BS EN 62718:2016

BSI Standards Publication

Railway applications — Rolling stock — DC supplied electronic ballasts for lighting fluorescent lamps (IEC 62718:2013 + COR1:2016)

bsi.

National foreword

This British Standard is the UK implementation of EN 62718:2016. It is identical to IEC 62718:2013, incorporating corrigendum February 2016. It supersedes BS EN 50311:2003 which is withdrawn.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by IEC corrigendum February 2016 is indicated in the text by ⟦AC1⟩ ⟨AC1⟧.

The UK participation in its preparation was entrusted by Technical Committee GEL/9, Railway Electrotechnical Applications, to Subcommittee GEL/9/2, Railway Electrotechnical Applications - Rolling stock.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2016

ISBN 978 0 580 87028 6

ICS 45.060.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2016.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62718

April 2016

ICS 45.060

Supersedes EN 50311:2003

English Version

Railway applications - Rolling stock - DC supplied electronic ballasts for lighting fluorescent lamps (IEC 62718:2013 + COR1:2016)

Applications ferroviaires - Matériel roulant - Ballasts électroniques à courant continu pour lampes fluorescentes d'éclairage
(IEC 62718:2013 + COR1:2016)

Bahnanwendungen - Bahnfahrzeuge - Gleichstromversorgte elektronische Vorschaltgeräte für Leuchtstofflampen
(IEC 62718:2013 + COR1:2016)

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

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

Ref. No. EN 62718:2016 E

European foreword

This document (EN 62718:2016) consists of the text of IEC 62718:2013 + COR1:2016 prepared by IEC/TC 9 "Electrical equipment and systems for railways".

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-10-08
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2019-04-08

This document supersedes EN 50311:2003.

EN 62718:2016 includes the following significant technical changes with respect to EN 50311:2003:

- Sections 8.2.1.3 and 9.3.2.7: the value is extended from “50 Hz” to “50 Hz or 60 Hz”;
- Sections 8.2.3.1 and 9.3.4.1: the specified Level (0,7 mA) of leakage current in EN 50311:2003 is omitted, instead of it a reference to the standard (IEC 60598-1:2008, Section 10.3) is noted;
- Section 9.3.2.8: Table 3 - Dielectric test voltage values are referenced to IEC 62497-1, this cause an extension of the nominal voltage levels;
- Section 9.3.4.1: the values of R and C in Figure 3 (EN 50311:2003 R = 2 000 Ω ± 100 Ω C = 112 nF ± 6 nF) are omitted;
- new Annex A (informative): Distance between lamp an metallic support (before it was normative in Section 8.2.4.4 of EN 50311:2003);
- Annex H from EN 50311:2003 is omitted.

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Endorsement notice

The text of the International Standard IEC 62718:2013 was approved by CENELEC as a European Standard without any modification.

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

IEC 60068-1:1988	NOTE	Harmonized as EN 60068-1:1994 [1)] (not modified).
IEC 60081	NOTE	Harmonized as EN 60081.
IEC 60901:1996	NOTE	Harmonized as EN 60901:1996 (not modified).
IEC 60927	NOTE	Harmonized as EN 60927.
IEC 61347-2-7:2011	NOTE	Harmonized as EN 61347-2-7:2012 (not modified).
CISPR 15:2005	NOTE	Harmonized as EN 55015:2006 [2)] (not modified).
CISPR 15:2005/A1:2006	NOTE	Harmonized as EN 55015:2006/A1:2007 [2)] (not modified).

[1)] Superseded by EN 60068-1:2014 (IEC 60068-1:2013): DOW = 2016-11-11.

[2)] Superseded by EN 55015:2013 (CISPR 15:2013 + IS1:2013 + IS2:2013): DOW= 2016-06-12.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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

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

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

Publication	Year	Title	EN/HD	Year
IEC 60068-2-1	2007	Environmental testing - Part 2-1: Tests - Test A: Cold	EN 60068-2-1	2007
IEC 60068-2-2	2007	Environmental testing - Part 2-2: Tests - Test B: Dry heat	EN 60068-2-2	2007
IEC 60068-2-30	2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)	EN 60068-2-30	2005
IEC 60077-1 (mod)	1999	Railway applications - Electric equipment for rolling stock - Part 1: General service conditions and general rules	EN 60077-1	2002
IEC 60417-DB	-	Graphical symbols for use on equipment	-	-
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529 +corr. May	1991 1993
IEC 60571	2012	Railway applications - Electronic equipment used on rolling stock	EN 50155 + corr. May + AC	2007 2010 2012
IEC 60598-1 (mod)	2008	Luminaires - Part 1: General requirements and tests	EN 60598-1 A11	2008 [3)] 2009 [3)]
IEC 60929	-	AC and/or DC-supplied electronic control gear for tubular fluorescent lamps - Performance requirements	EN 60929	-
IEC 61140	-	Protection against electric shock - Common aspects for installation and equipment	EN 61140	-
IEC 61347-1 (mod)	2007	Lamp controlgear - Part 1: General and safety requirements	EN 61347-1	2008 [4)]
IEC 61347-2-3	-	Lamp controlgear - Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps	EN 61347-2-3	-

[3)] Superseded by EN 60598-1:2015 (IEC 60598-1:2014): DOW = 2017-10-20.

[4)] Superseded by EN 61347-1:2015 (IEC 61347-1:2015): DOW = 2018-03-26.

Publication	Year	Title	EN/HD	Year
IEC 61373	-	Railway applications - Rolling stock equipment - Shock and vibration tests	EN 61373	-
IEC 62236-3-2	2008	Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus	EN 50121-3-2	2006
IEC 62497-1	-	Railway applications - Insulation coordination - Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment	EN 50124-1	-
IEC 62498-1	-	Railway applications - Environmental conditions for equipment - Part 1: Equipment on board rolling stock	EN 50125-1	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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RAILWAY APPLICATIONS – ROLLING STOCK – DC SUPPLIED ELECTRONIC BALLASTS FOR LIGHTING FLUORESCENT LAMPS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62718 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This standard is based on EN 50311:2003.

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

FDIS	Report on voting
9/1769A/FDIS	9/1798/RVD

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

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

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

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

INTRODUCTION

This International Standard has been developed specifically for railway applications, to supplement the current standards. It covers general safety and performance requirements in addition to or in place of those contained in IEC 61347-1, IEC 61347-2-3 and 61347-2-7.

NOTE 1 When applied unchanged, the clauses of IEC 61347 are either referred in this standard or introduced into it if they are short texts.

NOTE 2 When a clause of IEC 61347 applies with changes or is replaced by more specific requirements, generally a short note explains the difference or the reason for that.

RAILWAY APPLICATIONS – ROLLING STOCK – DC SUPPLIED ELECTRONIC BALLASTS FOR LIGHTING FLUORESCENT LAMPS

1 Scope

This International Standard specifies the performance and constructional requirements, and associated tests, for d.c. supplied electronic ballasts used to supply fluorescent lamps for lighting on railway rolling stock. Its requirements replace those of IEC 61347 for all railway rolling stock applications and specify and complete those of IEC 61347 for the specific needs of railway rolling stock applications.

This international standard applies to electronic ballasts

– supplying pre-heated cathode fluorescent lamps without integrated starters, tubular or single capped, according to IEC 60081 and IEC 60901 respectively,
– having a single and non adjustable luminous flux level.

It does not apply to electronic ballasts supplying non pre-heated cathode lamps and/or lamps with integrated starters.

2 Normative references

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

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12h + 12h cycle)*

IEC 60077-1:1999, *Railway applications – Electric equipment for rolling stock – Part 1: General service conditions and general rules*

IEC 60417, *Graphical symbols for use on equipment – Available from:http/www.graphical-symbols.info/equipment*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)* [1]

IEC 60571:2012, *Railway applications – Electronic equipment used on rolling stock*

IEC 60598-1:2008, *Luminaries – Part 1: General requirements and tests*

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

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

1 There is a consolidated edition 2.1 (2001), comprising edition 2 (1989) and Amendment 1 (1999).

NOTE IEC 60536 was replaced by IEC 61140.

IEC 61347-1:2007, *Lamp controlgear – Part 1: General and safety requirements*[2]

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

IEC 61373, *Railway applications – Rolling stock equipment – Shock and vibration tests*

IEC 62236-3-2:2008, *Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus*

IEC 62497-1, *Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment*

IEC 62498-1, *Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 General terms

3.1.1
nominal value
a suitable approximate quantity value used to designate or identify a characteristic of a component, device or equipment

[SOURCE: IEC 60050-811:1991, 811-11-01]

3.1.2
rated value
a quantity value assigned, generally by a manufacturer, for a specified operating condition of a component, device or equipment

[SOURCE: IEC 60050-811:1991, 811-11-02]

3.1.3
voltage range
range of supply voltage over which the electronic ballast is intended to be operated

[SOURCE: IEC 61347-1:2007, 3.8]

3.1.4
rated voltage
voltage declared by the manufacturer to which all the electronic ballast characteristics are related and which is not less than 85 % of the maximum value of the rated voltage range

Note 1 to entry: The term « rated voltage » generally used in railway applications has been preferred to « design voltage » defined in 3.7 of IEC 61347-1:2007.

2 There is a consolidated edition 2.2 (2012), comprising edition 2 (2007), Amendment 1 (2010) and Amendment 2 (2012).

3.1.5
rated maximum operating temperature of a ballast case
t_c
highest permissible temperature which may occur on the outer surface (at the indicated place, if marked) under normal operating conditions and at the rated voltage or maximum of the rated voltage range

3.1.6
type test
a test of one or more devices made to a certain design to show that the design meets certain specifications

[SOURCE: IEC 60050-811:1991, 811-10-04]

3.1.7
routine test
a test to which each individual device is subjected during or after manufacture to ascertain whether it complies with certain criteria

[SOURCE: IEC 60050-811:1991, 811-10-05]

3.1.8
sampling test
a test on a number of devices taken at random from a batch

[SOURCE: IEC 60050-811:1991, 811-10-06]

3.1.9
investigation test
a special test of an optional character carried out in order to obtain additional information

[SOURCE: IEC 60050-811:1991, 811-10-07]

3.1.10
exposed conductive part
any metallic or other form of conductive material which is not energised except in case of failure, and which may be accessible to touch

[SOURCE: IEC 61991:2000, 3.2.8]

3.1.11
protective bonding
equipotential connection for protective purpose

[SOURCE: IEC 61991:2000, 3.2.17]

3.2 Lamps and characteristics

3.2.1
d.c. supplied electronic ballast
electronic ballast
d.c. to a.c. inverter using semi-conductor devices which may include stabilising elements for supplying power to one or more fluorescent lamps

Note 1 to entry: For the purposes of this standard d.c. supplied electronic ballast includes starter and ballast functions.

Note 2 to entry: The term « electronic ballast » is more commonly used than d.c. supplied electronic ballast and will be used in this standard.

[SOURCE: IEC 61347-1:2007, 3.2.1]

3.2.2
started fluorescent lamp
a fluorescent lamp when a current is crossing the space between the two cathodes

3.2.3
lighted fluorescent lamp
a fluorescent lamp emitting light that can be observed visually, uniformly distributed within the space between the two cathodes. A lamp is not lighted when the light emitted is only localised around the cathodes

3.2.4
extinguished fluorescent lamp
a fluorescent lamp emitting no light, when visually observed

Note 1 to entry: A lamp which emits light around the cathode(s) is not considered as extinguished.

3.2.5
switching cycle
the complete power cycle between extinguished, started, lighted and extinguished states

4 Classification

Electronic ballasts are classified according to parameters determined by the performance required and the mechanical characteristics. These parameters which may be chosen or specified by the purchaser are the following:

– nominal supply voltage;
– number and type (power) of lamps;
– temperature operating class;
– bare or housed ballast;
– size and fixations;
– wiring diagram;
– type of terminals.

Other requirements (e.g. special length cables, burn-in, etc.) shall be defined by the purchaser.

5 Characteristics

5.1 Rated voltages

Rated voltages and rated voltage ranges are defined in IEC 60571.

For maintenance of existing rolling stock, other nominal voltage values and widened ranges should be agreed between user and manufacturer.

5.2 Overvoltages

Electronic ballasts shall withstand supply overvoltages as defined in IEC 60571.

5.3 Type of fluorescent lamps

The manufacturer shall declare the types of lamps for which the ballast is designed and, from these types, those which shall be considered as reference for design and used for testing the ballast.

6 Product information

6.1 Nature of information

6.1.1 General

The following information, which includes that required by IEC 61347-2-3 when appropriate, shall be given by the manufacturer.

6.1.2 Identification

– manufacturer's name or trademark;

– mode number or type reference of the manufacturer;

– modification status given by letters or figures (e.g. A, B, C, etc., to tick off).

6.1.3 Characteristics

– rated voltage and voltage range;

– all possible wiring diagrams showing and identifying the terminals;

– open circuit voltage;

– temperature operating class;

Temperature operating class has been preferred to rated maximum operating temperature (t_c), see 8.2.1.5.

– symbol for earthing (protective bonding to the car body) as applicable; graphic symbol  IEC 60417–5019(2012-11);

– reference to this standard (instead of category defined in Clause 6 of IEC 61347-1:2007);

– type and nominal value of replaceable fuse, if any.

6.1.4 Other characteristics and information for installation

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

– nominal working frequency of lamp operation and its range;

– mechanical characteristics;

– weight;

– installation recommendation such as

  • type of cable and wiring between electronic ballast and lamp,

  • type of terminals, etc.

– rated input withstand voltage;

– supplementary information if required.

6.2 Marking

All relevant information, as detailed in ⟦AC1⟩ 6.1.2 and 6.1.3 ⟨AC1⟧, shall be marked on the nameplate, away from the base plate and preferably on top of the electronic ballast. Marking shall be indelible and easily legible. Test of compliance is described in 7.1 of IEC 61347-1:2007.

The symbol for earthing (protective bonding) shall be marked as close as possible to the earth terminal or one of the bolted fixation, if they are used as such. It may be marked away from the nameplate but shall not be marked on screws or other easily removable parts. It shall be visible after installation.

For traceability, markings shall also contain at least one of the following:

– the manufacturing serial number;
– the manufacturing date;
– the code of manufacturing.

It is preferred that all markings are placed on a nameplate. The nameplate shall not be conductive, if only stuck.

6.3 Instructions for storage, installation, operation and maintenance

Only instructions needed to comply with the requirements shall be given by the manufacturer. Any other instructions are at the manufacturer's discretion.

7 Normal service conditions

Where relevant, requirements of IEC 60571, which refers to IEC 62498-1, shall apply.

8 Constructional and performance requirements

8.1 Constructional requirements

8.1.1 General

Construction shall comply with the constructional requirements given in IEC 60571, where relevant, with the following additions.

8.1.2 Dimensions and wiring diagram

For maintenance purposes and in order to achieve interchangeability with existing units, it is recommended that the electronic ballasts comply with dimensions and wiring diagrams given in one of the informative Annexes B to G, depending on the type of unit.

Electronic ballasts without housing shall comply with the requirements agreed between the purchaser and the manufacturer.

8.1.3 Terminals

Type of terminals to be provided for the ballasts may be chosen by the purchaser.

Screws, current-carrying parts and mechanical connections shall comply with the requirements of Clause 8 and Clause 17 of IEC 61347-1:2007 when appropriate.

Electronic ballasts without housing shall comply with the requirements agreed between the purchaser and the manufacturer.

8.1.4 Provisions for repair

Unless the electronic ballast unit is the agreed lowest replaceable unit for repairing, electronic ballast shall be designed such that all necessary access for diagnosis and repair is possible without damage or undue deterioration to the components or wiring.

The enclosure shall provide the necessary protection against the environmental influences. It shall be possible to dismantle and repair or replace the components.

8.1.5 Clearance and creepage distances

Clearance and creepage distances shall comply with IEC 62497-1 considering

– pollution degree PD1 for housed printed circuit board and PD2 for external parts,
– overvoltage category OV2.

The values shall not be lower than those required by Clause 16 of IEC 61347-1:2007.

8.1.6 Protection

In order to maintain operability of the lighting equipment, the electronic ballast shall isolate itself from the circuit in case of an internal short-circuit and may include, for example

– either a calibrated fuse fitted as a replaceable component,
– or three printed tracks used as fuses which can be changed over during repair; then they shall not be used to protect against incorrect connection of polarity (see 8.2.2.2).

The protection calibration shall be, in case of short-circuit, such that the peak current value is limited to 20 times the continuous current I_r at the rated voltage.

The general protection value of the lighting circuit, chosen by the customer, should be at least equal to 25 times the current absorbed by one electronic ballast.

8.1.7 Inrush current

The peak inrush current which may occur at the time of switch-on, measured in specified conditions of low impedance source, shall be less than 20 times the continuous current I_r of the electronic ballast supplied at the rated voltage. Before 1,5 ms, the current shall be at its permanent value.

A more restrictive limit of inrush current may be specified by the customer.

8.2 Performance requirements

8.2.1 Electronic ballast parameters in accordance with lamps characteristics

8.2.1.1 General

All requirements given hereinafter are only applicable for appropriate type(s) of lamp(s) for which the electronic ballast is designed, and the characteristics which comply with the requirements of their relevant standard.

8.2.1.2 Current wave form supplied to lamps

The current wave form supplied to the lamps shall be such that the electronic ballast complies with the electromagnetic compatibility requirements (see 8.2.3.4). In any case the ratio between the peak value and the r.m.s value shall not exceed 1,7.

NOTE In Japan, a crest factor of 2,1 maximum is permitted, when additional cathode heating is applied.

8.2.1.3 Luminous flux – Luminance

At the ambient air temperature of 22 °C ± 5 K, the lamp supplied by the electronic ballast at the rated voltage shall emit a luminous flux at least equal to those emitted by the same lamp supplied by any 50 Hz or 60 Hz a.c. reference ballast as defined in IEC 61347-1, the voltage of which being set to obtain the nominal power in the lamp.

8.2.1.4 Efficiency

At the ambient air temperature of 22 °C ± 5 K, the power supplied to the lamp(s) by the electronic ballast at the rated voltage shall be at least equal to 0,75 time the power absorbed by the electronic ballast input.

8.2.1.5 Frequency

The operating frequency shall be at least 18 kHz, irrespective of the working conditions considered as possible in this standard.

If needed to avoid EMC problems, the purchaser can either fix on special request the frequency range in which the electronic ballast operates or exclude a special frequency range.

8.2.1.6 Temperature

The electronic ballast shall withstand, without requiring any additional heat sink, the whole temperature range for which it is designed irrespective of the supply voltage within the rated voltage range.

The electronic ballast shall start the lamp for all temperatures equal to or higher than –5 °C irrespective of the applied supply voltage within the rated voltage range.

In addition, for operating classes T2 and TX, the electronic ballast shall start the lamp at temperatures equal to or higher than –25 °C irrespective of the applied supply voltage between the nominal voltage and the maximum voltage.

No damage shall occur to electronic ballast or to the lamp(s) at temperatures outside the range required for lamp starting.

Reduced lighting performance is accepted when the temperature around the lamp is less than –5 °C.

8.2.2 Exceptional conditions of use

8.2.2.1 General

In addition to normal conditions of use, electronic ballasts are required to endure the following exceptional conditions without any damage to the electronic ballasts or to the lamps.

8.2.2.2 Polarity reversal protection

Electronic ballasts shall be provided with protection against an incorrect polarity of the supply voltage at the input terminals. A continuous supply with incorrect polarity shall not damage the unit. During this period the electronic ballast shall withstand the overvoltage requirements without failure.

If any fuses are allowed to be blown then the fuse shall be replaceable without removing the electronic ballast. Following the correct polarity connection and the replacement of the fuse, the electronic ballast shall operate properly.

8.2.2.3 Changing of lamps

Electronic ballasts shall be able to withstand the effects of removing one or more lamps, at any voltage within the rated voltage range.

They shall be able to light one or more new lamps, as soon as fitted, at the minimum temperature of 15 °C and at the rated voltage. At lower temperature and voltage values, the lighting of the new lamp may require a new switching cycle.

8.2.2.4 Abnormal function of the lamp

Electronic ballasts shall be able to withstand the effects of any failure of a lamp or lamps such as

– non-lighting of one or more lamps,
– lamps with one or both filaments cut,
– abnormal variation of filament resistance,
– lamps functioning as a diode.

8.2.2.5 Output voltage without lamps

Independent of either being on load or off load, the insulation of cables connecting the lamps to the ballast shall not be exposed to excessive dielectric stress.

At the rated voltage and 5 s after switching on, electronic ballasts peak voltages between any cable and car body shall be less than 800 V.

8.2.2.6 Short-circuit

Electronic ballasts shall be able to withstand short-circuits of every filament.

8.2.2.7 Gradually decreasing supply voltage

The electronic ballasts shall not be damaged when the supply falls or remains below the lowest limit value of the rated voltage range, irrespective of the rate of the decreasing voltage.

8.2.2.8 Pre-heating current

The electronic ballasts shall allow short-term cycles of lighting/extinguishing without shortening lamp working lives. This shall be achieved with a time delay for the starting process including the time which is required to heat the filaments before starting or an equivalent system.

The limiting values of effective heating current shall comply with the requirements of IEC 60929.

8.2.3 Electronic ballast design requirements

8.2.3.1 Leakage current

The leakage current between each input connection and metallic housing, measured in specified conditions, shall not exceed the limit stated in 10.3 of IEC 60598-1:2008.

8.2.3.2 Ripple factor of input current

The ripple factor of the current measured according to the conditions of 9.3.3.2 shall not be greater than 10 %.

Ripple factor of the current is calculated as (%) = $100 \times \frac{(I_{max} - I_{min})}{(I_{max} + I_{min})}$.

8.2.3.3 Ripple factor of input voltage

Due to battery charging, the d.c. supply voltage has a pulsating voltage. The electronic ballast shall operate from a supply voltage affected by a ripple factor not greater than 15 %.

Ripple factor of a voltage is calculated as (%) = $100 \times \frac{(U_{max} - U_{min})}{(U_{max} + U_{min})}$.

8.2.3.4 Electromagnetic compatibility (EMC)

Emission and immunity requirements apply to the electronic ballast including wiring and lamps as recommended by the manufacturer. Therefore, radio disturbance characteristics shall be considered on the complete electrical lighting equipment (luminaries).

Emission shall comply with Clause 7 of IEC 62236-3-2:2008 considering Table 4 and Table 6 limits. In addition Table 3 limits apply to the output when the electronic ballast is considered alone.

Immunity shall comply with Clause 8 of IEC 62236-3-2:2008 considering Table 7 and Table 9 limits.

8.2.3.5 Magnetic effects

Electronic ballasts shall be designed to be fastened on a metal plate. Additionally, any metallic part installed at distance of 25 mm or ⟦AC1⟩ more ⟨AC1⟧ from the electronic ballast shall not have any influence on its performance.

NOTE Electronic ballasts may be installed at distances of less than 25 mm from a metallic part if, after manufacturer's agreement, it has been proven that there is no influence on performance.

8.2.3.6 Predicted reliability

Where a reliability level is required, then IEC 60571 applies. The component reliability data shall be agreed between the manufacturer and the purchaser at the time of tender and the calculation shall be based on ground mobile environmental operation and on ambient temperature of 40 °C.

8.2.3.7 Burn-in

The standard does not deal with burn-in. At the time of tender, the purchaser may require from the manufacturer to submit electronic ballasts to a systematic burn-in process at the end of the manufacturing process. The burn-in test should reflect the specified operating conditions.

8.2.4 Installation requirements

8.2.4.1 General

All performance deterioration due to the installation and which are not covered by the following requirements of this standard shall be subject of a special agreement.

8.2.4.2 Quality of cables

The purchaser shall verify that the cable used between electronic ballast and lamps can withstand the output voltage without lamps (conditions given in 8.2.2.5).

8.2.4.3 Cross-section area of cables

The minimum cross-section area for cables used between electronic ballast and lamps shall be 0,5 mm^2.

8.2.4.4 Length of wiring between electronic ballast and lamps

The length of each pair of cables supplying lamps including that between two lamps connected in series shall not be more than 3 m. Nevertheless, after manufacturer's agreement, longer cables may be used according to the capacity provided by the insulating material.

8.2.4.5 Protective bonding to the car body

For railway application bonding to the car body makes both protective earth and functional earth.

Exposed conductive parts of electronic ballasts which do not comply with double insulation design (see IEC 61140) shall be bonded to the car body to achieve human safety by protection against electrical hazards. This can be obtained satisfactorily

– by wiring on a special terminal,
– or by the fixations on the metallic plate itself bonded. These fixations shall then be considered as having the same performance as terminals, i.e. the fixation areas shall be of good conductivity,
– or by wiring on one of the fixations which is to be considered as a terminal.

All parts of a bonding terminal shall be such as to minimise the risk of electrolytic corrosion resulting from contact with the bonding conductor or any other metal in contact with them.

The screw or other parts of the bonding terminal shall be made of brass or other metal with a good resistance against corrosion, or a material with a non-rusting surface and at least one of the contact surfaces shall be bare metal.

8.2.4.6 Environment

The electronic ballasts shall be fitted in such a manner that in any case the surrounding air temperature is not greater than those given in IEC 60571 according to the temperature operating class.

8.3 Safety requirements

Electronic ballasts shall be designed to operate in normal use without causing any danger to the user or surroundings.

The electronic ballasts shall comply with requirements of IEC 61347-2-3. However this standard refers to the applicable clauses with relevant changes necessary for railway applications, if any; and it refers to clauses of IEC 61347-2-3 which shall apply, if appropriate, even if no reference is made.

Protection against accidental contact with live parts shall comply with Clause 11 of IEC 61347-1:2007.

Protection of housing electronic ballasts shall comply with code IP40 according to IEC 60529.

Electronic ballasts shall not be impaired when they are submitted to overvoltages defined in IEC 60571.

Electronic ballasts shall be designed according to fire requirements given in IEC 60598-1.

9 Tests

9.1 Test conditions

9.1.1 Environmental conditions

Unless otherwise specified, all tests shall be performed under normal atmospheric conditions in accordance with Clause 4 of IEC 62498-1:2010.

Before testing, the electronic ballasts shall be placed under these conditions for 24 h.

The effective atmospheric conditions in the test room shall not be subjected to major or rapid variations during a test period. These conditions shall be recorded in test report.

9.1.2 Other conditions

The electronic ballast placed horizontally shall be normally earthed (bonded) but shall not be fastened on a metallic support.

The tubular lamps should be placed along a metallic plate at the relevant maximum distance required in Annex A. The metallic plate is connected to the bonded pole of the electronic ballast supply.

Electronic ballast performance shall be measured with new fluorescent lamps. A fluorescent lamp is considered new when it has been aged during 100 h.

Unless otherwise specified, the electronic ballast shall be loaded with a maximum number of lamps so that all output circuits are connected during tests.

If appropriate, tests required by IEC 61347-1:2007 may be mixed with those of this standard to be carried out simultaneously.

9.2 Kinds of tests

9.2.1 Type tests

Type tests are intended to check that a product complies with its specification. They are carried out on ten random samples taken from a mass produced batch consisting of at least fifty items. Before testing the electronic ballast samples shall be submitted to a systematic burn-in of 96 h at 70 °C with the maximum voltage supply and the maximum number of lamps.

NOTE Tests carried out on prototype in order to prove the design or the ability of the manufacturer to design a product are not considered as type tests. Type tests validate both design and manufacturing process.

Type tests are grouped together in 5 sequences as shown in Table 1. For each sequences, the tests shall be carried out in the order listed.

The ten samples are submitted to sequences as follows:

– 4 items are submitted to sequences 1 and 2;
– 2 items are submitted to sequences 1 and 3;
– 2 items are submitted to sequences 1 and 4;
– 1 item is submitted to sequences 1 and 5;
– 1 item is submitted to sequences 1, 2 and 5.

Results to be obtained are given in the relevant subclauses of 9.3 and 9.4.

Table 1 – Type tests

Test designation	Clause reference	Number of items tested
Sequence 1		10
Visual examination	9.3.2.1	
Marking	9.3.2.2	
Weight	9.3.2.3	
Lighting	9.3.2.4	
Efficiency	9.3.2.5	
Consumption	9.3.2.6	
Luminous flux	9.3.2.7	
Dielectric test	9.3.2.8	
Sequence 2		5
Inrush current	9.3.3.1	
Ripple factor of input current	9.3.3.2	
Current wave form supplied to lamps	9.3.3.3	
Frequency	9.3.3.4	
Gradually decreasing of supply voltage	9.3.3.5	
Sequence 3		2
Leakage current	9.3.4.1	
Endurance	9.3.4.2	
Pre-heating current	9.3.4.3	
Sequence 4		2
Output voltage without lamps	9.3.5.1	
Changing lamps	9.3.5.2	
Abnormal function of the lamp	9.3.5.3	
Electromagnetic compatibility (EMC)	9.3.5.4	
Overvoltage withstand	9.3.5.5	
Polarity reversal	9.3.5.6	
Short-circuit	9.3.5.7	
Internal protection	9.3.5.8	
Sequence 5		2
Damp heat test	9.3.6.1	
Dry heat test	9.3.6.2	
Cold test	9.3.6.3	
Vibration test	9.3.6.4	
Shock test	9.3.6.5	
Fire behaviour	9.3.6.6	

9.2.2 Routine tests

Routine tests are designed to check the invariability of technical characteristics and are carried out on every production batch.

They are carried out after burn-in if a specific one is required in manufacturing process (see 8.2.3.7).

The routine tests list is given by Table 2.

NOTE Acceptance tests carried out at the time of delivery are stated between manufacturer and customer. These tests are chosen amongst the routine tests. Acceptance criteria and acceptance quality level according to ISO 2859-1 are also stated.

Table 2 – Routine tests

Test designation	Clause reference
Visual examination	9.3.2.1
Marking	9.3.2.2
Lighting	9.3.2.4
Consumption	9.3.2.6
Luminous flux (or lamp current)	9.3.2.7
Dielectric test	9.3.2.8
Frequency	9.3.3.4
NOTE If engineering and statistical analyses show that routine test are not required, sampling test may be made instead after agreement between the manufacturer and the user. The number of items tested should be stated according to the expected acceptance quality level (AQL).	

9.2.3 Investigatory tests

Investigatory tests may be done as an extension of type tests. Their purpose is to give additional information on the electronic ballast characteristics. They shall be agreed at contract stage and carried out at the purchaser's request.

9.3 Verification of constructional and performance requirements

9.3.1 General

Unless otherwise required all tests shall be carried out in the test conditions defined in 9.1.

9.3.2 Sequence 1

9.3.2.1 Visual examination

Electronic ballasts shall not reveal faults such as scratches, scores marks of impact, etc. that are visible to persons with normal or corrected sight.

In addition, requirements of 8.1.2 to 8.1.6 shall be checked during type tests.

9.3.2.2 Marking

Electronic ballasts shall satisfy the requirements given in 6.2.

9.3.2.3 Weight

Weight shall be that given in manufacturer's data sheets.

9.3.2.4 Lighting

The electronic ballast being supplied at the minimum voltage of the rated voltage range shall light up the fluorescent lamps. This is checked visually.

9.3.2.5 Efficiency

With the electronic ballast being supplied at its rated supply voltage, the efficiency is calculated as the ratio between the sum of power supplied to all the lamps required and the power absorbed by the electronic ballast.

The value shall comply with 8.2.1.4.

9.3.2.6 Consumption

When supplied at the rated supply voltage, the current absorbed by the electronic ballast shall not be greater than necessary to supply all lamps taking into account an efficiency of 0,75 for the ballast.

For type tests the current shall be measured after the electronic ballast is supplied for 1 h with the rated voltage.

9.3.2.7 Luminous flux

The test is performed at the ambient air temperature of 22 °C ± 5 K.

The method consists of comparing the luminous flux emitted after a minimum of 15 min or after the characteristic has settled by the same lamp supplied by a reference ballast and by the electronic ballast.

Firstly, the luminous flux of the lamp is measured in the centre of the lamp when supplied at its rated power, this is achieved by setting of the 50 Hz or 60 Hz a.c. supply voltage.

Secondly, the reference ballast is replaced by the electronic ballast to be tested, supplied at the rated voltage, and the luminous flux is measured in the same conditions as previously.

The second measurement shall not be less than the first one.

NOTE The luminous flux of a lamp is usually measured with an integrating photometer. For ratio measurements, a suitable luxmeter is sufficient as there is close relationship between flux and luminous intensity at a fixed point

9.3.2.8 Dielectric test

For dielectric test, ballasts shall be placed on a metallic plate and ballasts with insulating housing shall be wrapped with a conductive foil.

The test is carried out with a d.c. voltage applied gradually in 10 s and maintained during 60 s ± 5 s. For routine tests the full voltage duration is reduced to 5 s.

The test voltage shall be applied

– case 1: between input circuit against output circuit(s) connected together to the metallic plate (protective bonding),
– case 2: between output circuit(s) connected together against the metallic plate (protective bonding).

In both cases all terminals of the same circuit (input or output) shall be short-circuited.

The dielectric test voltage values are given in Table 3.

The test may also be carried out with an a.c. voltage, the peak value being equal to the d.c. value.

No insulation breakdown of the test voltage and no flashover shall occur during the test and the leakage current shall be less than 1 mA.

Table 3 – Dielectric test voltage values

Nominal voltage of electronic ballast	D.C. test voltage values	
	Case 1	Case 2
V	V	V
24	500	2 000
32 – 48	700	2 000
64 – 72 – 87 – 96 – 110	1 200	2 000

NOTE Values are in accordance with IEC 62497-1 considering

– overvoltage category OV2 for case 1,

– and overvoltage category OV1 for case 2.

9.3.3 Sequence 2

9.3.3.1 Inrush current

The electronic ballast is connected, with a quick closing switch, to a voltage source whose internal impedance is represented by a capacitor of 10 000 μF in accordance with Figure 1.

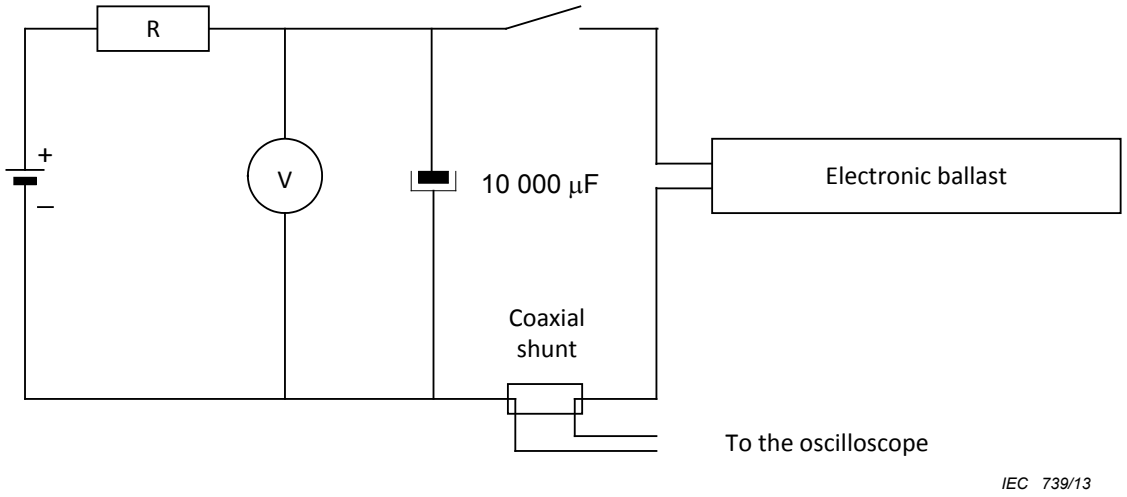


Figure 1 – Test circuit

A suitable passband measuring device shall be used to record the current absorbed when the switch closes. The length of each cable made of copper conductors of 1,5 mm^2 cross-section area between the electronic ballast and the source shall be equal to 3 m and shall be as straight as possible.

The circuit defined by Figure 1 should also be used for the test required by IEC 61347-2-3.

Five measurements shall be made with the capacitor voltage being equal to the rated voltage.

The instantaneous current value shall not exceed the curve given by Figure 2.

An appropriate curve may be used if a specific condition has been required (see note of 8.1.7).

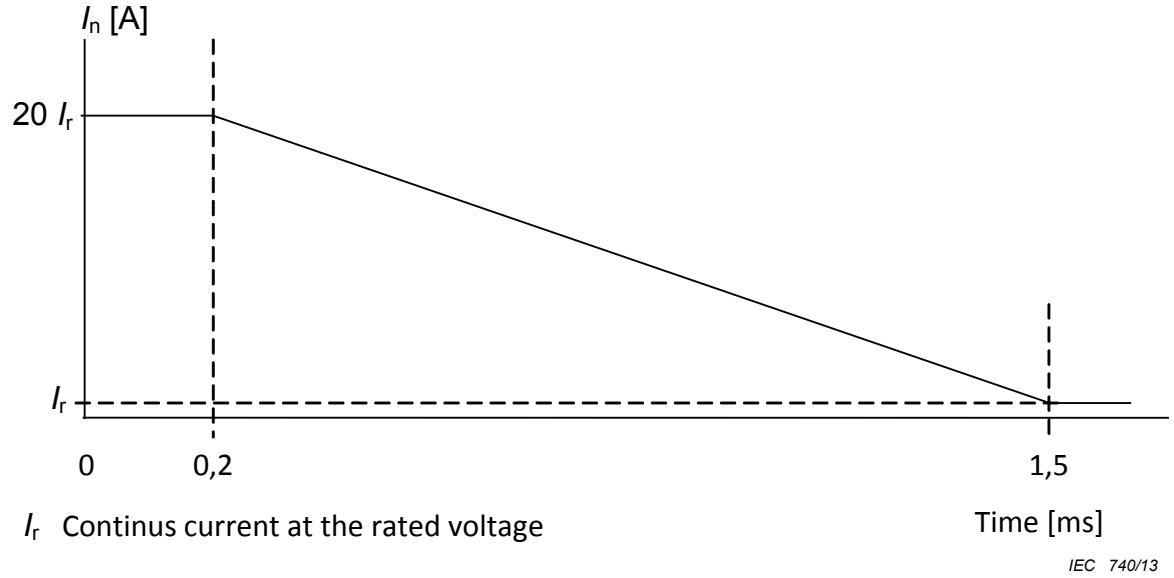


Figure 2 – Current limiting curve

9.3.3.2 Ripple factor of input current

The electronic ballast is supplied by the source defined by Figure 1.

The test consists of evaluating the maximum value of the a.c. component of the current absorbed by the electronic ballast.

9.3.3.3 Current wave form supplied to lamps

When supplied at the rated voltage, the ratio between the peak value and the r.m.s. value of the current with which the electronic ballast supplies the fluorescent lamps shall not exceed 1,7.

9.3.3.4 Frequency

The electronic ballast is supplied at any voltage, within the relevant voltage range given in 5.1. The frequency of the voltage supplying the fluorescent lamps is measured when the electronic ballast is fully loaded and after removing lamps one by one, successively.

Frequency shall be checked during all tests where the electronic ballast is supplied irrespective of the voltage, environment and load conditions.

The frequency shall comply with the requirement of 8.2.1.5.

9.3.3.5 Gradual decrease of supply voltage

The electronic ballast is supplied at the minimum value of its rated voltage range. The voltage is then reduced to zero in equal steps of 0,1 time the rated voltage, the voltage at each step being maintained for 15 min.

It is visually checked during the test that the lamps are extinguished.

At the end of the test the electronic ballast is supplied at the rated voltage, all lamps shall then light up.

9.3.4 Sequence 3

9.3.4.1 Leakage current

The electronic ballast being supplied at the rated voltage, the leakage current shall be measured between each input connections and the metallic support on which the ballast is fitted. The electric circuit is as shown in Figure 3. The values of the resistance and the capacitor are defined in Figure G.4 of IEC 60598-1:2008.

The test shall be carried out with lamps as well as without lamps.

The leakage currents measured shall be lower than the limit stated in 10.3 of IEC 60598-1:2008.

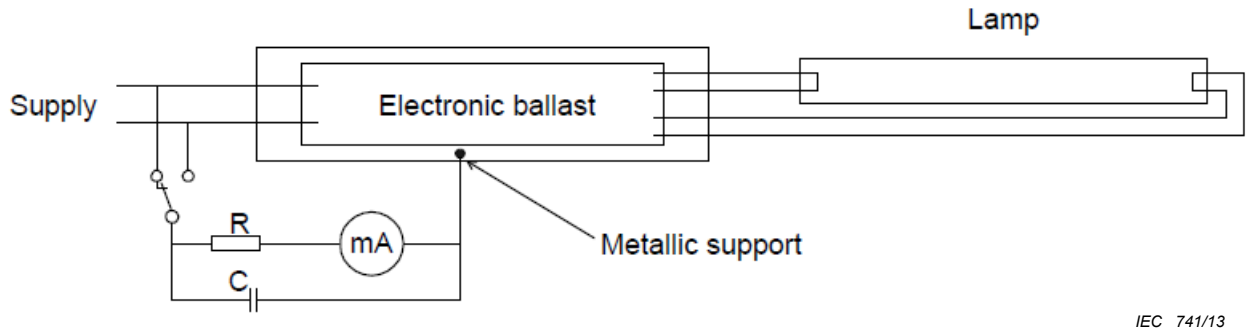


Figure 3 – Circuit for leakage current measurement

9.3.4.2 Endurance

The test shall be performed at an ambient air temperature of 22 °C ± 5 K.

The electronic ballast alternatively supplies three identical loads consisting of maximal number of lamps. The loads are switched over during the off period of the switching cycle.

Any fluorescent lamp which fails during the test shall be immediately replaced.

The switching cycle is such that the switching on time is at least 5 s and the switching off time is at least 10 s.

When supplied at the rated voltage, the electronic ballast shall endure 30 000 switching cycles.

At the end of the test, the electronic ballast shall still start the lamps as agreed, at the minimum and maximum values of the voltage range and the number of lamps replaced during the test shall not be more than a third of the total number of lamps.

9.3.4.3 Pre-heating current

Pre-heating current time, before lighting, shall be measured successively at the minimum, rated and maximum voltages after a switching off period of longer than 30 s. The measured values shall be within 0,4 s and 2 s.

When supplied at the rated voltage, the electronic ballast shall be submitted to ten lighting cycles consisting of 10 s “on” followed by 2 s “off”. The pre-heating time shall not vary by more than 10 % of the first measurement.

9.3.5 Sequence 4

9.3.5.1 Output voltage without lamps

The steady state output voltages shall be measured when the electronic ballast, fitted on a metallic plate, is supplied at the rated voltage, using appropriate means.

The measurements shall be made between every filament circuit and metallic plate.

Peak values of the voltages shall be less than 800 V.

9.3.5.2 Changing lamps

This test shall be carried out at the ambient air temperature of 22 °C ± 5 K.

The electronic ballast being supplied at the rated value, every possible combination of removal of one or several lamps, including the different types if any, shall be tested.

Each test combination shall be maintained for 30 min. After each one, the electronic ballast, full loaded, shall operate again and all lamps shall light up.

9.3.5.3 Abnormal function of the lamp

These are performance tests which may be carried out in addition to those of IEC 61347-2-3 relating to safety.

Test A – Lamp broken

The lamps are connected in such manner that filaments are normally supplied but that current cannot flow between them. Lamp filaments may also be simulated by equivalent resistors. The electronic ballast shall be supplied with the maximum value of the voltage range for 1 h.

After the test the electronic ballast is normally loaded and supplied at the rated voltage, then the lamp shall light up.

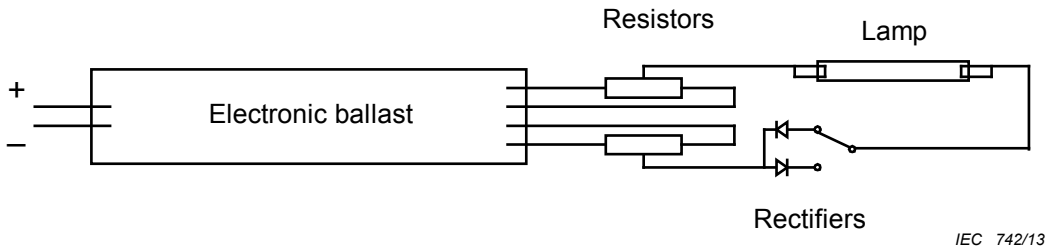
Test B – Cathode deactivated (rectifying effect)

A resistor shall be connected in place of each lamp cathode. The resistor value shall be derived from the value of nominal operational current of the lamp prescribed in the relevant standard – or the value declared by the manufacturer if none is given in the standard – and determined with the following formula:

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

where I_n is nominal operational current of the lamp in A.

The lamp shall be connected to the midpoints of the appropriate resistors according to Figure 4. The rectifier polarity shall be chosen so as to give the most unfavourable operating conditions. If necessary, the lamp shall be started using a suitable starting device.



Rectifier characteristics:

$U_{RRM} \geq 3\ 000$ V $I_R \leq 10$ μA $I_F \geq 3$ times the lamp current

$t_{IT} \leq 500$ ns (measured with $I_F = 0{,}5$ A and $I_R = 1$ A to $I_R = 0{,}25$ A)

Figure 4 – Circuit for test B: Cathode deactivated (rectifying effect)

9.3.5.4 Electromagnetic compatibility (EMC)

The ballast shall meet the requirements given in 8.2.3.4.

The emission test shall be carried out with test methods and test set up given in IEC 60571.

9.3.5.5 Overvoltage withstand

This test shall be carried out according to IEC 60571 with the following changes:

– the ambient air temperature is 22 °C ± 5 K;
– the electronic ballast is supplied at the rated voltage;
– the test with wave form H is replaced by electromagnetic compatibility test (see 9.3.5.4).

9.3.5.6 Polarity reversal

The electronic ballast shall be supplied at the maximum value of the rated voltage range.

The electronic ballast shall be connected so that the supply voltage positive polarity is connected to negative input and vice versa.

The full voltage is applied instantaneously and maintained for 1 h.

After the test, the electronic ballast shall be normally connected to the lamps and supplied at its rated voltage.The lamps shall light up, after fuse replacement if necessary.

9.3.5.7 Short-circuit

One lamp is removed from the circuit and the two terminals corresponding to one filament supplying are short circuited. The electronic ballast shall be supplied at the maximum value of the voltage range for 1 h.

After the test, the electronic ballast shall be normally connected to the lamps and supplied at the rated voltage. The lamps shall light up.

The test shall be repeated for each filament, unless the manufacturer agrees to carry out the test on all filaments simultaneously.

9.3.5.8 Internal protection

This test is not applicable to standardised replaceable fuses which shall comply with their product standard.

The test shall be carried out on a bare printed board circuit normally fitted in its housing if any, with a soldered strap making a short-circuit downstream of the printed circuit fuse. The input circuit terminals shall be connected to the source described in 9.3.3.1 through a standard cartridge fuse for domestic and similar purposes (national standard).The fuse rating shall be the next highest value to the figure equal to 25 times the maximum input current given in the manufacturer data sheet.

After closing the circuit only the printed circuit fuse shall be blown without other damage to adjacent components or environment.

9.3.6 Sequence 5

9.3.6.1 Damp heat test

This test shall be carried out to demonstrate both compliance with IEC 61347-2-3 and performance requirements of this standard.

The de-energised electronic ballast shall be submitted to test Db variant 2 of IEC 60068-2-30 with the following conditions:

– severity:
  - temperature: 55 °C ± 1 K;
  - number of cycles: 2;
– intermediate checking and inspection:
  - consumption between 1 h and 1,5 h after the start of the second cycle, compliance to 9.3.2.6;
  - lighting just before the end of each cycle with compliance to 9.3.2.4;
– final checking and measurements:
  - dielectric test according to 9.3.2.8;
  - lighting according to 9.3.2.4;
  - visual examination according to 9.3.2.1.

The electronic ballast shall not fail during the test and no deterioration shall appear after the test.

9.3.6.2 Dry heat test

The electronic ballast shall be submitted to the test Bd of IEC 60068-2-2 with the following conditions:

– severity:
  - temperature: 40 °C ± 1 K for operating class T1;
    35 °C ± 1 K for operating class T2;
    45 °C ± 1 K for operating class T3; or
    50 °C ± 1 K for operating class TX;
– intermediate checking and inspection:
  - the electronic ballast is permanently supplied at the maximum value of the voltage range;
  - temperature of hottest components is checked to make sure that temperature-rises do not exceed the limits specified in IEC 60571 for electronic components and IEC 60077-1 for other parts;

– final checking and measurements:
  - dielectric test according to 9.3.2.8;
  - lighting according to 9.3.2.4;
  - visual examination according to 9.3.2.1.

The electronic ballast shall not fail during the test and no deterioration shall appear after the test.

9.3.6.3 Cold test

The test comprises different stages which shall be applied successively for the minimum temperature to withstand and for the minimum temperature for starting of the lamps.

The electronic ballast and the lamps are submitted to test Ad of IEC 60068-2-1 with the following conditions:

– severity:
  - temperature: –25 °C ± 1 K for operating classes T1 and T3; or
    –40 °C ± 1 K for operating classes T2 and TX;
  - duration: 2 h for operating classes T1 and T3;
    3 h for operating classes T2 and TX.
– intermediate checking and inspection:
  - after 1 h a lighting test shall be carried out at the rated voltage. Light up of the lamps is not required;
  - after the 2 h duration test the temperature is increased, in order to verify the conditions of 8.2.1.5, up to

    –25 °C ± 1 K and then to –5 °C ± 1 K for operating classes T2 and TX, each temperature being maintained during 1 h,

    –5 °C ± 1 K for operating classes T1 and T3.

The electronic ballast shall be kept at each relevant temperature and after 1 h the lighting test shall be carried out at the corresponding minimum voltage required in 8.2.1.6. The lamps shall start.

– final checking and measurements:
  - dielectric test according to 9.3.2.8;
  - lighting according to 9.3.2.4;
  - visual examination according to 9.3.2.1.

The electronic ballast and the lamps shall not fail during the test and no deterioration shall appear after the test.

9.3.6.4 Vibration test

The test shall be carried out with the method and requirements given in IEC 61373.

9.3.6.5 Shock test

The test shall be carried out with the method and requirements given in IEC 61373.

9.3.6.6 Fire behaviour

The test shall be carried out with the methods and requirements given in IEC 60598-1 which takes precedence over those of IEC 61347-2-3.

Annex A
(informative)

Distance between lamp and metallic support

Electronic ballasts are designed to supply tubular fluorescent lamps mounted along a metallic support which is bonded to the car body in order to ensure a starting under satisfactory conditions. No other device shall be placed near the lamps to assist starting.

The metallic support of 40 mm width shall be located at the following maximum distance from the tubular lamp surface:

– 20 mm for lamps with a diameter of 25 mm to 38 mm;

– 7 mm for lamps with a diameter of 15 mm.

This Annex is not relevant for single capped lamps.

Annex B
(informative)

Electronic ballast for lamps up to 40 W (case 1)

This annex gives the overall dimensions of a housing for electronic ballasts having a maximum output power of 40 W capable to supply either one lamp of 40 W maximum or two lamps of 20 W maximum, see Figure B.1.

The use of this housing for a new electronic ballast design is recommended to offer a possible replacement of an old type for maintenance.

Dimensions in millimetres

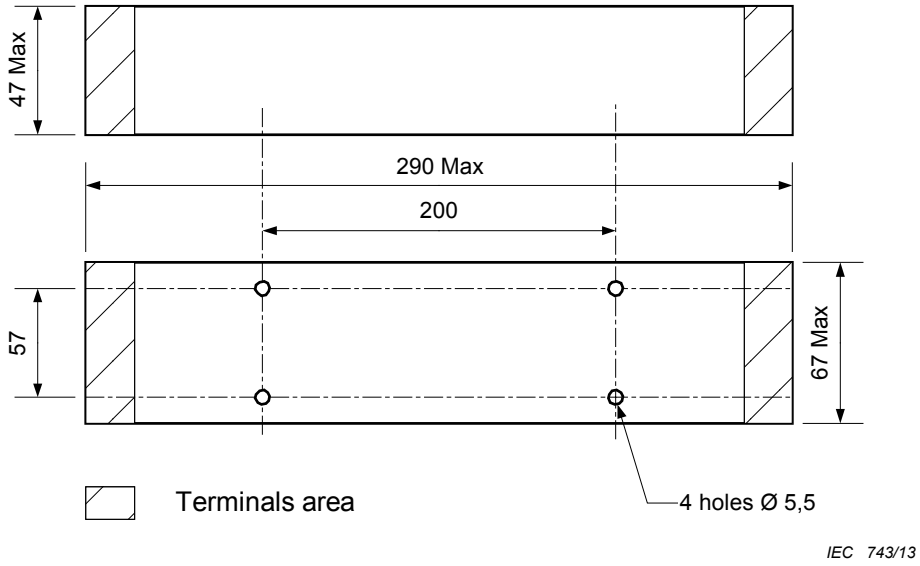


Figure B.1 – Overall dimensions for electronic ballast

The possible schematic diagrams to be used are given in Figure G.1, Figure G.2 and Figure G.3.

Annex C
(informative)

Electronic ballast for lamps up to 40 W (case 2)

This annex gives the overall dimensions of a housing for electronic ballasts having a maximum output power of 40 W capable to supply either one lamp of 40 W maximum or two lamps of 20 W maximum, see Figure C.1.

The use of this housing for a new electronic ballast design is recommended to offer a possible replacement of an old type for maintenance.

Dimensions in millimetres

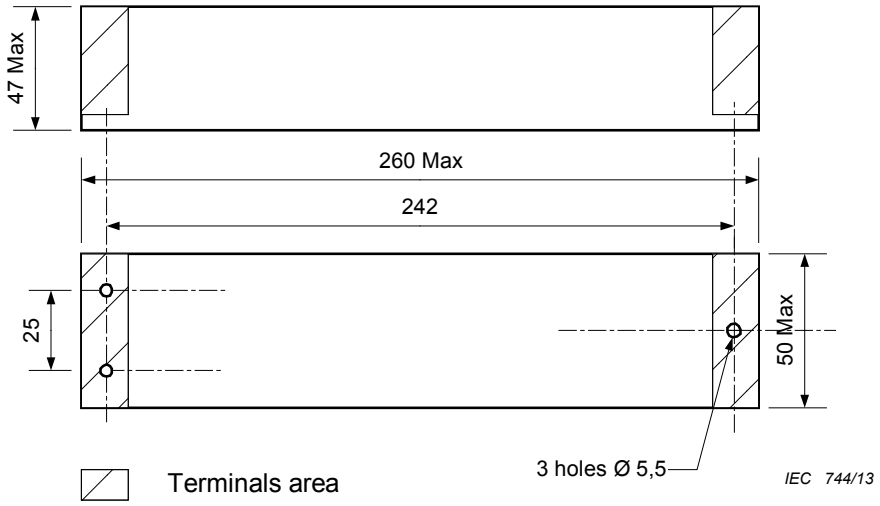


Figure C.1 – Overall dimensions for electronic ballast

The possible schematic diagrams to be used are given in Figure G.1, Figure G.2 and Figure G.3.

Annex D
(informative)

Electronic ballast for lamps up to 15 W

This annex gives the overall dimensions of a housing for electronic ballasts having a maximum output power of 15 W capable to supply one lamp of 15 W, see Figure D.1.

The use of this housing for a new electronic ballast design is recommended to offer a possible replacement of an old type for maintenance.

Dimensions in millimetres

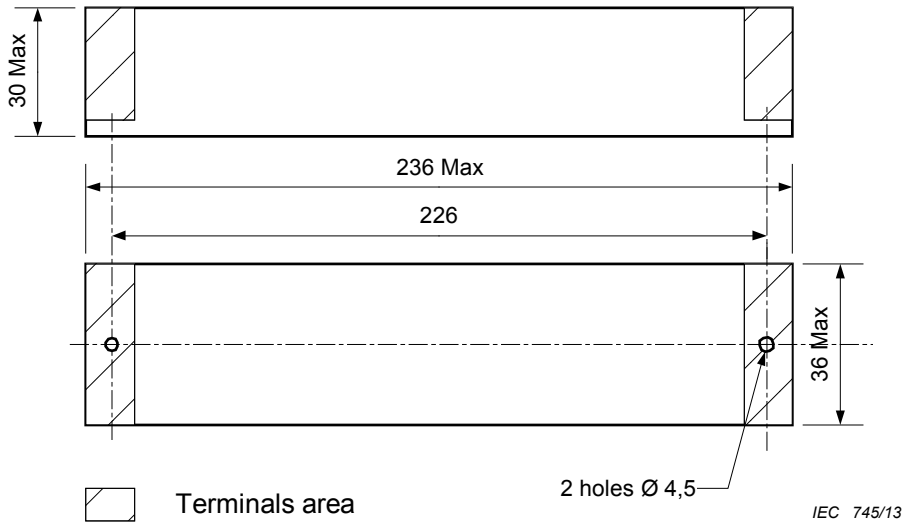


Figure D.1 – Overall dimensions for electronic ballast

The possible schematic diagrams to be used are given in Figure G.4 and Figure G.5.

Annex E
(informative)

Electronic ballast for lamps up to 20 W

This annex gives the overall dimensions of a housing for electronic ballasts having a maximum output power of 20 W capable to supply either one lamp of 20 W maximum or two lamps of 10 W maximum, see Figure E.1.

The use of this housing for a new electronic ballast design is recommended to offer a possible replacement of an old type for maintenance.

Dimensions in millimetres

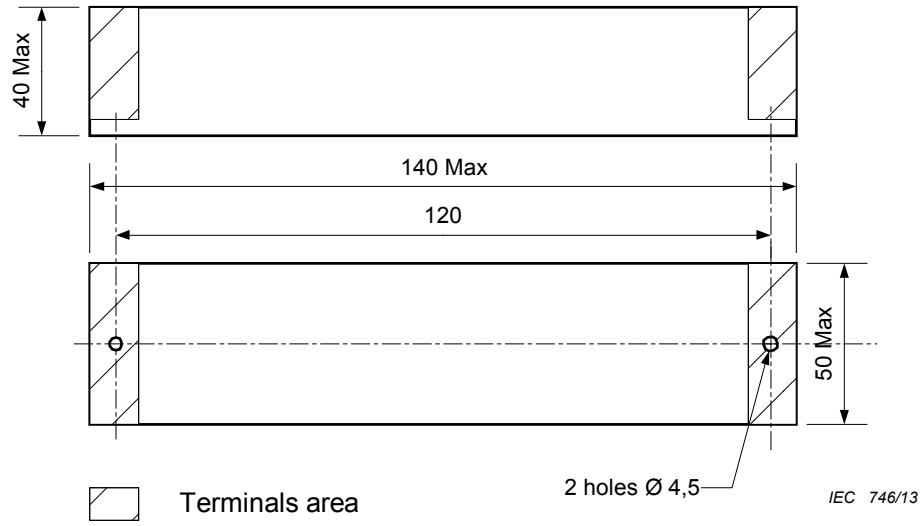


Figure E.1 – Overall dimensions for electronic ballast

The possible schematic diagrams to be used are given in Figure G.4, Figure G.6 and Figure G.7.

Annex F
(informative)

Electronic ballast for lamps up to 10 W

This annex gives the overall dimensions of a housing for electronic ballasts having a maximum output power of 10 W capable to supply one lamp of 10 W maximum, see Figure F.1.

The use of this housing for a new electronic ballast design is recommended to offer a possible replacement of an old type for maintenance.

Dimensions in millimetres

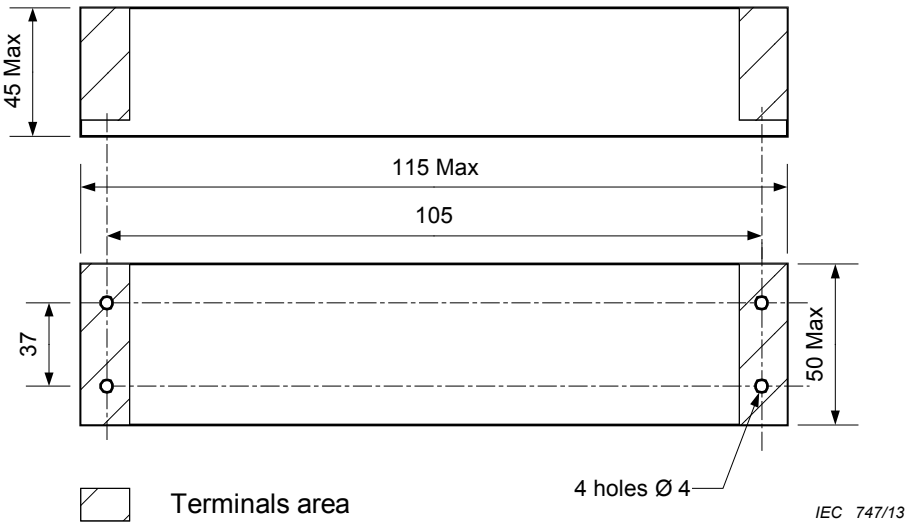


Figure F.1 – Overall dimensions for electronic ballast

The possible schematic diagram to be used is given by in Figure G.4.

Annex G
(informative)

Basic schematic diagrams

This annex gives the basic schematic diagrams for electronic ballasts which are commonly used with the relevant housings given in Annexes B to F.

The diagrams correspond to the housing as follows:

Circuit diagram G.1 is used with housing of Annex B and Annex C.

Circuit diagram G.2 is used with housing of Annex B and Annex C.

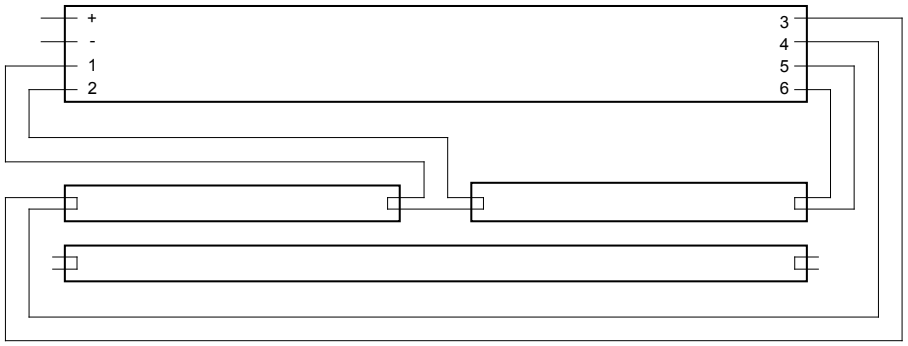
Circuit diagram G.3 is used with housing of Annex B and Annex C.

Circuit diagram G.4 is used with housing of Annex D, Annex E and Annex F.

Circuit diagram G.5 is used with housing of Annex D.

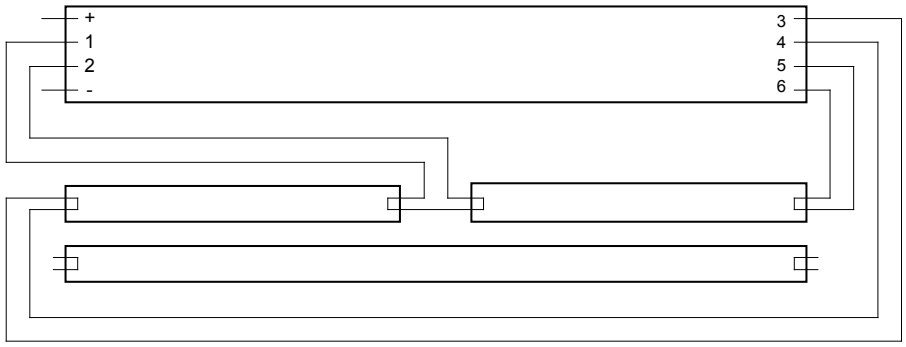
Circuit diagram G.6 is used with housing of Annex E.

Circuit diagram G.7 is used with housing of Annex E.



IEC 748/13

Figure G.1 – One or two tubular lamps



IEC 749/13

Figure G.2 – One or two tubular lamps

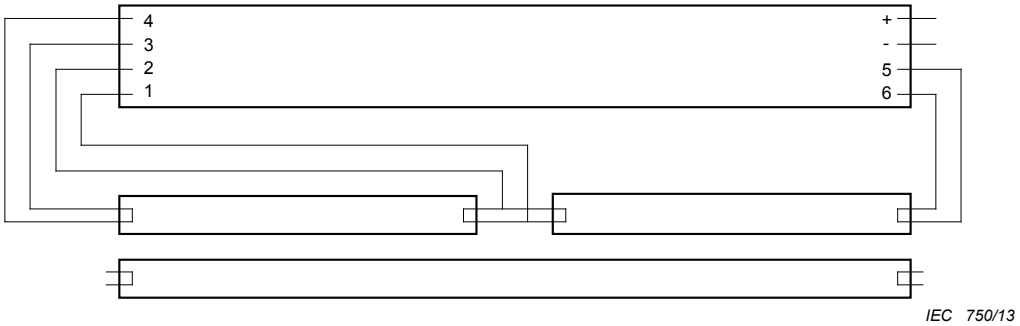


Figure G.3 – One or two tubular lamps

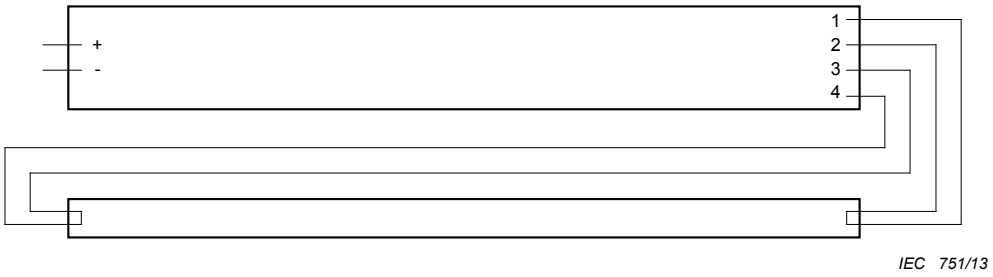


Figure G.4 – One tubular lamp

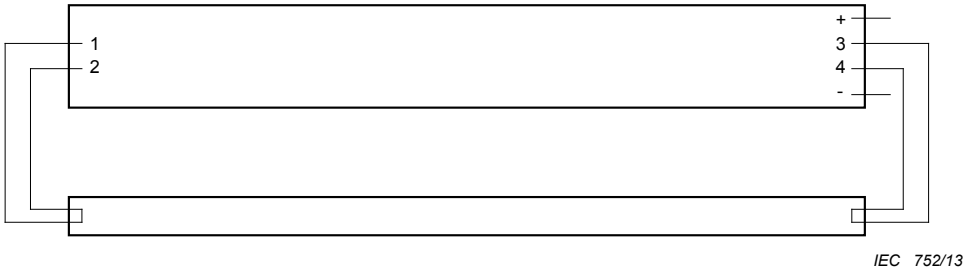


Figure G.5 – One tubular lamp

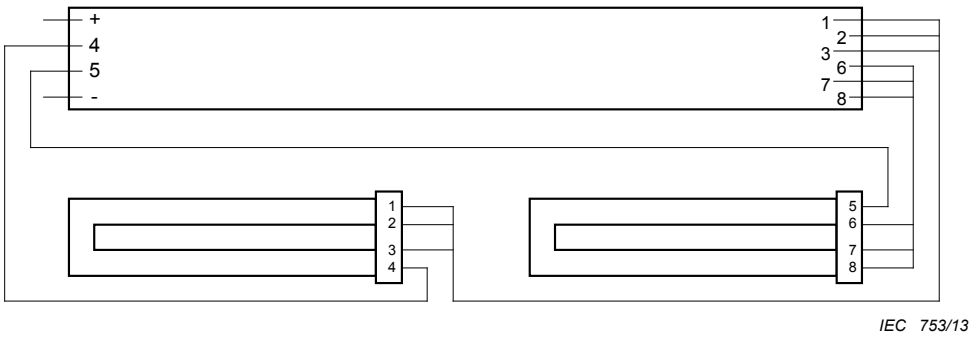


Figure G.6 – One or two single capped lamps

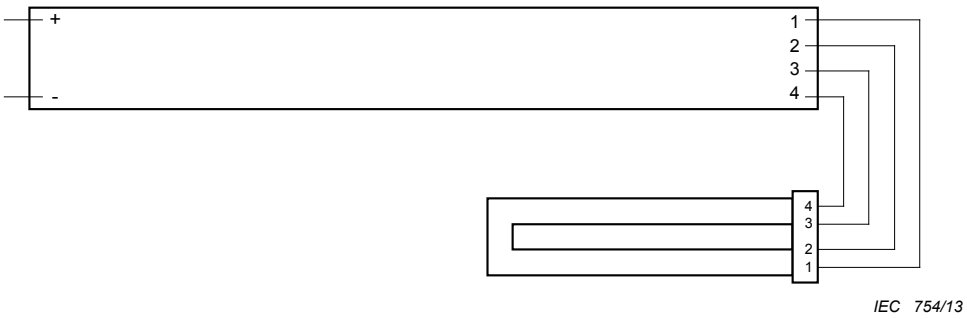


Figure G.7 – One single capped lamp

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1) Superseded by EN 60068-1:2014 (IEC 60068-1:2013): DOW = 2016-11-11.

2) Superseded by EN 55015:2013 (CISPR 15:2013 + IS1:2013 + IS2:2013): DOW= 2016-06-12.

3 There is a consolidated edition 2.2 (2001) comprising edition 2 (1996), Amendment 1 (1997) and Amendment 2 (2000).

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