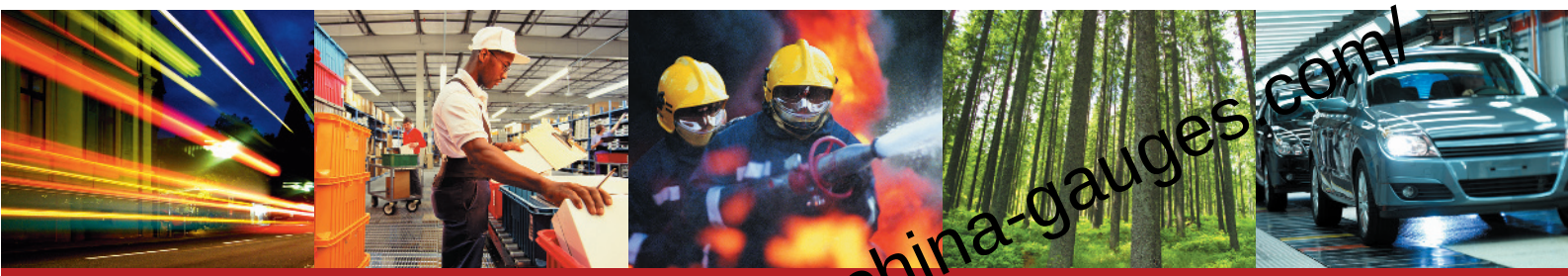
BS EN 61199:2011+A2:2015



BSI Standards Publication

Single-capped fluorescent lamps — Safety specifications

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National foreword

This British Standard is the UK implementation of EN 61199:2011+A2:2015. It is identical to IEC 61199:2011, incorporating amendment 1:2012 and amendment 2:2014. It supersedes BS EN 61199:2011+A1:2013, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by ⟨A1⟩ ⟨A1⟩.

The UK participation in its preparation was entrusted by Technical Committee CPL/34, Lamps and Related Equipment, to subcommittee CPL/34/1, Electric lamps.

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 2015

ISBN 978 0 580 83745 6

ICS 29.140.30

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 30 September 2011.

Amendments/corrigenda issued since publication

Date	Text affected
31 May 2013	Implementation of IEC amendment 1:2012 with CENELEC endorsement A1:2013
28 February 2015	Implementation of IEC amendment 1:2014 with CENELEC endorsement A2:2015

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61199:2011+A2

January 2015

ICS 29.140.30

English version

Single-capped fluorescent lamps - Safety specifications

(IEC 61199:2011)

Lampes à fluorescence à culot unique - Specifications de sécurité
(CEI 61199:2011)

Einseitig gesockelte Leuchtstofflampen - Sicherheitsanforderungen
(IEC 61199:2011)

This European Standard was approved by CENELEC on 2011-08-15. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

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

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CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 61199:2011 E

Foreword

The text of document 34A/1468/FDIS, future edition 3 of IEC 61199, prepared by SC 34A, "Lamps", of IEC TC 34, "Lamps and related equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61199:2011.

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)	2012-05-15
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2014-08-15

This document supersedes EN 61199:1999.

Main technical changes are the introduction of requirements for high frequency operation, a new temperature measurement position and few new cap-holder fits.

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

Endorsement notice

The text of the International Standard IEC 61199:2011 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 62471 NOTE Harmonized as EN 62471.

Foreword to amendment A1

The text of document 34A/1538/CDV, future edition 1 of IEC 61199:2011/A1, prepared by SC 34A, "Lamps", of IEC TC 34, "Lamps and related equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61199:2011/A1:2013.

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)	2013-08-22
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2015-11-01

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

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

Endorsement notice

The text of the International Standard IEC 61199:2011/A1:2012 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A2

The text of document 34A/1740/CDV, future IEC 61199:2011/A2, prepared by SC 34A “Lamps” of IEC/TC 34 “Lamps and related equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61199:2011/A2:2015.

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)	2015-07-16
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-09-03

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

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

Endorsement notice

The text of the International Standard IEC 61199:2011/A2:2014 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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

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

Publication	Year	Title	EN/HD	Year
IEC 60061-1	-	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 1: Lamp caps	EN 60061-1	-
IEC 60061-2	-	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 2: Lampholders	EN 60061-2	-
IEC 60061-3	-	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 3: Gauges	EN 60061-3	-
IEC 60061-4	-	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 4: Guidelines and general information	EN 60061-4	-
IEC 60155	-	Glow-starters for fluorescent lamps	EN 60155	-
IEC 60360	-	Standard method of measurement of lamp cap temperature rise	EN 60360	-
IEC 60410	-	Sampling plans and procedures for inspection by attributes	-	-
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	-	-
IEC 60598-1 (mod) -	2008 -	Luminaires - Part 1: General requirements and tests	EN 60598-1 + A11	2008 2009
IEC 60695-2-10	-	Fire hazard testing - Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN 60695-2-10	-
IEC 60901	-	Single-capped fluorescent lamps - Performance specifications	EN 60901	-
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	-
IEC 61347-2-8	-	Lamp controlgear - Part 2-8: Particular requirements for ballasts for fluorescent lamps	EN 61347-2-8	-

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SINGLE-CAPPED FLUORESCENT LAMPS – SAFETY SPECIFICATIONS

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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International Standard IEC 61199 has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

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

FDIS	Report on voting
34A/1468/FDIS	34A/1493/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 third edition cancels and replaces the second edition published in 1999. It constitutes a technical revision. Main technical changes are the introduction of requirements for high frequency operation, a new temperature measurement position and few new cap-holder fits.

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

For the ease of measurement, a new location for measuring the maximum cap temperature and maximum cap temperature rise has been introduced with this third edition of this standard, resulting in new temperature values. However, the design of lampholders is based on the traditional measurement location. Therefore, a new Annex I has been introduced, providing the previous methods and values for those lamp types and kinds of lamp operation, which have been already covered in the previous edition of this standard. For lamps which are operated by means of an electronic ballast however, also a new measurement method and temperature limits are given.

Special attention has been given to the requirements related to high frequency operation, not covered in the previous edition.

A1 The standards IEC 62471,and IEC/TR 62471-2, contain horizontal requirements available that need to be introduced into product standards, e.g. to IEC 61199.

The horizontal requirements are transformed into requirements for single-capped fluorescent lamps.

The lamps within the scope of this standard are general lighting service (GLS) lamps according to the definition 3.11 of IEC 62471;2006. "...lamps intended for lighting spaces that are typically occupied or viewed by people..."

According to Clause 6 of IEC 62471:2006, radiation of GLS lamps is measured at a distance equivalent to 500 lx.

Measured at the 500 lx distance, GLS lamps will not exceed risk group 1 for blue light hazard and risk group 0 for IR radiation. This combination of risk group and hazard does not require marking (Table 1 of IEC/TR 62471-2:2009).

Hazards from UV radiation of GLS lamps are sufficiently covered in 4.11 of IEC 61199,.

Hence, IEC 62471 does not require any additional marking for GLS lamps. A1

SINGLE-CAPPED FLUORESCENT LAMPS – SAFETY SPECIFICATIONS

1 Scope

This International Standard specifies the safety requirements for single-capped fluorescent lamps for general lighting purposes of all groups having caps according to Table 1.

It also specifies the method a manufacturer should use to show compliance with the requirements of this standard on the basis of whole production appraisal in association with his test records on finished products. This method can also be applied for certification purposes. Details of a batch test procedure which can be used to make limited assessment of batches are also given in this standard.

〈A1〉 This part of the standard covers photobiological safety according to IEC 62471 and IEC/TR 62471-2.

Blue light and infrared hazards are below the level which requires marking. 〈A1〉

NOTE Compliance with this standard concerns only safety criteria and does not take into account the performance of single-capped fluorescent lamps for general lighting purposes with respect to luminous flux, colour, starting and operational characteristics. For this information, readers are referred to IEC 60901.

Table 1 – Sheet references of IEC 60061

Cap type	Sheet numbers	
	IEC 60061-1 Lamp caps	IEC 60061-3 Cap gauges
2G7	7004-102	7006-102
2GX7	7004-103	7006-102
2G8	7004-141	7006-141, 141H, 141J, 141K
GR8	7004-68	7006-68A, 68B, 68E
G10q	7004-54	7006-79
GR10q	7004-77	7006-77A, 68B, 68E
GU10q	7004-123	7006-123, 123A
GX10q	7004-84	7006-79, 84, 84A and 84B
GY10q	7004-85	7006-79, 85 and 85A
GZ10q	7004-124	7006-79
2G10	7004-118	7006-118
2G11	7004-82	7006-82
2GX11-1	7004-82A	7006-82F, 82G, 82H
2GX13	7004-125	7006-125A, 125B
G23	7004-69	7006-69
GX23	7004-86	7006-86
G24, GX24	7004-78	7006-78
GZ24q	*	*
GX32	7004-87	7006-87

* to be developed.

It may be expected that lamps which comply with this standard will operate safely at supply voltages between 90 % and 110 % of rated supply voltage of the used ballast and when operated with a ballast complying with IEC 61347-2-3 or IEC 61347-2-8 with a starting device complying with IEC 60155 (if applicable) and in a luminaire complying with IEC 60598-1.

2 Normative references

The following reference documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the reference document (including any amendments) applies.

IEC 60061-1 *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 1: Lamp caps*

IEC 60061-2, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 2: Lampholders*

IEC 60061-3, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 3: Gauges*

IEC 60061-4, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 4: Guidelines and general information*

IEC 60155, *Glow-starters for fluorescent lamps*

IEC 60360, *Standard method of measurement of lamp cap temperature rise*

IEC 60410, *Sampling plans and procedures for inspection by attributes*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

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

IEC 60695-2-10, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

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

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

IEC 61347-2-8, *Lamp control gear – Part 2-8: Particular requirements for ballasts for fluorescent lamps*

3 Terms and definitions

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

3.1
single-capped fluorescent lamp
low-pressure mercury discharge lamp having a single cap in which most of the light from the lamp is emitted by a layer of fluorescent material excited by the ultraviolet radiation from the discharge

3.2
group
lamps having the same electrical and cathode characteristics, the same physical dimensions and the same starting method

3.3
type
lamps of the same group having the same photometric and colour characteristics

3.4
family
lamp groups which are distinguished by common features of materials, components, tube diameter and/or method of processing

3.5
nominal value
approximate quantity value used to designate or identify a lamp

3.6
rated value
quantity value for a characteristic of a lamp for specified operating conditions

The value and the conditions are specified in this standard, or assigned by the manufacturer or responsible vendor.

3.7
design test
test made on a sample for the purpose of checking compliance of the design of a family, group or a number of groups with the requirements of the relevant clause

3.8
periodic test
test, or series of tests, repeated at intervals in order to check that a product does not deviate in certain respects from the given design

3.9
running test
test repeated at frequent intervals to provide data for assessment

3.10
batch
all lamps of one family and/or group and identified as such and put forward at one time for test or checking compliance

3.11
whole production
production during a period of twelve months of all types of lamps within the scope of this standard and nominated in a list of the manufacturer for inclusion in the certificate

3.12
SoS value
abbreviation for the “sum of the squares” (SoS) of the two currents through the two lead wires at a lamp electrode

The currents are measured as r.m.s. values. The lead current at one electrode coil, which gets the higher r.m.s. current value is called I_{LH} (“lead high”), the lead current with the lower r.m.s. value is called I_{LL} (“lead low”). The values of the two currents have to be squared and added (SoS = $I_{LH}^2 + I_{LL}^2$).

3.13
specific effective radiant UV power
effective power of the UV radiation of a lamp related to its luminous flux

Unit: mW/klm

NOTE The effective power of the UV radiation is obtained by weighting the spectral power distribution of the lamp with the UV hazard function $S_{UV}(\lambda)$. Information about the relevant UV hazard function is given in IEC 62471. It only relates to possible hazards regarding UV exposure of human beings. It does not deal with the possible influence of optical radiation on materials, like mechanical damage or discoloration.

4 Safety requirements

4.1 General

Lamps shall be so designed and constructed that in normal use they present no danger to the user or the surroundings.

In general, compliance is checked by carrying out all the tests specified.

4.2 Marking

4.2.1 The following information shall be legibly and durably marked on the lamps:

a) mark of origin (this may take the form of a trade mark, the manufacturer's name or the name of the responsible vendor);
b) the nominal wattage (marked "W" or "watts") or any other indication which identifies the lamp.

4.2.2 Compliance is checked by the following:

a) presence and legibility of the marking by visual inspection;
b) durability of marking by applying the following test on unused lamps.

The area of the marking on the lamp shall be rubbed by hand with a smooth cloth damped with water for a period of 15 s.

After this test, the marking shall still be legible.

4.3 Mechanical requirements for caps

4.3.1 Construction and assembly

Caps shall be so constructed and assembled to the tube(s) that the whole assembly remains intact and attached during and after operation. In case of lamps with G10q, GZ10q and 2GX13 caps, the caps shall be capable of being rotated like described in Annex A.

Compliance is checked by carrying out the tests given in Annex A.

At the end of the tests, the caps shall show no damage that impairs safety.

4.3.2 Dimensional requirements for caps

4.3.2.1 Lamps shall use standardized caps in accordance with the dimensional requirements of IEC 60061-1.

4.3.2.2 Compliance is checked by using the gauges shown in Table 1.

4.3.3 Pin connections and keying configurations

4.3.3.1 Pin connections

The connection of lamp cathodes to the pins of caps having four pins shall conform to the requirements shown in Annex E for the relevant cap.

Compliance is checked by electrical continuity tests between relevant pins and/or by visual inspection.

4.3.3.2 Key configuration

For those cap types incorporating keys which ensure non-interchangeability with similar lamp types, the caps shall conform to the cap/key version given in the relevant lamp data sheet of IEC 60901. Annex F gives guidance to which cap/key shall be used when designing lamps to operate on a certain ballast.

Compliance is checked by a suitable measuring system and/or visual inspection.

〈A2〉 4.3.4 System requirements

Where a cap sheet as specified in IEC 60061-1 includes information on system requirements, lamps shall not exceed the limits specified.

Compliance is checked by measurement. 〈A2〉

4.4 Insulation resistance

4.4.1 The insulation resistance between the metal parts, if any, of the cap and all pins connected together shall not be less than 2 MΩ.

4.4.2 Compliance is checked by measurement with suitable test equipment using a d.c. voltage of 500 V.

In the case of caps made entirely from insulating material, the test is made between all pins connected together and metal foil wrapped over those surfaces that are accessible when the cap has been connected to a lampholder with minimum shrouding dimensions, as given in IEC 60061-2.

4.5 Electric strength

4.5.1 The insulation between the same parts as those referred to in 4.4 shall withstand the test voltage of 4.5.2. No flash-over or breakdown shall occur during the test.

4.5.2 Compliance is checked with a 1 500 V a.c. voltage of substantially sine-wave form, with a frequency of 50 Hz or 60 Hz and applied for 1 min. Initially, not more than half the prescribed voltage shall be applied; it shall then be raised rapidly to the full value.

Glow discharges without a drop in voltage are neglected.

4.6 Parts which can become accidentally live

4.6.1 Metal parts, if any, intended to be insulated from live parts shall not be or become live.

4.6.2 With the exception of cap pins, no live part shall project from any part of the cap.

4.6.3 Compliance is checked by a suitable measuring system which may include visual inspection where appropriate. In addition, there shall be regular daily checks of the equipment or a verification of the effectiveness of the inspection. See 5.5.4.

4.7 Resistance to heat and fire

4.7.1 Insulating material of caps shall be sufficiently resistant to heat.

4.7.2 Compliance is checked by the following tests.

4.7.2.1 Samples are tested for a period of 168 h in a heating cabinet at a temperature as given in Annex G.

At the end of the test, the samples shall not have undergone any change impairing their future safety, especially in the following respects:

– reduction in the protection against electric shock as required in 4.4 and 4.5;
– loosening of cap pins, cracks, swelling and shrinking as determined by visual inspection.

At the end of the test, the dimensions shall comply with the requirements of 4.3.2.

4.7.2.2 Samples are subjected to a ball-pressure test by means of the apparatus shown in Figure G.1.

The surface of the part under test is placed in the horizontal position and a steel ball of 5 mm diameter is pressed against this surface by a force of 20 N. If the surface under test bends, the part where the ball presses shall be supported.

The test shall be made in a heating cabinet at a temperature of 125 °C ± 5 °C.

After 1 h, the ball shall be removed and the diameter of the impression measured. This diameter shall not exceed 2 mm.

The test shall not be made on parts of ceramic material.

4.7.3 Insulating material of caps shall be resistant to abnormal heat and to fire.

4.7.4 Compliance is checked by the following test.

Parts are subjected to a test using a nickel-chromium glow-wire heated to 650 °C. The test apparatus shall be that described in IEC 60695-2-10.

The sample to be tested is mounted vertically on the carriage and pressed against the glow-wire tip with a force of 1 N, preferably 15 mm or more from the upper edge of the sample. The penetration of the glow-wire into the sample is mechanically limited to 7 mm. After 30 s the sample is withdrawn from contact with the glow-wire tip.

Any flame or glowing of the sample shall extinguish within 30 s of withdrawing the glow-wire and any burning or molten drops shall not ignite a piece of tissue paper consisting of five layers, spread out horizontally 200 mm ± 5 mm below the sample.

The glow-wire temperature and heating current shall be constant for 1 min prior to commencing the test. Care shall be taken to ensure that heat radiation does not influence the sample during this period. The glow-wire tip temperature is measured by means of a sheathed fine-wire thermocouple constructed and calibrated as described in IEC 60695-2-10.

NOTE Precautions should be taken to safeguard the health of personnel conducting tests against risks of

– explosion or fire;

– inhalation of smoke and/or toxic products;

– toxic residues.

4.8 Creepage distance for caps

4.8.1 The minimum creepage distance between contact pins and the metal parts (if any) of the cap shall be in accordance with the requirements in IEC 60061-4, sheet 7007-6. Relevant cap standard sheet numbers of IEC 60061-1 are given in Table 1.

4.8.2 Compliance is checked by measurement in the most onerous position.

4.9 Lamp cap temperature rise

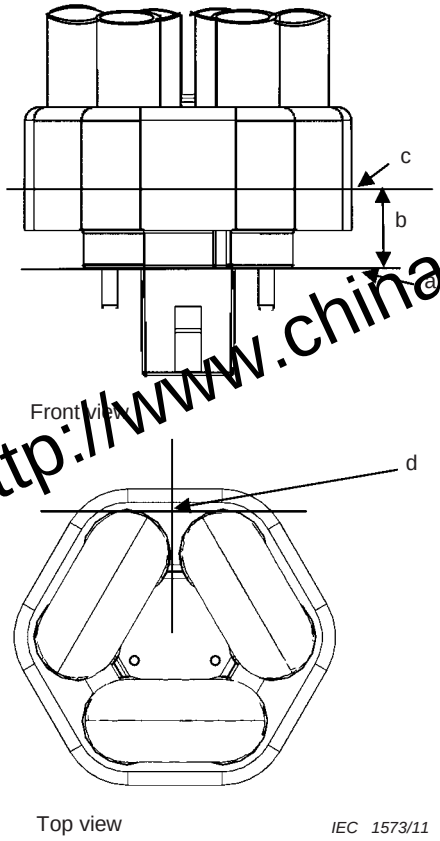
4.9.1 The lamp cap temperature rise above ambient temperature shall not exceed the relevant value given in Table B.1 and Table B.2.

4.9.2 The test procedure is specified in Annex B.

4.9.3 Conditions of compliance are given in Clause D.4.

4.9.4 Where it can be shown that one lamp group produces the highest cap temperature rise for a given lamp family, only tests on this one lamp group are necessary to show compliance of all identically capped lamps.

NOTE There is a correlation between the highest temperature on the cap surface as given in Annex C and the temperature on a point at the side surface of the cap, closer to the lamp reference plane, which is given in Annex I. The point on the side surface of the cap is described in Table I.1. The maximum temperature which can be expected at that point is given in Table I.2. An example for the location of the 2 points for temperature measurement is shown in Figure 1.



Key

a reference plane

b distance *x* as given in Table I.1

c circumferential line on the side surface (Annex I)

d highest temperature on the cap surface (Annex C)

Figure 1 – Places where to measure the temperature

4.10 Radio interference suppression capacitors

4.10.1 General

Lamps which contain integral means of starting and/or contain capacitors to suppress radio interference shall have capacitors which comply with the following requirements.

4.10.2 Moisture resistance

The capacitor shall be resistant to moisture. Compliance is checked by the following test.

Before humidity treatment, the capacitors shall be kept at an ambient temperature which does not differ from the temperature within the humidity test enclosure by more than $^{+4}_{0}$ °C for at least 4 h.

Immediately after the humidity treatment of 48 h in an atmosphere of 91 % to 95 % relative humidity and an ambient temperature between 20 °C and 30 °C maintained within limits

of ±1 °C, the capacitor shall be subjected to and satisfactorily withstand a d.c. voltage of 2 000 V without breakdown for 1 min.

The test voltage shall be applied across the terminations of the capacitor and initially shall not be more than half the prescribed voltage. It shall then be raised gradually to the full value.

4.10.3 Resistance to flame and ignition

The capacitor shall be resistant to flame and ignition.

Compliance is checked by the following test. The capacitors are each subjected to a gradually increasing a.c. voltage until breakdown occurs. The voltage source used to this effect shall have a short-circuit power of approximately 1 kVA.

Thereafter, each capacitor shall be connected in series with an inductive ballast, of a rated wattage suitable for operating the relevant lamps and operated for 5 min at the rated voltage of the ballast.

During this test, the capacitor shall not induce flame or cause ignition.

4.11 UV radiation

The specific effective radiant UV power emitted by the lamp shall not exceed the value of 2 mW/klm. For reflector lamps, it shall not exceed the value of 2 mW/(m^2 · klx).

NOTE In IEC 62471, exposure limits are given as effective irradiance values (unit W/m^2) and for risk group classification, the values for general lighting lamps are to be reported at an illuminance level of 500 lx. The borderline for risk group exempt is 0,001 W/m^2 at an illuminance level of 500 lx. This means the specific value, related to the illuminance, is 0,001 divided by 500 in W/(m^2·lx), which is 2 mW/(m^2·klx). Since lx = lm/m^2 this equals 2 mW/klm specific UV power.

Compliance is checked by spectroradiometric measurement, under the same conditions as for the lamp's electrical and photometric characteristics as given in IEC 60901.

4.12 Information for luminaire design

Refer to Annex C.

4.13 Information for ballast design

Refer to Annex H.

4.14 Information for lampholder design

Refer to Annex I.

5 Assessment

5.1 General

This clause specifies the method a manufacturer should use to show that his product conforms to this standard on the basis of whole production assessment, in association with his test records on finished products. This method can also be applied for certification purposes. Subclauses 5.2, 5.3 and 5.5 give details of assessment by means of the manufacturer's records.

Details of a batch test procedure which can be used to make limited assessment of batches are given in 5.4 and 5.6. Requirements for batch testing are included in order to enable the assessment of batches presumed to contain unsafe lamps. As some safety requirements

cannot be checked by batch testing, and as there may be no previous knowledge of the manufacturer's quality, batch testing cannot be used for certification purposes nor in any way for an approval of the batch. Where a batch is found to be acceptable, a testing agency may only conclude that there is no reason to reject the batch on safety grounds.

5.2 Whole production assessment by means of the manufacturer's records

5.2.1 The manufacturer shall show evidence that his products comply with the particular requirements of 5.3. To this end, the manufacturer shall make available all the results of his product testing pertinent to the requirements of this standard.

5.2.2 The test results may be drawn from working records and, as such, may not be immediately available in collated form.

5.2.3 The assessment shall be based in general on individual factories each meeting the acceptance criteria of 5.3. However, a number of factories may be grouped together, providing they are under the same quality management. For certification purposes, one certificate may be issued to cover a nominated group of factories, but the certification authority shall have the right to visit each plant to examine the relevant local records and quality control procedures.

5.2.4 For certification purposes, the manufacturer shall declare a list of marks of origin and corresponding lamp families, groups and/or types which are within the scope of this standard and manufactured in a nominated group of factories. The certificate shall be taken to include all lamps so listed made by the manufacturer. Notification of additions or deletions may be made at any time.

5.2.5 In presenting the test results, the manufacturer may combine the results of different lamp families, groups and/or types according to column 4 of Table 2.

The whole production assessment requires that the quality control procedures of a manufacturer shall satisfy recognized quality system requirements for final inspection. Within the framework of a quality system based also on in-process inspection and testing, the manufacturer may show compliance with some of the requirements of this standard by means of in-process inspection instead of finished product testing.

Table 2 – Grouping of test records – Sampling and acceptable quality levels (AQL)

1 Clause or Subclause	2 Test	3 Type of test	4 Permitted accumulation of test records between lamp groups	5 Minimum annual sample per accumulation		6 AQL*
				For lamps made most of the year	For lamps made infrequently	%
4.2.2 a)	Marking – legibility	Running	All families with the same method of marking	200	32	2,5
4.2.2 b)	Marking – durability	Periodic	All families with the same method of marking	50	20	2,5
4.3.1 (Annex A as appropriate)	Construction and assembly of cap to bulb (unused lamps)	Periodic or design	All families using the same method of attachment and same tube diameter	125 or use Clause D.1	80 or use Clause D.1	0,65 –
	Construction and assembly of cap to bulb (after heating test)	Design	All families using the same method of attachment and same tube diameter	Use Clause D.1	Use Clause D.1	–
4.3.2.2	Dimensional requirements for caps	Periodic	All families using the same method of attachment and same tube diameter	32	32	2,5
4.3.3.1	Cap pin connection	Periodic	By group and type	125	80	0,65
4.3.3.2 (where applicable)	Cap key configuration	Periodic	By group and type	125	80	0,65
4.4	Insulation resistance	Design	All families using the same cap	Use Clause D.2	Use Clause D.2	–
4.5	Electric strength	Design	All families using the same cap	Use Clause D.2	Use Clause D.2	–
4.6	Accidentally live part	100 % Inspection	By group and type	–	–	–
4.7.2	Resistance to heat	Design	All families	Use Clause D.3	Use Clause D.3	–
4.7.4	Resistance to fire	Design	All families	Use Clause D.3	Use Clause D.3	–
4.8	Cap creepage distance	Design	All families	Use Clause D.3	Use Clause D.3	–
4.9	Cap temperature rise	Design	Lamps selected according to 4.9.3	Use Clause D.4	Use Clause D.4	–
4.10	Capacitor test	Design	All families using the same capacitor	Use Clause D.3	Use Clause D.3	–
4.11	UV radiation	Design	By family, group, type	4	4	-

* For the use of this term, see IEC 60410.

5.2.6 The manufacturer shall provide sufficient test records with respect to each clause and subclause as indicated in column 5 of Table 2.

5.2.7 The number of non-conformities in the manufacturer's records shall not exceed the limits shown in Table 3 or Table 4 relevant to the acceptable quality level (AQL) values shown in column 6 of Table 2.

Table 3 – Acceptance numbers AQL = 0,65 %

Number of lamps in manufacturer's records	Acceptance number	Number of lamps in manufacturer's records	Qualifying limit for acceptance as percentage of lamps in records
80	1	2 001	1,03
81 to 125	2	2 100	1,02
126 to 200	3	2 400	1,00
201 to 260	4	2 750	0,98
261 to 315	5	3 150	0,96
316 to 400	6	3 550	0,94
401 to 500	7	4 100	0,92
501 to 600	8	4 800	0,90
601 to 700	9	5 700	0,88
701 to 800	10	6 800	0,86
801 to 920	11	8 200	0,84
921 to 1 040	12	10 000	0,82
1 041 to 1 140	13	13 000	0,80
1 141 to 1 250	14	17 500	0,78
1 251 to 1 360	15	24 500	0,76
1 361 to 1 460	16	39 000	0,74
1 461 to 1 570	17	69 000	0,72
1 571 to 1 680	18	145 000	0,70
1 691 to 1 780	19	305 000	0,68
1 781 to 1 890	20	1 000 000	0,67
1 891 to 2 000	21		

Table 4 – Acceptance numbers AQL = 2,5 %

Number of lamps in manufacturer's records	Acceptance number
20	1
21 to 32	2
33 to 50	3
51 to 65	4
66 to 80	5
81 to 100	6
101 to 125	7
126 to 145	8
146 to 170	9
171 to 200	10
201 to 225	11
226 to 255	12
256 to 285	13
286 to 315	14
316 to 335	15
336 to 360	16
361 to 390	17
391 to 420	18
421 to 445	19
446 to 475	20
476 to 500	21
501 to 535	22
536 to 560	23
561 to 590	24
591 to 620	25
621 to 650	26
651 to 680	27
681 to 710	28
711 to 745	29
746 to 775	30
776 to 805	31
806 to 845	32
846 to 880	33
881 to 915	34
916 to 955	35
956 to 1 000	36

Number of lamps in manufacturer's records	Qualifying limit for acceptance as percentage of lamps in records
1 001	3,65
1 075	3,60
1 150	3,55
1 250	3,50
1 350	3,45
1 525	3,40
1 700	3,35
1 925	3,30
2 200	3,25
2 525	3,20
2 950	3,15
3 600	3,10
4 250	3,05
5 250	3,00
6 400	2,95
8 200	2,90
11 000	2,85
15 500	2,80
22 000	2,75
34 000	2,70
60 000	2,65
110 000	2,60
500 000	2,55
1 000 000	2,54

5.2.8 The period of review for assessment purposes need not be limited to a predetermined year, but may consist of 12 consecutive calendar months immediately preceding the date of review.

5.2.9 A manufacturer who has met, but no longer meets, the specified criteria, shall not be disqualified from claiming compliance with this standard providing he can show that:

a) action has been taken to remedy the situation as soon as the trend was reasonably confirmed from his test records;

b) the specified acceptance level was re-established within a period of

   1) six months for 4.3.1 and 4.9;

   2) one month for the other Clauses and Subclauses.

When compliance is assessed after corrective action has been taken in accordance with items a) and b), the test records of these lamp families, groups and/or types which do not comply shall be excluded from the 12-month summation for their period of non-compliance. The test results relating to the period of corrective action shall be retained in the records.

5.2.10 A manufacturer who has failed to meet the requirements of a clause or subclause where grouping of the test results is permitted under 5.2.5 shall not be disqualified for the whole of the lamp families, groups and/or types so grouped if he can show by additional testing that the problem is present only in certain families, groups and/or types so grouped. In this case, either these families, groups and/or types are dealt with in accordance with 5.2.9 or they are deleted from the list of families, groups and/or types which the manufacturer may claim are in conformity with the standard.

5.2.11 In the case of a family, group and/or type which has been deleted under 5.2.10 from the list (see 5.2.4), it may be reinstated if satisfactory results are obtained from tests on a number of lamps equivalent to the minimum annual sample specified in Table 2, required by the clause or subclause where non-compliance occurred. This sample may be collected over a short period of time.

5.2.12 In the case of new products, there may be features which are common to existing lamp families, groups and/or types, and these can be taken as being in compliance if the new product is taken into the sampling scheme as soon as manufacture is started. Any feature not so covered shall be tested before production starts.

5.3 Assessment of the manufacturer's records of particular tests

Table 2 specifies the type of test and other information which applies to the method of assessing compliance to the requirements of various clauses or subclauses.

A design test need be repeated only when a substantial change is made in the physical or mechanical construction, materials, or manufacturing process used to manufacture the relevant product. Tests are required for only those properties affected by the change.

5.4 Rejection conditions of batches

Rejection is established if any rejection number in Table 5, with due regard to Annex D, is reached irrespective of the quantity tested. A batch shall be rejected as soon as the rejection number for a particular test is reached.

Table 5 – Batch sample size and rejection number

Clause or Subclause	Test	Number of lamps tested	Rejection number
4.2.2 a)	Marking – legibility	200	11
4.2.2 b)	Marking – durability	50	4
4.3.1	Construction and assembly for caps (unused lamps)	125 or apply Clause D.1 as relevant	3 or apply Clause D.1 as relevant
4.3.2.2	Dimensional requirements for caps	32	3
4.3.3.1	Pin connections	125	3
4.3.3.2	Key configuration	125	3
4.4	Insulation resistance	Apply Clause D.2	
4.5	Electric strength	Apply Clause D.2	
4.6	Accidentally live parts	500	1
4.3.1	Construction and assembly for caps (after heating)	Apply Clause D.1	
4.7.2	Resistance to heat	Apply Clause D.3	
4.7.4	Resistance to fire	Apply Clause D.3	
4.8	Cap creepage distance	Apply Clause D.3	
4.9	Cap temperature rise	Test not applicable	
4.10	Radio interference suppression capacitors	Apply Clause D.3	

5.5 Sampling procedures for whole production testing

5.5.1 The conditions of Table 2 apply.

5.5.2 The whole production running tests shall be applied at least once per production day. They may also be based on in-process inspection and testing.

The frequency of application of the various tests may be different, providing the conditions of Table 2 are met.

5.5.3 Whole production tests shall be made on samples randomly selected at a rate not less than that indicated in column 5 of Table 2. Lamps selected for one test need not be used for other tests.

5.5.4 For whole production testing of the requirements for accidentally live parts (see 4.6), the manufacturer shall demonstrate that there is a continuous 100 % inspection.

5.6 Sampling procedures for batch testing

5.6.1 The lamps for testing shall be selected in accordance with a mutually agreed method so as to ensure proper representation. Selection shall be randomly made as nearly as possible from one-third of the total number of containers in the batch, with a minimum of 10 containers.

5.6.2 In order to cover the risk of accidental breakage, a certain number of lamps in addition to the test quantity shall be selected. These lamps shall only be substituted for lamps of the test quantities if necessary to make up the required quantities of lamps for the tests.

It is not necessary to replace an accidentally broken lamp if the results of the test are not affected by its replacement, provided the required quantity of lamps for the following test is available. If replaced, such a broken lamp shall be neglected in calculating results.

Lamps having broken bulbs when removed from the packaging after transit shall not be included in the test.

5.6.3 Number of lamps in the batch sample

There shall be at least 500 lamps (see Table 5).

5.6.4 Sequence of the tests

The testing shall be carried out in the order of the clause or subclause numbers listed in Table 5, up to and including 4.6. Subsequent tests may involve damage to the lamp and each test sample shall be taken separately from the original sample.

Annex A
(normative)

Tests for assessing caps for construction and assembly

A.1 GR8, G10q, GR10q, GU10q, GZ10q and 2GX13 caps

A.1.1 For unused lamps

Where lamps are so constructed that the action of inserting or withdrawing them from lampholders could conceivably cause parts of the cap to pull apart, the following design tests shall be applied. For conditions of compliance, see Clause D.1.

A pull of 80 N for GR8, G10q, GR10q GU10q and GZ10q caps and 40 N for 2GX13 caps shall be exerted between the parts of the cap identified as conceivable to pull apart. The pull shall be applied for 1 min without a jerk. At the end of the test, the cap shall be safe and shall not exhibit any opening of seams or the like such that a jointed test finger as described in IEC 60529 can be inserted to touch live parts.

The means of applying the pull to the cap parts shall not weaken the structure. If necessary, specially prepared samples shall be provided by mutual agreement between manufacturer and test authority.

For lamps with G10q, GZ10q and 2GX13 caps, the following additional periodic test shall be applied. The cap shall be capable of being rotated, without difficulty, over at least an arc of ± 5° about the nominal angle α to the plane through the lamp tube. The lead wires shall not short-circuit during maximum rotation of the cap. After moving the cap to the most onerous position, a jointed test finger shall not be able to be inserted to touch live parts.

A.1.2 For lamps after heating test

After heating lamps for a period of 2 000 h ± 50 h in an oven held at a temperature as specified in Annex G, all tests and requirements given in A.1.1 shall be applied as design tests. For conditions of compliance, see Clause D.1.

A.2 2G7, 2GX7, 2G8, GX10q, GY10q, 2G10, 2G11, 2GX11, GR14q, G23, GX23, G24, GX24, GZ24 and GX32 caps

A.2.1 For unused lamps

Compliance is checked by the following periodic tests.

[A2] Neither lamp bulb nor lamp cap shall be loosened either by an axial pull of 40 N or by a bending moment of 2 Nm. [A2] The bending shall be applied by holding in a uniform manner that part of the glass tube closest to the cap. [A2] The pivot point lies at the cap reference plane (mating plane with the lamp holder) for caps with a guide post. In case of caps without a guide post, the pivot point lies in a plane which is above the cap reference plane at a distance defined by the maximum of dimension Y found in the relevant lamp holder standard. [A2]

A.2.2 For lamps after heating test

After heating lamps for a period of 2 000 h ± 50 h in an oven held at a temperature as specified in Annex G, all tests and requirements given in A.2.1 shall be applied as design tests with an axial pull of 40 N. The bending moment the caps shall withstand is 1,5 Nm. For conditions of compliance, see Clause D.1.

Annex B
(normative)

Maximum lamp cap temperature rise values and method of measurement

B.1 General test conditions

B.1.1 The lamp shall be operated in a draught-free atmosphere at an ambient temperature of 25 °C ± 5 °C, suspended in low mass nylon slings with the cap pins facing vertically upwards.

B.1.2 Electrical connections to the lamp shall be made with copper conductors having a cross-sectional area of 1 mm^2 ± 5 %, attached to the relevant cap pins.

B.1.3 Tests for maximum lamp cap temperature rise

B.1.3.1 Test for maximum lamp cap temperature rise, lamps for 50 Hz /60 Hz operation (test at abnormal operating conditions)

The lamp shall be a normal production lamp but specially produced such that its cathodes are deactivated, i.e. without emitter.

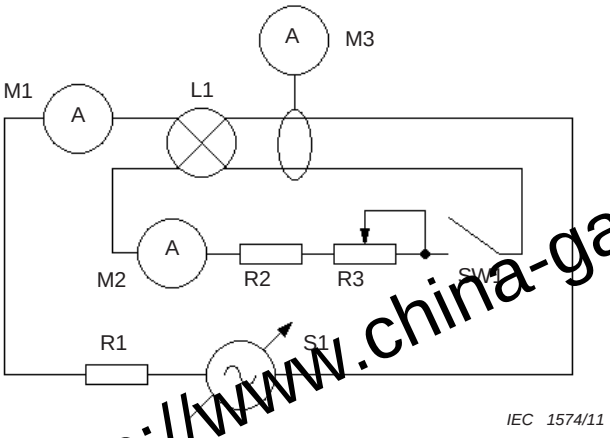
The starter shall be short circuited, i.e. the cathodes shall be operated in series, no discharge current. The lamp shall be operated with its relevant reference ballast for 50 Hz/60 Hz operation, which shall be supplied with 1,10 times its rated voltage.

B.1.3.2 Test for maximum lamp cap temperature rise, lamps for starterless operation (test at normal operating conditions)

The lamp shall be a normal production lamp.

The lamp shall be operated at the highest discharge current (see Table F.1). In the case of 4-pin lamps, an additional current shall be supplied to each electrode until the maximum SoS value is reached (see Table F.1).

An example for a possible test circuit is given in Figure B.1.



Key

M1 and M2	galvanically coupled hf amp meters for measurement of the lead currents
M3	meter with a hf current probe for measurement of the discharge current
S1	adjustable hf voltage source
R1	ballast resistor for limiting the discharge current
R3	adjustable resistor, which in series with R2 allows adjustment of the lead current
R1, R2 and R3	resistors that shall be selected with respect to the expected lamp voltage and the targets for the lead currents I_{LL} and I_{LH}
SW1	switch which shall be closed after lamp ignition
L1	lamp under test

Figure B.1 – Example for a test circuit for the measurement of the cap temperature rise at maximum discharge current and maximum SoS

B.1.4 The test for maximum cap temperature rise shall be conducted according to the relevant description in IEC 60360.

B.1.5 The tests B.1.3.1 or B.1.3.2 respectively shall continue until a stable temperature is achieved.

B.1.6 Where necessary, the surface of caps shall be suitably prepared to give good contact with the temperature measuring device (e.g. thermocouples).

B.1.7 To enable testing the lamp equipped with an outer bulb, the manufacturer or responsible vendor shall provide separately: the lamp without a bulb and a bulb. After attaching the measuring device to the cap, the bulb shall be attached to the cap in such way to create the working condition of a lamp as similar to the original as possible.

B.2 Particular test conditions

B.2.1 2G7, 2GX7, 2G8, GX10q, GY10q, 2G10, 2G11, 2GX11, GR14q, G23, GX23, G24, GX24, GZ24 and GX32 caps

B.2.1.1 General

The highest temperatures on the lamp cap occur close to the electrode-containing legs. Those legs have only one connection (bridge or bend) to another leg.

B.2.1.1.1 Lamps having electrodes in adjacent legs (Figure B.2, example A, B and D)

The temperature rise shall be calculated from the temperature measured at the lamp cap surface, on the outer tangent plane connecting the electrode-containing legs, at the point halfway between the two legs. In case there are 2 symmetric outer tangent planes, any of them can be used. If the shortest distance between such position and the surface of the electrode-containing leg is more than 3 mm, the measurement position shall be taken at a position on the tangent at a distance 3 mm from the surface of the electrode-containing leg. In the latter case, one shall take measurements at both electrode-containing legs and take the highest temperature reading, to identify the worst case situation in case of asymmetrical thermal load to the electrodes.

In lamp cap designs which do not have material on the positions described above, one shall take the temperature measurement on the nearest point on the lamp cap surface when moving from above positions towards the center of the leg.

B.2.1.1.2 Lamps having electrodes not in adjacent legs (Figure B.2, example C)

The temperature rise shall be calculated from the temperature measured at the lamp cap surface on the outer tangent plane connecting the electrode-containing leg and the nearest leg, again at the point halfway between both legs. In case there are 2 symmetric outer tangent planes, any of them can be used. If the distance between such position and the surface of the electrode-containing leg is more than 3 mm, the measurement position shall be taken at a position on the tangent at a distance 3 mm from the surface of the electrode-containing leg. Also in this case, one shall take measurements at both electrode-containing legs and take the highest temperature reading.

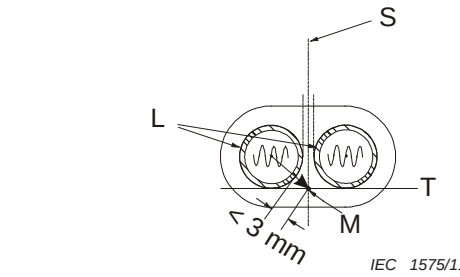


Figure B.2a – Dual

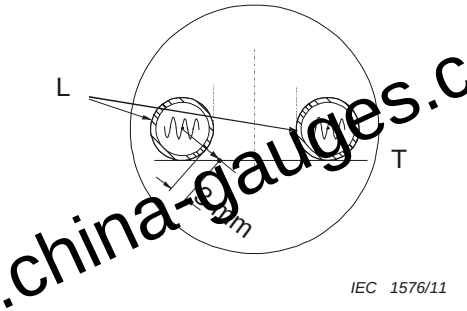


Figure B.2b – Helical, spiral or twisted

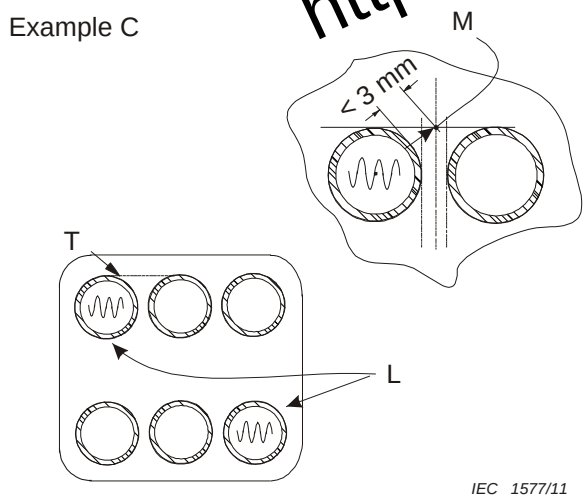


Figure B.2c – Multi-limbed

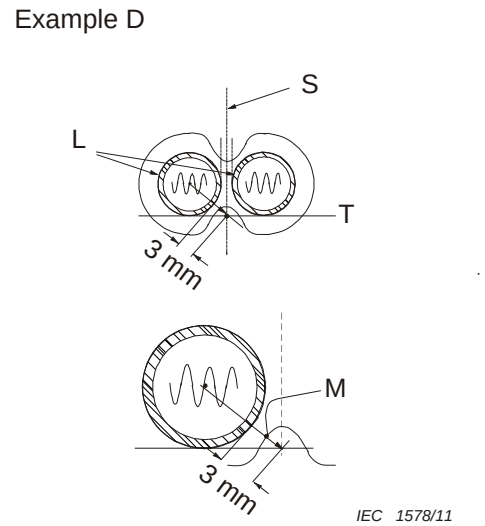


Figure B.2d – Dual with indent

Key to examples A, B, C and D

L electrode containing legs

T tangent

S symmetry axis

M measurement point

Figure B.2a: “Dual” – The measurement point is halfway between the adjacent legs.

Figure B.2b: “Helical, spiral or twisted” – The halfway point is more than 3 mm away from an electrode-containing leg. The measurement point shall be 3 mm away from an electrode-containing leg.

Figure B.2c: “Multi-limbed” – If in none of the adjacent legs the second electrode is contained, the measuring point is chosen in 3 mm distance to the adjacent leg.

Figure B.2d: “Dual” – No material at the 3 mm distance position.

Figure B.2 – Examples where to measure the temperature according to Clause B.2

B.2.2 GR8, G10q, GR10q, GU10q, GZ10q and 2GX13 caps

B.2.2.1 GR8 and GR10q caps (all wattages, excluding 10 W)

The temperature rise shall be calculated from the temperature measured at a point on the cap surface which is equidistant between the two glass limbs which emerge from the cap, and which lies on the straight line which joins the axes of the glass limbs.

B.2.2.2 G10q and GR10q (10 W) caps

The temperature rise shall be calculated from the temperature measured at the centre of the cap face which is opposite to that containing the cap pins.

B.2.2.3 2GX13 caps

The temperature rise shall be calculated from the temperature measured on the centre point of the cap surface, which is equidistant from the two pairs of pins.

B.2.2.4 GU10q and GZ10q caps

The temperature rise shall be calculated from the temperature measured at the surface of the plastic as close as the centre of four pins.

Table B.1 – Maximum cap temperature rise, lamps with internal or external starter (test at abnormal operating conditions)

Cap designation	Lamp nominal wattage W	Maximum cap temperature rise K
2G7, 2GX7, 2G10	All	135
GR8	16	45
GR8	28	35
G10q	All	–*
GR10q	10, 28 and 38	35
GR10q	16 and 21	45
GX10q, GY10q	All	135
2G11	18, 24, 36	135
G23	All	135 (plastic cap) / 80 (metal cap)
GX23, G24, GX32	All	135
GX24	13, 18, 26	135
NOTE For lamps with G23 cap, the cap material might be either plastic or metal. In case of a metal cap, due to the higher conducted heat, which flows from the measurement point, a lower maximum cap temperature rise limit is defined.		
* Under consideration.		

Table B.2 – Maximum cap temperature rise, lamps for starterless operation (test at normal operating conditions)

Cap designation	Lamp nominal wattage W	Maximum cap temperature rise K
2G8-1	All	65
GU10q	All	50
GZ10q	All	40
2G11	40, 55, 80	135
2GX11	28	135
2GX13	All	50
GR14q	All	135
GX24q	32, 42, 57, 70	135
GZ24q	42	160

Annex C
(informative)

Information for luminaire design

C.1 Guidelines for safe lamp operation

To ensure safe lamp operation, it is essential to observe the following recommendations.

C.2 Maximum lamp cap temperature

C.2.1 The measuring point is given in Clause B.2.

C.2.2 Compliance is checked in accordance with the relevant test specified in 12.4.1 or 12.5.1 of IEC 60598-1.

C.2.3 Lamps with internal or external starter

A magnetic ballast with (short-circuited) internal or external starter is used. The luminaire designer should ensure that the cap temperature of the lamp, under abnormal operating conditions, does not exceed the maximum cap temperature value shown in Table C.1.

Luminaires should be tested using the intended lamp with the starter short-circuited (test at abnormal operating conditions), i.e. the cathodes operated in series.

Table C.1 – Maximum cap temperature, lamps with internal or external starter (test at abnormal operating conditions)

Cap designation	Lamp nominal wattage W	Maximum cap temperature °C
2G7, 2GX7, 2G10	All	200
GR8	All	110
G10q	All	120*
GR10q	All	110
GX10q, GY10q	All	*
2G11	18, 24, 36	200
G23	All	200**
GX23, G24, GX32	All	200
GX24	13, 18, 24	200

* Under consideration.

** There are two versions of G23 caps available, plastic or metal. This test should be conducted using a plastic cap version.

C.2.4 Lamps for starterless operation

A high frequency ballast or magnetic ballast for starterless operation is used. The luminaire designer should ensure that the cap temperature of the lamp under normal operating conditions does not exceed the maximum temperature value shown in Table C.2.

Table C.2 – Maximum cap temperature, lamps for starterless operation (test at normal operating conditions)

Cap designation	Lamp nominal wattage W	Maximum cap temperature °C
2G7, 2GX7, 2G10, 2G11, 2GX11	All	180
2G8-1	All	180
G10q	All	-*
GR10q	All	100
GU10q	All	125
GX10q, GY10q	All	-*
GZ10q	All	100
2GX13	All	75
GR14q	All	180
G24q, GX24q, GX32q	All	180
GZ24q	42	160
* Under consideration.		

C.3 Cap/holder

C.3.1 Key configuration

The luminaire designer should ensure that, if applicable, a holder with the correct key version for the intended lamp/ballast combination is installed in the luminaire.

Compliance is checked by visual inspection.

C.3.2 Lampholder temperature

The information under Annex I should be regarded.

C.4 Water contact

All lamps within the scope of this standard should be protected from direct water contact, e.g.by drips, splashing etc., by the luminaire if rated at IPX1 or higher.

NOTE The X in the IP number indicates a missing numeral but both of the appropriate numerals are marked on the luminaire.

Annex D
(normative)

Conditions of compliance for design tests

D.1 Cap construction and assembly (4.3.1)

Sample size: 32	Rejection number: 2

D.2 Insulation resistance and electric strength (4.4 and 4.5)

Each test shall be assessed separately

First sample: 125	Accept when no failure has been found Rejection number: 2
If one failure is found, take a second sample of 125	Rejection number: 2 in the combined sample

D.3 Resistance to heat (4.7.2), resistance to fire (4.7.4), cap creepage distances (4.8), capacitor test (4.10)

Each test shall be assessed separately.

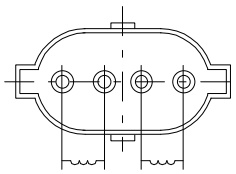
First sample: 5	Accept when no failure has been found Rejection number: 2
If one failure is found, take a second sample of 5	Rejection number: 2 in the combined sample

D.4 Cap temperature rise (4.9)

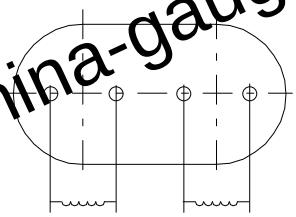
First sample: 5	Accept if all samples have a temperature rise of at least 5 K below limit
In other cases, take a second sample of 5	Rejection number: 2 in the combined sample with a cap temperature rise that exceeds the limit in Table B.2 in the combined sample

Annex E
(normative)

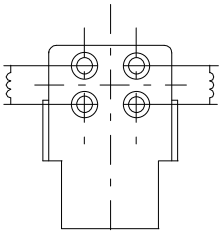
Cathode connection configurations



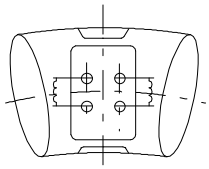
Caps 2G7, 2GX7



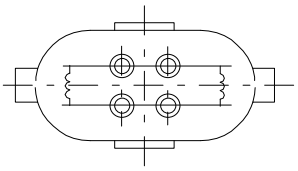
Caps 2G10, 2G11, 2GX11



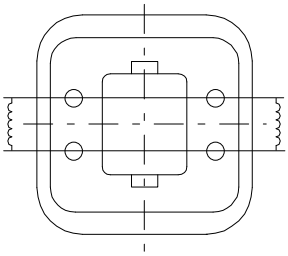
Cap GR10q



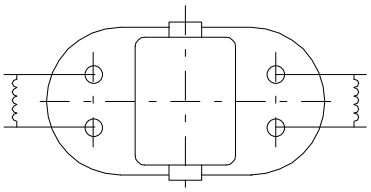
Cap G10q



Caps GX10q, GY10q

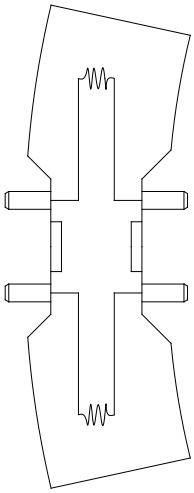


Caps G24q, GX24q, GZ24q

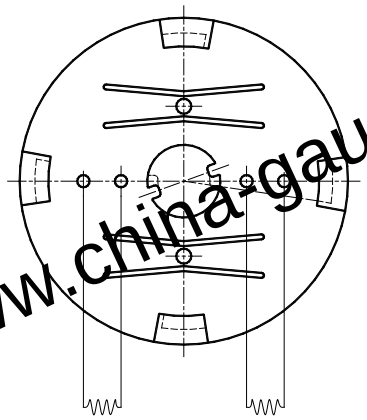


Cap GX32q

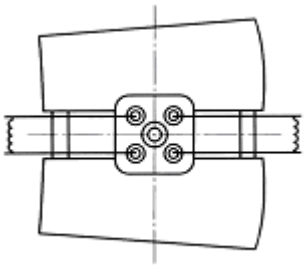
IEC 1579/11



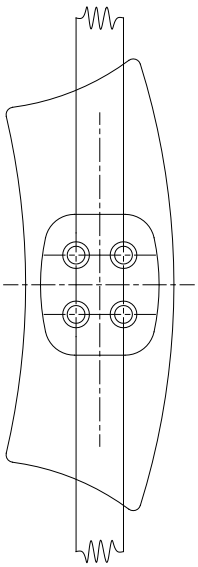
Cap 2GX13



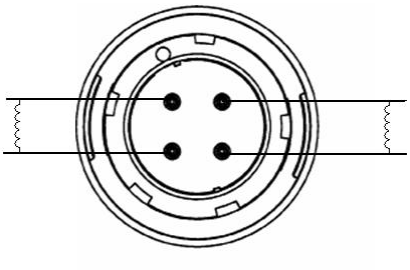
Cap 2G8



Cap GU10q



Cap GZ10q



Cap GR14q

IEC 1580/11

Figure E.1 – Where to connect the cathodes of different caps

Annex F
(normative)

Normal and abnormal lamp operation, lamp non-interchangeability requirements

F.1 Maximum currents

F.1.1 Lamps using internal or external starter

For lamps using either an internal or external starter, the most onerous situation with regard to cap temperature occurs when the pre-heat current flows continuously through the lamp electrodes. This can happen at the end of lamp life when the lamp does not start.

Therefore, a lamp using internal or external starter shall not be connected to a ballast having a maximum pre-heat current which results under abnormal operating conditions as described under B.1.3.1 in a higher temperature than the cap of the lamp can withstand.

F.1.2 Starterless lamps

For lamps in high frequency operation or used with a magnetic ballast for starterless operation, the pre-heat current shall not be applied over a period of more than 10 s. If a lamp does not start within this period, the current through the electrodes has to be reduced until the SoS value for the currents through the lead wires at each electrode stays below the “Maximum SoS” value as specified in Table F.1. Also at end of lamp life the ballast has to prevent overheating by suitable measures (see Annex H).

NOTE This means that the most onerous situation with regard to cap temperature occurs when a lamp is operated at the maximum allowed lamp current with an additional electrode heating current of such a value that a maximum SoS value is applied to both electrodes of the lamp.

Therefore the lamp shall not be connected to a ballast exceeding the highest discharge current and/or the highest SoS like given in Table F.1, which would result in a higher temperature than the cap of the lamp can withstand.

F.2 Lamp non-interchangeability requirements

All new lamp designs shall comply with the temperature requirement at the maximum preheat current, maximum discharge current, maximum SoS and maximum power as described in Table F.1 in order to safeguard interchangeability.

NOTE 1 For some types of lamp caps, it is necessary to introduce a non-interchangeability feature, which prevents the incorrect installation of different lamps using similar cap types into the luminaire circuit.

For certain lamps, such a feature has been introduced by means of different cap/holder keys, and Table F.1 gives the relationship between a specific cap/holder designation and the allowable maximum pre-heat current for a lamp with internal or external starter, where the lamp is not operating (abnormal operation).

Table F.1 also gives the maximum discharge current, maximum SoS and maximum rated lamp power with the lamp operating for lamps without starter (normal operation) because the temperature at the lamp end is created by the SoS, the lamp discharge current and the power dissipated by the lamp.

If a new lamp is designed to operate at a higher preheat current, discharge current, SoS or power than the maximum value of an existing key with the same cap, a new key shall be defined.

NOTE 2 Also shown in Table F.1 are cap types which do not have a keying feature because no existing lamp/circuit combination exceeds the maximum allowable pre-heat current or discharge current, SoS and rated lamp power with the lamp operating.

Table F.1 – Maximum allowable currents and rated lamp power

Cap/holder (designation key)	Pre-heat current safety limit A Operation with internal/external starter	Discharge current safety limit A starterless and/or electronic operation	SoS safety limit A^2 starterless and/or electronic operation	Maximum rated lamp power W starterless and/or electronic operation (interchangeability)
2G7 2GX7	0,240 0,530	0,220 0,480	0,200 -*	15 -*
G23 GX23	0,240 0,530	0,220 0,480	n/a n/a	15 -*
2G8-1	***	1,080	1,50	200
GR8***	0,780	0,690	n/a	30
GR10q***	0,780	0,690	0,900	60
2G10	0,780	0,690	0,900	40
2G11	0,780	0,690	0,900	90
2GX11	**	0,250	0,300	30
G10q	0,950	-*	-*	60
GU10q	**	0,460	0,700	100
GY10q-4 GY10q-5 GY10q-6	1,100 -* -*	-* -* -*	-* -* -*	-* -* -*
GZ10q	**	0,460	0,850	50
2GX13	**	0,630	0,850	65
GR14q	**	0,210	0,06	30
G24d-1 G24d-2 G24d-3	0,280 0,380 0,550	0,210 0,240 0,360	n/a n/a n/a	15 20 35
G24q-1 G24q-2 G24q-3	0,280 0,380 0,550	0,210 0,240 0,360	0,150 0,200 0,270	15 20 35
GX24d-1 GX24d-2 GX24d-3	0,280 0,380 0,550	0,210 0,240 0,360	n/a n/a n/a	15 20 35
GX24q-1 GX24q-2 GX24q-3	0,280 0,380 0,550	0,210 0,240 0,360	0,150 0,200 0,270	15 20 35
GX24q-4 GX24q-5 GX24q-6	** ** **	0,360 0,360 0,360	0,270 0,270 0,270	45 60 80
GZ24q	**	0,360	0,270	45
GX32d-1 GX32d-2 GX32d-3	0,650 0,850 1,080	-* -* -*	n/a n/a n/a	20 22 30

* under consideration

** starterless operation only

*** new lamp designs shall not use this cap

Annex G
(normative)

Information for thermal tests

The information given in this annex refers to 4.7 and Annex A.

Table G.1 – Test temperatures

Cap designation	Lamp nominal wattage W	Temperature °C
2G7, 2GX7, 2G10, 2G11, 2GX11	All	160
2G8	All	160
GR8	All	130
G10q	All	140
GR10q	10	140
GR10q	16, 21, 28, 38	130
GU10q	All	160
GX10q, GY10q	All	160
GZ10q	All	160
2GX13	All	130
GR14q	All	140
G23, GX23, G24, GX24, GX32	All	160
GZ24*	42	160
* Test to be conducted only in case of no metal cover of the cap.		

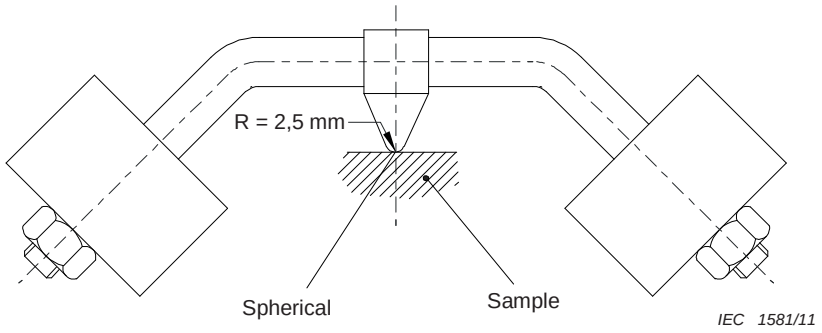


Figure G.1 – Ball-pressure apparatus

Annex H
(informative)

Information for ballast design

H.1 Guidelines for safe lamp operation

To ensure safe lamp operation, it is essential to observe the following recommendations.

H.2 Lamp end temperature under abnormal operating conditions

In the case where a lamp does not start, any continuation of cathode preheating should not lead to overheating of the lamp ends.

In the case of a starterless ballast, the cathode pre-heat current should be decreased within 10 s until the SoS value for the currents through the lead wires at each electrode stays below the “maximum SoS” value as specified in Table F.1.

A2 At the end of lamp life, phenomena can occur that could lead to overheating of the lamp cap. This should be prevented by suitable measures in the circuit. Phenomena that can occur are a restless phase where the impedance of the lamps changes rapidly, leading together with the ballast to high voltage peaks. Also light variation can be observed. Another phenomena is a d.c. effect, this is caused by a less efficient emission of electrons by one of the electrodes. This will lead to extra power losses in the electrode space, which heats up the lamp ends. Another phenomena is a change in the electrode resistance, due to the breaking of the electrode. A2

Each kind of ballast should comply with the maximum values for pre-heat current, discharge current and SoS from Table F.1 where applicable.

Annex I
(informative)

Information for lampholder design

I.1 Maximum lamp cap temperature related to the lamp / lampholder interface

I.1.1 Temperature point for 2G7, 2GX7, 2G8, GX10q, GY10q, 2G10, 2G11, 2GX11, G23, GX23, G24, GX24, and GX32 caps

The point where the temperature limit is given is the hottest point on the cap surface at a distance *x* from the reference plane of the cap, as indicated in Table I.1, in the direction of the glass limbs.

Table I.1 – Temperature point

Cap designation	Distance *x* mm
2G7, 2GX7	8
2G8, GR14q	13
GX10q, GY10q	8
G23, GX23	8
2G10, 2G11, G24, GX24, 2GX11, GZ24q	12
GX32	16

I.1.2 Temperature point for GR8, G10q, GR10q, GU10q, GZ10q and 2GX13 caps

I.1.2.1 Temperature point for GR8 and GR10q caps (all wattages, excluding 10 W)

The point where the temperature limit is given is a point on the cap surface, which is equidistant between the two glass limbs which emerge from the cap, and which lies on the straight line, which joins the axes of the glass limbs.

I.1.2.2 G10q and GR10q (10 W) caps

The point where the temperature limit is given is at the centre of the cap face, which is opposite to that containing the cap pins.

I.1.2.3 2GX13 caps

The point where the temperature limit is given is on the centre point of the cap surface, which is equidistant from the two pairs of pins.

I.1.2.4 GU10q and GZ10q caps

The point where the temperature limit is given is at the surface of the plastic as close as the centre of four pins.

I.1.3 Temperature data

The maximum lamp cap temperature which has to be expected at the location on the cap surface as described under I.1.1 and I.1.2 is listed in Table I.2.

Table I.2 – Maximum temperatures related to lampholder design

Cap designation	Lamp nominal wattage W	Temperature °C
2G7	All	140
2GX7	All	140
G23	All	140
GX23	All	140
2G8-1	All	140
GR8	All	110
GR10q	All	110
2G10	All	140
2G11	All	140
G10q	All	110
GU10q	All	125
GX10q-2	13	120
GX10q-3	18	120
GX10q-4	27	120
GY10q-4	27, 30	120
GY10q-5	28	120
GY10q-6	36	120
2GX11	28	140
GZ10q	All	100
2GX13	All	75
GR14q-1	All	140
G24d-1	10, 13	140
G24d-2	18	140
G24d-3	26	140
G24q-1	10, 13	140
G24q-2	18	140
G24q-3	26	140
GX24d-1	13	140
GX24d-2	18	140
GX24d-3	26	140
GX24q-1	13	140
GX24q-2	18	140
GX24q-3	26, 32	140
GX24q-4	42	140
GX24q-5	57	140
GX24q-6	70	140
GZ24q	42	160
GX32d-1	15	140
GX32d-2	20	140
GX32d-3	27	140

Bibliography

IEC 62471, *Photobiological safety of lamps and lamp systems*

〖A1〗 IEC/TR 62471-2, *Photobiological safety of lamps and lamp systems – Part 2: Guidance on manufacturing requirements relating to non-laser optical radiation safety* 〈A1〉

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