controlgear for maintained and non-maintained emergency lighting purposes.

It includes specific requirements for electronic controlgear and control units for self-contained luminaires for emergency lighting as specified ~~by~~ in IEC 60598-2-22.

It is intended for controlgear for fluorescent lamps, ~~but it is also applicable to~~ and other lamp types ~~e.g.~~ for example incandescent lamps, high pressure discharge lamps and LEDs.

This ~~standard~~ document covers the emergency mode operation of a controlgear. For controlgear with a combination of normal and emergency lighting operation, the normal lighting operation aspects are covered by the appropriate Part 2 of the IEC 61347 series.

DC supplied electronic controlgear for emergency lighting ~~may~~ can (or ~~may~~ not) include ~~batteries~~ the electric source for safety services (ESSS).

~~This standard also includes operational requirements for electronic controlgear, which, in the case of d.c. supplied electronic controlgear, are regarded as performance requirements. This is because non-operational emergency lighting equipment presents a safety hazard. It~~ This document does not apply to d.c. supplied electronic controlgear for emergency lighting, which are intended for connection to a ~~centralised~~ centralized emergency power supply system. A ~~centralised~~ centralized emergency power supply system could be a central battery system.

NOTE Annex J of IEC 61347-2-3:2011/AMD1:2016 applies to a.c., a.c./d.c. or d.c. supplied electronic controlgear for connection to ~~centralised~~ centralized emergency power supply systems that are also intended for emergency lighting operations from a.c./d.c. supplies.

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.

IEC 60081, *Double-capped fluorescent lamps – Performance specifications*

IEC 60598-2-22:2021, *Luminaires – Part 22: Particular requirements – Luminaires for emergency lighting*

IEC 60901, *Single-capped fluorescent lamps – Performance specifications*

IEC 60921, *Ballasts for tubular fluorescent lamps – Performance requirements*

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

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

IEC 61347-2-3, *Lamp control gear – Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps*

IEC 61558-1:2005, *Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests*
Amendment 1 (2009)¹

IEC 61558-2-1:2007, *Safety of power transformers, power supply units and similar products– Part 2-1: Particular requirements and tests for separating transformers and power supplies incorporating separating transformers for general applications*

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 62034, *Automatic test systems for battery powered emergency escape lighting*

3 Terms and definitions

For the purposes of this part of IEC 61347, the terms and definitions of Clause 3 of IEC 61347-1 and Clause 22.3 in IEC 60598-2-22 apply, together with the following:

3.1

emergency lighting

lighting provided for use when the supply to the normal lighting fails

3.2

changeover operation

automatic connection of the lamp to emergency lighting supply when failure of the normal lighting supply occurs, and connecting automatically back to the normal lighting supply when it is restored

3.3

recharging device

device to maintain the ~~battery charge and to recharge the battery within a specified time~~ charge of and recharge an electric source for safety services (ESSS)

3.4

protection device against extensive discharge

automatic device to disconnect the ~~ballast~~ controlgear from the ~~battery~~ electric source for safety services (ESSS) when the ~~battery~~ ESSS voltage drops below a certain value

3.5

rated duration of emergency operation

time, as claimed by the manufacturer, for which the rated emergency ballast lumen factor is achieved

¹ There exists a consolidated edition 2.1 (2009) comprising IEC 61558-1 (2005) and its Amendment 1 (2009).

3.6

maximum d.c. operating voltage

maximum supply voltage declared by the controlgear manufacturer

For battery supplied controlgear, this is the maximum battery voltage available in the fully charged condition.

3.7

rated d.c. operating voltage

nominal supply voltage declared by the controlgear manufacturer

For battery supplied controlgear, this is the nominal battery voltage declared by the battery manufacturer.

3.8

d.c. voltage range

voltage range between minimum and maximum rated d.c. operating voltages

3.9

rated a.c. operating voltage

nominal supply voltage declared by the controlgear manufacturer for battery charger or maintained controlgear operation

3.10

a.c. voltage range

voltage range between minimum and maximum rated a.c. operating voltages

3.11

remote control

device to prevent discharge of the ~~battery~~ electric source for safety services (ESSS) by the lamp operating circuit when normal illumination has been switched off centrally, ~~e.g. during night time~~

3.12

indicator

~~device to indicate that:~~

~~a) the battery is being charged,~~

~~b) circuit continuity exists through the tungsten filament of emergency lighting lamps where appropriate~~

device that indicates the luminaire is connected, the electric source for safety services (ESSS) is being charged, and circuit continuity exists through the tungsten filament of emergency lighting lamps where appropriate

3.13

emergency ballast lumen factor

EBLF

ratio of the emergency luminous flux of the lamp supplied by the emergency controlgear to the luminous flux of the same lamp operated with the appropriate reference ballast at its rated voltage and frequency

The emergency ballast lumen factor is the minimum of the values measured at the appropriate time after failure of the normal supply and continuously to the end of the rated time duration.

3.14

control unit

unit or set of units comprising a supply change-over system, ~~a battery~~ an electric source for safety services (ESSS) charging device and ~~where appropriate,~~ a means for testing as appropriate

3.15

automatic test function

~~an automatic testing~~ function for emergency lighting operation as covered by IEC 62034

3.16

emergency output factor

EOF_x

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

EXAMPLE: $I_{\text{emergency}}$ compared with I_{rated} according to IEC 61347-2-13.

Note 1 to entry: The electrical output parameter can be current (EOF_I), voltage (EOF_U) or power (EOF_P) at the output(s) of the controlgear (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 value measured at the appropriate time after failure of the normal supply and continuously for the duration of the emergency operation.

Note 3 to entry: The EOF_x of LED controlgear used for emergency operation only, is not indicated on the emergency controlgear as it depends directly also on the controlgear used for the normal operation mode. For example for EOF_I it can be calculated in the final application from $I_{\text{emergency}}$ and $I_{\text{normal mode}}$.

Note 4 to entry: The use of EOF_I higher than 1 is not suitable for direct calculation of the luminous flux of the luminaire in emergency mode.

3.17

emergency output current

$I_{\text{emergency}}$

forward current supplied to the LED light source measured at the output of the controlgear in emergency mode

3.18

$I_{\text{normal mode}}$

rated output current delivered from constant current controlgear to the LED light source in normal operating mode

3.19

rated duration of emergency operation

time, as claimed by the manufacturer, during which the rated emergency lumen output is provided

3.20

rest mode

state of a controlgear in a self-contained emergency luminaire where the output is intentionally shut down while the normal supply is off and that, in the event of restoration of the normal supply, automatically reverts to normal mode

[SOURCE: IEC 60598-2-22:2021, 22.3.18, modified – The definition has been revised to assign this function to the controlgear.]

3.21

remote inhibiting mode

state of a controlgear in a self-contained emergency luminaire which is inhibited from operating by a remote device while the normal supply is on and in the case of a normal supply failure when the controlgear in the luminaire does not change over to emergency mode

[SOURCE: IEC 60598-2-22:2021, 22.3.21, modified – The definition has been revised to assign this function to the controlgear.]

4 General requirements

The requirements of Clause 4 of IEC 61347-1 apply.

For controlgear that are rated for operation of a range of lamp types, the tests of Clauses 15, 16, 17, 18, 19, 20, 22 and 34 shall be repeated with each rated lamp type. For other tests, the lamp type having the highest rated power should be selected.

For controlgear incorporating an automatic test function, the relevant requirements of IEC 62034 as defined in Annex K of this standard apply.

5 General notes on tests

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

Number of specimens:

The following number of specimens shall be submitted for testing:

- 1 unit for the tests of Clauses 6 to 12, 15 to 27 and 29 to 34;
- 3 units may be used for the tests of Clause 15 to reduce the time test;
- 1 unit for the test of Clause 28, fault conditions (additional units or components, where necessary, may be required in consultation with the manufacturer);
- where required new ~~batteries~~ ESSSs of the type and make provided with the controlgear, or typical of the type specified by the controlgear manufacturer, shall be submitted.

Unless otherwise specified, the ~~battery~~ ESSS voltage shall be measured between the controlgear terminals.

For controlgear incorporating an automatic testing function, the controlgear supplied for test shall be provided with all additional system components and any external software that is required to verify correct operation of the automatic testing function.

6 Classification

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

In addition controlgear shall be classified according to the incorporation of an automatic testing function for emergency lighting operation, in accordance with IEC 62034:

- with automatic test function,
- without automatic test function.

7 Marking

7.1 Items to be marked

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

- items a), b), c), d), e), f), k) and l) of 7.1 of IEC 61347-1, together with open circuit voltage (for warning only, not to be tested);

- controlgear without an enclosure are only required to be marked with items a) and b) of Clause 7.1 if IEC 61347-1;
- indication of type and current rating of the fuse, if applicable;
- electronic controlgear complying with this standard shall be marked with the following symbol:



- controlgear classified as being provided with an automatic test function shall be marked with the symbol



- a declaration of the maximum working voltage (r.m.s.) according to Clause 35 between
 - output terminals;
 - any output terminal and earth, if applicable.

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

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

7.2 Information to be provided

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

NOTE 1 For integral controlgear, the requirements of this subclause may be met by the provision of equivalent information required by IEC 60598-2-22.

- items h), i), j), and n) of 7.1 of IEC 61347-1, together with
- mention of whether the ~~ballast~~ controlgear is suitable for use only on battery supply not having a trickle or intermittent re-charging circuits;
- rated duration of emergency operation for each lamp capable of being operated by the ~~ballast~~ controlgear;
- information whether the controlgear is intended for use in luminaries for high-risk task area lighting;
- mention of whether the controlgear is proof against supply voltage polarity reversal;
- declaration of the emergency ballast lumen factor (EBLF) for ~~each lamp capable of being operated by the ballast~~ controlgear for fluorescent lamp; for multi lamp controlgear the EBLF for each lamp-ballast combination;
- declaration of emergency output factor (EOF_x) for LED controlgear supplying light source in both normal and emergency operation. In case of settable electrical output parameter, a range shall be provided or alternatively the value of the electrical parameter (e.g. $I_{\text{normal mode}}$ and $I_{\text{emergency}}$ from constant current controlgear) shall be provided for the calculation of EOF.
- marking of the relevant output parameter (e.g. $I_{\text{emergency}}$ from constant current controlgear or output current range) for LED controlgear used for emergency operation only, since the EOF₁ is not applicable. In the case of controlgear providing different parameters from constant values (e.g. a combination of constant power for some load range and constant current for other load ranges) it shall be marked with the maximum $I_{\text{emergency}}$ and details for the parameters delivered shall be provided in the manufacturer's catalogue or similar.

- for LED controlgear providing constant current the minimum and the maximum output voltage load shall be provided. In addition, for settable controlgear the output voltage range shall be given for the whole range of currents in the manufacturer catalogue or similar (e.g. table or operating area diagram).
- limits of the ambient temperature range within which the ballast will start and operate the lamp as intended over the declared voltage range. If the ~~battery~~ ESSS or other parts of the controlgear have different limits, these values are to be declared;
- the manufacturer shall declare the type of insulation used between the supply and the ~~battery~~ ESSS circuit (e.g. no insulation, basic insulation or double/reinforced insulation);
- information on whether the recharging device will recharge the ~~battery~~ ESSS normally after the test of 22.3 (example: by incorporation of self-resetting replaceable fuse) or fail (example: by incorporation of single operation protection device);
- supply current from ~~battery~~ ESSS at rated d.c. operating voltage for each lamp capable of being operated by the ~~ballast~~ controlgear;
- for controlgear designed to use rechargeable battery, information required for correct battery selection shall be provided. ~~This to include:~~

If the manufacturer indicates that batteries are only replaceable with a specific type, the battery technology (e.g. NiMH) together with the type reference or the code of the replaceable battery shall be provided. If the battery is replaceable with another type, the following details shall be provided:

- technology of the battery (e.g. NiCd, NiMH, ~~etc.~~);
- type designation of the battery according to the relevant standard (e.g. temperature classification, ~~etc.~~);
- capacity and voltage of the battery;
- information about the charge rating of the controlgear (maximum and minimum charge current and voltage limits);
- information about the discharge rating request by the controlgear (maximum and minimum discharge current and voltage limits);
- temperature rating to provide the controlgear performances;

Controlgear containing any non-replaceable battery shall be marked to indicate that the battery is non-replaceable.

NOTE 2 All electrical data are based on 25 °C reference conditions.

NOTE 3 Reference to ~~a battery~~ an ESSS type and manufacturer is also acceptable.

- for controlgear designed to use an EDLC as an ESSS, information required for correct EDLC selection shall be provided.

If the manufacturer indicates that the EDLC is only replaceable with a specific type, the type reference or the code of the replaceable EDLC shall be provided. If the EDLC is replaceable with another type, the following details shall be provided:

- type of EDLC (according to the applicable IEC standard);
- rated voltage, and maximum charge voltage provided by the controlgear;
- capacity;
- temperature rating;
- temperature classification;
- dimensions.

Controlgear containing non-replaceable EDLC(s) shall be marked to indicate that the EDLC is non-replaceable.

NOTE 4 All electrical data are based on 25 °C reference conditions.

NOTE 5 Reference to an ESSS type and manufacturer is also acceptable.

- information regarding the installation, commissioning and use of controlgear having an automatic testing function.
- the rated charge time, if lower than 24 h, can be declared;
- the manufacturer shall make available information of the allowed time for the controlgear to stay in rest mode or remote inhibiting mode after a full charging period, in order to provide at least 50 % of the rated duration of the emergency operation.
 - time shall be declared in days;
 - for controlgear provided without battery or without a clear indication about which battery to use, details for calculation shall be provided in accordance with 25.6.2.

NOTE 6 Examples of declared periods are 7, 30 or 90 days.

8 Protection against accidental contact with live parts

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

9 Terminals

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

10 Provisions for protective earthing

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

11 Moisture resistance and insulation

The requirements of Clause 11 of IEC 61347-1 apply.

12 Electric strength

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

13 Thermal endurance test for windings of ~~ballasts~~ controlgear

The requirements of Clause 13 of IEC 61347-1 are not applicable.

14 ~~Fault conditions~~ Void

~~Not applicable.~~

15 Starting conditions

The ~~ballast~~ controlgear/control unit shall be designed so that the appropriate lamp(s) achieve sufficient switchings.

Compliance is checked by the following test:

Three new lamps shall achieve 200 switchings when operated at the rated operating voltage in a cycle: 30 s “on”, 120 “off”. If one lamp does not achieve 200 switchings, a further 3 lamps shall be tested, each of which shall achieve 200 switchings.

The 200 switchings shall occur from normal mode with lamp-OFF, and to emergency mode with lamp-ON.

After this test, the ~~ballast~~ controlgear/control unit shall start and operate the three lamps, pre-conditioned by 200 switchings, at the rated operating voltage.

Additionally, the same three lamps shall start and operate from the appropriate mains operation reference ~~ballast~~ controlgear/circuit.

16 Lamp current

The requirements in this clause only apply to fluorescent lamps. Requirements for other light sources are under consideration.

The controlgear shall limit the arc current delivered to a reference lamp to a value not exceeding 125 % of that delivered to the same lamp when operated with a reference controlgear. Measurements shall be made in 25 °C ambient temperature, the test controlgear shall be operated at its rated operating voltage, and the appropriate reference controlgear shall be operated at its rated voltage and frequency.

Reference lamps and ~~ballasts~~ controlgear shall be in compliance with IEC 60081, IEC 60901, IEC 60921 and IEC 60929.

17 Supply current

At the d.c. rated operating voltage, the supply current from the ~~battery~~ ESSS shall not differ by more than ± 15 % from the declared value when the ~~ballast~~ controlgear is operated with a reference lamp.

The supply shall be of low impedance and low inductance (applicable only to ~~batteries~~ ESSSs remote from the ~~ballast~~ controlgear).

Compliance is checked by measurement.

18 Maximum current in any lead (with cathode preheating)

The requirements in this clause only apply to fluorescent lamps. Requirements for other light sources are under consideration.

The current flowing in any one of the cathode terminations shall not exceed the value given in the relevant lamp data sheets of IEC 60081 and IEC 60901.

Compliance is checked by the relevant tests and measurements described in Clause 11 of IEC 60929.

19 Lamp operating current waveforms

The requirements in this clause only apply to fluorescent lamps. Requirements for other light sources are under consideration.

~~Ballasts~~ Controlgear shall provide the correct waveform.

The waveform of the current supplied in the steady state to a reference lamp, associated with a ~~ballast~~ controlgear supplied at its rated operating voltage, shall be such that the peak

current does not exceed 1,7 times the rated lamp current as specified on the relevant lamp data sheet of IEC 60081 and IEC 60901.

Additionally, the peak current shall not exceed 3 times the measured r.m.s. lamp current.

Compliance is checked by measurement.

20 Functional safety (EBLF, EOF_x)

20.1 Requirements for fluorescent lamp controlgear

The requirements ~~in this clause~~ of 20.1 only apply to fluorescent lamps. ~~Requirements for other light sources are under consideration.~~ Measurements shall be made using a new lamp which has been aged according to the appropriate lamp standard for initial luminous flux measurements.

The appropriate lamp associated to the controlgear shall provide the necessary light output after changeover to the emergency mode. This is verified if the declared emergency ballast lumen factor (EBLF) is achieved during emergency operation at 25 °C.

Compliance is checked by the following test:

Electronic controlgear provided with or without ~~batteries~~ ESSs:

For measurement of EBLF, voltages representative of a fully charged ~~battery~~ ESS and the ~~battery~~ ESS voltage present just before lamp extinguishing are used as follows:

V₁ – Full charge battery voltage per cell dependent on battery type as follows:

<i>NiCd (Nickel Cadmium)</i>	<i>1,35 V per cell;</i>
<i>NiMH (Nickel Metal-Hydride)</i>	<i>1,35 V per cell;</i>
<i>Pb (Lead acid)</i>	<i>2,10 V per cell;</i>
<i>Li(NiCoMn)O₂ (Lithium Nickel Manganese Cobalt Oxide)</i>	<i>4,0 V;</i>
<i>LiFePO₄ (Lithium Iron Phosphate)</i>	<i>3,65 V;</i>
<i>LTO (Lithium Titanate Oxide)</i>	<i>2,80 V;</i>

(values given by default and can be different depending on the battery manufacturer's declaration of design);

EDLC – Full charge EDLC voltage measured after full charge;

V_{min} – End of capacity battery voltage per cell dependent on battery type as follows:

<i>NiCd</i>	<i>1,10 V;</i>
<i>NiMH</i>	<i>1,10 V;</i>
<i>Pb</i>	<i>1,80 V;</i>
<i>Li(NiCoMn)O₂</i>	<i>3,10 V;</i>
<i>LiFePO₄</i>	<i>2,00 V;</i>
<i>LTO</i>	<i>1,65 V;</i>

(values given by default and can be different depending on the battery manufacturer's declaration of design);

EDLC – The lowest value measured at the end of emergency operation immediately before the light source extinguishes.

Where the controlgear cut off voltage is above these voltages, the cut off voltage becomes V_{min} .

Measurement of EBLF shall be made at 25 °C, using a lamp of the appropriate type and having not been lit for 24 h. The first measurements are made at V_1 at 5 s and 60 s after the application of the d.c. voltage, and then in steady conditions at V_{min} .

The lowest value of the values measured at 60 s and V_1 or in steady conditions at V_{min} shall be retained and shall reach at least the declared EBLF.

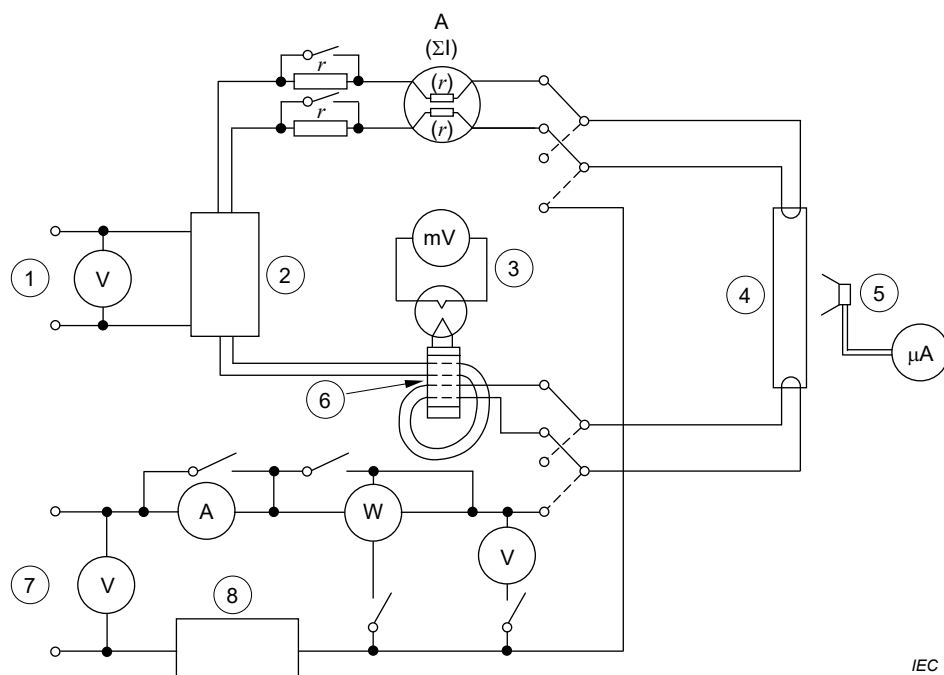
The value measured at 5 s and V_1 shall reach at least 50 % of declared EBLF.

NOTE 1 Replace 60 s by 0,5 s for ~~ballasts~~ controlgear declared for use in luminaires for high-risk task area lighting.

NOTE 2 As declared, EBLF ~~must~~ shall be reached after 0,5 s, measurements at 5 s are not considered.

NOTE 3 1 Any test circuit corresponding to that of Figure 1 can be used to make the measurement of EBLF. The luminous flux of a lamp is usually measured with an integrating photometer. For ratio measurements of luminous fluxes, a suitable illuminance meter is sufficient as there is a close relationship between luminous flux and illumination at a fixed point.

NOTE 4 2 Other methods may apply for determining EBLF, in particular methods which permanently record the luminous flux of the lamp associated to the ~~ballast~~ controlgear under test.



Key

- 1 Supply
- 2 **Ballast** Controlgear under test
- 3 Thermocouple
- 4 Reference lamp
- 5 Photocell
- 6 Current transformer
- 7 Supply
- 8 Reference ballast

Figure 1 – Suitable circuit for the measurement of lamp current and luminous flux

20.2 Requirements for LED lamp controlgear

20.2.1 Constant current LED controlgear: EOF_I and $I_{\text{emergency}}$

LED light sources show a direct relation between forward current and light output with only a slight deviation due to an improved efficacy when operated at lower temperatures.

The emergency output factor of the forward current, EOF_I , is the ratio of the average current measured in emergency mode ($I_{\text{emergency}}$) and the average forward current measured at rated conditions ($I_{\text{normal mode}}$).

Compliance is checked by the following test set-up:

For compliance measurements of EOF_I the controlgear shall be operated with a load producing the maximum and the minimum of the output voltage range (or power).

Electronic controlgear provided with or without ESSs:

For the measurement of $I_{\text{emergency}}$ and EOF_I voltages representative of a fully charged battery and the battery voltage present just before the lamp extinguishes are used as follows:

V_1 – Full charge battery voltage per cell dependent on battery type as follows:

NiCd	1,35 V per cell;
NiMH	1,35 V per cell;
Pb	2,10 V per cell;
Li(NiCoMn)O ₂	4,0 V;
LiFePO ₄	3,65 V
LTO	2,80 V;

(values given by default and can be different depending on the battery manufacturer's declaration of design).

EDLC – Full charge EDLC voltage measured after full charge;

V_{min} – End of capacity battery voltage per cell dependent on battery type as follows:

NiCd	1,10 V;
NiMH	1,10 V;
Pb	1,80 V;
Li(NiCoMn)O ₂	3,1 V;
LiFePO ₄	2,00 V;
LTO	1,65 V.

(values given by default and can be different depending on the battery manufacturer's declaration of design).

EDLC – the lowest value measured at the end of emergency operation immediately before the light source extinguishes.

Where the controlgear cut off voltage is above these voltages, the cut off voltage becomes V_{min} .

Measurement of $I_{emergency}$ shall be made at an ambient temperature of 25 °C. The first measurement of the output current is made at V_1 at 5 s and at 60 s after the application of the d.c. voltage.

The second measurement of the output current is made at V_{min} .

The lower of the current measured at 60 s and V_1 or V_{min} shall be retained as $I_{emergency}$ and shall reach at least the declared value for $I_{emergency}$ and EOF_1 when compared with the output current ($I_{normal mode}$) of the controlgear measured under normal conditions with the same load.

The value measured at 5 s and V_1 shall reach at least 50 % of the current $I_{emergency}$.

$$EOF_1 = \frac{I_{emergency}}{I_{normal mode}}$$

For LED controlgear declared for use in luminaires for high-risk task area lighting the measurements at V_1 are carried out after 0,5 s.

20.2.2 Constant voltage and constant power LED controlgear

Tests to check constant voltage and constant power LED controlgear are under consideration.

NOTE Voltage and/or power controlled LED controlgear are designed to operate LED light sources with an integrated current control unit. The light output ratio of the LED light source therefore depends directly on the characteristic of the LED module and on the heat sink (luminaire). Marking voltage and/or power controlled LED controlgear with EBLF or EOF_x is therefore outside the scope of this standard.

20.3 Requirements for other light source controlgear

Requirements for other light sources are under consideration.

21 Changeover operation

Changeover from normal to emergency mode shall occur at not less than 0,6 times rated supply voltage. It shall not occur at greater than 0,85 times rated supply voltage.

In the case of a rated supply voltage range, then changeover from normal to emergency mode shall occur at not less than 0,6 times the maximum of the rated supply voltage range. It shall not occur at greater than 0,85 times the minimum of the rated supply voltage range.

Controlgear with a selectable input voltage should be tested for changeover operation at each voltage setting.

The normal mains supply to the ~~ballast~~ controlgear shall be reduced within 0,5 s to 0,6 times rated voltage after which the emergency lamps shall operate.

The ~~ballast~~ controlgear shall be switched off and on 500 times, each cycle consisting of 2 s off and 2 s on (at 0,85 times the rated supply voltage), throughout these cycles and on completion the ~~ballast~~ controlgear shall operate the emergency lamp when switched into emergency mode operation.

NOTE 1 It may be necessary to ensure that ~~batteries~~ ESSs are not fully discharged before completion of this test. Additional charging periods ~~may~~ can be required.

For ~~ballasts~~ controlgear with rest mode facility, changeover from rest mode to normal mode shall occur automatically at not greater than 0,9 times the minimum rated supply voltage. In this case, the switching test is carried out as above but with the off cycle extended to 3 s minimum, with the rest mode command sent to the ~~ballast~~ controlgear after 2 s following the off periods in the 500 switching cycles. The off period time shall be as short as possible to ensure the operation of the rest mode facility.

NOTE 2 In Japan, changeover from normal to emergency mode at not less than 0,4 times the rated supply voltage is accepted. In the case of universal controlgear without a selectable input voltage, changeover from normal to emergency mode at not less than 0,4 times the minimum of the supply voltage range is accepted.

22 Recharging device

The recharging device, if provided, shall provide the rated charge performance as declared by the controlgear manufacturer to charge the ~~battery~~ ESS within 24 h, or the recharging time declared by the manufacturer as in 7.2, over the rated ambient temperature range and when operating at voltages within the range of 0,9 times the rated operating voltage (range) and 1,06 times the rated operating voltage (range).

Transformers built into controlgears for self-contained emergency luminaires for charging the batteries shall comply with the relevant requirements of IEC 61558-2-1:2009, IEC 61558-2-6:2009 and IEC 61558-2-16:2009, these requirements being specified ~~in 4.2 and 5.13 of IEC 61558-1:2005+Amendment 1:2009~~ for associated transformers as required in IEC 61558-1.

~~The output voltage of the recharging device shall not exceed 50 V d.c. during operation with or without the batteries connected.~~

Compliance is checked by the tests of 22.1 to 22.5.

22.1 Low temperature operation – The ~~battery~~ ESSS shall be charged for 48 h or twice the charge time as declared in 7.2 with a minimum of 12 h and then discharged until the voltage indicated in Table 1 is achieved.

Table 1 – Voltage per cell to which the battery is discharged

Battery type	Discharge condition/cell V	
	Duration: 1 h	Duration: 3 h
Nickel-cadmium	1,0	1,0
Lead-acid	1,75	1,80
Nickel-metal-hydride	1,0	1,0

Battery type	Discharge condition per cell V	
	Up to 1 h duration	Greater than 1 h duration
NiCd	1,0	1,0
Pb	1,75	1,8
NiMH	1,0	1,0
Li(NiCoMn)O ₂	3,0	3,0
LiFePO ₄	2,0	2,0
LTO	1,5	1,5

The values given apply at an ambient temperature of (20 ± 5) °C.

The above-mentioned limits can be modified if supported by the battery manufacturer's declaration of design.

The EDLC is discharged until the light source is off.

The values apply at an ambient temperature of (20 ± 5) °C ~~and the preferred duration specified in A.4.2 d) and A.5.2 c) of IEC 60598-2-22.~~

The recharging device shall then be operated to charge the fully discharged ~~battery~~ ESSS at 0,9 times the rated supply voltage and at the minimum of the declared ambient temperature range of the controlgear (if not declared, at room temperature), for a period of 24 h or the charge time as declared in 7.2.

During the test, all parts, including ~~batteries~~ the ESSSs and lamps, shall be placed within the test cabinet. ~~Where~~ When the ambient temperature rating limit of the test ~~battery~~ ESSS is different from that declared for the ~~ballast~~ controlgear ~~then~~, the ~~battery~~ ESSS should be held separately at its own ~~minimum~~ declared minimum temperature rating.

Normal lighting supply failure shall then be simulated and the ~~battery~~ ESSS shall operate the lamp from the controlgear for the rated duration of the operation.

- For controlgear designed to operate with batteries, at the end of the rated duration, the measured battery voltage shall be at least $V_{\min}$ as specified in Clause 20.
- For controlgear designed to operate with EDLCs, the duration of the light source operating in emergency mode shall be increased to a factor K_d that takes into consideration the EDLC capacitance degradation during its lifetime.

NOTE Details for the calculation of factor K_d are given in Clause A.8 of IEC 60598-2-22.

Compliance shall be checked by measurement.

22.2 High temperature operation – The test of 22.1 is repeated at 0,9 times the rated operating voltage but at the maximum of the declared ambient temperature range.

Normal lighting supply failure shall then be simulated and the ~~battery~~ ESSS shall operate the lamp from the controlgear for the rated duration of the operation.

- For controlgear designed to operate with batteries, at the end of the rated duration, the measured battery voltage shall be at least $V_{\min}$ as specified in Clause 20.
- For controlgear designed to operate with EDLCs the duration of the light source operating in emergency mode shall be increased to a factor K_d that takes into consideration the EDLC capacitance degradation during its lifetime.

NOTE Details for the calculation of factor K_d are given in Clause A.8 of IEC 60598-2-22.

During the test, all parts, including ~~batteries~~ ESSSs and lamps, shall be placed within the test cabinet. ~~Where~~ When the ambient temperature rating limit of the test ~~battery~~ ESSS is different from that declared for the ~~ballast~~ controlgear, ~~then~~ the ~~battery~~ ESSS should be held separately at its own ~~maximum~~ declared maximum temperature rating.

Compliance shall be checked by measurement.

22.3 Abnormal operating condition – The recharging device shall be operated at 1,1 times the rated supply voltage and the maximum of the declared ambient temperature range with the ~~batteries~~ ESSS disconnected and replaced by a short circuit ~~link~~. The test shall continue until stable conditions are achieved or a protective device (e.g. fuse or thermal link) operates.

There shall be no emission of flames or molten material, or production of flammable gases from the recharging device.

On completion of the test period, the short circuit link shall be removed, the ~~battery~~ ESSS shall be reconnected and user replaceable fuse links replaced where necessary. The recharging device shall remain safe. In the case of chargers containing self-resetting or user-replaceable protective devices, normal ~~battery~~ ESSS recharge shall occur.

~~**22.4** Maximum output voltage – The output voltage of the recharging device shall not exceed 50 V d.c. when operated at 1,1 times the rated supply voltage with and without the batteries connected.~~

~~*Compliance shall be checked by measurement.*~~

Void.

22.5 ~~Battery~~ ESSS charge and discharge characteristics – The test of ~~Subclause~~ 22.1 is repeated at 0,9 and 1,1 times the rated operating voltage but under reference operating ambient temperature characteristics of $25\text{ °C} \pm 2\text{ °C}$.

During both charge and discharge cycles, the current and voltage characteristics applied to the ~~battery~~ ESSS shall be within those declared by the ~~ballast~~ controlgear manufacturer, as required by ~~Subclause~~ 7.2 ~~of this standard~~.

Compliance shall be checked by measurement.

22.6 Lamp failure – Any lamp failure (emergency or normal operating lighting lamps) shall not interrupt the charging current to the ~~battery~~ ESSS and shall not cause an overload that could impair the operation of the ~~battery~~ ESSS.

Compliance is checked by removal of the lamp during ~~battery~~ ESSS charging. Testing is conducted under rated supply voltage conditions and at $25\text{ °C} \pm 2\text{ °C}$.

NOTE In Japan, JIL5501 and JIL5502² are used as application standards of the Building Law and Fire and Disaster Management Act instead of Subclauses 22.1 to 22.5.

22.7 Chargers for lithium batteries shall operate the cells in accordance with the recommendations of the battery manufacturer's declaration of design (an example can be seen in Annex M). Unless detailed otherwise by the battery manufacturer's declaration of design, recharging of the battery shall be in accordance with the criteria given in Table 1 and Table 3. To determine the values for a battery pack the values shall be calculated depending on the battery pack configuration of series and or parallel cells.

Additionally:

The battery charge shall not start if the cell temperature is below T_{cmin} (minimum temperature at charge start).

The battery charge shall not start if the cell temperature is above T_{cmax} (maximum temperature at charge start).

The temperature sensor location shall be defined in conjunction with the battery manufacturer and its position should be clearly marked on the label or manufacturer's data sheet. The thermal sensor location should reflect the maximum temperature of the battery pack.

NOTE 1 If a temperature sensor is built-in, for test purposes, this temperature can be simulated by a resistor with appropriate value.

NOTE 2 The temperature control can be contained within the battery, as part of the battery protection, or as part of the controlgear.

Unless otherwise declared by the battery manufacturer, if two or more cells are connected in series, each cell voltage shall be monitored separately with appropriate control such as equalization to ensure that the voltage limits of Table 3 are not exceeded. This control may be contained within the battery, as part of the battery protection, or as part of the controlgear.

Compliance shall be checked by measurement.

²—JIL5501, *Specification of luminaires for emergency lighting (escape lighting)*

—JIL5502, *Basic requirements for luminaires and active system for escape lighting*

Table 3 – Voltage, current and temperature values per cell

Battery cell type	$V_{\max}$	V_{rv}	V_{low}	$I_{low} @ V_{low}$	$I_{\max}$	I_{eoc}	T_{cmin}	T_{cmax}
Li(NiCoMn)O ₂	4,00 V	3,85 V	2,5 V	C5A (20 × 10 ⁻⁶)	0,5 C5A	0,02 C5A	5 °C	40 °C
LiFePO ₄	3,65 V	3,40 V	2,0 V	C5A (20 × 10 ⁻⁶)	0,5 C5A	0,02 C5A	0 °C	55 °C
LTO	2,80 V	2,75 V	1,5 V	C5A (20 × 10 ⁻⁶)	0,5 C5A	0,02 C5A	0 °C	45 °C

Key

$V_{\max}$ Maximum cell voltage

V_{rv} Cell recovery voltage (recommended voltage at which charge is started again after reaching $V_{\max}$ and charge stopped)

V_{low} Minimum cell voltage. V_{low} is also applicable to cells connected in series as part of a battery. The minimum battery voltage is referred as V_{blow} .

$I_{low} @ V_{low}$ Maximum permissible current draw at the minimum cell voltage

$I_{\max}$ Maximum charge current

I_{eoc} Charge current at "end of charge"

T_{cmin} Minimum cell temperature

T_{cmax} Maximum cell temperature

The above-mentioned limits can be modified if supported by a declaration supplied by the battery manufacturer.

These values for T_{cmin} and T_{cmax} are applicable for both the start of charge and during charge unless otherwise specified in the battery manufacturer's declaration of design.

23 Protection against excessive discharge

Controlgear utilizing lead-acid batteries, and controlgear utilizing a battery of three or more nickel-cadmium cells in series, or a battery of one or more NiMH or Li cells, shall be protected against polarity reversal of individual cells, or cells damage. This protection shall be achieved by the incorporation of an electrical system that limits further battery discharge to the current specified below when the battery voltage has fallen to $V_{low} V_{blow}$, determined below in a) to ed).

NOTE 1 This provision is intended to avoid an irreversible capacity loss due to a deep discharge of cells.

a) For lead-acid batteries:

- $V_{low} = X \cdot n$ where n is the number of cells.
 $X = 1,6 \text{ V}$ for 1 h duration or less;
 $X = 1,7 \text{ V}$ for greater than 1 h duration;
- $I \leq 10^{-5} \times C20A$ where C20 is the battery capacity in ampere hours for a 20 h constant current discharge.

This requirement applies to all emergency controlgear utilizing a lead-acid battery regardless of the number of cells.

b) For nickel-cadmium batteries:

- $V_{low} = X \cdot n$ where n is the number of cells.
 $X = 0,8 \text{ V}$ for all duration values.
- $I \leq 0,0015 \times C5A$ where C5 is the battery capacity in ampere hours for 5 h constant current discharge.

This requirement applies only to emergency controlgear utilizing a battery of three or more nickel cadmium cells in series.

c) For NiMh batteries:

- $V_{low} = X \cdot n$ where n is the number of cells;
 $X = 0,8 \text{ V}$ for all duration values.

If a higher value is specified by the battery manufacturer in the technical data sheet, this value will have to be applied for X .

- $I \leq 25 \times 10^{-6} \text{ C5A}$, or
- $I \leq 1 \times 10^{-3} \text{ C5A}$ during the first 72 h and then $5 \times 10^{-6} \text{ C5A}$, where C5 is the battery capacity in ampere hours for 5 h constant current discharge.

This requirement applies to all emergency controlgear utilizing a nickel metal hydride battery regardless of the number of cells.

d) For Li batteries:

- $V_{blow} = X \cdot n$ where n is the number of cells in series;
 X = refer to V_{low} in Table 3;

If a different value is specified by the battery manufacturer in the declaration of design, this value shall be applied for X .

- $I \leq I_{low} \cdot m$, where m is the number of cells in parallel, as per Table 3 or as specified by the battery manufacturer in the declaration of design.

The protection system shall prevent any further discharge of the batteries by a lamp or inverter, even where a battery voltage rise due to natural regeneration occurs, until the normal supply has been restored.

Compliance is checked by following test.

Following a full charge cycle (24 h at rated voltage), the battery voltage and discharge current are measured during an emergency mode cycle to full discharge (or battery cut-off switching). The battery voltage shall not fall below V_{low} and the discharge current shall not exceed that specified above. Testing is conducted at $25 \text{ °C} \pm 2 \text{ °C}$.

The battery cut-off switching point, of an emergency luminaire, can be higher than V_{blow} . In this case the luminaire is permitted to consume current at a level $> I_{low}$ until V_{blow} is reached.

NOTE 2 It can be necessary for the manufacturer to supply a sample controlgear and battery, with the battery $\geq V_{blow}$, so the test can be conducted.

24 Indicator

If the ~~ballast~~ controlgear has an indicator incorporated or associated, it shall comply with the requirements of 22.6.7 of IEC 60598-2-22.

Compliance is checked by inspection.

25 Remote control, rest mode, inhibition mode

NOTE A description of rest mode and inhibition mode function is given in Annex D of IEC 60598-2-22.

25.1 There shall be no switch between the ~~battery~~ ESSS and emergency lighting lamps other than the changeover device.

Controlgear shall not contain any manual or non-self-resetting switch isolating the emergency circuit(s) from the mains supply other than rest mode or inhibition mode testing facilities.

25.2 Controlgear with a rest mode facility shall be provided with either a control device or a means of connection of a remote facility for changing from emergency mode to rest mode. In the event of restoration of the normal supply, operation shall automatically revert to normal mode.

Controlgear intended for use with remote inhibiting facilities shall be provided with a means of connection to the remote inhibiting circuit.

Compliance is checked by inspection.

25.3 The operation of controlgear with a remote inhibiting facility in the emergency mode shall not be influenced by a short circuit or a contact to earth in the wiring to a remote control device.

Compliance is checked by simulation of these wiring faults in conjunction with the test of 28.2.

25.4 The operation of a remote control device for controlgear with rest mode or remote inhibiting facilities provided with the controlgear shall be independent of the ~~battery~~ ESSS of the controlgear and the normal mains supply.

Compliance is checked by inspection.

25.5 The operation of controlgear with rest mode facility in the emergency mode shall not be influenced by a short-circuit, a contact to earth or an interruption in the wiring to a remote control changeover device.

Compliance is checked by simulating these wiring faults in conjunction with the tests given in 28.2.

25.6 ~~In controlgear with a rest mode or inhibiting facility, the current drain from the batteries with the controlgear in rest mode shall not exceed the following:~~

- ~~— for lead-acid batteries $4 \times 10^{-5} \times C_{20}A$ where C_{20} is the battery capacity in ampere hours for a 20 h constant current discharge;~~
- ~~— for nickel-cadmium batteries $0,0015 \times C_5A$ where C_5 is the battery capacity in ampere hours for a 5 h constant current discharge;~~
- ~~— for nickel-metal hydride batteries $10^{-3} \times C_5A$ where C_5 is the battery capacity in ampere hours for a 5 h constant current discharge. It is furthermore limited to a maximum period of time of 21 days. Beyond this period, the current shall not exceed $25 \times 10^{-6} \times C_5A$. If the residual current consumed on the battery when in rest mode is lower than $1 \times 10^{-3} \times C_5A$, the maximum period of time of 21 days can be increased proportionally as necessary.~~

~~*Compliance is checked by measurement of the battery discharge current with the controlgear in the rest mode following a full battery charge cycle (24 h at rated supply voltage). Testing is conducted at $25^\circ C \pm 2^\circ C$.*~~

~~NOTE—The quantity of electricity consumed within 21 days at a rate of $1 \times 10^{-3} C_5A$ includes cell self-discharging.~~

For controlgear with rest mode or remote inhibiting mode, the drain current shall be limited according to 25.6.1 and 25.6.2.

25.6.1 In controlgear with rest mode or remote inhibiting mode, the current drain from the ESSS shall be measured with the controlgear in the rest mode or remote inhibiting mode, following a full ESSS charge cycle (24 h at rated supply voltage). For the measurement of I_{RM} a voltage source set at V_1 in accordance with Clause 20 may be used as an alternative method. Testing is conducted at $25^\circ C \pm 2^\circ C$.

25.6.2 The ESSS discharge current measured in 25.6.1 shall be used to calculate the maximum off time (T_{RM}) to stay in rest mode or remote inhibiting mode after a full charging period, in order to provide at least 50 % of the rated duration of emergency operation.

$$\text{For all ESSSs: } T_{RM} = (0,5 C_{nom}) / I_{RM}$$

where:

- T_{RM} is the calculated time to keep the emergency luminaire in rest mode or remote inhibiting mode preserving 50 % of its rated duration of emergency operation;
- C_{nom} is the nominal ESSS capacity expressed as intended by relevant standards;
- I_{RM} is the current drain from the ESSS in rest mode condition or remote inhibiting mode measured in accordance with 25.6.1.

Compliance is checked by comparing the calculated T_{RM} with declared rest/inhibition mode period. The calculated T_{RM} shall not be lower than the declared rest/inhibition period.

26 Temperature cycling test and endurance test

The controlgear shall operate satisfactorily during service.

Compliance shall be checked by the following tests.

The ~~ballast~~ controlgear shall be mounted in accordance with the manufacturer's instructions (including heat sinks, if specified), operated in association with appropriately rated lamp(s) at the maximum voltage of the rated voltage range and subjected to a temperature cycling test and an endurance test, as follows.

- a) *The temperature cycling test shall be carried out, starting at the lower limit of the ambient temperature range for 1 h. The temperature shall then be raised to the upper limit of the ambient temperature range and maintained there for 1 h. Five such temperature cycles shall be carried out.*
- b) *The endurance test shall be carried out at the ambient temperature which produces t_c for a period of 50 h.*

At the end of this time, and after cooling to room temperature, the controlgear shall restart and operate the lamps at its rated operating voltage.

27 Polarity reversal

When the ~~ballast~~ controlgear is declared to be proof against supply voltage polarity reversal, it shall be capable to operate with reverse voltage for 1 h.

Compliance is checked by operating ~~ballast~~ controlgear at reversed polarity for 1 h at the maximum d.c. operating voltage and with appropriate lamp(s). At the end of this test period, the supply shall be connected correctly and the lamp shall start and operate normally.

28 Fault conditions

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

28.2 The operation of controlgear in the emergency mode shall not be influenced by a short-circuit, a contact to earth or an interruption in the wiring of the normal supply to the controlgear.

Compliance is checked by simulation of these supply wiring faults during emergency mode operation. The controlgear shall function normally during the test.

28.3 For lithium batteries, the limits for $V_{\max}$ and $I_{\max}$ shall not be exceeded, in accordance with the values listed in Table 3 or as defined in the battery manufacturer's declaration of design.

29 Construction

The requirements of Clause 15 of IEC 61347-1 apply together with the following:

29.1.1 If applicable or if the devices in question are provided, 22.6.1, 22.6.7, 22.6.9, 22.6.11, 22.6.19 and 22.20 of IEC 60598-2-22 shall be complied with.

NOTE For the design of controlgear, the manufacturer should, in addition, keep in mind that Clauses 22.16 and 22.18 of IEC 60598-2-22 apply to a complete luminaire. As the tests in question cannot be made without a complete luminaire, no requirements in that respect are included in this standard (except for 22.16.1).

29.1.2 A ~~ballast~~ controlgear supplied with ~~batteries~~ an ESSS shall incorporate a battery or EDLC that meets the requirements of Annex I and is designed to operate the ESSS for at least ~~4~~ four years of normal operation. This ~~battery~~ ESSS shall be used only for emergency related functions within the luminaire or its satellite(s).

Compliance is checked by inspection and the tests specified in Annex I.

30 Creepage distances and clearances

The requirements of Clause 16 of IEC 61347-1 apply.

31 Screws, current-carrying parts and connections

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

32 Resistance to heat, fire and tracking

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

33 Resistance to corrosion

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

34 Abnormal lamp conditions

34.1 Controlgear shall not impair safety when operated under abnormal lamp conditions.

34.2 Abnormal conditions for controlgear for fluorescent lamps

Compliance is checked by the following test.

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

- a) the lamp or one of the lamps is not inserted;*
- b) the lamp does not start because one of the cathodes is broken;*
- c) the lamp does not start although the cathode circuits are intact (de-activated lamp);*
- d) the lamp operates, but one of the cathodes is de-activated or broken (rectifying effect).*

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

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

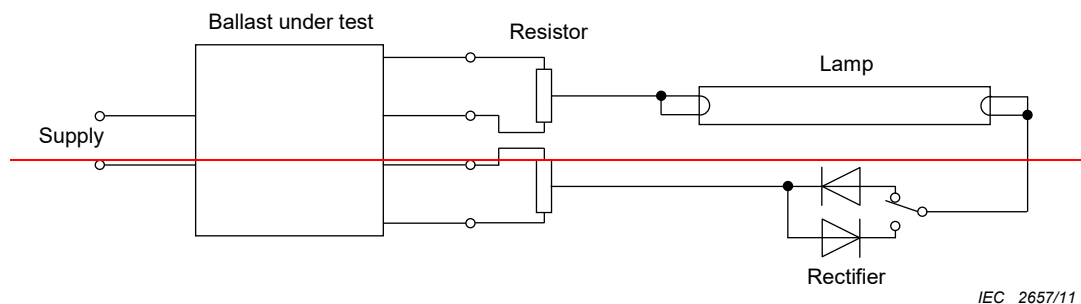
where

I_n is the rated lamp current of the lamp.

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

When testing electronic ~~ballasts~~ controlgear for the rectifying effect, the circuits shown in Figure 2a and Figure 2b ~~is~~ are used.

The lamp is connected to the midpoints of the appropriate equivalent resistors. The rectifier polarity is chosen so as to give the most unfavourable conditions. If necessary, the lamp is started using a suitable starting device.



The rectifier characteristics shall be:

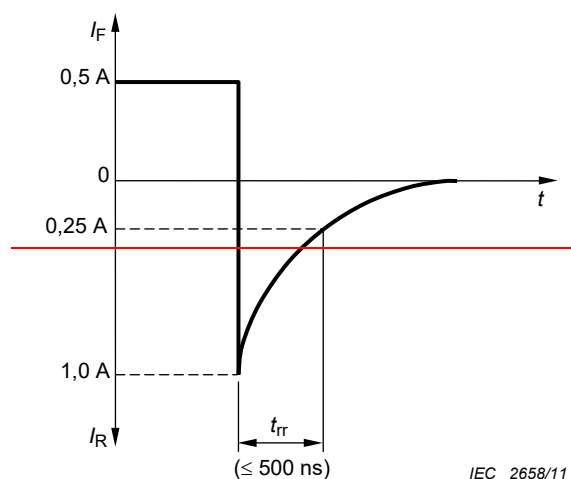
Peak inverse voltage $U_{RRM} \geq 3\,000\text{ V}$

Reverse leakage current $I_R \leq 10\text{ }\mu\text{A}$

Forward current $I_F \geq \text{three times nominal lamp running current}$

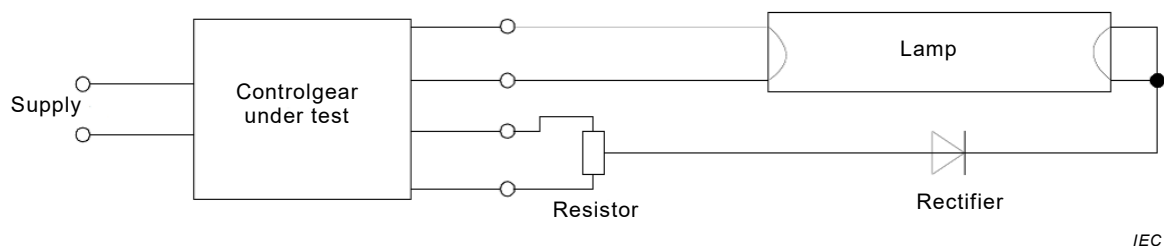
Reverse recovery time $t_{rr} \leq 500\text{ ns}$
(maximum frequency: 150 kHz) (measured with $I_F = 0,5\text{ A}$ and $I_R = 1\text{ A}$ to $I_R = 0,25\text{ A}$)

Figure 2a – Circuit for testing

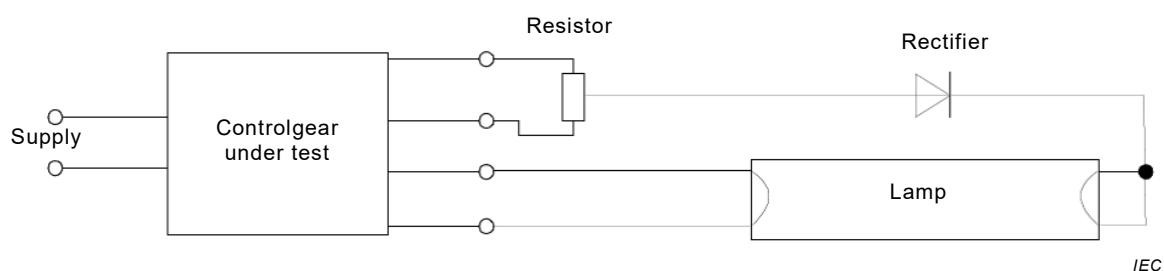


NOTE The following types of diodes (three diodes in series) are recommended as a suitable rectifier: RGP 30 M, BYM 96 E, BYV 16.

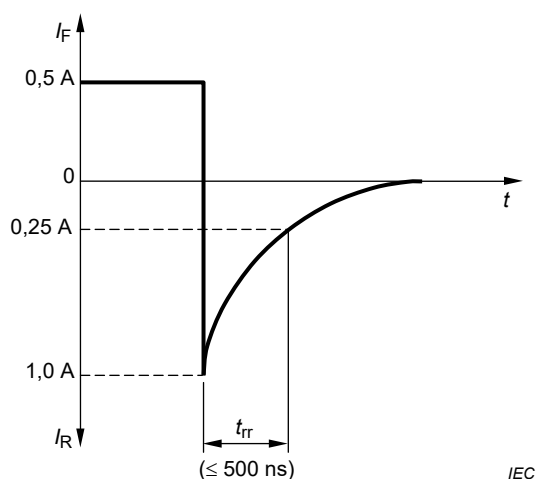
Figure 2b – Recovery time t_{rr} of the diode



a) Testing the first direction of the rectifying effect



b) Testing the opposite direction of the rectifying effect



c) Recovery time t_{rr} of the diode

Key

The rectifier characteristics shall be:

Peak inverse voltage $U_{RRM} \geq 3\,000\text{ V}$

Reverse leakage current $I_R \leq 10\text{ }\mu\text{A}$

Forward current $I_F \geq$ three times nominal lamp running current

Reverse recovery time $t_{rr} \leq 500\text{ ns}$

(maximum frequency: 150 kHz) (measured with $I_F = 0.5\text{ A}$ and $I_R = 1\text{ A}$ to $I_R = 0.25\text{ A}$)

The following types of diodes (three diodes in series) are recommended as a suitable rectifier: RGP 30 M, BYM 96 E, BYV 16.

Figure 2 – Circuit for testing rectifying effect ~~test~~

34.3 Abnormal conditions for d.c. supplied electronic step-down convertors for filament lamps

The output voltage of the convertor when operated under abnormal conditions shall not exceed 115 % of the rated output voltage.

Each of the following conditions shall be applied with the convertor operating according to the manufacturer's instructions (including heatsinks, if specified) for 1h.

- a) No lamp is inserted.
- b) Twice the number of lamps of the type for which the convertor is designed are connected in parallel to the output terminals.
- c) The output terminals of the convertor shall be short-circuited. If the convertor is designed for operation of more than one lamp, each pair of output terminals for connecting a lamp shall be short-circuited in turn.

34.4 Abnormal conditions for controlgear for d.c. supplied electronic controlgear for LED modules

34.4.1 The short circuit in 34.4.2 and 34.4.3 shall be applied with the length of the output cable of both 20 cm and 200 cm, unless otherwise declared by the manufacturer.

34.4.2 Controlgear that are of the constant voltage output type

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

- a) No LED module is inserted. If the controlgear is designed with multiple output circuits, each pair of corresponding output terminals for connecting a LED module shall be opened.
- b) Double the LED modules or equivalent load for which the controlgear is designed, connected in parallel to the output terminals.
- c) The output terminals of the controlgear shall be short-circuited.

If the controlgear is designed with multiple output circuits, each pair of corresponding output terminals for connecting a LED module shall be short-circuited in turn.

34.4.3 Controlgear that are of the constant current output type

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

- a) No LED modules are connected.
If the controlgear is designed with multiple output circuits, each pair of corresponding output terminals for connecting a LED module shall be opened in turn and then all opened simultaneously.

NOTE Opening of all terminals simultaneously is essential for the open load condition.

- b) Double the LED modules or equivalent load for which the controlgear is designed, connected in series to the output terminals.
- c) The output terminals of the controlgear shall be short-circuited.
If the controlgear is designed with multiple output circuits, each pair of corresponding output terminals for connecting a LED module shall be short-circuited in turn.

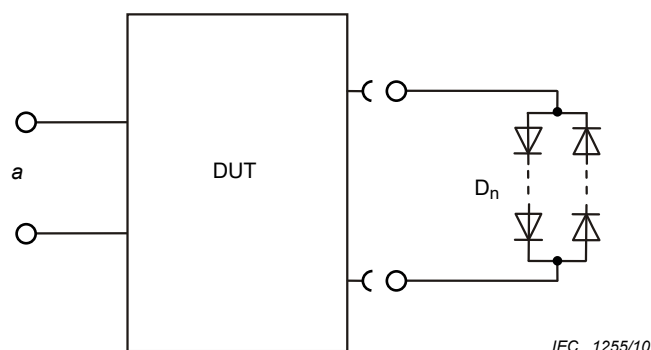
34.5 Abnormal conditions for ~~ballast~~ controlgear for d.c. supplied electronic controlgear for discharge lamps (excluding fluorescent lamps)

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

- a) lamp is not inserted or does not ignite;
- b) burner leaks;
- c) the lamp operates, but rectifies.

Condition a) is tested with open output.

Condition b) is tested with the circuit in Figure 3 (see below).



Key

- a supply
- DUT device under test
- D_n circuit of some diodes in series, and anti-parallel to them, the same number of diodes in series which yields a voltage of 10 V to 15 V across them.

Figure 3 – Circuit to test whether a controlgear can withstand a leaking burner

Condition c) is tested with circuit in Figure 4 (see below).

The lamp in the circuit is replaced by test circuit as shown in Figure 4.

Both current directions have to be checked: ~~ballast~~ controlgear terminal 1 with circuit wire 1 and ~~ballast~~ controlgear terminal 1 with circuit wire 2.

The control gear is stabilised at the ambient temperature of the draught-proof enclosure between 10 °C and 30 °C.

The resistor R_1 has to be chosen such that the electrical operating conditions are the same as with the lamp. An appropriate resistance value can be found by calculation:

$$R_1 = U_{\text{lamp magn}}^2 / P_{\text{lamp magn.}}$$

where

- $U_{\text{lamp magn.}}$ is the lamp voltage in magnetic ~~ballast~~ controlgear operation;
- $P_{\text{lamp magn.}}$ is the lamp wattage in magnetic ~~ballast~~ controlgear operation;
- $U_{\text{lamp magn.}}$ and $P_{\text{lamp magn.}}$ are taken from the relevant lamp standard sheet as long as electronic lamp operation data are not available from the lamp manufacturer.

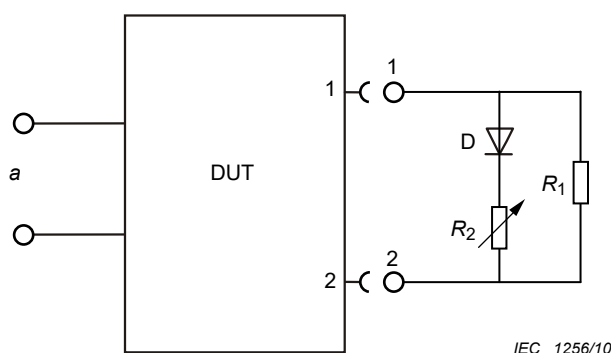
NOTE R_1 changes as a function of lamp type for the same lamp wattage.

The test is commenced by varying the resistor R_2 to adjust the current to a value equal to twice the normal lamp current; when this is reached, no further adjustment of R_2 is made.

If after 1 h the internal protection of the control gear has not operated, the resistor R_2 shall be adjusted to increase the current up to three times maximum the normal lamp current.

If the internal protection of the control gear operates before the current reaches a value equal to twice the normal lamp current, the control gear is loaded, varying the resistance R_2 , by a current equal to 0,95 times the value of the lowest current which causes the protective device to operate. The lowest current causing the protective device to operate is determined by initially operating the control gear at the normal lamp current and gradually increasing the output current in steps of 2 % (each step is maintained until steady condition is achieved) until the protective device operates. However, the current shall not be adjusted above a value of 3 times the normal lamp current.

The steady state condition is considered to have been reached when the difference between two consecutive readings of temperature rise over the ambient taken at half hour interval has not exceeded 1 K.



Key

a supply

DUT device under test

D 100 A, 600 V

R_2 0...200 Ω (wattage rating of the resistor shall be at least $\frac{1}{2}$ lamp wattage)

R_1 $U_{\text{lamp magn}}^2 / P_{\text{lamp.magn}}$

The above wattage rating of the resistor shall be at least $\frac{1}{2}$ lamp wattage.

Figure 4 – Circuit to test whether a ballast controlgear can withstand rectification

34.6 Compliance

Controlgear shall be so designed that when operated under abnormal conditions specified in Subclauses 34.2 to 34.5, there shall be no emission of flames, or molten material, or production of flammable gasses. Protection against accidental contact, in accordance with Subclause 10.1 of IEC 61347-1 shall not be impaired. After the tests, when the lamp controlgear has returned to ambient temperature, the insulation resistance measured at approximately 500 V d.c. shall not be less than 1 M Ω . To check whether gases liberated from the convertor are flammable or not, a test with a high frequency spark generator is made.

35 Protection of associated components

35.1 Controlgear for fluorescent lamps

~~35.1~~ 35.1.1 Peak voltage limits

Under conditions of normal operation, verified with dummy cathode resistors inserted and conditions of abnormal operation, as specified in Clause 34, the voltage at the output terminals shall at no time exceed the maximum permitted peak value specified in Table 1.

Table 2 – Relation between ~~r.m.s.~~ RMS working voltage and maximum peak voltage

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

~~35.1.1~~ 35.1.2 Working voltage limits

Under normal operating conditions, and from 5 s after the switch on or beginning of the starting process, the voltage at the output terminals shall not exceed the maximum working voltage for which the controlgear is declared.

~~35.1.2~~ 35.1.3 Compliance

For checking compliance of 35.1.1 and 35.1.2, the output voltages measured shall be those between any output terminal and earth. Additionally, voltages that appear between output terminals shall be measured in cases where the voltage is present across insulation barriers within associated components.

35.2 Controlgear for metal halide lamps

Under consideration.

35.3 Controlgear for LED lamps and LED modules

Under consideration.

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 test 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 I (normative)

Batteries ESSs for emergency lighting luminaires

The requirements of Annex A of IEC 60598-2-22 apply.

Annex J (informative)

Rest mode and inhibition mode facilities

The requirements of Annex D of IEC 60598-2-22 apply.

Annex K (normative)

Ballasts Controlgear incorporating an automatic testing function for emergency lighting operation

Table K.1 details the relevant requirements of IEC 62034 and their application as applied to **ballasts controlgear** incorporating an automatic testing function under the scope of this standard. This annex is to be read in conjunction with IEC 62034.

Table K.1 – Relevant requirements of IEC 62034

IEC 62034 Clause	Test/Requirement	Application to ballasts controlgear under IEC 61347-2-7
4	Requirements	
4.1	Safety, construction and installation instructions	a) With exception of item b) below all requirements are covered by the requirements of IEC 61347-2-7. b) Requirement of IEC 62034, Subclause 4.1 applies – Design and construction to ensure only authorized personnel can change test duration and frequency of tests.
4.2	Monitoring of the timing circuit	Not applicable. This requirement applies only for the situation of a single timing device for a complete system.
4.3	Function requirements	
4.3.1	The automatic test system (ATS)	Check intervals covered by Clause 5; Fault detection covered by Subclauses 4.3.2, 4.3.3, 4.5; Only additional requirement of this clause is with respect to reporting of faults within 24 h – This to be checked following the tests of 4.5, 4.3.2, 4.3.3.
4.3.2	Emergency battery supply	IEC 62034, Subclause 4.3.2 applies directly.
4.3.3	Lamps tested in emergency mode	IEC 62034, Subclause 4.3.3 applies. <i>NOTE The intention of this clause is not just to test that operation of the emergency lamp is from the emergency supply but also to check that any charge to the battery during the duration check is suitably compensated for (e.g. by increasing the test duration). The term 'full load' given in the compliance clause means "maximum discharge load current of the circuit, excluding the starting period".</i>
4.3.4	Maintained lamps tested in emergency mode and in normal mains condition	IEC 62034, Subclause 4.3.4 applies directly. <i>NOTE Manufacturer to declare if this clause is applicable to his product</i>
4.4	Protection against system part failures and faults	
4.4.1	Intercommunications failure	IEC 62034, Subclause 4.4.1 applies directly. <i>NOTE Failure is removal of control signal/connections (could be by wire; radio signal; mains carried signal). Emergency operation not to be inhibited.</i>
4.4.2	System interconnection	IEC 62034, Subclause 4.4.2 applies with respect to the described fault conditions being applied to the ballast control and communications connections.

IEC 62034 Clause	Test/Requirement	Application to ~~ballasts~~ controlgear under IEC 61347-2-7
4.4.3	Component failures	IEC 62034, Subclause 4.4.3 applies directly. <i>NOTE "Component failures" covers all internal components of products in the system down to capacitor, resistor, etc. level as per test of IEC 61347-1, Clause 14. This clause is only applicable where a component fault could mimic a control signal. If a manufacturer's declaration is given that this is not possible, then no test is required.</i>
4.4.4	System parts compatibility	Not applicable – system requirement
4.4.5	Electromagnetic immunity	IEC 62034, Subclause 4.4.5 applies directly.
4.4.6	Software failure	IEC 62034, Subclause 4.4.6 applies. <i>NOTE To be covered by manufacturers declaration plus supporting documented evidence such as flow charts, fault mode analysis, etc.</i>
4.5	Test of emergency lamps	IEC 62034, Subclause 4.5 applies. <i>NOTE Fault indication may be provided by visual signal and/or a defined communication signal from the ~~ballast~~ controlgear.</i>
5	Test duration and interval	
5.1	Functional test	IEC 62034, Subclause 5.1 applies. <i>NOTE Where applicable, test function and test postponement functions controlled by the ~~ballast~~ controlgear are to be demonstrated. Conformity of timing requirements and details of operation to be provided by manufacturer's declaration.</i>
5.2	Duration test	IEC 62034, Subclause 5.2 applies. <i>NOTE Where applicable test function and test postponement functions controlled by the ~~ballast~~ controlgear are to be demonstrated. Conformity of timing requirements and details of operation to be provided by manufacturer's declaration.</i>
6	Protection of a building during periods of test and subsequent recharge of the emergency lighting system	
6.1	General	Not applicable – Building/System requirement
6.2	Accuracy and protection of timing periods	
6.2.1	General	Not applicable – Building/System requirement
6.2.2	Timing accuracy	Not applicable – Building/System requirement
6.2.3	Protection of timing function	Not applicable – Building/System requirement
6.3	Requirements for premises that may be occupied during test and recharge periods	
6.3.1	General	Not applicable – Building/System requirement
6.3.2.	Testing of self-contained luminaires	
6.3.2.1	General	Not applicable – Building/System requirement
6.3.2.2	Testing of alternate luminaire	Not applicable – Building/System requirement
6.3.2.4.3	Manual initiation of test function	Not applicable – Building/System requirement
6.3.2.4	Automatic initiation of test function	Not applicable – Building/System requirement
6.3.3	Test for centrally powered systems	
6.3.3.1	General	Not applicable – Building/System requirement
6.3.3.2	Dual batteries	Not applicable – Building/System requirement
6.3.3.3	Manual initiation of the test function	Not applicable – Building/System requirement

IEC 62034 Clause	Test/Requirement	Application to ~~ballasts~~ controlgear under IEC 61347-2-7
6.3.3.4	Limited duration test	Not applicable – Building/System requirement
6.3.4	Automatic test recording facilities	Not applicable – Building/System requirement
7	Indication and recording of results that the equipment has to perform	
7.1	General	IEC 62034, Subclause 7.1 applies. Where applicable, test reporting functions controlled by the ~~ballast~~ controlgear are to be demonstrated.
7.2	Indication	IEC 62034, Subclause 7.2 applies. For ~~ballasts~~ controlgear, the mains supply function is covered by battery charge indicator.
7.3	Recording	IEC 62034, Subclause 7.3 applies. Where applicable, test recording functions controlled by the ~~ballast~~ controlgear are to be demonstrated.

Annex L (informative)

Compatibility between normal mains operation electronic controlgear and ~~battery~~ electric source for safety services (ESSS) powered emergency operation controlgear

This annex is relevant only for ~~battery~~ ESSS-supplied electronic controlgear for emergency lighting intended for use in maintained mode and operating in association with electronic controlgear for fluorescent lamps as covered by IEC 61347-2-3.

L.1 Changeover

L.1.1 General

With undefined timing for the changeover operation between the normal (maintained) and the emergency operation (in both directions – from the maintained to the emergency mode and back), it could be possible that the mains lighting electronic controlgear will detect a lamp failure and switch off the lamp supply upon restoration of the normal mains supply. To reduce the risk of such situations, and to improve the compatibility of mains and emergency controlgear from different manufacturers, a definition of the timing for the changeover operation may be prescribed.

This informative annex details two separate test procedures that may be used to reduce the risk of this unwanted 'lamp fault detection'.

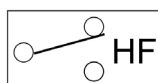
These are:

Procedure A: Timing Inspection (see L.1.2) and changeover voltage (see Clause L.2)

or

Procedure B: Inspection (see L.1.3) and changeover voltage (see Clause L.2)

Controlgear covered by this standard and meeting the requirements of Procedure A of this annex may be marked with the following symbol.



L.1.2 Procedure A – Timing inspection

If the emergency electronic controlgear is provided with a changeover circuit the following timing test (see Figure L.1) for the emergency controlgear with integrated changeover operation should be fulfilled:

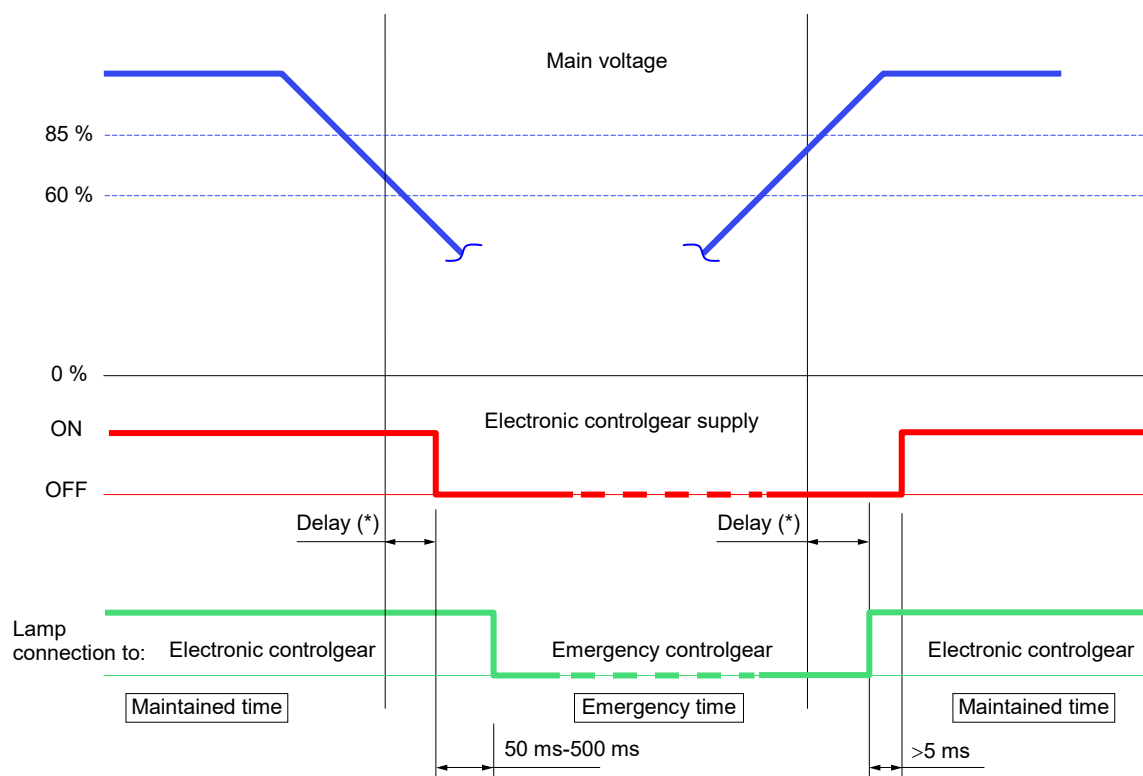
a) Transition from the maintained operation to the emergency operation

After the switch "OFF" time of the supply voltage for the electronic controlgear, an interval between 50 ms and 500 ms has to be fulfilled for disconnecting the lamp from the output terminals of the electronic controlgear.

b) Transition from the emergency operation to the maintained operation

The lamps shall be connected to the terminals of the mains operating electronic controlgear at least 5 ms before the supply voltage is restored to the mains operating electronic controlgear.

Timing diagram



(*) These delay times are caused by the response time of components used and have no relevance for this compatibility test

IEC 2659/11

Figure L.1 – Timing diagram: changeover operation

Compliance of the changeover operation should be verified during the changeover operation of the emergency controlgear with the battery, by using an oscilloscope to verify the timing intervals specified by items a) and b) of this subclause.

Emergency controlgear complying with this test can be expected to operate in successful association with all types of mains supply operating electronic controlgear for fluorescent lamps.

L.1.3 Procedure B – Inspection

If the emergency controlgear is provided with a changeover circuit, the following function test for the complete emergency and mains system can be used to verify correct operation.

- a) Switch the supply voltage on and off with the characteristic described in Figure L.2 with:

$$t_1 = 10 \text{ ms}$$

$$t_2 \geq 2 \text{ s}$$

$$t_3 = 10 \times (t_1 + t_2)$$

- b) Repeat test a) with the variation of t_1 :

(t_1 variations =xx=: 20 ms, 30 ms, 40 ms, 50 ms, 60 ms, 70 ms, 80 ms, 90 ms, 100 ms)

$$t_1 = \text{xx ms}$$

$$t_2 \geq 2 \text{ s}$$

$$t_3 = 10 \times (t_1 + t_2)$$

c) Repeat test a) with the variation of t_1 :

(t_1 variations=xxx=: 150 ms, 200 ms, 250 ms, 300 ms, 350 ms, 400 ms, 450 ms, 500 ms)

$$t_1 = \text{xxx ms}$$

$$t_2 \geq 2 \text{ s}$$

$$t_3 = 10 \times (t_1 + t_2)$$

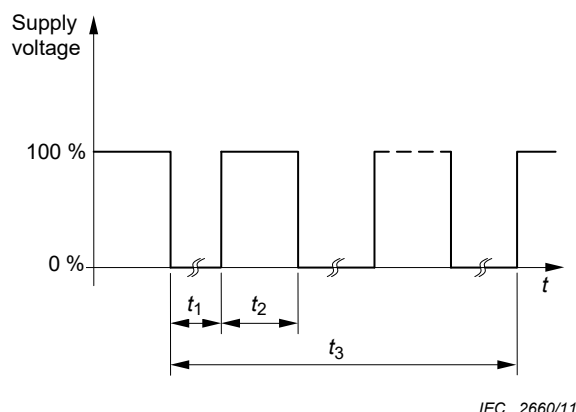


Figure L.2 – Supply voltage for the function test

For this test, it is necessary to connect the electronic controlgear and the emergency controlgear to the same supply voltage.

Compliance: For each test a), b) and c), the voltage to the lamps from the mains operated electronic controlgear should be present during t_2 and after t_3 of every step.

Emergency controlgear complying with this test can be expected to operate correctly in association only with the mains operating electronic controlgear type used in the test.

L.2 Procedures A and B – Changeover voltages

To ensure compatibility between normal mains operation electronic controlgear and ~~battery~~ ESSS-powered emergency operation controlgear, it is necessary that no voltage should be present at the mains electronic controlgear lamp terminals and between the lamp terminals and ground, when the inverter of the ~~battery~~ ESSS-powered emergency operation controlgear is on.

Compliance is checked by measuring voltages present at the ~~battery~~ ESSS-powered emergency operation controlgear terminals used to connect the associated mains electronic controlgear, and from these terminals to ground during emergency mode operation. These voltages ~~must~~ shall not exceed 10 V.

Annex M (informative)

Example of battery manufacturer's declaration of design for a Li battery

Table M.1 provides details of the information expected to be provided in a battery manufacturer's declaration of design for a lithium battery.

Table M.1 – Example of battery manufacturer's declaration of design for a Li battery

	Data
Name or identification of manufacturer	
Designation of manufacturer model or reference	
Normative designation of the battery format	
Rated voltage of the battery	V
Rated capacity C5	Ah
Charge type and specification:	
NOTE To be defined by the battery manufacturer.	
Values of safety battery protection:	
Overcurrent discharge protection	A
Deep discharge protection	V
Overvoltage protection	V
Full charge battery voltage	V per cell
Minimum cell voltage (V_{low})	V per cell
Cut-off battery voltage (V_{blow})	V
Residual discharge current ($I_{low}@ V_{low}$)	 μ A
Cell recovery voltage (V_{rv})	V
End of capacity battery voltage (V_{min})	V
Maximum cell voltage (V_{max})	V
Maximum charge current (I_{max})	A
Charge current "at end of charge" (I_{eoc})	A
Minimum cell temperature (T_{cmin})	°C
Maximum cell temperature (T_{cmax})	°C
Maximum cell temperature at the end of charge	°C
Maximum cell temperature in discharge mode	°C
Built-in charge equalization device	YES / NO
Built-in protection electronic device (excessive discharge current, deep voltage discharge and overvoltage)	YES / NO
Built-in temperature control or measurement	YES / NO
Position of thermal sensor (if applicable)	
Maximum discharge rates for 1 h:	Xxx % C5 @ xx °C
Maximum discharge rates for 3 h:	Xxx % C5 @ xx °C
4-year design life for use in an emergency luminaire (select only one option)	40 °C YES/NO 55 °C YES/NO
NOTE Values for voltage apply to the battery pack unless otherwise stated for the cell.	

Bibliography

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

JIL5501, *Specification of luminaires for emergency lighting (escape lighting)*

JIL5502, *Basic requirements for luminaires and active system for escape lighting*
