

Auxiliaries for lamps — Capacitors for use in tubular fluorescent and other discharge lamp circuits — General and safety requirements

ICS 29.140.30

National foreword

This British Standard is UK implementation of EN 61048:2006+A1:2016. It is identical to IEC 61048:2006, incorporating amendment 1:2015. It supersedes BS EN 61048:2006 which will be withdrawn on 11 August 2018.

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/34/3, Auxiliaries for lamps.

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

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**Auxiliaries for lamps -
Capacitors for use in tubular fluorescent
and other discharge lamp circuits -
General and safety requirements
(IEC 61048:2006)**

Appareils auxiliaires pour lampes -
Condensateurs destinés à être utilisés
dans les circuits de lampes tubulaires
à fluorescence et autres lampes
à décharge -
Prescriptions générales et de sécurité
(CEI 61048:2006)

Geräte für Lampen -
Kondensatoren für Leuchtstofflampen-
und andere Entladungslampenkreise -
Allgemeine Anforderungen und
Sicherheitsanforderungen
(IEC 61048:2006)

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CENELEC

European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 34C/720/FDIS, future edition 2 of IEC 61048, prepared by SC 34C, Auxiliaries for lamps, of IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61048 on 2006-05-01.

This European Standard replaces EN 61048:1993 + A1:1996 +A2:1999.

In this EN 61048:2006 conformity of production has been changed from "informative" to "normative", thus providing a higher degree of safety for capacitors.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2007-02-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2009-05-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61048:2006 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

The text of document 34C/1155/FDIS, future IEC 61048:2006/A1, prepared by SC 34C "Auxiliaries for lamps" of IEC/TC 34 "Lamps and related equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61048:2006/A1:2016.

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standard or by endorsement
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standards conflicting with the
document have to be withdrawn

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 61048:2006/A1:2015 was approved by CENELEC as a European Standard without any modification.

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INTRODUCTION

This International Standard covers general and safety requirements for certain capacitors for use in tubular fluorescent and other discharge lamp circuits.

Performance requirements for these capacitors are the subject of IEC 61049.

NOTE Safety requirements ensure that electrical equipment constructed in accordance with these requirements, does not endanger the safety of persons, domestic animals or property when properly installed and maintained and used in applications for which it was intended.

AUXILIARIES FOR LAMPS – CAPACITORS FOR USE IN TUBULAR FLUORESCENT AND OTHER DISCHARGE LAMP CIRCUITS – GENERAL AND SAFETY REQUIREMENTS

1 Scope

This International Standard states the requirements for both self-healing and non-self-healing continuously rated a.c. capacitors of up to and including 2,5 kVAr, and not less than 0,1 μ F, having a rated voltage not exceeding 1 000 V, which are intended for use in discharge lamp circuits operating at 50 Hz or 60 Hz and at altitudes up to 3 000 m.

NOTE These lamps and associated ballasts are covered by IEC 60081, IEC 60901, IEC 60188, IEC 60192, IEC 60662, and IEC 61167 and by IEC 61347-2-8 and IEC 61347-2-9, respectively.

It covers capacitors intended for connection in shunt or in series with the lamp circuit or an effective combination of these.

It covers only impregnated or unimpregnated capacitors, having a dielectric of paper, plastic film or a combination of both, either metallized or with metal foil electrodes.

This standard does not cover radio-interference suppressor capacitors the requirements for which are found in IEC 60384-14.

Tests given in this standard are type tests. Requirements for testing individual capacitors during production are not included.

A1 Particular requirements for built-in capacitors having an insulation equivalent to double or reinforced insulation are given in Annex E. **A1**

2 Normative references

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.

IEC 60269 (all parts), *Low-voltage fuses*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

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

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

IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle flame method – Apparatus, confirmatory test arrangement and guidance*

IEC 61049:1991, *Capacitors for use in tubular fluorescent and other discharge lamp circuits – Performance requirements*

ISO 4046-4:2002, *Paper, board, pulps and related terms – Vocabulary – Paper and board grades and converted products*

3 Terms and definitions

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

3.1

rated voltage

U_n

r.m.s. value of the sinusoidal voltage, marked on the capacitor

3.2

rated maximum temperature

t_c

temperature, in degrees Celsius, which must not be exceeded by the hottest part of the capacitor surface during operation

NOTE The internal losses in a capacitor, though small, result in the surface temperature being above ambient air temperature and due allowance for this should be made.

3.3

rated minimum temperature

temperature, in degrees Celsius, of any part of the surface of the capacitor below which the capacitor must not be energized

3.4

discharge resistor

resistor connected across the terminals of a capacitor to reduce shock hazard from the charge stored in the capacitor

3.5

tangent of loss angle

$\tan \delta$

power loss of the capacitor divided by the reactive power of the capacitor at a sinusoidal voltage of rated frequency

3.6

self-healing

process by which the electrical properties of the capacitor, after a local breakdown of the dielectric, are rapidly and essentially restored to the values before the breakdown

3.7

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 specification

3.8

type test sample

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

3.9

capacitor of type A

self-healing parallel capacitor not necessarily including an interrupting device

3.10

capacitor of type B

self-healing capacitor used in series lighting circuits or a self-healing parallel capacitor, containing an interrupter device

4 General requirements

Capacitors shall be so designed that in normal use they function safely and cause no danger to persons or surroundings.

All exposed metal parts shall be constructed of non-ferrous material or shall be protected against rusting. Visible rust shall not occur. The test of Clause 15 will show whether the capacitor is sufficiently protected against rust.

Tests for checking the mechanical robustness are under consideration.

Compliance with the requirements of Clauses 4 to 11 is checked by measurement, inspection and by carrying out all the tests specified in this standard.

NOTE In Japan an additional capacitor type is permitted, details of which are to be found in JIS C 4908. Inclusion of the requirements for these capacitors in this standard is under consideration.

5 General notes on tests

Tests according to this standard are type tests, (Annex C excluded).

NOTE The requirements and tolerances permitted by this standard are related to testing of a type test sample submitted for that purpose. Compliance of the type test sample does not ensure compliance of the whole production of a manufacturer with this safety standard. Conformity of production is the responsibility of the manufacturer and includes routine tests and quality assurance in addition to type testing.

Capacitors shall be subjected to the tests detailed in Clause 12.

Unless otherwise specified, tests shall be carried out at a temperature of $(20 \pm 5) ^\circ\text{C}$, using where appropriate a voltage source as detailed in Annex A.

Test temperatures specified in particular clauses shall be subject to a tolerance of $\pm 2 ^\circ\text{C}$, unless otherwise stated.

Unless otherwise specified, the type shall be deemed to comply with any one clause or subclause if not more than one failure occurs in the test of that clause or subclause. If three or more failures occur, the type shall be rejected. If two failures occur in any one test, that test, and any preceding tests which may have influenced the test results, shall be repeated on the same quantity of capacitors and if any further failures occur, the type shall be rejected.

NOTE A repeat test may be permitted only once in a series of tests according to the requirements of this standard. A repeat test is not permitted in the destruction test, Clause 18, in the case of a catastrophic failure.

For a range of capacitors of the same construction, rated voltage and cross-sectional shape, each group referred to in Clause 12 shall contain as nearly as possible equal numbers of capacitors of the highest capacitance and the lowest capacitance in that range.

Moreover, the manufacturer shall provide data on the ratio of capacitance per area outer total surface of the container of each capacitance value in the range. The capacitor with the maximum capacitance per unit surface area shall also be tested if this ratio exceeds that of the maximum capacitance value in the range by 10 % or greater. Similarly, the capacitor with the minimum capacitance per unit area shall also be tested if the ratio is less than that of the minimum capacitance value in the range by 10 % or greater.

"Area" denotes total outer surface area of capacitor enclosure ignoring small protrusions, terminals and fixing studs.

With this procedure the tests qualify all intermediate values of capacitance in the range.

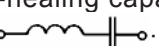
NOTE 1 The "same construction" is that which is declared by the manufacturer to be the same dielectric material, the same dielectric thickness, the same type of case (metal or plastic), the same generic family of filler or impregnating liquid, the same type of safety device and the same type of metallization (e.g. zinc or aluminium).

NOTE 2 "Cross-sectional shape" means: round, rectangular, oval, etc.

6 Marking

6.1 Required marking

Capacitors shall be legibly marked as follows:

- a) name or trade mark of the manufacturer or responsible vendor;
- b) manufacturer's catalogue number and/or model reference;
- c) rated capacitance and tolerance;
- d) rated voltage;
- e) when a discharge resistor is fitted, the symbol  ;
- f) when a current fuse is fitted, the symbol  ;
- g) rated frequency or frequency range;
- h) rated minimum and maximum temperatures, for example $-10\text{ }^{\circ}\text{C}/70\text{ }^{\circ}\text{C}$;
- i) if the capacitor is self-healing, the symbol  ;
- j) if a non-self-healing capacitor is exclusively intended for series operation the symbol  ;

This symbol shall not appear on capacitors bearing the self-healing symbol.

NOTE This type of capacitor is not intended to be connected across the mains supply.

- k) type A or B as applicable.

6.2 Additional information

- a) Declaration of value of discharge resistor, if fitted.
- b) Declaration whether the capacitor does not contain substances which are liquid at $(t_c + 10)\text{ }^{\circ}\text{C}$.

6.3 Durability and legibility of marking

Marking shall be durable and legible.

Compliance is checked by inspection and by trying to remove the marking by rubbing lightly, for 15 s each, with one piece of cloth soaked with water and another with petroleum spirit. The marking shall be legible after the test.

NOTE The petroleum spirit used should consist of a solvent hexane with a content of aromatics of maximum 0,1 volume percentage, a kauri-butanol value of 29, an initial boiling point of approximately 65 °C, a dry-point of approximately 69 °C and a density of approximately 0,68 g/cm³.

7 Terminations

7.1 Terminations shall be provided by means of either cables (tails) or terminals (screw, screwless, solder tag or the like). Terminations shall be capable of accepting the size and number of conductors appropriate to the rating and application of the capacitor. Cables (tails) shall be suitable for the rating of the capacitor, but in no case shall they be smaller than 0,5 mm² and their insulation shall be appropriate to the capacitor rated voltage and temperatures.

Screw terminals shall comply with section 14 of IEC 60598-1.

Screwless terminals shall comply with section 15 of IEC 60598-1.

7.2 The capacitor case, if of metal, shall either be fitted with an earthing terminal or be capable of being earthed (or connected to other metal parts, if any, of the luminaire) by clamping or by an appropriate fixing bracket. The part of the case to which such a clamp is fitted or the fixing bracket attached shall be free from paint or other non-conducting covering in order to ensure the maintenance of good electrical contact.

Compliance is checked by inspection and the following test:

A current of at least 10 A, derived from a source with a no-load voltage not exceeding 12 V, shall be passed between the earthing terminal or earthing contact and each of the accessible metal parts in turn. The voltage drop between the case and the clamping means or fixing bracket shall be measured and the resistance calculated from the current and the voltage drop.

In no case shall the resistance exceed 0,5 Ω .

The requirements of the previous paragraph do not apply to metal-cased capacitors completely covered in an insulating material, because these are tested according to 14.2.

8 Creepage distances and clearances

The creepage distances over external surfaces of terminal insulation and the clearances between the exterior parts of terminal connections or between such live parts and the metal case of the capacitor, if any, shall be not less than the minimum values given in Table 1.

These minimum distances shall apply to the terminals with or without the external wiring connected.

They are not intended to apply to internal distances and clearances.

Compliance is checked by measurement.

Table 1 – Minimum creepage distances and clearances

Rated voltage	Up to and including 24 V mm	Above 24 V up to and including 250 V mm	Above 250 V up to and including 500 V mm	Above 500 V up to and including 1 000 V mm
<i>Creepage distance</i>				
1) between live parts of different polarity	2	3 (2) ^a	5	6
2) between live parts and accessible metal parts which are permanently fixed to the capacitor, including screws of devices for fixing covers or fixing the capacitor to its support	2	4 (2) ^a 3 ^b	6 3 ^b	7
<i>Clearances</i>				
3) between live parts of different polarity	2	3 (2) ^a	5	6
4) between live parts and accessible metal parts which are permanently fixed to the capacitor, including screws or devices for fixing covers or fixing the capacitors to its support	2	4 (2) ^a 3 ^b	6 3 ^b	7
5) between live parts and a flat supporting surface or a loose metal cover, if any, if the construction does not ensure that the values of Item 4) above are maintained under the most unfavourable conditions	2	6	10	12
^a The values in brackets apply to creepage distances and clearances protected against pollution. For permanently sealed-off or compound-filled enclosures, creepage distances and clearances are not checked.				
^b For glass or other insulation with equivalent tracking qualities.				

The contribution to the creepage distances of any groove less than 1 mm wide shall be limited to its width.

Any air-gap of less than 1 mm shall be ignored in computing the total air path.

Creepage distances are distances in air, measured along the surface of insulating material.

9 Voltage rating

Capacitors shall be capable of withstanding for prolonged periods a voltage not exceeding 110 % of their rated voltage within the temperature ratings.

Compliance is checked by the test given in Clause 14.

NOTE This requirement is intended to cover variations in voltage due to supply fluctuations.

10 Fuses

Where an internal current fuse is fitted, it shall be adequately protected, enclosed and insulated so as to prevent flashover to, or contact with, a metal container in normal service in the event of the operation of the fuse.

Compliance is checked by inspection and by the tests given in 14.2 and 16.

NOTE In establishing the design of any internal fuse, the possibility of short circuits occurring external to the capacitor should be taken into account.

11 Discharge resistors

Capacitors may have a discharge resistor permanently connected across their terminals. If fitted, this discharge resistor shall have a value such that it will discharge the capacitor from the peak of the a.c. voltage applied to it, to a voltage not exceeding 50 V, within 1 min. Allowance shall be made for a voltage which is 10 % above its rated value.

The manufacturer shall declare the resistor value and tolerance.

Compliance is checked by measurement.

NOTE 1 Within the overall lamp circuit, it is essential that a discharge path be provided for any capacitor. It is recommended that this should be by means of a resistor integral with the capacitor, but other arrangements are possible.

NOTE 2 In certain cases, for example luminaires connected by plugs, a discharge to 50 V within 1 min may not be acceptable, see subclause 8.2.7 of IEC 60598-1.

12 Testing sequence

A total of 50 self-healing capacitors or 20 non-self-healing capacitors are taken and divided into groups as indicated below.

NOTE For capacitors above 1 kVAr, the quantities for testing can be agreed between manufacturer and testing authority.

The following initial tests are applied to all the capacitors in the order given:

- a) *sealing and heating test, if required, in accordance with Clause 13;*
- b) *high-voltage test between terminals in accordance with 14.1;*
- c) *high-voltage test between terminals and container in accordance with 14.2.*

The first group of 10 capacitors is subjected to a series of tests that are designed to check the ability of the capacitor design to withstand adverse operating conditions. Details of these tests are described in Clause 15. In addition, tests to check resistance to heat and fire are carried out in accordance with Clause 16.

The second group of 40 self-healing capacitors shall provide the samples for the tests of Clauses 17 and 18. Ten capacitors are submitted to the self-healing test and no subsequent testing. The remainder are used for the destruction test.