

English version

**Self-ballasted lamps for general lighting services -
Safety requirements
(IEC 60968:2012)**

Lampes à ballast intégré pour l'éclairage
général -
Exigences de sécurité
(CEI 60968:2012)

Lampen mit eingebautem Vorschaltgerät
für Allgemeinbeleuchtung -
Sicherheitsanforderungen
(IEC 60968:2012)

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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

Foreword

The text of document 34A/1540/CDV, future edition 2 of IEC 60968, prepared by SC 34A "Lamps" of IEC/TC 34A "Lamps and related equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60968:2013.

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) 2013-07-31
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-10-31

This document supersedes EN 60968:1990 + A1:1993 + A2:1999.

EN 60968:2013 includes the following significant technical changes with respect to EN 60968:1990 + A1:1993 + A2:1999:

- for reasons of photobiological safety, the scope has been extended;
- a new definition and clause on UV radiation have been introduced;
- clauses on normative references and an annex on literature were added;
- the latest IEC template has been adapted.

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 60968:2012 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 62471:2006 NOTE Harmonised as EN 62471:2008 (modified).

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60061	-	Lamp caps and holders together with gauges for the control of interchangeability and safety	-	-
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 60061-3	-	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 3: Gauges	EN 60061-3	-
IEC 60238	-	Edison screw lampholders	EN 60238	-
IEC 60360	-	Standard method of measurement of lamp cap temperature rise	EN 60360	-
IEC 60695-2-10	2000	Fire hazard testing - Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN 60695-2-10	2001
IEC 60695-2-11 + corr. January	2000 2001	Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products	EN 60695-2-11	2001
IEC 60695-2-12	2010	Fire hazard testing - Part 2-12: Glowing/hot-wire based test methods - Glow-wire flammability index (GWFI) test method for materials	EN 60695-2-12	2010
IEC 60695-2-13 + corr. February	2010 2012	Fire hazard testing - Part 2-13: Glowing/hot-wire based test methods - Glow-wire ignition temperature (GWIT) test method for materials	EN 60695-2-13	2010
IEC 60901	-	Single-capped fluorescent lamps - Performance specifications	EN 60901	-

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Self-ballasted lamps for general lighting services – Safety requirements

Lampes à ballast intégré pour l'éclairage général – Exigences de sécurité



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SELF-BALLASTED LAMPS FOR
GENERAL LIGHTING SERVICES –****Safety requirements**

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 60968 has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

This second edition cancels and replaces the first edition published in 1988, Amendment 1:1991 and Amendment 2:1999. This edition constitutes a technical revision.

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

- a) For reasons of photobiological safety, the scope has been extended.
- b) A new definition and clause on UV radiation have been introduced.
- c) Clauses on normative references and an annex on literature were added.
- d) The latest IEC template has been adapted.

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

CDV	Report on voting
34A/1540/CDV	34A/1579/RVC

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.

In this standard, the following print types are used:

- requirements proper: in roman type,
- *test specifications: in italic type,*
- explanatory matter: in smaller roman type.

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

With IEC 62471 and IEC/TR 62471-2, there are horizontal requirements available that need to be introduced into product standards, e.g. to IEC 60968. The horizontal requirement is transformed into a requirement for self-ballasted lamps.

The lamps within the scope of this standard are general lighting service (GLS) lamps according to the definition 3.11 in 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 will be covered by Clause 14 of IEC 60968.

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

SELF-BALLASTED LAMPS FOR GENERAL LIGHTING SERVICES –

Safety requirements

1 Scope

This International Standard specifies the safety and interchangeability requirements, together with the test methods and conditions, required to show compliance of tubular fluorescent and other gas-discharge lamps with integrated means for controlling starting and stable operation (self-ballasted lamps), intended for domestic and similar general lighting purposes, having:

- a rated wattage up to 60 W;
- a rated voltage of 100 V to 250 V;
- Edison screw or bayonet caps.

The requirements of this standard relate only to type testing.

Recommendations for whole product testing or batch testing are under consideration.

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.

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 60061, *Lamp caps and holders together with gauges for the control of interchangeability and safety*

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

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

IEC 60238, *Edison screw lampholders*

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

IEC 60695-2-10:2000, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60695-2-11:2000, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end products*

IEC 60695-2-12:2010, *Fire hazard testing – Part 2-12: Glowing/hot-wire based test methods – Glow-wire flammability test method for materials*

IEC 60695-2-13:2010, *Fire hazard testing – Part 2-13: Glowing/hot-wire based test methods – Glow-wire ignitability test method for materials*

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

3 Terms and definitions

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

3.1

self-ballasted lamp

unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a light source and any additional elements necessary for starting and stable operation of the light source

3.2

type

lamps that, independent of the type of cap, are identical in photometric and electrical rating

3.3

rated voltage

voltage or voltage range marked on the lamp

3.4

rated wattage

wattage marked on the lamp

3.5

rated frequency

frequency marked on the lamp

3.6

cap temperature rise

Δt_s

surface temperature rise (above ambient) of a standard test lampholder fitted to the lamp, when measured in accordance with the standard method described in IEC 60360

3.7

live part

conductive part which may cause an electric shock in normal use

3.8

type test

test or series of tests made on a type test sample for the purpose of checking compliance of the design of a given product with the requirements of the relevant standard

3.9

type test sample

sample consisting of one or more similar units submitted by the manufacturer or responsible vendor for the purpose of the type test

3.10

specific effective radiant UV power

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

Note 1 to entry: The specific effective radiant UV power is expressed in mW/klm.

Note 2 to entry: 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 General requirement and general test requirements

4.1 Self-ballasted lamps shall be so designed and constructed that in normal use they function reliably and cause no danger to the user or surroundings.

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

4.2 All measurements unless otherwise specified, are carried out at rated voltage and frequency and in a draught-proof room at (25 ± 1) °C.

If lamps are marked with a voltage range, rated voltage is taken as the mean of the voltage range marked.

4.3 Self-ballasted lamps are non-repairable, factory sealed units. They shall not be opened for any tests. In the case of doubt based on the inspection of the lamp and the examination of the circuit diagram, and in agreement with the manufacturer or responsible vendor, lamps specially prepared so that a fault condition can be simulated shall be submitted for testing (see Clause 13).

5 Marking

5.1 Lamps shall be clearly and durably marked with the following mandatory markings:

- 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) rated voltage or voltage range (marked "V" or "volts");
- c) rated wattage (marked "W" or "watts");
- d) rated frequency (marked in "Hz").

5.2 In addition the following information shall be given by the lamp manufacturer either on the lamp or packing or in the installation instructions:

- a) lamp current;
- b) burning position if restricted;
- c) for lamps with a weight significantly higher than that of the lamps for which they are a replacement, attention should be drawn to the fact that the increased weight may reduce the mechanical stability of certain luminaires;
- d) special conditions or restrictions which shall be observed for lamp operation, for example, operation in dimming circuits. Where lamps are not suitable for dimming, the symbol in Figure 1 may be used:



Figure 1 – Dimming not allowed

5.3 Compliance is checked by the following:

- a) presence and legibility of the marking required in 5.1 – by visual inspection;
- b) the durability of the marking is checked by trying to remove it by rubbing lightly for 15 s with a piece of cloth soaked with water and, after drying, for a further 15 s with a piece of cloth soaked with hexane. The marking shall be legible after the test;
- c) availability of information required in 5.2 – by visual inspection.

6 Interchangeability

6.1 Interchangeability shall be ensured by the use of caps in accordance with IEC 60061-1.

6.2 Compliance of the combination of cap and bulb is checked by the use of gauges for checking the dimensions controlling interchangeability in accordance with Table 1.

The gauges are those shown in the standard sheet included in IEC 60061-3.

6.3 Self-ballasted lamps, when capped either B22d or E27 shall have a mass not exceeding 1 kg and shall not impart a bending moment, at the lampholder, of more than 2 Nm.

Compliance shall be checked by measurement.

Table 1 – Interchangeability gauges and lamp cap dimensions

Lamp cap	Cap dimensions to be checked by the gauge	Gauge sheet no. from IEC 60061-3
B22d or B15d	A max. and A min. D1 max. N min. Diametrical position of the pins Insertion in lampholder Retention in lampholder	} 7006-10 and 7006-11 7006-4A 7006-4B
E27	Max. dimensions of the screw thread Min. major diameter of the screw thread Contact making	7006-27B 7006-28A 7006-50
E26 E14	Max. dimensions of the screw thread Max. dimensions of the screw thread Min. major diameter of the screw thread Contact making	7006-27D 7006-27F 7006-28B 7006-54

7 Protection against electric shock

Self-ballasted lamps shall be so constructed that, without any additional enclosure in the form of a luminaire, no internal metal parts or live metal parts of the lamp cap are accessible when the lamp is installed in a lampholder according to IEC 60238.

Compliance is checked by means of the test finger specified in Figure 2, if necessary, with a force of 10 N.

Lamps with Edison screw caps shall be so designed that they comply with the requirements for inaccessibility for general lighting service (GLS) lamps.

Compliance is checked with the aid of a gauge in accordance with the current edition of IEC 60061-3, sheet 7006-51A for E27 caps and sheet 7006-55 for E14 caps.

NOTE Requirements for E26 caps are under consideration.

Lamps with B22 or B15 caps are subject to the same requirements as normal incandescent lamps with this cap.

External metal parts other than current-carrying metal parts of the cap shall not be or become live. For testing, any movable conductive material shall be placed in the most onerous position without using a tool.

Compliance is checked by means of the insulation resistance and electric strength test (see Clause 8).

8 Insulation resistance and electric strength after humidity treatment

8.1 General

Insulation resistance and electric strength shall be adequate between current-carrying metal parts of the lamp and accessible parts of the lamp.

8.2 Insulation resistance

The lamp shall be conditioned for 48 h in a cabinet containing air with a relative humidity between 91 % and 95 %. The temperature of the air is maintained within 1 °C of any convenient value between 20 °C and 30 °C.

Insulation resistance shall be measured in the humidity cabinet with a d.c. voltage of approximately 500 V, 1 min after application of the voltage. The insulation resistance between current-carrying metal parts of the cap and accessible parts of the lamp (accessible parts of insulating material are covered with metal foil) shall be not less than 4 MΩ.

NOTE The insulation resistance of bayonet caps between shell and contacts is under consideration.

8.3 Electric strength

Immediately after the insulation resistance test, the same parts as specified above shall withstand a voltage test for 1 min with an a.c. voltage as follows:

- ES caps: between accessible parts and parts of screw caps (accessible parts of insulating material are covered with metal foil):
 - type HV (220 V to 250 V): 4 000 V r.m.s.

- type BV (100 V to 120 V): $2U + 1\,000$ V

Value U = rated voltage.

During the test, the eyelet and the shell of the cap are short-circuited.

Initially, no more than half the prescribed voltage is applied. It is then gradually raised to the full value.

No flash-over or breakdown shall occur during the test. Measurements shall be carried out in the humidity cabinet.

NOTE The distance between the foil and the current-carrying parts is under consideration.

- Bayonet caps: between shell and contacts (under consideration).

9 Mechanical strength

Torsion resistance: The cap shall remain firmly attached to the bulb or that part of the lamp which is used for screwing the lamp in or out when subjected to the torque levels listed below.

B22d	3 Nm
B15d	1,15 Nm
E26 and E27	3 Nm
E14	1,15 Nm

The test is made by means of the test holders shown in Figures 3 and 4.

The torque shall not be applied suddenly, but shall be increased continuously from zero to the specified value.

In the case of uncemented caps, relative movement between cap and bulb is permitted provided it does not exceed 10°.

After the mechanical strength test, the sample shall comply with the requirements of accessibility (see Clause 7).

10 Cap temperature rise

The cap temperature rise Δt_s of the complete lamp during run-up, stabilization period and after stabilization shall not exceed the values mentioned below when measured under the conditions specified in IEC 60360:

B22d.....	125 K
B15d.....	120 K
E27.....	120 K
E14.....	120 K
E26.....	under consideration

Measurement shall be carried out at rated voltage. If the lamp is marked with a voltage range, it shall be measured at the mean voltage of that range, provided the limits of the voltage range do not differ by more than 2,5 % from the mean voltage. For lamps with a wider range, the measurement shall be made at the highest value of the range.

11 Resistance to heat

Self-ballasted lamps shall be sufficiently resistant to heat. External parts of insulating material providing protection against electric shock, and parts of insulating material retaining live parts in position shall be sufficiently resistant to heat.

Compliance is checked by subjecting the parts to a ball-pressure test by means of the apparatus shown in Figure 5.

The test is made in a heating cabinet at a temperature of (25 ± 5) °C in excess of the operating temperature of the relevant part according to Clause 10, with a minimum of 125 °C for parts retaining live parts in position and 80 °C for other parts. The surface of the part to be tested is placed in the horizontal position and a steel ball of 5 mm diameter pressed against this surface with a force of 20 N.*

The test load and the supporting means are placed within the heating cabinet for a sufficient time to ensure that they have attained the stabilized testing temperature before the test commences.

The part to be tested is placed in the heating cabinet, for a period of 10 min, before the test load is applied.

If the surface under test bends, the part where the ball presses is supported. For this purpose, if the test cannot be made on the complete specimen, a suitable part may be cut from it.

The specimen shall be at least 2,5 mm thick, but if such a thickness is not available on the specimen, then two or more pieces are placed together.

After 1 h the ball is removed from the specimen which is then immersed for 10 s in cold water for cooling down to approximately room temperature. The diameter of the impression is measured, and shall not exceed 2 mm.

In the event of curved surfaces the shorter axis is measured if the indent is elliptical.

In case of doubt, the depth of the impression is measured and the diameter calculated using the formula $\varphi = 2\sqrt{p(5-p)}$, in which p is the depth of impression.

The test is not made on parts of ceramic material.

12 Resistance to flame and ignition

Parts of insulating material retaining live parts in position and external parts of insulating material providing protection against electric shock are subjected to the glow-wire test in accordance with IEC 60695-2-10, IEC 60695-2-11, IEC 60695-2-12 and IEC 60695-2-13, subject to the following details.

- *The test specimen is a complete lamp. It may be necessary to take away parts of the lamp to perform the test, but care is taken to ensure that the test conditions are not significantly different from those occurring in normal use.*
- *The test specimen is mounted 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, into the centre of the surface to be tested. The penetration of the glow-wire into the specimen is mechanically limited to 7 mm.*

* Under consideration.

If it is not possible to make the test on a specimen as described above because the specimen is too small, the above test is made on a separate specimen of the same material, 30 mm square and with a thickness equal to the smallest thickness of the specimen.

- *The temperature of the tip of the glow-wire is 650 °C. After 30 s the specimen is withdrawn from contact with the glow-wire tip.*

The glow-wire temperature and heating current are constant for 1 min prior to commencing the test. Care is taken to ensure that heat radiation does not influence the specimen 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.

- *Any flame or glowing of the specimen shall extinguish within 30 s of withdrawing the glow-wire, and any flaming drop shall not ignite a piece of the tissue paper, spread out horizontally 200 mm \pm 5 mm below the specimen.*

The test is not made on parts of ceramic material.

13 Fault conditions

The lamps shall not impair safety when operated under fault conditions which may occur during the intended use.

Each of the following fault conditions is applied in turn, as well as any other associated fault conditions that may arise from it as logical consequences. Only one component at a time is subjected to a fault condition.

- a) *In a switch-start circuit, the starter is short-circuited.*
- b) *Short-circuit across capacitors.*
- c) *The lamp does not start, because one of the cathodes is broken.*
- d) *The lamp does not start, although the cathode circuits are intact (de-activated lamp).*
- e) *The lamp operates, but one of the cathodes is de-activated or broken (rectifying effect).*
- f) *Opening or bridging other points in the circuit where the diagram indicates that such a fault condition may impair safety.*

Examination of the lamp and its circuit diagram will generally show the fault conditions which should be applied. These are applied in sequence in the order that is most convenient.

The manufacturer or responsible vendor shall submit a specially prepared lamp with the relevant fault condition, where possible in such a way that by operating a switch outside the lamp the fault condition is introduced.

Components or devices in which a short-circuit does not occur shall not be bridged. Similarly, components or devices in which an open circuit cannot occur shall not be interrupted.

Manufacturers or responsible vendors shall produce evidence that the components behave in a way that does not impair safety, for instance, by showing compliance with the relevant specification.

In the case of fault conditions a), b) or f), compliance is checked by operating the sample free burning at room temperature and at a voltage between 90 % and 110 % of the rated voltage or, in case of a voltage range, at a voltage between 90 % and 110 % of the mean voltage of that range until stable conditions have been reached, then introducing the fault condition.

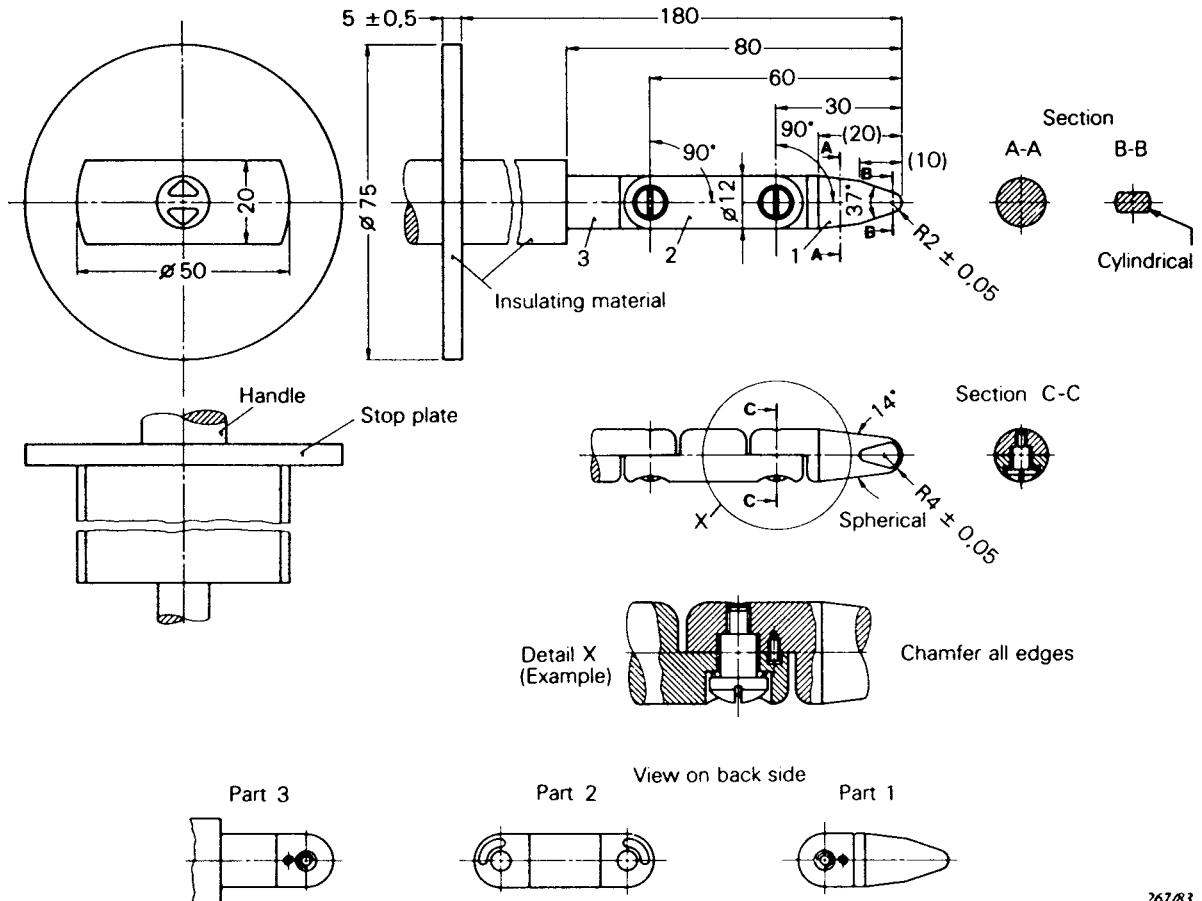
In the case of fault conditions c), d) or e), the same operating conditions apply but the fault condition is introduced at the start of the test.

The sample is then tested a further 8 h. During this test it shall not catch fire, or produce flammable gases and live parts shall not become accessible.

To check if gases liberated from component parts are flammable or not, a test with a high-frequency spark generator is made.

To check if accessible parts have become live, a test in accordance with Clause 7 is made. The insulation resistance (see 8.2) is checked with a d.c. voltage of approximately 1 000 V.

Linear dimensions in millimetres



Tolerances on dimensions without specific tolerance:

on angles: $\begin{matrix} 0 \\ -10' \end{matrix}$

on linear dimensions:

up to 25 mm: $\begin{matrix} 0 \\ -0,05 \end{matrix}$

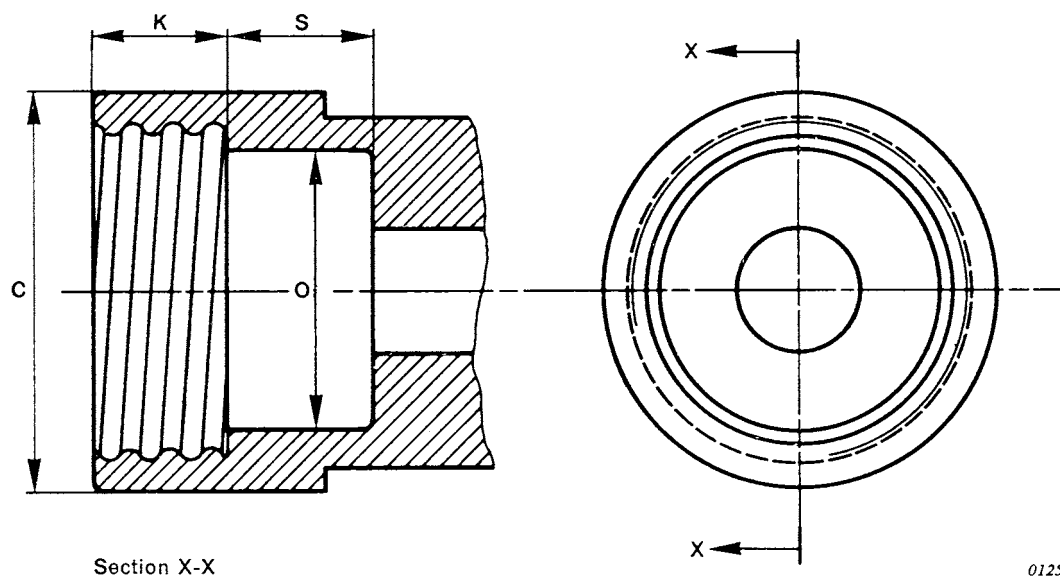
over 25 mm: $\pm 0,2$

Material of finger: e.g. heat-treated steel

Both joints of this finger may be bent through an angle of $\begin{matrix} +10^\circ \\ 0 \end{matrix}$, but in one and the same direction only.

Using the pin and groove solution is only one of the possible approaches in order to limit the bending angle to 90°. For this reason dimensions and tolerances of these details are not given in the drawing. The actual design shall ensure a 90° bending angle with a 0° to +10° tolerance.

Figure 2 – Standard test finger

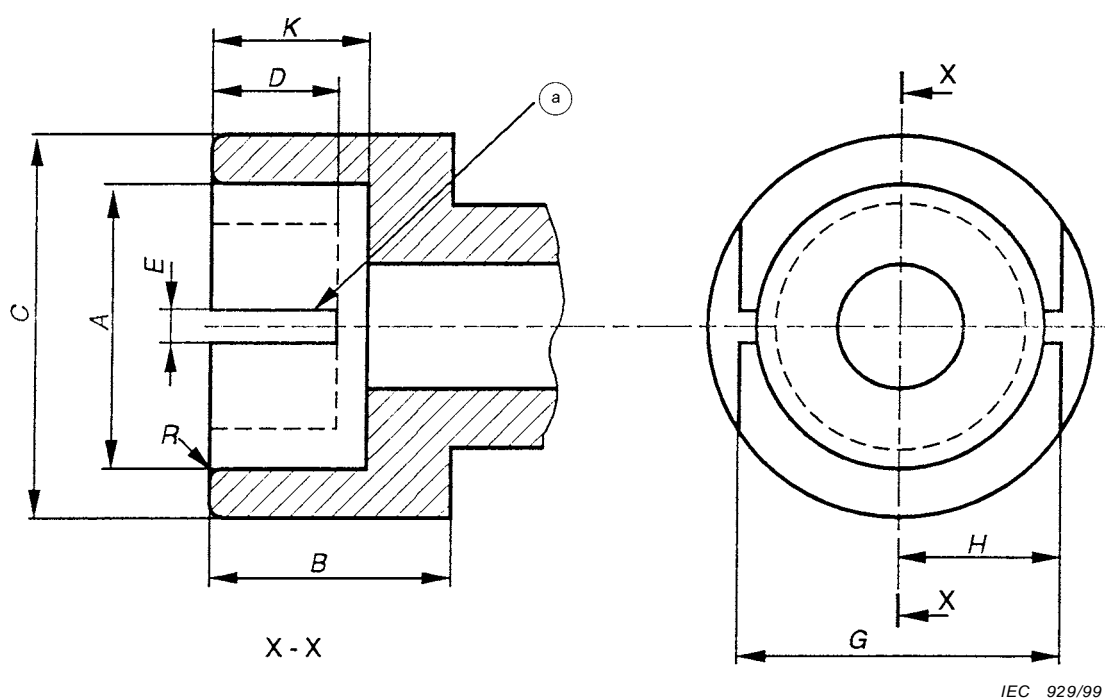


Dimension	E14	E26	E27	Tolerance
C	20,0	32,0	32,0	Min.
K	11,5	11,0	11,0	$\pm 0,3$
O	12,0	23,0	23,0	$\pm 0,1$
S	7,0	12,0	12,0	Min.

The drawing is intended only to illustrate the essential dimensions of the holder.

Thread to be in accordance with holder threads of IEC 60061.

Figure 3 – Holder for torsion test on lamps with screw caps

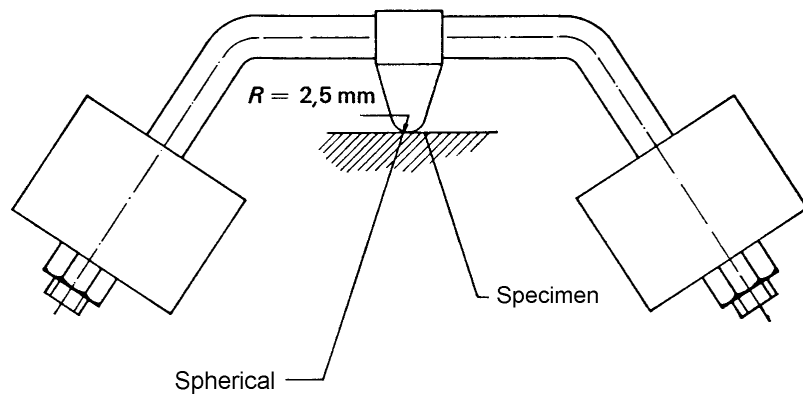


Dimensions	B15 mm	B22 mm	Tolerance mm
A	15,27	22,27	+0,03
B	19,0	19,0	Min.
C	21,0	28,0	Min.
D	9,5	9,5	Min.
E	3,0	3,0	+0,17
G	18,3	24,6	± 0,3
H	9,0	12,15	Min.
K	12,7	12,7	± 0,3
R	1,5	1,5	Approx.

The drawing illustrates the essential dimensions of the holder which need only be checked if doubt arises from the application of the test.

- (a) These slots shall be symmetrical on centre line.

Figure 4 – Holder for torque test on lamps with bayonet caps



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Figure 5 – Ball-pressure apparatus

14 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/(m²·klx).

NOTE In IEC 62471, exposure limits are given as effective irradiance values (unit W/m²) 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/m² at an illuminance level of 500 lx. This means the specific value, related to the illuminance, is 0,001 divided by 500 in W/(m²·lx), which is 2 mW/(m²·klx). Since lx = lm/m², this equals 2 mW/klm specific UV power.

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

Bibliography

IEC 62471:2006, *Photobiological safety of lamps and lamp systems*

IEC/TR 62471-2:2009, *Photobiological safety of lamps and lamp systems – Part 2: Guidance on manufacturing requirements relating to non-laser optical radiation safety*

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