



BSI Standards Publication

Single-capped fluorescent lamps - Performance specifications

National foreword

This British Standard is the UK implementation of EN 60901:1996+A6:2017. It is identical to IEC 60901:1996, incorporating amendments 1:1997, 2:2000, 3:2004, 4:2007, 5:2011 and 6:2017. It supersedes BS EN 60901:1996+A5:2012, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CPL/34/1, Electric lamps.

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

To facilitate updating, the data sheets in this standard do not carry page numbers but appear in numerical order according to the IEC reference code which appears at the foot of each sheet. In this code, the first set of digits represents the number of the IEC base document followed by the letters “IEC”; the second set represents the data sheet number and the third digit represents the edition number.

The amendment by which each page of the European Standard was introduced is indicated by an extension to the shoulder heading at the top of the page (e.g. EN 60901:1996/A2:2000). Where no such extension appears, the page is part of the original European Standard.

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

© The British Standards Institution 2018
Published by BSI Standards Limited 2018

ISBN 978 0 539 02678 8

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 15 November 1996.

Amendments/corrigenda issued since publication

Date	Text affected
31 January 1998	Implementation of IEC amendment 1:1997 with CENELEC endorsement A1:1997
22 October 2001	Implementation of IEC amendment 2:2000 with CENELEC endorsement A2:2000
27 September 2004	Implementation of IEC amendment 3:2004 with CENELEC endorsement A3:2004
29 August 2008	Implementation of IEC amendment 4:2007 with CENELEC endorsement A4:2008
30 June 2012	Implementation of IEC amendment 5:2011 with CENELEC endorsement A5:2012
30 April 2018	Implementation of IEC amendment A6:2017 with CENELEC endorsement A6:2017

Date	Text affected
30 November 2018	Missing data sheet pages added

September 2017

ICS 29.140.30

Descriptors: Lighting equipment, fluorescent lamp, lamp cap, safety, requirement

English version

Single-capped fluorescent lamps — Performance specifications (IEC 60901:1996)

Lampes à fluorescence à culot unique
Prescriptions de performances
(CEI 60901:1996)

Einseitig gesockelte Leuchtstofflampen
Anforderungen an die Arbeitsweise
(IEC 60901:1996)

This European Standard was approved by CENELEC on 1996-03-05. CENELEC members are bound to comply with the CENE/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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The text of document 34A/588/FDIS, future edition 2 of IEC 901, prepared by SC 34A, Lamps, of IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60901 on 1996-03-05.

This European Standard supersedes EN 60901:1990 and its amendments A1:1990 and A2:1993.

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) 1996-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-12-01

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given for information only. In this standard, Annex A, Annex B, Annex C and Annex ZA are normative and Annex D and Annex E are informative. Annex ZA has been added by CENELEC.

Foreword to amendment A1

The text of document 34A/706/FDIS, future amendment 1 to IEC 60901:1996, prepared by SC 34A, Lamps, of IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60901:1996 on 1997-07-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-04-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1998-04-01

Endorsement notice

The text of amendment 1:1997 to the International Standard IEC 60901:1996 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A2

The text of document 34A/908/FDIS, future amendment 2 to IEC 60901:1996, prepared by SC 34A, Lamps, of IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 60901:1996 on 2000-06-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2001-03-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2003-06-01

Endorsement notice

The text of amendment 2:2000 to the International Standard IEC 60901:1996 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A3

The text of document 34A/1078/FDIS, future amendment 3 to IEC 60901:1996, prepared by SC 34A, Lamps, of IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A3 to EN 60901:1996 on 2004-07-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2005-04-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2007-07-01

Endorsement notice

The text of amendment 3:2004 to the International Standard IEC 60901:1996 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A4

The text of document 34A/1234/FDIS, future amendment 4 to IEC 60901:1996, prepared by SC 34A, Lamps, of IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A4 to EN 60901:1996 on 2008-02-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2008-11-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2011-02-01

Endorsement notice

The text of amendment 4:2007 to the International Standard IEC 60901:1996 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A5

The text of document 34A/1506/FDIS, future edition 2 of IEC 60901:1996/A5, 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 60901:1996/A5:2012.

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) 2012-11-04
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2014-12-28

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 60901:1996/A5:2011 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A6

The text of document 34A/1801/FDIS, future edition 1 of IEC 60901:1996/A6/2014, prepared by IEC/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 60901:1996/A6:2017.

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 (dop) 2012-11-04
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2014-12-28

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60901:1996/A6:2014 are prefixed “Z”.

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

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annexes ZZ, which are an integral part of this document.

For the relationship with EU Directive(s) see informative Annexes ZZ, which are an integral part of this document.

Endorsement notice

The text of the International Standard IEC 60901:1996/A6:2014 was approved by CENELEC as a European Standard with agreed common modifications.

Contents

		Page
Section 1. General		
1.1 Scope	5	
1.2 General statement	5	
1.3 Normative references	5	
1.4 Definitions	6	
1.5 Lamp requirements	7	
1.6 Information for ballast and starter design	9	
1.7 Information for luminaire design	9	
Section 2. Data sheets		
2.1 General principles of numbering of data sheets	24	
2.2 Diagrammatic data sheets for location of lamp dimensions	24	
2.3 Lamp data sheets	37	
2.4 Maximum lamp outline sheets	273	
Annex A (normative) Method of test for starting characteristics	10	
Annex B (normative) Method of test for electrical, photometric and cathode characteristics	14	
Annex C (normative) Method of test for lumen maintenance and life	17	
Annex D (informative) Information for ballast and starter design	17	
Annex E (informative) Information for luminaire design	20	
Annex ZA (normative) Normative references to international publications with their corresponding European publications	21	
Figure A.1 — Circuit diagram for starting test for lamps with internal starter	12	
		Page
	Figure A.2 — Circuit diagram for starting test for lamps with external starter	12
	Figure A.3 — Circuit diagram for starting test for lamps with preheated cathodes for operation on starterless circuits	12
	Figure A.4 — Circuit diagram for starting test for lamps with preheated cathodes for operation on high frequency	13
	Figure A.5 — Circuit diagram for starting test for lamps with non-preheated cathodes for operating on high frequency	13
	Figure B.1 — Circuit diagram for measurement of electrical and photometric characteristics for lamps with internal starter	16
	Figure B.2 — Circuit diagram for measurement of electrical and photometric characteristics for lamps with external starter	16
	Figure B.3 — Circuit diagram for measurement of electrical and photometric characteristics for lamps for operation on high frequency	16

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.

1.2.Z1 Overall statement

Where a Commission Regulation specifies limits for parameters these limits shall be used instead of the limits specified in this standard.

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, A.C. 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

1.4.Z1

efficacy

'luminous efficacy of a source', 'light source efficacy' or 'lamp efficacy' (η_{source})

quotient of the luminous flux emitted (Φ) by the power consumed by the source

(P_{source}). $\eta_{\text{source}} = \Phi / P_{\text{source}}$. Unit: lm/W

Note 1 to entry: The power dissipated by auxiliary equipment such as ballasts is not included in the power consumed by the source.

[SOURCE: Regulation 245/2009 Annex II, 1.a)]

1.4.Z2

lamp lumen maintenance factor (LLMF)

ratio of the luminous flux emitted by the lamp at a given time in its life to the initial luminous flux

[SOURCE: Regulation 245/2009 Annex II, 1.b)]

1.4.Z3

lamp survival factor (LSF)

fraction of the total number of lamps which continue to operate at a given time under defined conditions and switching frequency

[SOURCE: Regulation 245/2009 Annex II, 1.c)]

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

- a) The initial reading of the voltage at the lamp terminals shall comply with the values specified on the relevant lamp data sheet.

NOTE 1 It may be expected that over the declared lifetime of the lamp, the lamp voltage may rise typically by 5 V to 10 V.

- b) 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

- a) The lead wire resistance of a lamp without internal starter shall not be higher than 1Ω.
- b) 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.
- c) 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 $25^\circ\text{C} \pm 1^\circ\text{C}$.

Both resistance values shall exclude lead wire resistance.

Conditions and method of test are given in Annex B.

1.5.7 Photometric characteristics

1.5.7.Z1 General

- 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 co ordinates 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.

1.5.7.Z2 Chromaticity, correlated colour temperature and colour rendering index

The chromaticity coordinates and correlated colour temperature of an individual lamp shall be calculated according to CIE 15 from a measurement made under the conditions of Annex B.

The colour rendering index of an individual lamp shall be calculated according to CIE 13.3 from a measurement made under the conditions of Annex B.

1.5.7.Z3 Efficacy

The efficacy of an individual lamp shall be calculated from a measurement of luminous flux and power according to the conditions of Annex B.

1.5.8.Z1 Lamp lumen maintenance factor

The lamp lumen maintenance factor of an individual lamp shall be calculated from measurements of its luminous flux made at appropriate times according to the conditions of Annex B. Lamp operation between these measurements shall be as prescribed in Annex C.

1.5.8.Z2 Lamp survival

The survival of an individual lamp shall be determined by operating lamps under the conditions prescribed in Annex C until the lamp fails to remain alight or delivers low light output (in case of doubt, low light output refers to noticeably less than 50 % of rated light output).

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.

1.5.Z1 Mercury content

The average mercury content shall be measured in accordance with the CV AAS method as described in EN 62321-4. Lamp sample preparation shall be in accordance with EN 62554.

Photometric characteristics shall be measured in accordance with EN 13032-1. For determination of the centre beam intensity of reflector lamps, EN 61341 shall be used.

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.

Bibliography

COMMISSION REGULATION (EC) No 245/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council

COMMISSION REGULATION (EU) No 874/2012 of 12 July 2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires

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.

NOTE 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.

NOTE 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.

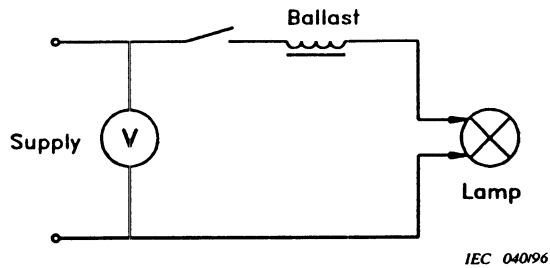


Figure A.1 — Circuit diagram for starting test for lamps with internal starter

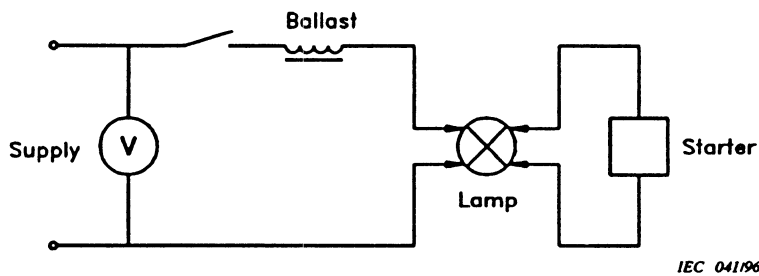


Figure A.2 — Circuit diagram for starting test for lamps with external starter

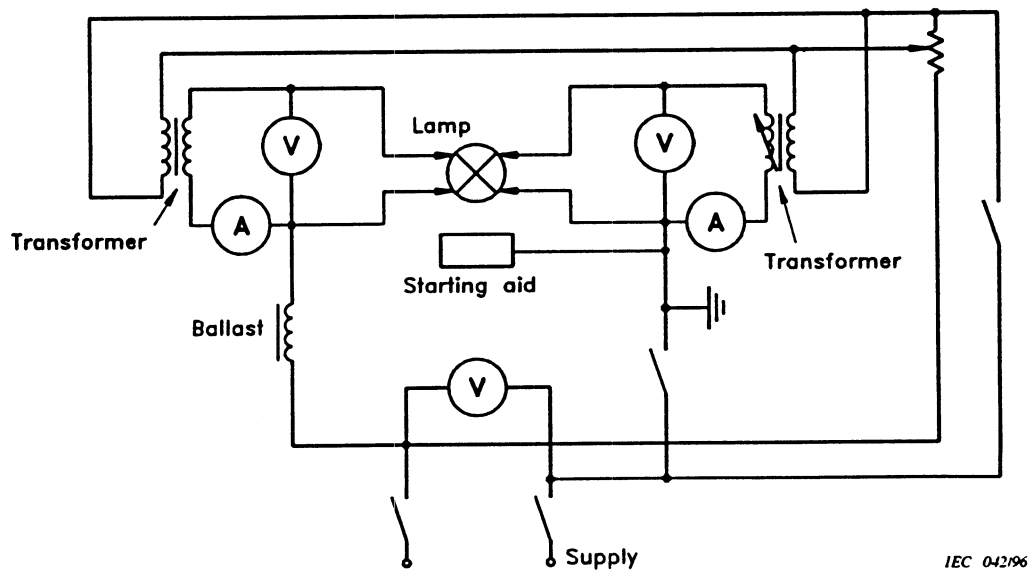
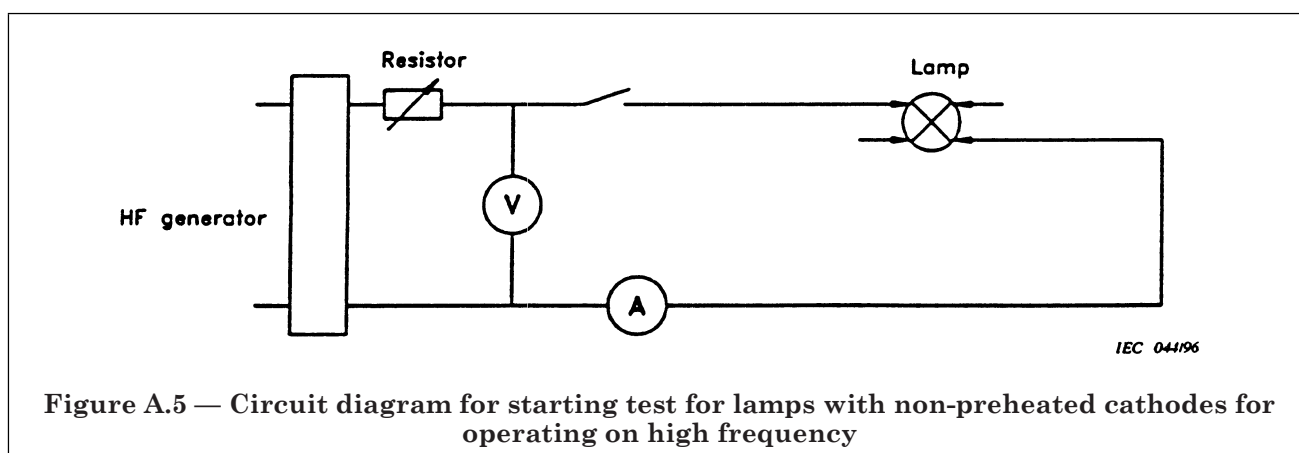
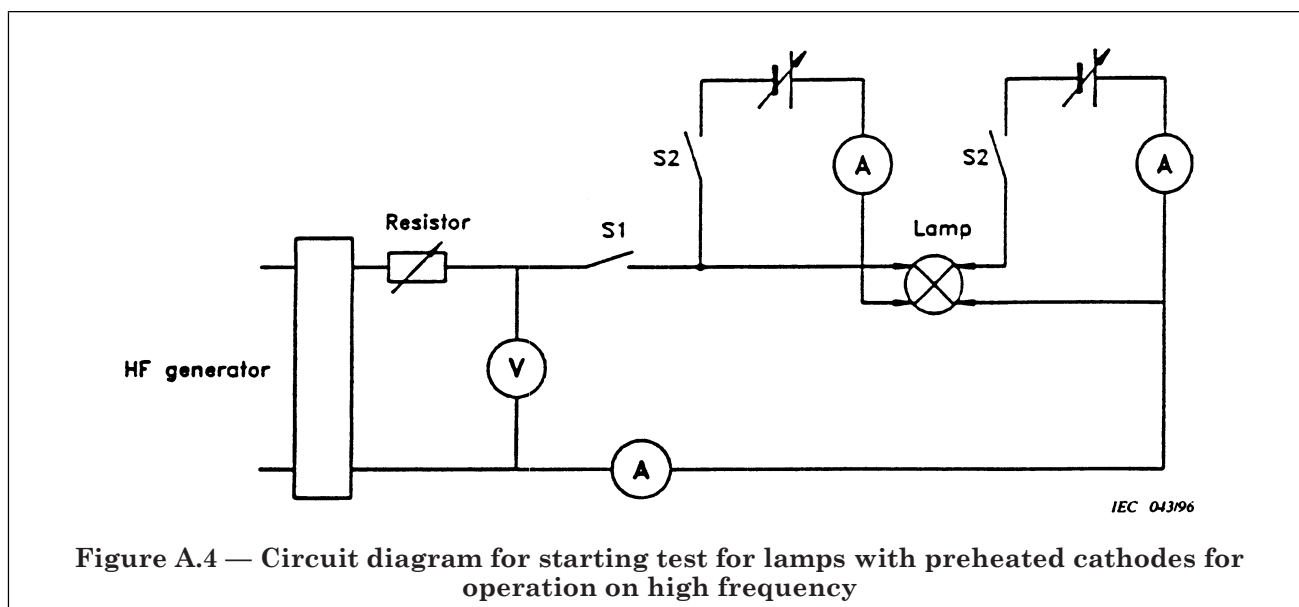


Figure A.3 — Circuit diagram for starting test for lamps with preheated cathodes for operation on starterless circuits



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 °C ± 1 °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 shipping and normal handling of the lamps, e.g. rotating of the lamp, any excess amount of mercury may be distributed in small droplets within the discharge tube. Proper conditioning 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 lamp conditioning may take up to 24 h. A lamp is ready for measurement when it has passed the conditioning period.

For conditioning and prewarming, the lamp may be operated in a location distant to the test location. Before moving an amalgam lamp to the test location, the lamp shall cool down for 1 min in the burning position to allow the amalgam to solidify. When moving to the test location, provided that the lamp has been kept in the same position and not subjected to vibration or shock and no warm glass parts are touched (i.e. creating a parasitic cold spot), a stabilisation period of 15 min to 120 min (see Table B.1) is necessary in the test location. To avoid cooling down of warm glass parts during moving the lamp to test location, thermally insulating gloves or similar technique shall be used. The interruption of the lamp supply should be as short as possible. If deviating from the values in Table B.1, the relevant specification of the manufacturer should be observed.

Measurement of light output and lamp operating voltage must be taken at least once per minute. During the final 5 min of stabilisation time, the difference of maximum and minimum readings of light output and lamp operating voltage shall be less than 1% of the average of the readings. If this is not feasible, the real fluctuation shall be stated.

Table B.1– Stabilisation time versus off time

Conditioning (can be part of aging)	h	20	
Off time (transport to test location)	min	5	> 5
Stabilisation time – non-amalgam lamps	min	15	60
Stabilisation time – amalgam lamps	min	60	120

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.

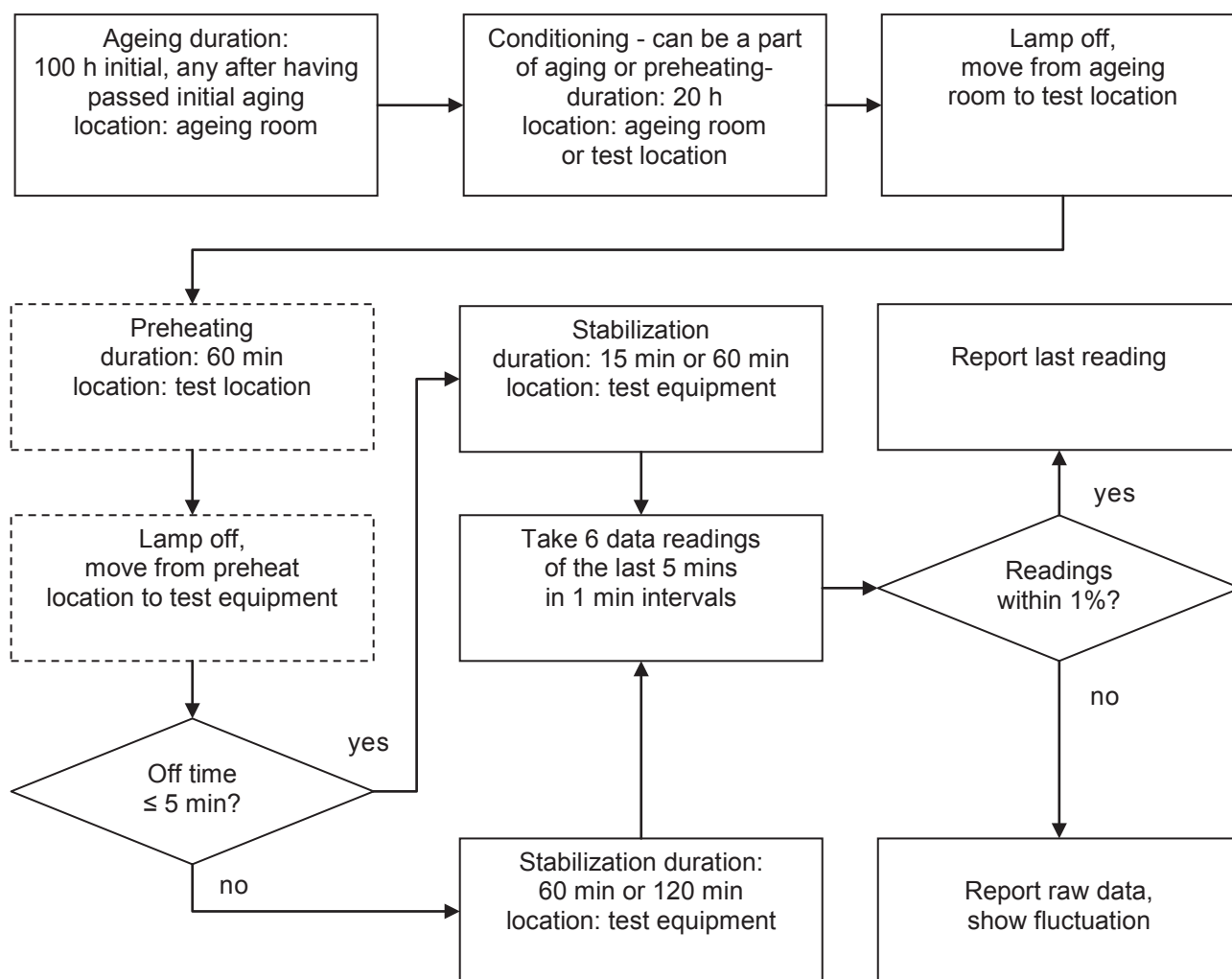
B.1.4 Supply voltage

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.



IEC 2501/11

NOTE Dashed lines mean optional items.

Figure B.1a – Typical flowchart of photometry test

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 $100\,000\ \Omega$, 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 frequencies

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 voltage drop over the cathode shall be measured. From these the cathode resistance shall be calculated.

To determine the resistance of the lead wires, take 5 lamps of the type to be measured. Crack off the end of the tubes carefully. Using a shorting link, short out the coil by clipping to the coil clamps. Drive a current of 100 mA through the leads. Measure the voltage at the normally used measurement point and calculate the lead resistance. The resulting value of the mean lead resistance may be used for any further measurements with lamps of the same mount construction.

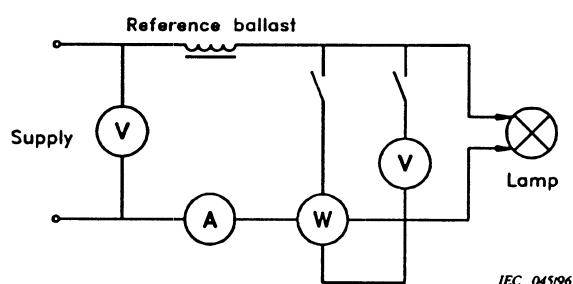


Figure B.1 — Circuit diagram for measurement of electrical and photometric characteristics for lamps with internal starter

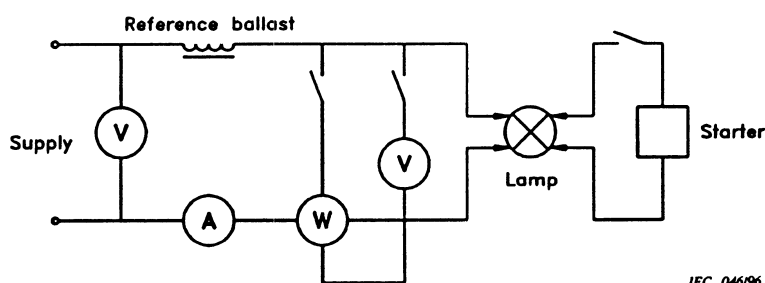


Figure B.2 — Circuit diagram for measurement of electrical and photometric characteristics for lamps with external starter

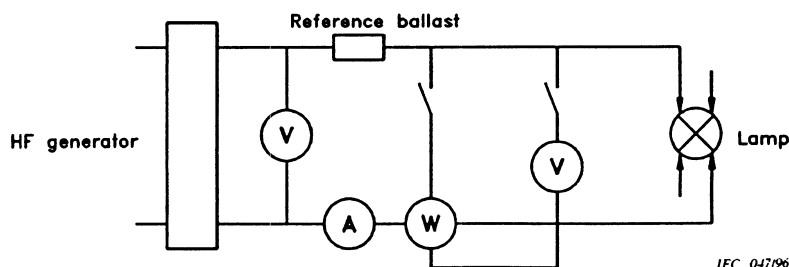


Figure B.3 — Circuit diagram for measurement of electrical and photometric characteristics for lamps for operation on high frequency

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

NOTE 2 If a cycle deviating from the 3 h cycle is requested, a 12 h cycle (11 h on, 1 h off) should be 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 on high frequency

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

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.

D.5 Tolerable DC-offset during preheat

The peak-peak value of the open-circuit voltage shall be less than or equal to 2,8 times the maximum r.m.s. value of the open circuit voltage for $t \leq t_s$. Narrow voltage peaks during the first half period of the mains voltage after switching on preheat shall be disregarded when testing the control gear against this subclause.

The DC-offset (mean value) of the open-circuit voltage shall not exceed the r.m.s. open circuit voltage for $t \leq t_s$ as specified on the relevant lamp data sheet. In cases where the r.m.s. open circuit voltage for $t \leq t_s$ is specified to less than 200 V, the DC-offset of the open-circuit voltage shall be less than or equal to 200 V.

D.6 Maximum asymmetric power

The control gear shall have adequate protection to prevent lamp cap overheating at the end of the lamp life cycle.

Values of maximum electrode power according to Table D.1 apply.

Table D.1 – Maximum asymmetric power

Sheet number 60901-IEC	Nominal power W	Shape	Cap	Maximum asymmetric power W
0005	5	Dual	G23	5
0007	7	Dual	G23	5
0009	9	Dual	G23	5
0011	11	Dual	G23	5
0013	13	Dual	GX23	5
0510	10	Quad	G24d-1	5
0513	13	Quad	G24d-1	5
0518	18	Quad	G24d-2	5
0526	26	Quad	G24d-3	5
0715	15	Quad	GX32d-1	5
0720	20	Quad	GX32d-2	5
0727	27	Quad	GX32d-3	5
1413	13	Multilimbed	GX24d-1	5
1418	18	Multilimbed	GX24d-2	5
1426	26	Multilimbed	GX24d-3	5
2005	5	Dual	2G7	5
2007	7	Dual	2G7	5
2009	9	Dual	2G7	5
2011	11	Dual	2G7	5
2127	27	Dual	GY10q-4	10
2128	28	Dual	GY10q-5	10
2130	30	Dual	GY10q-4	10
2136	36	Dual	GY10q-6	10
2218	18	Dual	2G11	7,5
2224	24	Dual	2G11	7,5
2236	36	Dual	2G11	7,5
2510	10	Quad	G24q-1	5
2513	13	Quad	G24q-1	5
2518	18	Quad	G24q-2	5
2526	26	Quad	G24q-3	5
2613	13	Quad	GX10q-2	7,5
2618	18	Quad	GX10q-3	7,5
2627	27	Quad	GX10q-4	7,5

Sheet number 60901-IEC	Nominal power W	Shape	Cap	Maximum asymmetric power W
3010	10	Square	GR10q	5
3016	16	Square	GR10q	5
3021	21	Square	GR10q	5
3028	28	Square	GR10q	7,5
3038	38	Square	GR10q	7,5
3118	18	Square	2G10	7,5
3124	24	Square	2G10	7,5
3136	36	Square	2G10	7,5
3222	22	Circular	G10q	10
3232	32	Circular	G10q	10
3240	40	Circular	G10q	10
3413	13	Multilimbed	GX24q-1	5
3418	18	Multilimbed	GX24q-2	5
3426	26	Multilimbed	GX24q-3	5
4224	24/27	Dual	2G11	7,5
4236	36/39	Dual	2G11	7,5
5010	10	Square	GR10q	5
5016	16	Square	GR10q	5
5021	21	Square	GR10q	5
5028	28	Square	GR10q	7,5
5038	38	Square	GR10q	7,5
5222	22	Circular	G10q	10
5232	32	Circular	G10q	10
5240	40	Circular	G10q	10
6014	14	Multilimbed	GR14q-1	5
6017	17	Multilimbed	GR14q-1	5
6240	40	Dual	2G11	7,5
6255	55	Dual	2G11	7,5
6280	80	Dual	2G11	7,5
6722	42	Circular	2GX13	7,5
6740	40	Circular	2GX13	7,5
6755	55	Circular	2GX13	7,5
6760	60	Circular	2GX13	7,5
6820	20	Circular	GZ10q	7,5
6827	27	Circular	GZ10q	7,5
6834	34	Circular	GZ10q	7,5
6841	41	Circular	GZ10q	7,5
6941	41	Circular	GU10q	10
6968	68	Circular	GU10q	10
6997	97	Circular	GU10q	10
7432	32	Multilimbed	GX24q-3	5
7442	42	Multilimbed	GX24q-4	5
7456	57	Multilimbed-6	GX24q-5	5
7457	57	Multilimbed-8	GX24q-5	5
7469	70	Multilimbed-6	GX24q-6	5
7470	70	Multilimbed-8	GX24q-6	5

Sheet number 60901-IEC	Nominal power W	Shape	Cap	Maximum asymmetric power W
7660	60	Multilimbed-6	2G8-1	7,5
7685	85	Multilimbed-6	2G8-1	7,5
7719	120	Multilimbed-6	2G8-1	7,5
7720	120	Multilimbed-8	2G8-1	7,5
7862	62	Multilimbed-8	2G8-2	7,5
7882	82	Multilimbed-8	2G8-2	7,5

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 such 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.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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

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

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
		Light and lighting – Measurement and presentation of photometric data of lamps and luminaires – Part 1: Measurement and file format	EN 13032-1 A1	2004 2012
IEC 60050-845	1987	International Electrotechnical Vocabulary – 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	EN 60061-1	1993
IEC 60081	1997	Double-capped fluorescent lamps – Performance specifications	EN 60081	1998
IEC 60155	1993	Luminaires – Part 1: General requirements and tests	EN 60155	1995
IEC 60598-1	1996	Luminaires – General requirements and tests	EN 60598-1	1997
IEC 60921	1988	Ballasts for tubular fluorescent lamps – Performance requirements	EN 60921	1991
IEC 60927	1996	Auxiliaries for lamps – Starting devices (other than glow starters) – Performance requirements	EN 60927	1996
IEC 60929	1990	AC supplied electronic ballasts for tubular fluorescent lamps – Performance requirements	EN 60929	1992
IEC 61199	1993	Single-capped fluorescent lamps – Safety specifications	EN 61199	1994
IEC/TS 61231	1999	International lamp coding system (ILCOS)	-	-
IEC 62321-4	-	Determination of certain substances in electrotechnical products - Part 4: Mercury in polymers, metals and electronics by CV-AAS, CV-AFS, ICP-OES and ICP-MS	EN 62321-4	-
IEC 62554	-	Sample preparation for measurement of mercury level in fluorescent lamps	EN 62554	-

Annex ZZA (informative)

Relationship between this European Standard and the eco-design requirements of Commission Regulation (EC) No 245/2009 aimed to be covered

This European Standard has been prepared under a Commission's standardization request M/495 to provide one voluntary means of conforming to the ecodesign requirements of Commission Regulation (EC) No 245/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council [2009 OJ L76].

Once this standard is cited in the Official Journal of the European Union under that Commission Regulation, compliance with the clauses of this standard given in Table ZZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding ecodesign requirements of that Regulation and associated EFTA regulations.

Table ZZA.1 – Correspondence between this European Standard and Commission Regulation (EC) No 245/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council [2009 OJ L76] and Commission's standardization request M/495

Ecodesign requirement of Regulation (EC) No 245/2009 [2009 OJ L76]	Clause(s) / subclause(s) of this EN	Remarks / Notes
Annex III, article 1.1 and article 1.3(a)	Annex B	Lamp power
Annex III, article 1.1 and article 1.3(b)	Annex B	Luminous flux
Annex III, Table 12 and article 1.3(e)	Clause 1.5.8.Z2	Lamp survival factor (LSF)
Annex III, Table 11 and article 1.3(d)	Clause 1.5.8.Z1	Lamp lumen maintenance factor (LLMF)
Annex I, articles 1(a) and 1(f)	Clause 1.5.7.Z2	Chromaticity coordinates (x, y)
Annex III, Table 6, article 1.2 and article 1.3(g)	Clause 1.5.7.Z2	Colour rendering index (CRI)
Annex III, Table 6 and article 1.3(h)	Clause 1.5.7.Z2	Correlated colour temperature (CCT)
Annex I, articles 1(f)	Clause 1.5.2	Caps
Annex III article 1.3(f)	Clause 1.5.Z1	Mercury content

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the products falling within the scope of this standard.

Annex ZZB (informative)

Relationship between this European Standard and the energy labelling requirements of Commission Delegated Regulation (EU) No 874/2012 aimed to be covered

This European Standard has been prepared under a Commission's standardisation request M/495 to provide one voluntary means of conforming to the energy labelling requirements of Commission Delegated Regulation (EU) No 874/2012 of 12 July 2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires [2012 OJ L258].

Once this standard is cited in the Official Journal of the European Union under that Commission Regulation, compliance with the clauses of this standard given in Table ZZC.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding energy labelling requirements of that Regulation and associated EFTA regulations.

Table ZZB.1 – Correspondence between this European Standard and Commission Regulation (EU) No 874/2012 of 12 July 2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires [2012 OJ L258] and Commission's standardisation request M/495

Energy labelling requirement of Regulation (EU) No 874/2012 [2012 OJ L258]	Clause(s) / subclause(s) of this EN	Remarks / Notes
Article 1	Annex B	Applicable parameter according to Article 1 luminous flux
Annex VII	Annex B	Lamp power
Annex VII	Annex B	Luminous flux

WARNING 1: Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2: Other Union legislation may be applicable to the products falling within the scope of this standard.

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

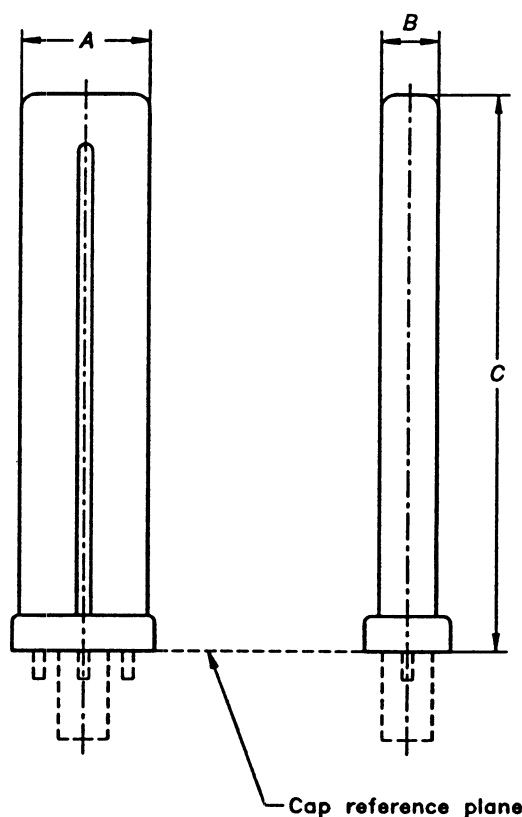
2.2.1 List of diagrammatic data sheets

- 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)

**SINGLE-CAPPED FLUORESCENT LAMPS
DIAGRAMMATIC DATA SHEET FOR
LOCATION OF LAMP DIMENSIONS**

Dual-shaped

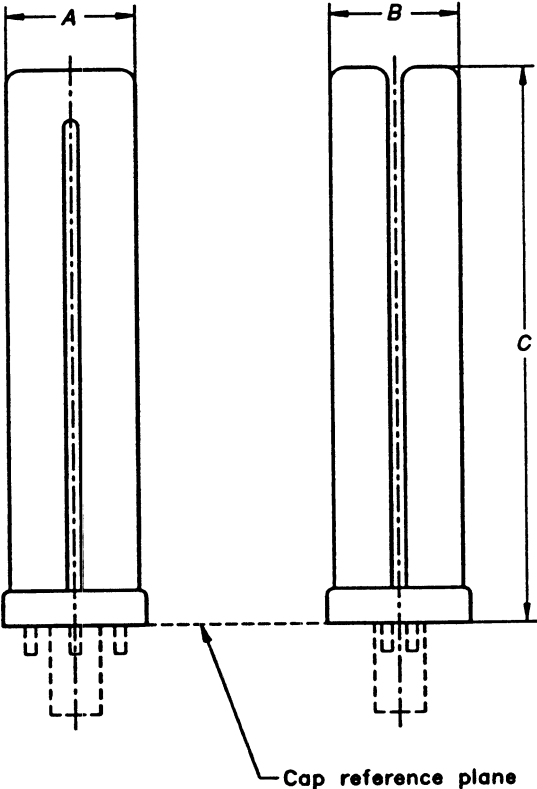
These drawings are intended only to indicate dimensions to be controlled and are to be used in conjunction with the relevant lamp standard sheets.

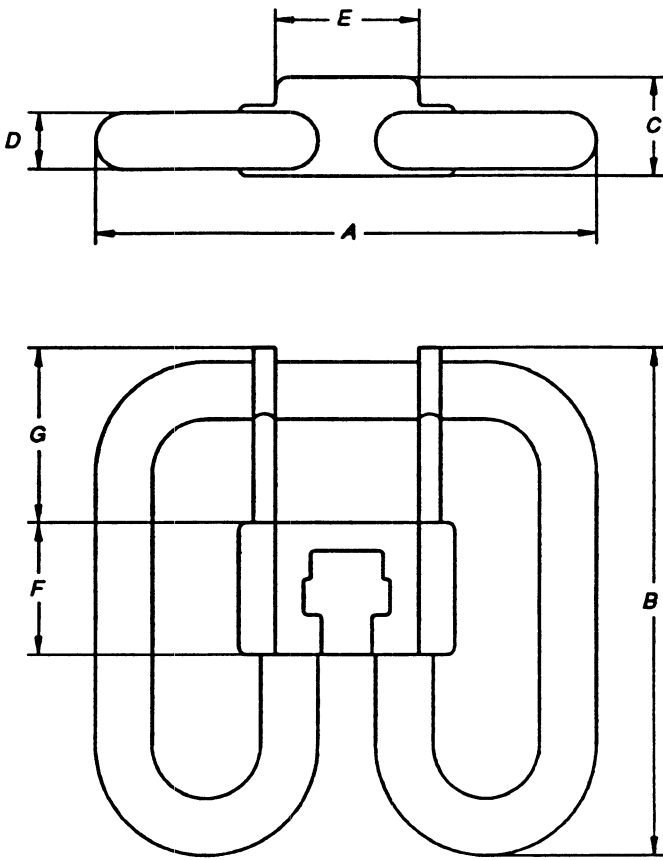


IEC 04896

NOTE Dimensions A and B refer to the glass parts of the lamp.

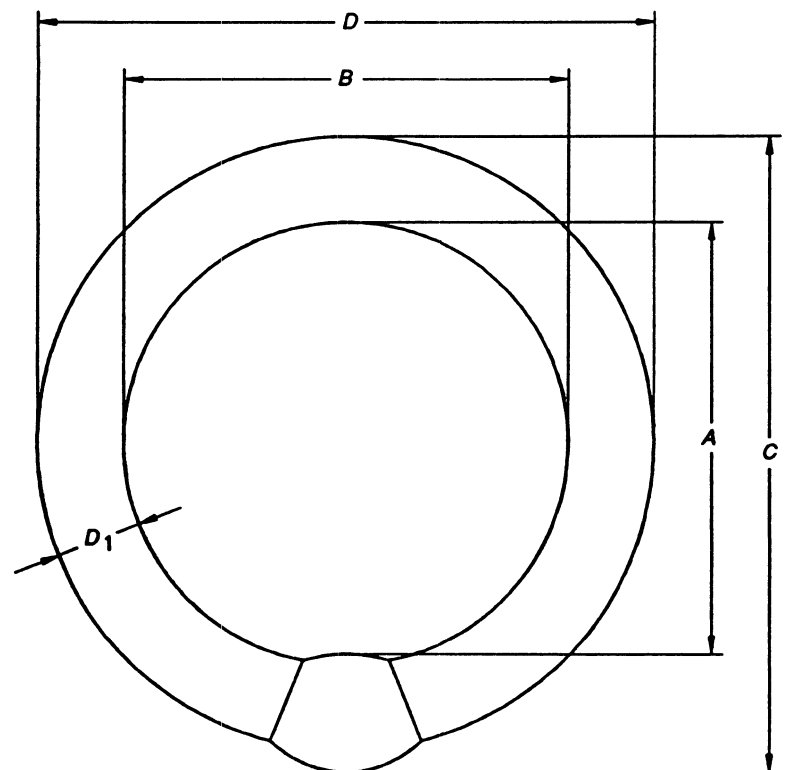
901-IEC-01-1

	SINGLE-CAPPED FLUORESCENT LAMPS DIAGRAMMATIC DATA SHEET FOR LOCATION OF LAMP DIMENSIONS Quad-shaped	
These drawings are intended only to indicate dimensions to be controlled and are to be used in conjunction with the relevant lamp standard sheets.  The diagram shows two side views of a quad-shaped single-capped fluorescent lamp. The left view shows the overall width dimension A across the top of the glass envelope. The right view shows the width dimension B across the top of the glass envelope and the height dimension C from the cap reference plane to the top of the glass envelope. A dashed line indicates the cap reference plane, which is the base of the lamp. The lamp has a central vertical axis and a central longitudinal axis. The cap is shown at the bottom of the lamp, with a dashed line indicating its position relative to the glass envelope. The text 'Cap reference plane' is written below the diagram, with a line pointing to the dashed line. The text 'IEC 049/96' is written below the diagram. NOTE Dimensions A and B refer to the glass parts of the lamp.		
901-IEC-02-1		

	SINGLE-CAPPED FLUORESCENT LAMPS DIAGRAMMATIC DATA SHEET FOR LOCATION OF LAMP DIMENSIONS Square-shaped	
These drawings are intended only to indicate dimensions to be controlled and are to be used in conjunction with the relevant lamp standard sheets.  The diagram consists of two views of a square-shaped single-capped fluorescent lamp. The top view is a side profile showing the lamp's cross-section with dimensions: A (total length), B (total height), C (height of the main body), D (height of the base), and E (width of the top cap). The bottom view is an end-on view showing the lamp's footprint with dimensions: F (width of the base) and G (height of the base). The lamp has a central square-shaped cap and two U-shaped bases on either side. IEC 05096		
901-IEC-03-1		

SINGLE-CAPPED FLUORESCENT LAMPS
DIAGRAMMATIC DATA SHEET FOR
LOCATION OF LAMP DIMENSIONS
Circular-shaped

These drawings are intended only to indicate dimensions to be controlled and are to be used in conjunction with the relevant lamp standard sheets.



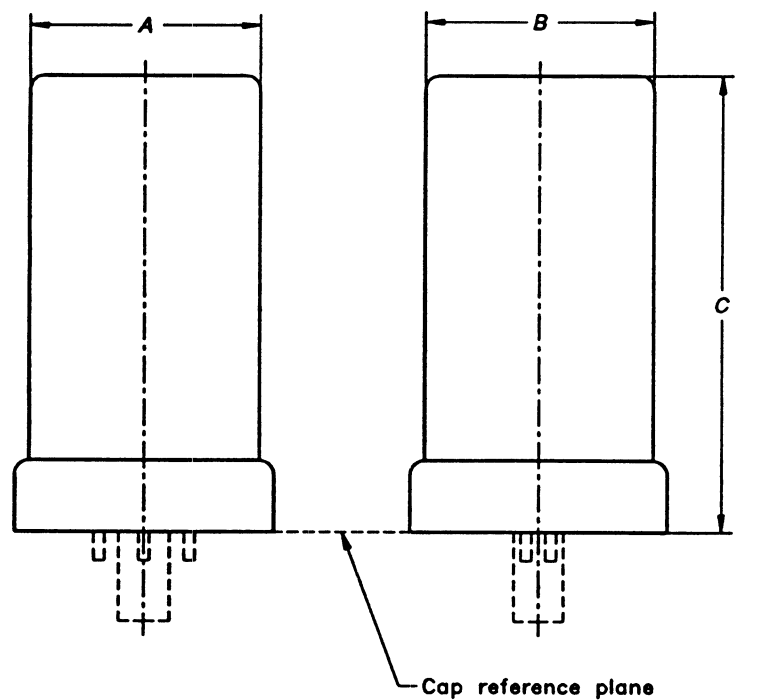
IEC 051/96

901-IEC-04-1

**SINGLE-CAPPED FLUORESCENT LAMPS
DIAGRAMMATIC DATA SHEET FOR
LOCATION OF LAMP DIMENSION**

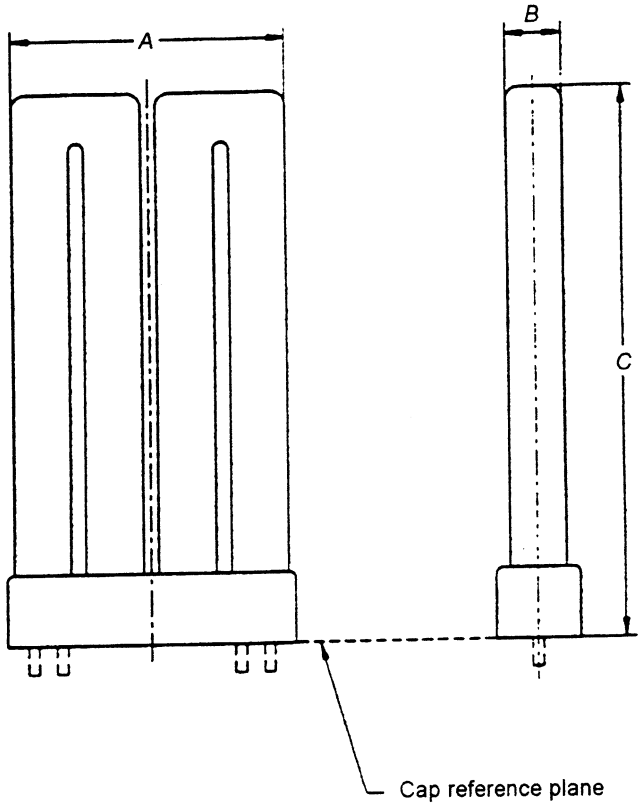
Multi-limbed

These drawings are intended only to indicate dimensions to be controlled and are to be used in conjunction with the relevant lamp standard sheets.



NOTE Dimensions A and B refer to the glass parts of the lamp.

901-IEC-05-1

	SINGLE-CAPPED FLUORESCENT LAMPS DIAGRAMMATIC DATA SHEET FOR LOCATION OF LAMP DIMENSIONS Cap: 2G10 Square-shaped	
These drawings are intended only to indicate dimensions to be controlled and are to be used in conjunction with the relevant lamp standard sheets.  Cap reference plane IEC 668/97 NOTE Dimensions A and B refer to the glass parts of the lamp.		
901-IEC-06-1		

2.3 Lamp data sheets

2.3.1 List of lamp data sheets

Sheet No. 60901-IEC-	Nominal wattage W	Frequency		Shape	Cap	Means of starting	Circuit		Cathode type
		Hz					A.C. mains	High frequency	
0005	5	50	60	Dual	G23	Internal	—	—	Preheated
0007	7	50	60	Dual	G23	Internal	—	—	Preheated
0009	9	50	60	Dual	G23	Internal	—	—	Preheated
0011	11	50	—	Dual	G23	Internal	—	—	Preheated
0013	13	—	60	Dual	GX23	Internal	—	—	Preheated
0510	10	50	60	Quad	G24d-1	Internal	—	—	Preheated
0513	13	50	60	Quad	G24d-1	Internal	—	—	Preheated
0518	18	50	60	Quad	G24d-2	Internal	—	—	Preheated
0526	26	50	60	Quad	G24d-3	Internal	—	—	Preheated
0715	15	—	60	Quad	GX32d-1	Internal	—	—	Preheated
0720	20	—	60	Quad	GX32d-2	Internal	—	—	Preheated
0727	27	—	60	Quad	GX32d-3	Internal	—	—	Preheated
1016	16	50	—	Square	GR8	Internal	—	—	Preheated
1028	28	50	—	Square	GR8	Internal	—	—	Preheated
1413	13	50	60	Multi-limbed	GX24d-1	Internal	—	—	Preheated
1418	18	50	60	Multi-limbed	GX24d-2	Internal	—	—	Preheated
1426	26	50	60	Multi-limbed	GX24d-3	Internal	—	—	Preheated
2005	5	50	60	Dual	2G7	External	Starter	Starterless	Preheated
2007	7	50	60	Dual	2G7	External	Starter	Starterless	Preheated
2009	9	50	60	Dual	2G7	External	Starter	Starterless	Preheated
2011	11	50	—	Dual	2G7	External	Starter	Starterless	Preheated
2127	27	50	60	Dual	GY10q-4	External	Starter	—	Preheated
2128	28	50	60	Dual	GY10q-5	External	Starter	—	Preheated
2130	30	50	60	Dual	GY10q-4	External	Starter	—	Preheated
2136	36	50	60	Dual	GY10q-6	External	Starter	—	Preheated
2218	18	50	60	Dual	2G11	External	Starter	Starterless	Preheated
2224	24	50	60	Dual	2G11	External	Starter	Starterless	Preheated
2236	36	50	60	Dual	2G11	External	Starter	Starterless	Preheated
2510	10	50	60	Quad	G24q-1	External	Starter	Starterless	Preheated
2513	13	50	60	Quad	G24q-1	External	Starter	Starterless	Preheated
2518	18	50	60	Quad	G24q-2	External	Starter	Starterless	Preheated
2526	26	50	60	Quad	G24q-3	External	Starter	Starterless	Preheated
2613	13	50	60	Quad	GX10q-2	External	Starter	—	Preheated
2618	18	50	60	Quad	GX10q-3	External	Starter	—	Preheated
2627	27	50	60	Quad	GX10q-4	External	Starter	—	Preheated
3010	10	50	—	Square	GR10q	External	Starter	—	Preheated
3016	16	50	—	Square	GR10q	External	Starter	—	Preheated
3021	21	50	—	Square	GR10q	External	Starter	—	Preheated
3028	28	50	—	Square	GR10q	External	Starter	—	Preheated
3038	38	50	—	Square	GR10q	External	Starter	—	Preheated
3118	18	50	60	Square	2G10	External	Starter	Starterless	Preheated
3124	24	50	60	Square	2G10	External	Starter	Starterless	Preheated
3136	36	50	60	Square	2G10	External	Starter	Starterless	Preheated
3222	22	50	60	Circular	G10q	External	Starter	—	Preheated
3232	32	50	60	Circular	G10q	External	Starter	—	Preheated
3240	40	50	—	Circular	G10q	External	Starter	—	Preheated
3413	13	50	60	Multi-limbed	GX24q-1	External	Starter	Starterless	Preheated
3418	18	50	60	Multi-limbed	GX24q-2	External	Starter	Starterless	Preheated
3426	26	50	60	Multi-limbed	GX24q-3	External	Starter	Starterless	Preheated
4224	24/27	—	60	Dual	2G11	External	Starterless	—	Preheated, low resistance
4236	36/39	—	60	Dual	2G11	External	Starterless	—	Preheated, low resistance
5010	10	50	—	Square	GR10q	External	Starterless	—	Preheated, high resistance
5016	16	50	—	Square	GR10q	External	Starterless	—	Preheated, high resistance
5021	21	50	—	Square	GR10q	External	Starterless	—	Preheated, high resistance
5028	28	50	—	Square	GR10q	External	Starterless	—	Preheated, low resistance
5038	38	50	—	Square	GR10q	External	Starterless	—	Preheated, low resistance
5222	22	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance
5232	32	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance
5240	40	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance

Sheet No. 60901-IEC-	Nominal wattage W	Frequency Hz	Shape	Cap	Means of starting	Circuit		Cathode type
						AC mains	High frequency	
6240	40	≥ 20 k	Dual	2G11	External	—	Starterless	Preheated
6255	55	≥ 20 k	Dual	2G11	External	—	Starterless	Preheated
6280	80	≥ 20 k	Dual	2G11	External	—	Starterless	Preheated
6722	22	≥ 20 k	Circular	2GX13	External	—	Starterless	Preheated
6740	40	≥ 20 k	Circular	2GX13	External	—	Starterless	Preheated
6755	55	≥ 20 k	Circular	2GX13	External	—	Starterless	Preheated
6760	60	≥ 20 k	Circular	2GX13	External	—	Starterless	Preheated
6820	20	≥ 20 k	Circular	GZ10q	External	—	Starterless	Preheated
6827	27	≥ 20 k	Circular	GZ10q	External	—	Starterless	Preheated
6834	34	≥ 20 k	Circular	GZ10q	External	—	Starterless	Preheated
6841	41	≥ 20 k	Circular	GZ10q	External	—	Starterless	Preheated
6941	41	≥ 20 k	Circular	GU10q	External	—	Starterless	Preheated
6968	68	≥ 20 k	Circular	GU10q	External	—	Starterless	Preheated
6997	97	≥ 20 k	Circular	GU10q	External	—	Starterless	Preheated
7432	32	≥ 20 k	Multilimbed	GX24q-3	External	—	Starterless	Preheated
7442	42	≥ 20 k	Multilimbed	GX24q-4	External	—	Starterless	Preheated
7456	57	≥ 20 k	Multilimbed-6	GX24q-5	External	—	Starterless	Preheated
7457	57	≥ 20 k	Multilimbed-8	GX24q-5	External	—	Starterless	Preheated
7469	70	≥ 20 k	Multilimbed-6	GX24q-6	External	—	Starterless	Preheated
7470	70	≥ 20 k	Multilimbed-8	GX24q-6	External	—	Starterless	Preheated
7660	60	≥ 20 k	Multilimbed-6	2G8-1	External	—	Starterless	Preheated
7685	85	≥ 20 k	Multilimbed-6	2G8-1	External	—	Starterless	Preheated
7719	120	≥ 20 k	Multilimbed-6	2G8-1	External	—	Starterless	Preheated
7720	120	≥ 20 k	Multilimbed-8	2G8-1	External	—	Starterless	Preheated
7862	62	≥ 20 k	Multilimbed-8	2G8-2	External	—	Starterless	Preheated
7882	82	≥ 20 k	Multilimbed-8	2G8-2	External	—	Starterless	Preheated

2.3.2 List of lamp data sheets in order of wattage

Sheet No. 60901-IEC-	Nominal wattage W	Frequency		Shape	Cap	Means of starting	Circuit		Cathode type
		Hz					A.C. mains	High frequency	
0005	5	50	60	Dual	G23	Internal	—	—	Preheated
2005	5	50	60	Dual	2G7	External	Starter	Starterless	Preheated
0007	7	50	60	Dual	G23	Internal	—	—	Preheated
2007	7	50	60	Dual	2G7	External	Starter	Starterless	Preheated
0009	9	50	60	Dual	G23	Internal	—	—	Preheated
2009	9	50	60	Dual	2G7	External	Starter	Starterless	Preheated
0510	10	50	60	Quad	G24d-1	Internal	—	—	Preheated
2510	10	50	60	Quad	G24q-1	External	Starter	Starterless	Preheated
3010	10	50	—	Square	GR10q	External	Starter	—	Preheated
5010	10	50	—	Square	GR10q	External	Starterless	—	Preheated, high resistance
0011	11	50	—	Dual	G23	Internal	—	—	Preheated
2011	11	50	—	Dual	2G7	External	Starter	Starterless	Preheated
0013	13	—	60	Dual	GX23	Internal	—	—	Preheated
0513	13	50	60	Quad	G24d-1	Internal	—	—	Preheated
1413	13	50	60	Multi-limbed	GX24d-1	Internal	—	—	Preheated
2513	13	50	60	Quad	G24q-1	External	Starter	Starterless	Preheated
2613	13	50	60	Quad	GX10q-2	External	Starter	—	Preheated
3413	13	50	60	Multi-limbed	GX24q-1	External	Starter	Starterless	Preheated
0715	15	—	60	Quad	GX32d-1	Internal	—	—	Preheated
1016	16	50	—	Square	GR8	Internal	—	—	Preheated
3016	16	50	—	Square	GR10q	External	Starter	—	Preheated
5016	16	50	—	Square	GR10q	External	Starterless	—	Preheated, high resistance
0518	18	50	60	Quad	G24d-2	Internal	—	—	Preheated
1418	18	50	60	Multi-limbed	GX24d-2	Internal	—	—	Preheated
2218	18	50	60	Dual	2G11	External	Starter	Starterless	Preheated
2518	18	50	60	Quad	G24q-2	External	Starter	Starterless	Preheated
2618	18	50	60	Quad	GX10q-3	External	Starter	—	Preheated
3118	18	50	60	Square	2G10	External	Starter	Starterless	Preheated
3418	18	50	60	Multi-limbed	GX24q-2	External	Starter	Starterless	Preheated
0720	20	—	60	Quad	GX32d-2	Internal	—	—	Preheated
6820	20	≥ 20 k		Circular	GZ10q	External	—	Starterless	Preheated
3021	21	50	—	Square	GR10q	External	Starter	—	Preheated
5021	21	50	—	Square	GR10q	External	Starterless	—	Preheated, high resistance
3222	22	50	60	Circular	G10q	External	Starter	—	Preheated
5222	22	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance
6722	22	≥ 20 k		Circular	2GX13	External	—	Starterless	Preheated
2224	24	50	60	Dual	2G11	External	Starter	Starterless	Preheated
3124	24	50	60	Square	2G10	External	Starter	Starterless	Preheated
4224	24/27	—	60	Dual	2G11	External	Starterless	—	Preheated, low resistance
0526	26	50	60	Quad	G24d-3	Internal	—	—	Preheated
1426	26	50	60	Multi-limbed	GX24d-3	Internal	—	—	Preheated
2526	26	50	60	Quad	G24q-3	External	Starter	Starterless	Preheated
3426	26	50	60	Multi-limbed	GX24q-3	External	Starter	Starterless	Preheated
0727	27	—	60	Quad	GX32d-3	Internal	—	—	Preheated
2127	27	50	60	Dual	GY10q-4	External	Starter	—	Preheated
2627	27	50	60	Quad	GX10q-4	External	Starter	—	Preheated
6827	27	≥ 20 k		Circular	GZ10q	External	—	Starterless	Preheated
1028	28	50	—	Square	GR8	Internal	—	—	Preheated
2128	28	50	60	Dual	GY10q-5	External	Starter	—	Preheated
3028	28	50	—	Square	GR10q	External	Starter	—	Preheated
5028	28	50	—	Square	GR10q	External	Starterless	—	Preheated, low resistance
2130	30	50	60	Dual	GY10q-4	External	Starter	—	Preheated
3232	32	50	60	Circular	G10q	External	Starter	—	Preheated
5232	32	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance
7432	32	≥ 20 k		Multi-limbed	GX24q-3	External	—	Starterless	Preheated
6834	34	≥ 20 k		Circular	GZ10q	External	—	Starterless	Preheated
2136	36	50	60	Dual	GY10q-6	External	Starter	—	Preheated
2236	36	50	60	Dual	2G11	External	Starter	Starterless	Preheated
3136	36	50	60	Square	2G10	External	Starter	Starterless	Preheated
4236	36/39	—	60	Dual	2G11	External	Starterless	—	Preheated, low resistance
3038	38	50	—	Square	GR10q	External	Starter	—	Preheated
5038	38	50	—	Square	GR10q	External	Starterless	—	Preheated, low resistance
3240	40	50	—	Circular	G10q	External	Starter	Starterless	Preheated
5240	40	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance
6240	40	≥ 20 k		Dual	2G11	External	—	Starterless	Preheated
6740	40	≥ 20 k		Circular	2GX13	External	—	Starterless	Preheated
6841	41	≥ 20 k		Circular	GZ10q	External	—	Starterless	Preheated
6941	41	≥ 20 k		Circular	GU10q	External	—	Starterless	Preheated
7442	42	≥ 20 k		Multilimbed	GX24q-4	External	—	Starterless	Preheated
6255	55	≥ 20 k		Dual	2G11	External	—	Starterless	Preheated
6755	55	≥ 20 k		Circular	2GX13	External	—	Starterless	Preheated
7456	57	≥ 20 k		Multilimbed-6	GX24q-5	External	—	Starterless	Preheated
7457	57	≥ 20 k		Multilimbed-8	GX24q-5	External	—	Starterless	Preheated
6760	60	≥ 20 k		Circular	2GX13	External	—	Starterless	Preheated
7660	60	≥ 20 k		Multilimbed-6	2G8-1	External	—	Starterless	Preheated
7862	62	≥ 20 k		Multilimbed-8	2G8-2	External	—	Starterless	Preheated
6968	68	≥ 20 k		Circular	GU10q	External	—	Starterless	Preheated
7469	70	≥ 20 k		Multilimbed-6	GX24q-6	External	—	Starterless	Preheated
7470	70	≥ 20 k		Multilimbed-8	GX24q-6	External	—	Starterless	Preheated
6280	80	≥ 20 k		Dual	2G11	External	—	Starterless	Preheated
7882	82	≥ 20 k		Multilimbed-8	2G8-2	External	—	Starterless	Preheated
7685	85	≥ 20 k		Multilimbed-6	2G8-1	External	—	Starterless	Preheated
6997	97	≥ 20 k		Circular	GU10q	External	—	Starterless	Preheated
7719	120	≥ 20 k		Multilimbed-6	2G8-1	External	—	Starterless	Preheated
7720	120	≥ 20 k		Multilimbed-8	2G8-1	External	—	Starterless	Preheated

	SINGLE-CAPPED FLUORESCENT LAMP DATA SHEET			Page 1		
Dual-shaped						
ILCOS: FSD-5-I-G23						
Nominal wattage	Circuit	Cathode	Cap			
5 W	Internal starter	Preheated	G23			
Dimensions (mm)						
A	B		C			
Max.	Max.		Max.			
28	13		85			
Cap: see sheet 7004-69 of IEC 61-1.						
Starting characteristics						
Frequency	Ballast rated voltage	Test voltage (r.m.s.)	Starting time			
Hz	V	V	s			
50	220	198	10			
60	118	106	10			
Electrical characteristics						
Frequency	Rated wattage	Voltage (r.m.s.) at lamp terminals			Rated lamp cur- rent	Rated preheat current
Hz	W	V			A	A
		Rated	Minimum	Maximum		
50	5,4	35	30	40	0,180	0,190
60	5,5	35	30	40	0,180	0,190
Test position: vertical, cap-up.						
901-IEC-0005-1						

	SINGLE-CAPPED FLUORESCENT LAMP DATA SHEET				Page 2
					Dual-shaped
ILCOS: FSD-5-I-G23					
Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A	Ω	
50	9	220	0,170	1 180	0,12
60	5,5	118	0,180	605	0,075
Information for ballast design					
Frequency	Hz			50	60
Preheat cathode current	A	Min.		0,153	0,153
		Max.		0,240	0,240
Open circuit voltage across lamp	V	Min. (r.m.s.)		198	108
		Max. (peak)		400	440
Substitution resistor for both cathodes in series			Ω	160	160
Lamp operating current	A	Max.		0,190	0,190
Information for luminaire design					
Maximum lamp outline: see sheet 901-IEC-A010, with dimension H:				mm	85
Maximum cap-guidepost temperature				°C	90
901-IEC-0005-1					

	SINGLE-CAPPED FLUORESCENT LAMP DATA SHEET			Page 1		
Dual-shaped						
ILCOS: FSD-7-I-G23						
Nominal wattage	Circuit	Cathode	Cap			
7 W	Internal starter	Preheated	G23			
Dimensions (mm)						
A	B		C			
Max.	Max.		Max.			
28	13		115			
Cap: see sheet 7004-69 of IEC 61-1.						
Starting characteristics						
Frequency	Ballast rated voltage	Test voltage (r.m.s.)	Starting time			
Hz	V	V	s			
50	220	198	10			
60	118	106	10			
Electrical characteristics						
Frequency	Rated wattage	Voltage (r.m.s.) at lamp terminals			Rated lamp	Rated preheat
		V			current	current
Hz	W	Rated	Minimum	Maximum	A	A
50	7,1	47	42	52	0,175	0,190
60	7,0	45	40	50	0,180	0,190
Test position: vertical, cap-up.						

	SINGLE-CAPPED FLUORESCENT LAMP DATA SHEET				Page 2
					Dual-shaped
ILCOS: FSD-7-I-G23					
Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A	Ω	
50	9	220	0,170	1 180	0,12
60	7	118	0,180	570	0,075
Information for ballast design					
Frequency	Hz		50	60	
Preheat cathode current	A	Min.	0,153	0,153	
		Max.	0,240	0,240	
Open circuit voltage across lamp	V	Min. (r.m.s.)	198	108	
		Max. (peak)	400	440	
Substitution resistor for both cathodes in series		Ω	160	160	
Lamp operating current	A	Max.	0,190	0,190	
Information for luminaire design					
Maximum lamp outline: see sheet 901-IEC-A010, with dimension H:			mm	115	
Maximum cap-guidepost temperature			°C	90	
901-IEC-0007-1					

	SINGLE-CAPPED FLUORESCENT LAMP DATA SHEET			Page 1		
Dual-shaped						
ILCOS: FSD-9-I-G23						
Nominal wattage	Circuit	Cathode	Cap			
9 W	Internal starter	Preheated	G23			
Dimensions (mm)						
A	B		C			
Max.	Max.		Max.			
28	13		145			
Cap: see sheet 7004-69 of IEC 61-1.						
Starting characteristics						
Frequency	Ballast rated voltage	Test voltage (r.m.s.)	Starting time			
Hz	V	V	s			
50	220	198	10			
60	118	106	10			
Electrical characteristics						
Frequency	Rated wattage	Voltage (r.m.s.) at lamp terminals			Rated lamp	Rated preheat
		V			current	current
Hz	W	Rated	Minimum	Maximum	A	A
50	8,7	60	54	66	0,170	0,190
60	9,0	59	53	65	0,180	0,190
Test position: vertical, cap-up.						
901-IEC-0009-1						

	SINGLE-CAPPED FLUORESCENT LAMP DATA SHEET				Page 2
Dual-shaped					
ILCOS: FSD-9-I-G23					
Reference ballast characteristics					
Frequency	Nominal wattage	Rated voltage	Calibration current	Voltage/current ratio	Power factor
Hz	W	V	A	Ω	
50	9	220	0,170	1 180	0,12
60	9	118	0,180	515	0,075
Information for ballast design					
Frequency	Hz		50	60	
Preheat cathode current	A	Min.	0,153	0,153	
		Max.	0,240	0,240	
Open circuit voltage across lamp	V	Min. (r.m.s.)	198	108	
		Max. (peak)	400	440	
Substitution resistor for both cathodes in series	Ω		160	160	
Lamp operating current	A	Max.	0,190	0,190	
Information for luminaire design					
Maximum lamp outline: see sheet 901-IEC-A010, with dimension H:			mm	145	
Maximum cap-guidepost temperature			°C	90	
901-IEC-0009-1					