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Titel / title:

IEC 60901:1996, A3:2004
Single-capped fluorescent lamps -
Performance specifications

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**NORME
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**CEI
IEC**

60901

AMENDEMENT 3
AMENDMENT 3

2004-05

Amendement 3

**Lampes à fluorescence à culot unique –
Prescriptions de performances**

Amendment 3

**Single-capped fluorescent lamps –
Performance specifications**

*Les feuilles de cet amendement sont à insérer dans la
Publication 60901 (2001)*

*The sheets contained in this amendment are to be
inserted in Publication 60901 (2001)*

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AVANT-PROPOS

Le présent amendement a été établi par le sous-comité 34A: Lampes, du comité d'études 34 de la CEI: Lampes et équipements associés.

Le texte de cet amendement est issu des documents suivants:

FDIS	Rapport de vote
34A/1078/FDIS	34A/1082/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cet amendement.

Le comité a décidé que le contenu de la présent publication ne sera pas modifié avant 2006. A cette date, la publication sera

- reconduite;
- supprimée;
- remplacée par une édition révisée, ou
- amendée.

FOREWORD

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

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

FDIS	Report on voting
34A/1078/FDIS	34A/1082/RVD

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The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

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- withdrawn;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

INSTRUCTIONS POUR L'INSERTION DES NOUVELLES PAGES ET FEUILLES DE CARACTÉRISTIQUES DANS LA PUBLICATION

1. Retirer la page de titre et insérer la nouvelle page de titre.
2. Retirer la page 4 et insérer la nouvelle page 4.
3. Retirer les pages I-1 et I-9 et insérer les nouvelles pages I-1 et I-9.
4. Retirer la page II-3 et insérer les nouvelles pages II-3 et II-3a.
5. Retirer la page II-5 et insérer les nouvelles pages II-5 et II-5a.

SECTION 2 – FEUILLES DE CARACTÉRISTIQUES

6. Retirer les feuilles
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2007-1 (page 3)
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1. Remove title page and insert new title page.
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2. Remove pages I-2 and I-10 and insert new pages I-2 and I-10.
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4. Remove pages II-4 and insert new pages II-6 and II-6a.

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6240-2 (page 2)

**NORME
INTERNATIONALE
INTERNATIONAL
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**CEI
IEC
60901**

1996

AMENDEMENT 2
AMENDMENT 2

2000-04

Amendement 2

**Lampes à fluorescence à culot unique –
Prescriptions de performances**

Amendment 2

**Single-capped fluorescent lamps –
Performance specifications**

*Les feuilles de cet amendement sont à insérer dans la
Publication 60901 (1996)*

*The sheets contained in this amendment are to be
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AVANT-PROPOS

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Le texte de cet amendement est issu des documents suivants:

FDIS	Rapport de vote
34A/908/FDIS	34A/914/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cet amendement.

FOREWORD

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

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34A/908/FDIS	34A/914/RVD

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

**NORME
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**CEI
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60901

Deuxième édition
Second edition
1996

Modifiée selon l'amendement 1 (1997)
Amended in accordance with amendment 1 (1997)

**Lampes à fluorescence à culot unique
Prescriptions de performances**

**Single-capped fluorescent lamps
Performance specifications**

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1. Retirer la page de titre et insérer la nouvelle page de titre.
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3. Retirer les pages B-7 à E-1 et insérer les nouvelles pages B-7 à E-1.
4. Retirer les pages II-3 à II-7 et insérer les nouvelles pages II-3 à II-7.

SECTION 2 – FEUILLES DE CARACTÉRISTIQUES

5. Retirer les feuilles
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0526-1 (pages 1 et 2)
1413-1 (page 2)
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7432-2 (pages 1 et 2)
7442-2 (pages 1 et 2)

7. Insérer les nouvelles feuilles A020-1 et B410-1.

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2. Remove pages I-2 to A-1 and insert new pages I-2 to A-1.
3. Remove pages B-8 to E-1 and insert new pages B-8 to E-1.
4. Remove pages II-4 to II-8 and insert new pages II-4 to II-8.

SECTION 2 – DATA SHEETS

5. Remove sheets.
0518-1 (pages 1 and 2)
0526-1 (pages 1 and 2)
1413-1 (page 2)
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7. Insert new sheets A020-1 and B410-1.

B-8 无报

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SINGLE-CAPPED FLUORESCENT LAMPS – PERFORMANCE SPECIFICATIONS

FOREWORD

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International Standard IEC 60901 has been prepared by subcommittee 34A: Lamps, of IEC technical committee 34: Lamps and related equipment.

This consolidated version of IEC 60901 is based on the second edition (1996) [documents 34A/588/FDIS and 34A/634/RVD], its amendment 1 (1997) [documents 34A/706/FDIS and 34A/743/RVD], its amendment 2 (2000) [documents 34A/908/FDIS and 34A/914/RVD], and its amendment 3 (2004) [documents 34A/1078/FDIS and 34A/1082/RVD].

It bears the edition number 2.3.

The origin (edition 2 or amendments 1, 2 or 3) of the standard sheets constituting this consolidated edition may be identified by the headers of the sheets.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

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

SINGLE-CAPPED FLUORESCENT LAMPS – PERFORMANCE SPECIFICATIONS

Section 1: General

1.1 Scope

This International Standard specifies the performance requirements for single-capped fluorescent lamps for general lighting service.

The requirements of this standard relate only to type testing. Conditions of compliance, including methods of statistical assessment, are under consideration.

The following lamp types and modes of operation with external ballasts are included:

- a) lamps operated with an internal means of starting, having preheated cathodes, for operation on a.c. mains frequencies;
- b) lamps operated with an external means of starting, having preheated cathodes, for operation on a.c. mains frequencies with the use of a starter, and additionally operating on high frequency;
- c) lamps operated with an external means of starting, having preheated cathodes, for operation on a.c. mains frequencies without the use of a starter (starterless), and additionally operating on high frequency;
- d) lamps operated with an external means of starting, having preheated cathodes, for operation on high frequency;
- e) lamps operated with an external means of starting, having non-preheated cathodes, for operation on high frequency.

For some of the requirements given in this standard reference is made to "the relevant lamp data sheet". For some lamps these data sheets are contained in this standard. For other lamps, falling under the scope of this standard, the relevant data are supplied by the lamp manufacturer or responsible vendor.

1.2 General statement

It may be expected that lamps which comply with this standard will start and operate satisfactorily at voltages between 92 % and 106 % of rated supply voltage and at an ambient air temperature of between 10 °C and 50 °C, when operated with a ballast complying with IEC 60921 or IEC 60929, where relevant with a starter complying with IEC 60155 or IEC 60927, and in a luminaire complying with IEC 60598-1.

NOTE For some lamps, additional information for high-frequency ballast design is given for proper starting at an ambient air temperature of -15 °C.

1.3 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(845):1987, *International Electrotechnical Vocabulary (IEV) – Chapter 845: Lighting*

IEC 60061-1:1969, *Lamp caps and holders together with gauges for the control of interchangeability and safety – Part 1: Lamp caps*

IEC 60081:1997, *Double-capped fluorescent lamps – Performance specifications*

IEC 60155:1993, *Glow starters for fluorescent lamps*

IEC 60598-1:1996, *Luminaires – Part 1: General requirements and tests*

IEC 60921:1988, *Ballasts for tubular fluorescent lamps – Performance requirements*

IEC 60927:1996, *Auxiliaries for lamps – Starting devices (other than glow starters) – Performance requirements*

IEC 60929:1990, *AC supplied electronic ballasts for tubular fluorescent lamps – Performance requirements*

IEC 61199:1993, *Single-capped fluorescent lamps – Safety specifications*

IEC/TS 61231:1999, *International lamp coding system (ILCOS)*

1.4 Definitions

For the purpose of this International Standard, the following definitions apply.

For definitions related to lighting, see IEC 60050(845).

1.4.1

fluorescent lamp

discharge lamp of the low pressure mercury type, in which most of the light is emitted by one or several layers of phosphors excited by the ultra-violet radiation from the discharge

1.4.2

single-capped fluorescent lamp

fluorescent lamp having a single cap, for operation on external circuits with either an internal or external means of starting

1.4.3

nominal value

approximate quantity value used to designate or identify a lamp

1.4.4

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

1.4.5

lumen maintenance

ratio of the luminous flux of a lamp at a given time in its life to its initial luminous flux, the lamp being operated under specified conditions. This ratio is generally expressed as a percentage

1.4.6**initial readings**

starting characteristics of a lamp, measured before ageing, and the electrical, photometric and cathode characteristics of a lamp, measured at the end of the 100 h ageing period

1.4.7**conditioning period**

time required after switching on a lamp to reach stabilization of the vapour pressure within the discharge tube

1.4.8**starting aid**

conductive strip affixed to the outer surface of a lamp, or a conductive plate which is spaced within an appropriate distance from the lamp. A starting aid is usually connected to earth potential, and can only be effective when it has an adequate potential difference from one end of the lamp

1.4.9**reference ballast**

special ballast, either inductive for lamps for operation on a.c. mains frequencies, or resistive for lamps for operation on high frequency. It is designed for the purpose of providing comparison standards for use in testing ballasts, for the selection of reference lamps and for testing regular production lamps under standardized conditions. It is essentially characterized by the fact that at its rated frequency, it has a stable voltage/current ratio which is relatively uninfluenced by variations in current, temperature and magnetic surroundings, as outlined in the relevant ballast standard

1.4.10**calibration current of a reference ballast**

value of the current on which the calibration and control of the reference ballast are based

1.4.11**type test**

test or a 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

1.4.12**type test sample**

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

1.5 Lamp requirements**1.5.1 General**

A lamp, on which compliance with this standard is claimed, shall comply with the requirements of IEC 61199.

A lamp shall be so designed that its performance is reliable in normal and accepted use. In general, this can be achieved by satisfying the requirements of the following subclauses.

The requirements and information given apply to 95 % of production.

NOTE The requirements and tolerances permitted by this standard correspond to the testing of a type test sample, submitted by the manufacturer for that purpose. In principle this type test sample should consist of units having characteristics typical of the manufacturer's production and being as close to the production centre point values as possible.

It may be expected with the tolerances given in the standard that products manufactured in accordance with the type test sample will comply with the standard for the majority of production. Due to the production spread however, it is inevitable that there will sometimes be products outside the specified tolerances. For guidance on sampling plans and procedures for inspection by attributes, see IEC 60410.

1.5.2 Caps

The dimensions of the cap on a finished lamp shall be in accordance with IEC 60061-1.

1.5.3 Dimensions

The dimensions of a lamp shall comply with the values specified on the relevant lamp data sheet.

1.5.4 Starting characteristics

A lamp shall start fully within the time specified on the relevant lamp data sheet and remain alight.

Conditions and method of test are given in annex A.

1.5.5 Electrical characteristics

- The initial reading of the voltage at the lamp terminals shall comply with the values specified on the relevant lamp data sheet.
- The initial reading of the power dissipated by a lamp shall not exceed the rated wattage, specified on the relevant lamp data sheet, by more than 5 % + 0,5 W.

NOTE Cathode watts due to supplementary heating are not included in the rated lamp wattage unless otherwise stated on the lamp data sheet.

Conditions and method of test are given in annex B.

1.5.6 Cathode characteristics

- For a lamp having preheated cathodes for operation on a.c. mains frequencies starterless circuits, the initial reading of the resistance of each cathode shall be not less than the minimum value specified on the relevant lamp data sheet. These resistance values include lead wire resistance.
- For a lamp having preheated cathodes for operation on high frequency or additionally operating on high frequency, the initial reading of the resistance of each cathode, when heated with the specified test current, shall comply with the values specified on the relevant lamp data sheet. These resistance values include lead wire resistance.

In addition, the average value of the resistance ratio R_h/R_c of the coils of 10 cathodes shall be in the range $4,75 \pm 0,5$. R_h is the resistance of the cathode when heated with the specified test current. R_c is the resistance of the cathode at a temperature of $25\text{ °C} \pm 1\text{ °C}$. Both resistance values shall exclude lead wire resistance.

Conditions and method of test are given in annex B.

1.5.7 Photometric characteristics

- a) The initial reading of the luminous flux of a lamp shall be not less than 90 % of the rated value.
- b) The initial reading of the chromaticity coordinates x and y of a lamp shall be within 5 SDCM (standard deviation of colour matching) from the rated values.

NOTE See also the relevant annex on rated colour characteristics in IEC 60081.

- c) The initial reading of the general colour rendering index R_a of a lamp shall be not less than the rated value decreased by three.

Conditions and method of test are given in annex B.

1.5.8 Lumen maintenance

The lumen maintenance of a lamp, at any time in its life, shall be not less than 90 % (under consideration) of the rated lumen maintenance value.

Conditions and method of test are given in annex C.

1.5.9 Radio interference suppression (RIS)

A lamp with an internal starter shall contain means to aid in the suppression of radio interference, the effect of which shall be equivalent to that of the RIS capacitor prescribed in IEC 60155.

1.5.10 Marking

A lamp shall be marked with an identification which defines, with the aid of information made available by the manufacturer or responsible vendor, the electrical and photometric characteristics of the lamp.

For a lamp using amalgam as a means of mercury vapour pressure control and exhibiting a slow run-up, the immediate lamp wrapping or container shall be marked with the word "AMALGAM".

NOTE The marking of "AMALGAM" is required in order to make aware of the relatively slow run-up behaviour of lamps containing certain amalgam compositions. Lamps containing amalgam with no retardation of luminous flux during run-up, compared with non-amalgam lamps, are not addressed by the marking requirement.

1.6 Information for ballast and starter design

Refer to the relevant lamp data sheet and to annex D for information for ballast and starter design.

1.7 Information for luminaire design

Refer to the relevant lamp data sheet and to annex E for information for luminaire design.

Annex A (normative)

Method of test for starting characteristics

A.1 General

Tests shall be made in a draught-free atmosphere at an ambient temperature of between 20 °C and 27 °C and a relative humidity of 65 % maximum.

Metallic parts and wires in the vicinity of the lamp, except starting aids when required, shall be avoided as far as possible.

Immediately prior to the starting test the lamps shall be kept inoperative and in an ambient temperature of between 20 °C and 27 °C and a relative humidity of 65 % maximum for a period of at least 24 h.

A.2 Lamps having preheated cathodes for operation on a.c. mains frequencies with an internal or external starter

A.2.1 Test circuit

Lamps shall be tested with a 50 Hz or 60 Hz supply in the circuits shown in:

- figure A.1 for lamps with internal starter;
- figure A.2 for lamps with external starter.

A.2.2 Ballast

The ballast used shall comply with the requirements of IEC 921. It shall be rated as specified on the relevant lamp data sheet.

When the ballast, at its rated voltage, is associated with a test lamp, the lamp shall dissipate a power which does not differ from its rated value by more than 4 %. A test lamp is a lamp whose voltage at lamp terminals does not deviate by more than 2 % from its rated value, when operated with its reference ballast.

The preheating current, when measured at 90 % of rated ballast voltage, shall be between 1,1 and 1,2 times the rated lamp current. To obtain a value of the preheating current within this range, it may be necessary either to make a special selection from among commercial ballasts, or else to design and manufacture a ballast for this specific purpose. In some cases, it may be possible to bring the preheating current down to be within this range by adding resistance in series with the starter.

NOTE - In some cases, the ballast may include an autotransformer to increase (or reduce) the voltage to the proper value for the starting and operation of the lamp. Ballasts incorporating step-up transformers are particularly likely to be used in countries where 120 V or 100 V power systems predominate.

A.2.3 Starter

For lamps operated with an external starter, the type of glow starter to be used shall comply with the requirements of IEC 155, and shall in any case be subject to agreement with the lamp manufacturer or responsible vendor.

A.2.4 Test voltage

The test voltage applied to the circuit shall be as specified on the relevant lamp data sheet.

A.3 Lamps having preheated cathodes for operation on a.c. mains frequencies starterless circuits

A.3.1 Test circuit

Lamps shall be tested with a 50 Hz or 60 Hz supply in the circuit shown in figure A.3.

A.3.2 Ballast

The ballast used shall comply with the requirements of IEC 921. It shall be rated as specified on the relevant lamp data sheet.

When the ballast, at its rated voltage, is associated with a test lamp, the lamp shall dissipate a power which does not differ from its rated value by more than 4 %. A test lamp is a lamp whose voltage at lamp terminals does not deviate by more than 2 % from its rated value, when operated with its reference ballast.

NOTES

1 In some cases the ballast may include an autotransformer to increase (or reduce) the voltage to the proper value for the starting and operation of the lamp. Ballasts incorporating step-up transformers are particularly likely to be used in countries where 120 V or 100 V power systems predominate.

2 The earthing of the circuit as shown in figure A.3 may make it necessary to supply it through an isolating transformer

A.3.3 Starting aid

The starting aid, a metal plate, shall be connected to earth potential. Its dimensions shall be not less than the dimensions specified for the maximum lamp outlines of the relevant lamp. The distance between the surface of the lamp and the starting aid shall be as specified on the relevant lamp data sheet.

The manufacturer or responsible vendor shall specify whether or not the lamps require an external starting aid. For lamps not requiring a separate starting aid, the metal plate shall be removed.

A.3.4 Test voltages

The voltage of the heating circuit to be applied to the cathode terminals and the open circuit voltage at the lamp terminals for the starting test shall be as specified on the relevant lamp data sheet.

NOTE – The voltages specified for the starting test are chosen primarily to secure reproducibility of test results, and are not necessarily applicable to the design of ballasts.

The voltages of the main circuit and of the heating circuits shall be applied simultaneously.

The voltage applied to the cathode heating circuits shall not be so connected as to increase the voltage of the main circuit. The two circuits shall be connected in the same phase.

The two cathode heating transformers may be replaced by one with isolated secondary windings. The ratings of the transformer(s) shall be such that the voltage does not change by more than 2 % when the maximum cathode load is connected.

If the lamp does not start at the specified open circuit voltage, this voltage shall be gradually increased up to a maximum of 110 % of the test value. If the lamp still does not start, it shall be rejected. If the lamp does start, it shall be operated for half an hour at rated voltage and the normal test shall be made again after a rest period of 24 h.

A.4 Lamps for operation on high frequency

Lamps shall be tested with an a.c supply with a frequency between 20 kHz and 26 kHz in the circuits shown in:

- figure A.4 for lamps with preheated cathodes;
- figure A.5 for lamps with non-preheated cathodes.

The non-inductive ballast resistor shall be so adjusted that the high-frequency lamp current is equal to the value as specified on the relevant lamp data sheet.

The open circuit voltage applied to the circuit shall be as specified on the relevant lamp data sheet.

A starting aid shall not be used, unless otherwise stated on the relevant lamp data sheet, or by the manufacturer or responsible vendor.

For lamps with preheated cathodes, the cathode heating supplies shall be adjusted to supply a preheat current as specified on the relevant lamp data sheet. During the preheat time, specified on the relevant lamp data sheet, switch S_1 shall be kept open and switches S_2 closed. After this period of time, switches S_2 shall be opened simultaneously as switch S_1 is closed.

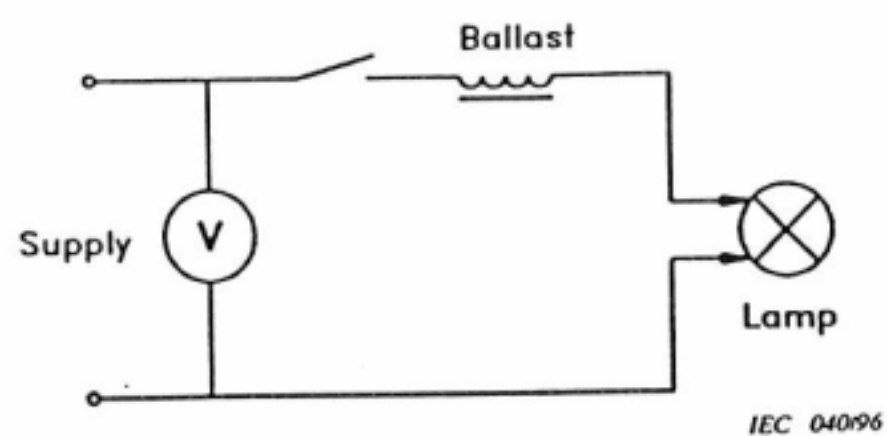


Figure A.1 – Circuit diagram for starting test for lamps with internal starter

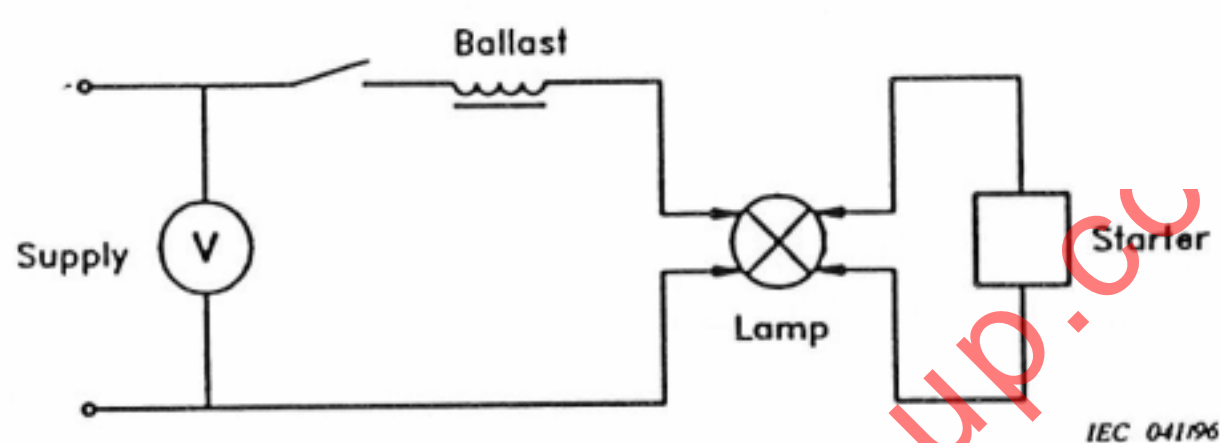


Figure A.2 – Circuit diagram for starting test for lamps with external starter

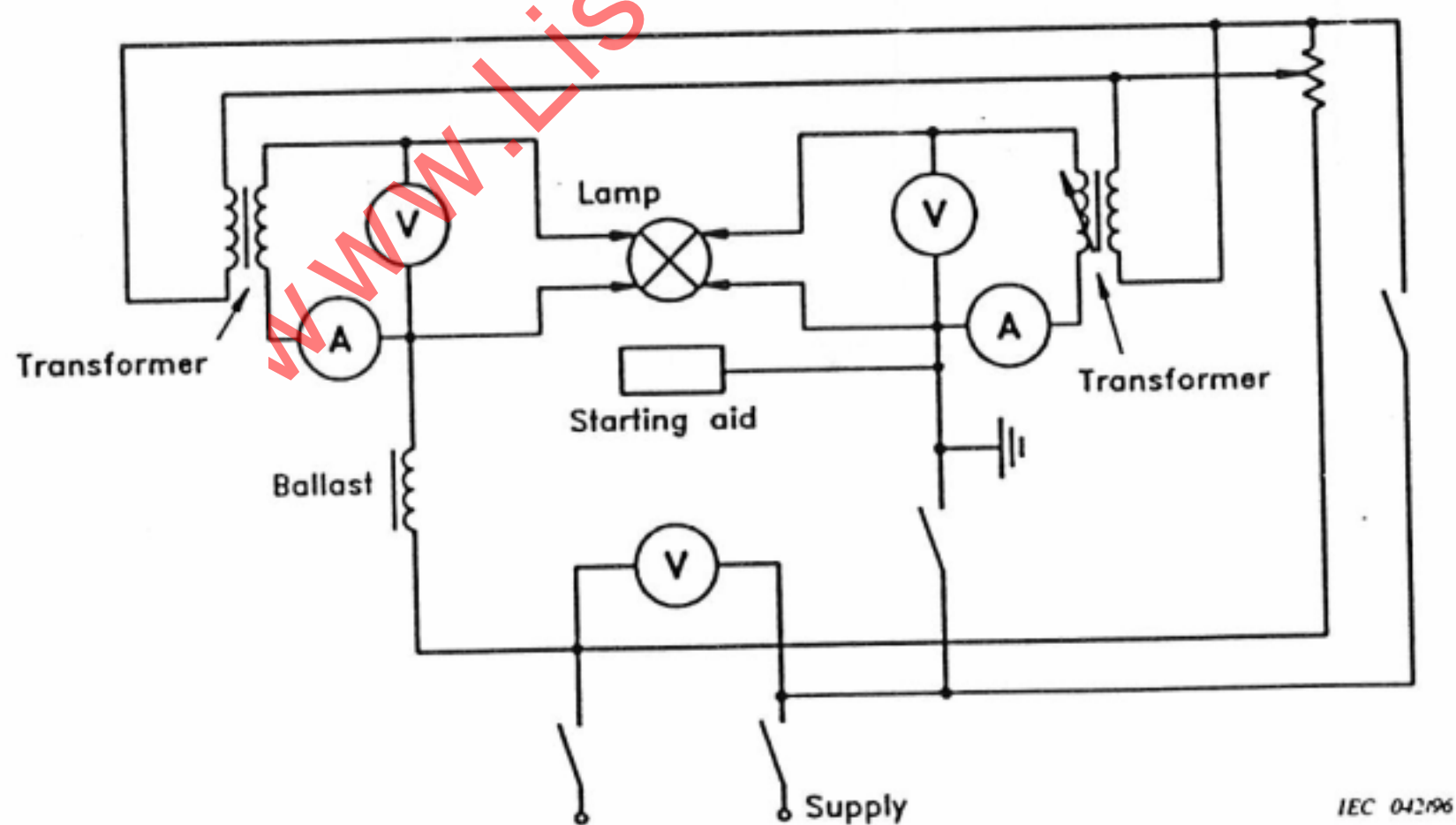


Figure A.3 – Circuit diagram for starting test for lamps with preheated cathodes for operation on starterless circuits

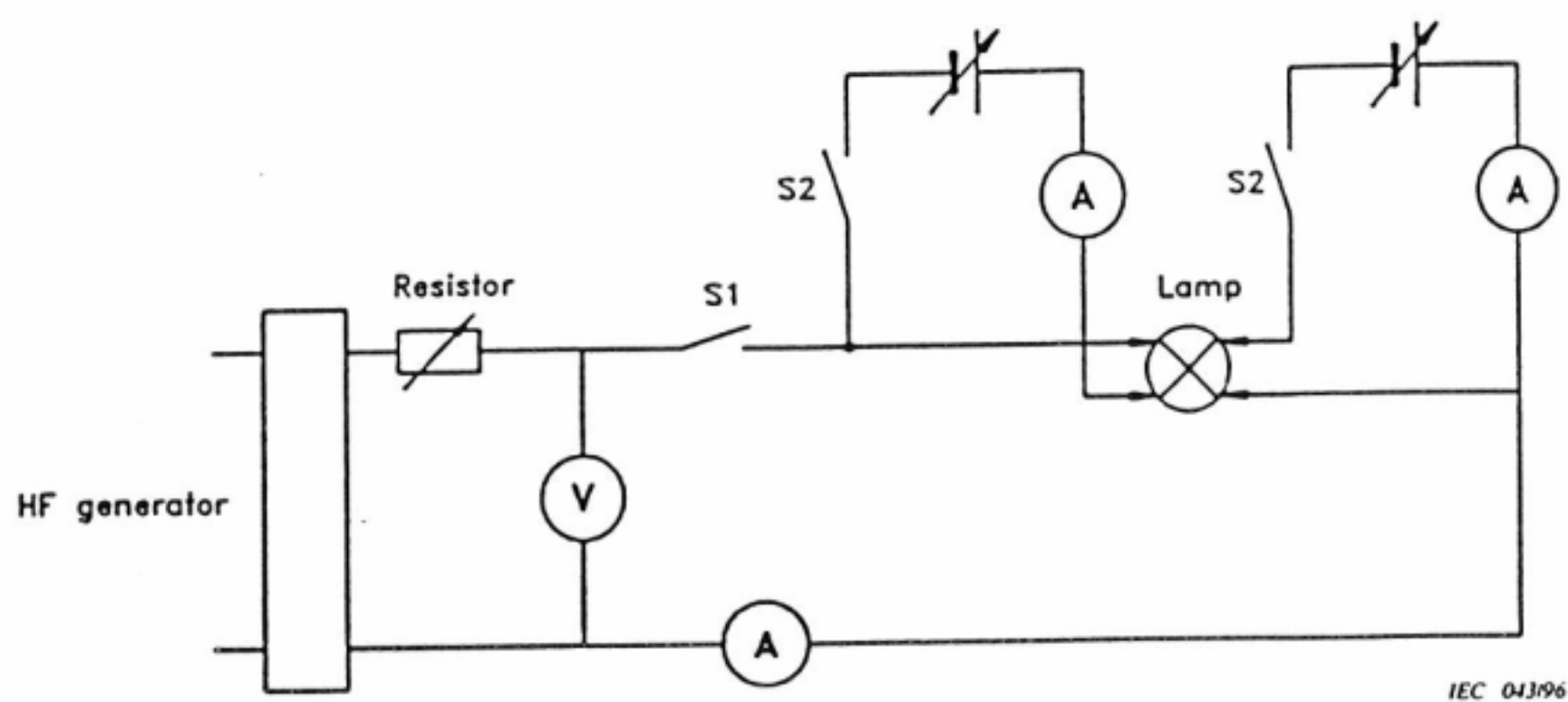


Figure A.4 – Circuit diagram for starting test for lamps with preheated cathodes for operation on high frequency

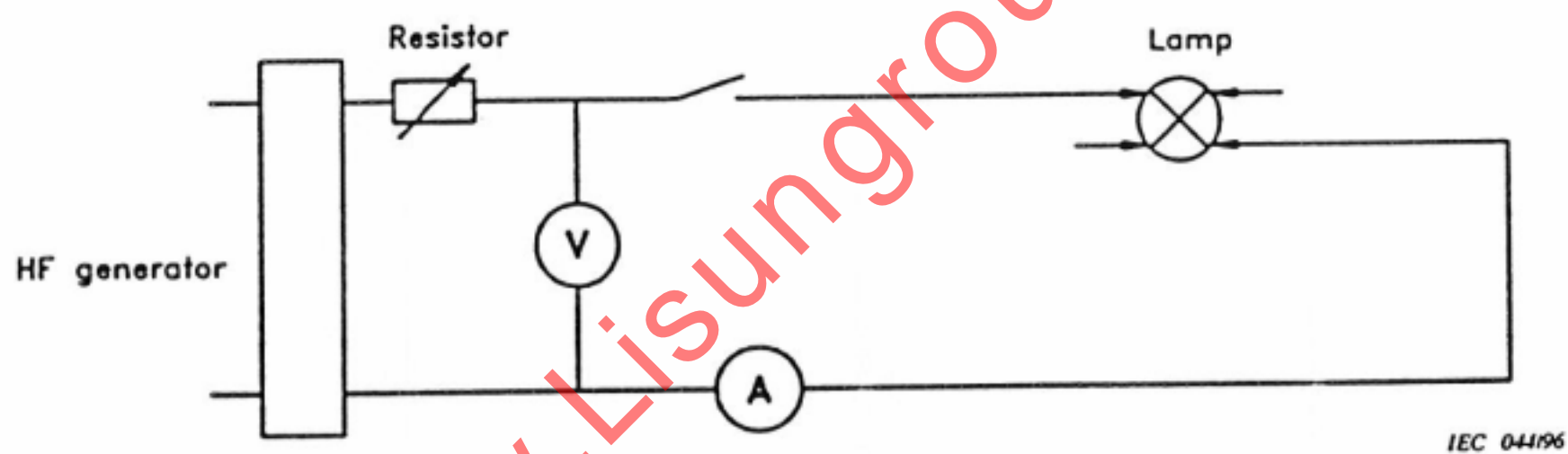


Figure A.5 – Circuit diagram for starting test for lamps with non-preheated cathodes for operating on high frequency

Annex B (normative)

Method of test for electrical, photometric and cathode characteristics

B.1 Electrical and photometric characteristics

B.1.1 General

Photometric characteristics shall be measured in accordance with the relevant recommendations of the CIE (Commission Internationale de l'Eclairage).

Before the lamps are measured for the first time, they shall be aged for a period of 100 h of normal operation.

Lamps shall be tested in a draught-free atmosphere at an ambient temperature of $25\text{ °C} \pm 1\text{ °C}$, unless otherwise specified on the relevant lamp data sheet.

Lamps shall be tested in the position as specified on the relevant lamp data sheet.

For lamps with external means of starting, the connections of the lamp contacts, with reference to the terminations of the ballast, shall not be changed for the whole course of the tests.

Measurements shall be made after a sufficient period of stabilization of the lamp. An appropriate stabilization time is 15 min, after the conditioning period as declared by the manufacturer or responsible vendor.

NOTE – During the shipping and normal handling of the lamps, any excess amount of mercury may be distributed in small droplets within the discharge tube. Stabilization is reached when all the excess mercury has been collected at the coldest spot in the tube. Experience has shown that initially this process of collecting may take up to 15 h. When a lamp, once having passed this conditioning period, is re-lit within 24 h, it will only need about 15 min for stabilizing, provided that the lamp has been kept in the same position and not subjected to vibration or shock.

B.1.2 Test circuit

Lamps shall be tested in the circuits shown in:

- figure B.1 for lamps with internal means of starting;
- figure B.2 for lamps with external means of starting;
- figure B.3 for lamps for operation on high frequency.

In the test circuit for lamps for operation on high frequency, given in figure B.3, connections shall be as short and straight as possible to avoid parasitic capacitance. The parasitic capacitance parallel to the lamp shall be less than 1 nF.

B.1.3 Ballast

Ballasts used for these tests shall be reference ballasts as specified in IEC 921 for a.c. mains frequencies, or IEC 929 for high frequency. The reference ballast electrical characteristics shall be as specified on the relevant lamp data sheet.

B.1.4 Supply voltage

The supply voltage shall be equal to the rated voltage of the reference ballast. During periods of stabilization, the supply voltage shall be stable within $\pm 0,5$ %, this tolerance being reduced to 0,2 % during measurement.

For a.c. mains supplies, the frequency shall be equal to the rated frequency of the reference ballast with a tolerance of 0,5 %. For high-frequency supplies, the frequency shall be between 20 kHz and 26 kHz.

The wave shape of the supply voltage shall be a sine wave. The total harmonic content shall not exceed 3 % (for high-frequency supplies this value is under consideration). The total harmonic content is defined as the root-mean-square (r.m.s.) summation of the individual harmonic components, using the fundamental as 100 %.

NOTE - This implies that the source of supply should have sufficient power, and that the supply circuit should have a sufficiently low impedance, compared with the ballast impedance. Care should be taken that this applies under all conditions that occur during the measurement.

B.1.5 Electrical instruments

Instruments shall be of the true r.m.s. type, essentially free from waveform errors and suitable for the frequency of operation.

The voltage measuring circuit of the instruments shall have an impedance not less than 100 000 Ω , and shall be disconnected when not in use. The current measuring circuit of the instruments shall have the lowest possible resistance and, if necessary, shall be short-circuited when not in use.

When measuring the lamp wattage, no correction shall be made for the wattmeter consumption (the circuit connection being made on the lamp side of the current measuring circuit).

When measuring the luminous flux, the voltage measuring circuit of the voltmeter and of the wattmeter shall be open.

B.2 Cathode characteristics of lamps having preheated cathodes for operation on starterless circuits

B.2.1 Test circuit

Cathode resistance shall be measured using a suitable d.c. supply or a 50 Hz or 60 Hz a.c. supply.

B.2.2 *Lamps for operation on a.c. mains frequencies*

The voltage at the cathode terminals shall be adjusted to the value of the test voltage given on the relevant lamp data sheet, and the current shall be measured. From these, after deduction of the consumption of the voltmeter, the cathode resistance shall be determined.

B.2.3 *Lamps for operation on high frequency*

The current flowing through the cathode shall be adjusted to the value of the test current given on the relevant lamp data sheet, and the supply voltage shall be measured. From these, after deduction of the voltage across the ammeter, the cathode resistance shall be determined.

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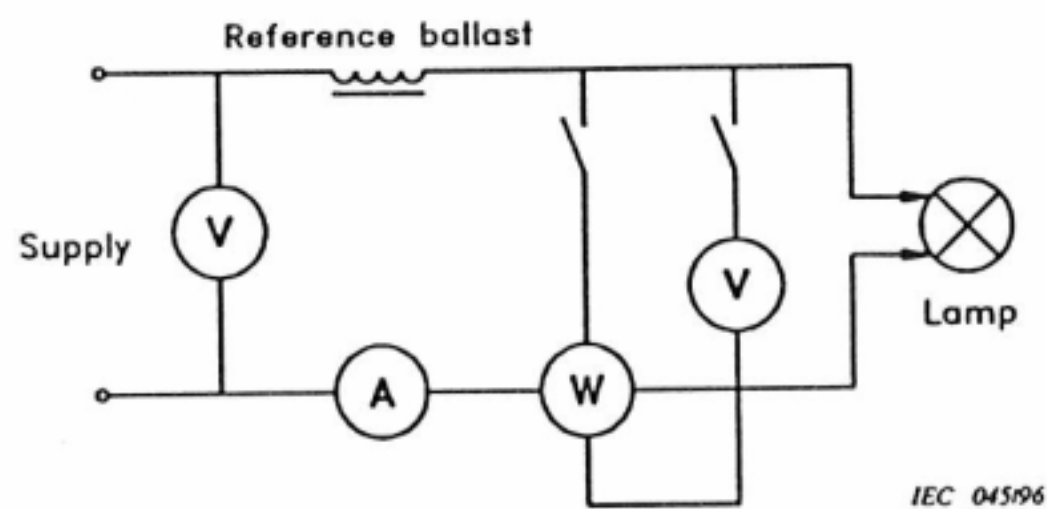


Figure B.1 – Circuit diagram for measurement of electrical and photometric characteristics for lamps with internal starter

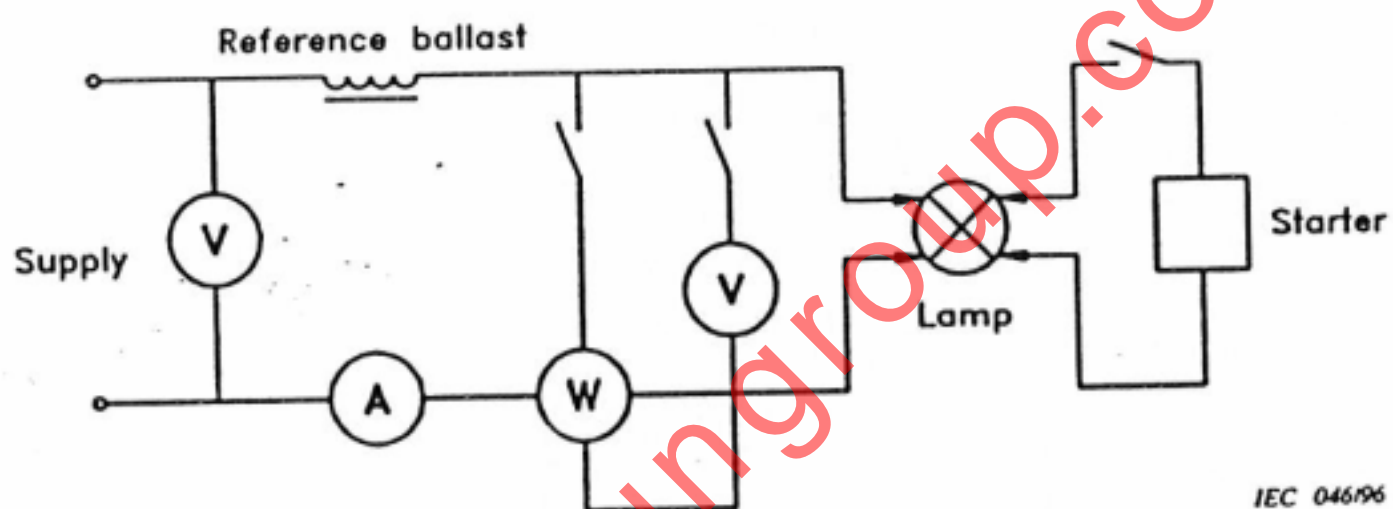


Figure B.2 – Circuit diagram for measurement of electrical and photometric characteristics for lamps with external starter

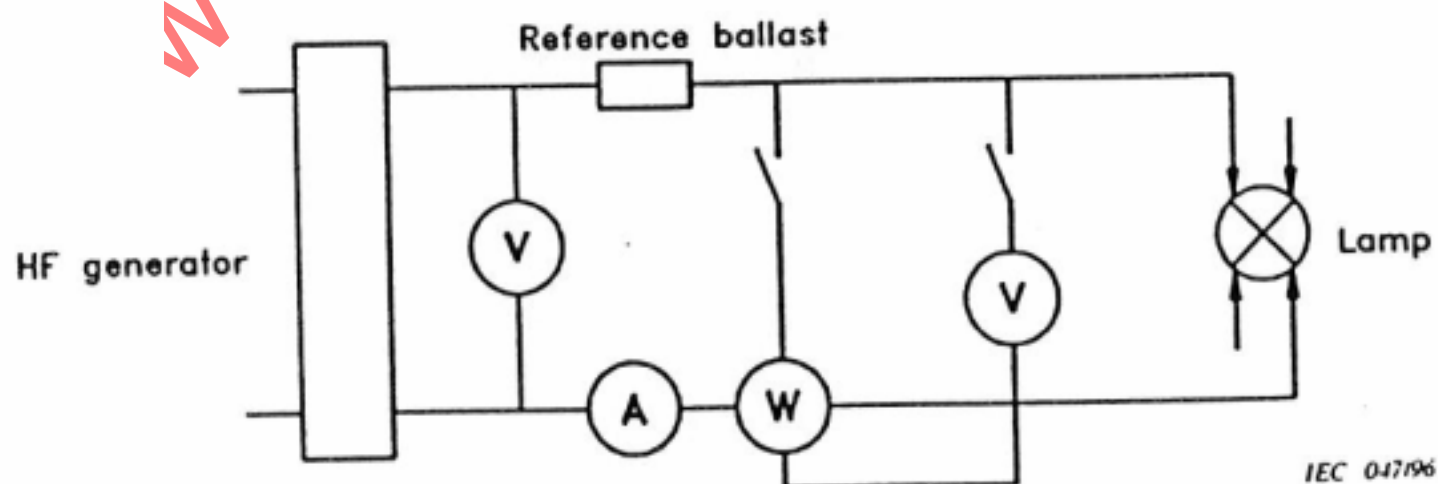


Figure B.3 – Circuit diagram for measurement of electrical and photometric characteristics for lamps for operation on high frequency

Annex C **(normative)**

Method of test for lumen maintenance and life

C.1 General

The luminous flux at a given time in the life of a lamp shall be measured as specified in annex B.

During the life testing, lamps shall be operated as follows.

Lamps shall be operated at an ambient temperature of between 15 °C and 50 °C. Excessive draughts shall be avoided and the lamps shall not be subject to extreme vibration and shock.

Lamps shall be operated in the test position as specified on the relevant lamp data sheet.

For lamps with external means of starting, the connections of the lamp contacts, with reference to the terminations of the ballast, shall not be changed for the whole course of the tests.

Lamps shall be operated in the circuit for which they are intended by the manufacturer.

Lamps shall be switched off for 15 min after each 2 h 45 min of operation.

NOTE In North America, a cycle of 3 h on, 20 min off is used.

C.2 Lamps for operation on a.c. mains frequencies

The ballast used shall comply with the requirements of IEC 60921.

When the ballast, at its rated voltage, is associated with a test lamp, the lamp shall dissipate a power which does not differ from its rated value by more than 4 %. A test lamp is a lamp whose voltage at lamp terminals does not deviate by more than 2 % from its rated value, when operated with its reference ballast.

NOTE The choice of the type of ballasts for these tests is left open, but the type used may have an influence on the results of the test. It is recommended that the type of ballast employed should be stated. In case of doubt, the use of an inductive type of ballast is recommended, because such a type has the smallest number of parameters capable of affecting the results.

For lamps operated with an internal or external starter, the preheating current, at rated supply voltage, shall not differ by more than 10 % from the rated value specified on the relevant lamp data sheet.

For lamps operated with an external starter, the type of starter to be used shall comply with the requirements of IEC 60155, and shall, in any case, be subject to agreement with the lamp manufacturer or responsible vendor.

During the life testing, the supply voltage and frequency shall not differ by more than 2 % from the rated voltage and frequency of the ballast used.

C.3 Lamps for operation at high frequency

The ballast used shall comply with the requirements of IEC 60929.

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Annex D (informative)

Information for ballast and starter design

D.1 General

In order to safeguard proper functioning of the lamp, the relevant information, given on the lamp data sheet and in this annex, should be taken into account when designing ballasts and starters.

D.2 Lamps operated with an internal means of starting

Lamps with an internal starter should not be operated on high frequency circuits.

D.3 Prestarting conditions for high frequency operated lamps

For lamps operated at high frequency with an external means of starting, and having preheated cathodes, the requirements for proper preheating are specified on the relevant lamp data sheet. An explanation of these requirements is given in annex D of IEC 60929 and in annex B of IEC 60927.

D.4 Frequency to be used for high frequency operated lamps

For lamps designed for operation at high frequency, a frequency range is prescribed for the reference ballast and for the testing of lamps (starting, electrical and photometric characteristics). This frequency range has been chosen for ease of reproducing test results and is not intended to restrict the design of high frequency ballasts, where for practical reasons a higher frequency may be appropriate.

Annex E (informative)

Information for luminaire design

E.1 General

In order to safeguard proper functioning of the lamp, the relevant information, given on the lamp data sheet and in this annex, should be taken into account when designing luminaires.

E.2 Maximum lamp outlines

For mechanical acceptance of lamps complying with this standard, a free space should be provided in the luminaire, based on the maximum lamp outlines.

Maximum outline drawings are given in 2.4.

E.3 Series capacitors used in capacitive circuits

An initial capacitor tolerance of 10 %, which is typical for shunt connected capacitors, is unsuitable for series capacitors. The summation of capacitor and ballast tolerances may lead to poor lamp performance, when unfavourable tolerances coincide.

In order to satisfy the requirements specified on the relevant lamp data sheets, either the capacitor tolerance should be narrow, or the capacitor and the inductive reactance component of the ballast should be selected so that unfavourable tolerances do not coincide.

E.4 Lamps operated with an internal means of starting

E.4.1 Lamps with an internal starter should not be operated on high-frequency circuits.

E.4.2 Under normal operation test conditions, according to 12.4.1 of IEC 598-1, where appropriate, the temperature of the lamp cap, measured at the bottom of the guide post, should not exceed the maximum value specified on the relevant lamp data sheet.

NOTE – The temperature limitation is necessary because of the presence of a glow starter and a radio interference suppression capacitor built into the lamp cap.

E.5 Starting aid

Operation of lamps on a.c. mains frequencies starterless circuits requires, in most cases, the presence of a conductive starting aid at earth potential. This can be a conventional part of the luminaire.

The distance between the surface of the lamp and the starting aid should not exceed the maximum value specified on the relevant lamp data sheet.

E.6 Lamp end support

For some lamps an additional lamp end supporting device is required, due to the length of the lamp. It should be designed so that it does not influence the intended lamp performance.

If a part of the device is located between the limbs of the lamp, it should not exert any force on the lamp other than that of gravity, taking into account a minimum gap between the limbs of the lamp, as specified on the relevant lamp data sheet.

If necessary for safeguarding non-interchangeability, the device should be located at a distance from the cap reference plane, as specified on the relevant lamp data sheet.

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Section 2: Data sheets

2.1 General principles of numbering of data sheets

The first number represents the number of this standard "60901", followed by the letters "IEC".

The second number represents the data sheet number.

The third number represents the edition of the page of the data sheet. In cases where a data sheet has more than one page, it is possible for the pages to have different edition numbers, with the data sheet number remaining the same.

2.2 Diagrammatic data sheets for location of lamp dimensions

2.2.1 *List of diagrammatic data sheets*

- 60901-IEC-01 Dual-shaped lamps
- 60901-IEC-02 Quad-shaped lamps
- 60901-IEC-03 Square-shaped lamps
- 60901-IEC-04 Circular-shaped lamps
- 60901-IEC-05 Multi-limbed lamps
- 60901-IEC-06 Square-shaped lamps (cap 2G10)

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