

Australian/New Zealand Standard™

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



AS/NZS 60901:2003

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-041, Lamps and Related Equipment. It was approved on behalf of the Council of Standards Australia on 12 June 2003 and on behalf of the Council of Standards New Zealand on 24 June 2003. It was published on 5 September 2003.

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Australian Chamber of Commerce and Industry
Australian Electrical and Electronic Manufacturers Association
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Electrical Compliance Testing Association of Australia
Energy Efficiency and Conservation Authority of New Zealand
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Australian/New Zealand Standard™

Single-capped fluorescent lamps— Performance specifications

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-041, Lamps and Related Equipment.

The objective of this Standard is to specify performance requirements for single capped fluorescent lamps for general lighting service.

This Standard is identical with, and has been reproduced from, IEC 60901:2001, *Single-capped fluorescent lamps—Performance specifications*. This Standard is a consolidation of IEC 60901:1996 plus Amendment 1:1997 and Amendment 2:2000.

A reference to an International Standard identified in the Normative References Clause by strikethrough (~~example~~) is replaced by a reference to the Australian or Australian/New Zealand Standard(s) listed immediately thereafter and identified by shading (example). Where the struck-through referenced document and the referenced Australian or Australian/New Zealand Standard are identical, this is indicated in parenthesis after the title of the latter.

The main changes with respect to the first edition of IEC 60901 are the following:

- (a) The removal of safety related items.
- (b) The abandonment of the division into three sections.
- (c) The introduction of new terminology.
- (d) A new numbering of the lamp data sheets.
- (e) The introduction of new lamp data sheets.

As this Standard is reproduced from an International Standard, the following applies:

- (i) Its number does not appear on each page of text and its identity is shown only on the cover and title page.
- (ii) In the source text ‘this standard’ should read ‘this Australian/New Zealand Standard’.
- (iii) A full point should be substituted for a comma when referring to a decimal marker.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the annex to which they apply. A ‘normative’ annex is an integral part of a Standard, whereas an ‘informative’ annex is only for information and guidance.

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Australian/New Zealand Standard**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.

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.

References to International Standards that are struck through in this Clause are replaced by references to equivalent Australian or Australian/New Zealand Standards that are listed immediately thereafter and identified by shading. Any Australian or Australian/New Zealand Standard that is identical to the International Standard it replaces is appropriately identified.

~~IEC 60050(845):1987, International Electrotechnical Vocabulary (IEV) — Chapter 845: Lighting~~

AS 1852.845—1989, *International electrotechnical vocabulary—Lighting* (identical to IEC 60050(845):1987)

IEC 60061-1, *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~~

AS/NZS 4782.1, *Double-capped fluorescent lamps—Performance specifications*

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

AS/NZS 60155:2000, *Glow-starters for fluorescent lamps*

~~IEC 60598-1:1996, Luminaires—Part 1: General requirements and tests~~

AS/NZS 60598.1:2001, *Luminaires—General requirements and tests*

~~IEC 60921:1988, Ballasts for tubular fluorescent lamps—Performance requirements~~

AS/NZS 60921, *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~~

AS/NZS 60929:2000, *Auxiliaries for lamps—A.C. supplied electronic ballasts for tubular fluorescent lamps—Performance requirements* (identical to IEC 60929:1990 including its Corrigendum 1 and Amendments 1 and 2)

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

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

AS/NZS 61231:2001, *International lamp coding system (IL-COS)* (identical to IEC TS 61231:1996)

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

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

- 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

The following information shall be marked on a lamp:

- a) the nominal wattage;
NOTE If necessary for proper identification, additional information should be added (for example the nominal tube diameter in millimetres).
- b) a further identification which defines, with the aid of information made available by the manufacturer or responsible vendor, the electrical and photometric characteristics of a lamp.

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 60921. 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 60155, 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 60921. 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.

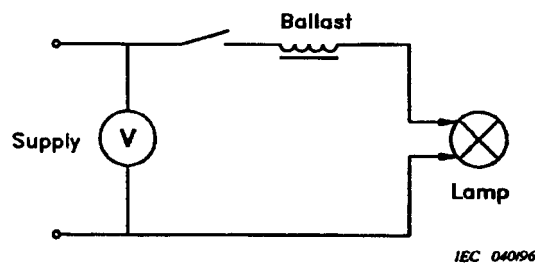


Figure A.1 – Circuit diagram for starting test for lamps with internal starter

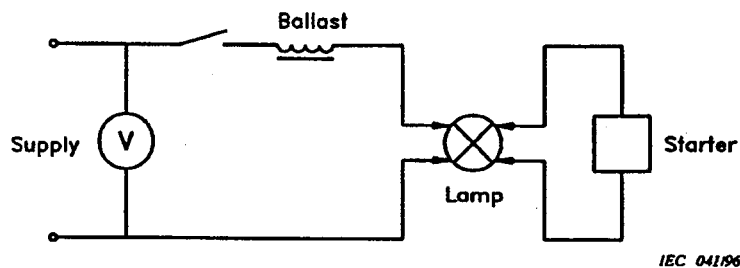


Figure A.2 – Circuit diagram for starting test for lamps with external starter

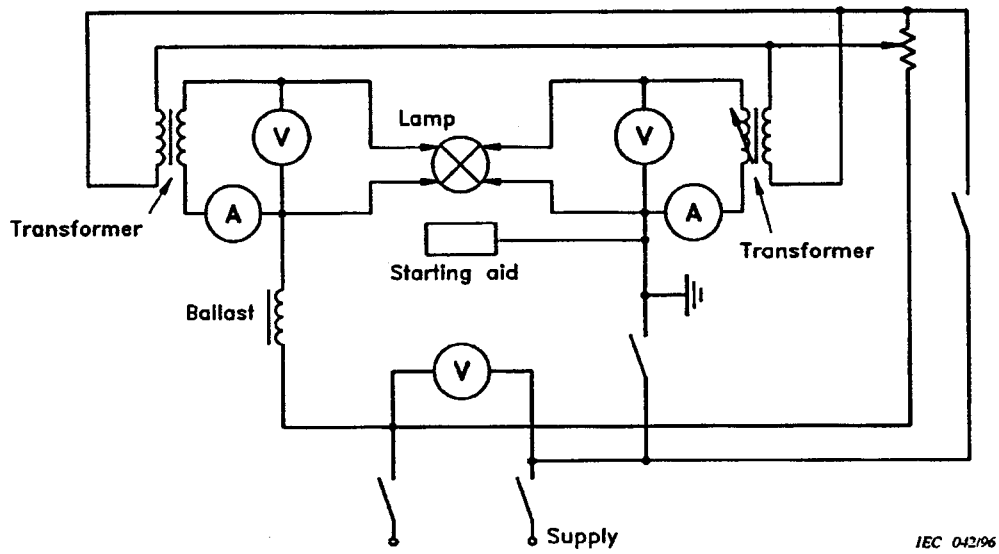


Figure A.3 – Circuit diagram for starting test for lamps with preheated cathodes for operation on starterless circuits

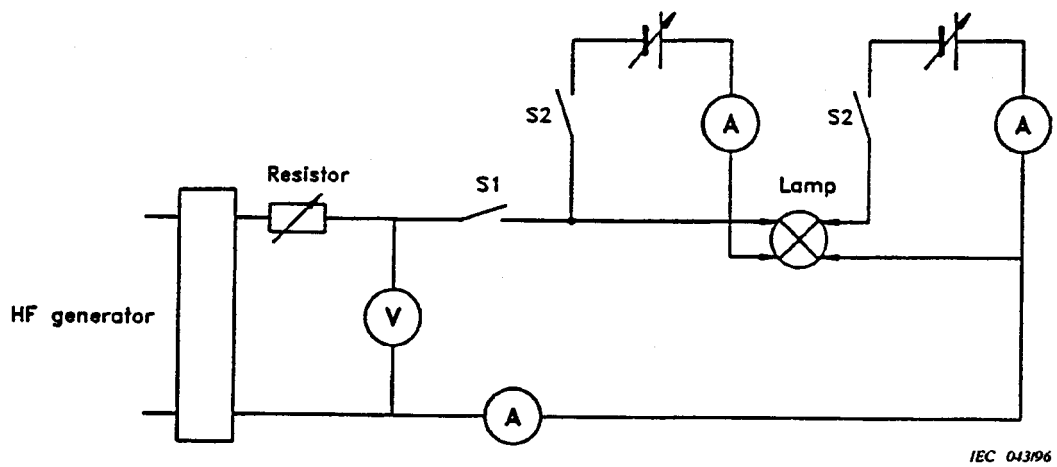


Figure A.4 – Circuit diagram for starting test for lamps with preheated cathodes for operation on high frequency

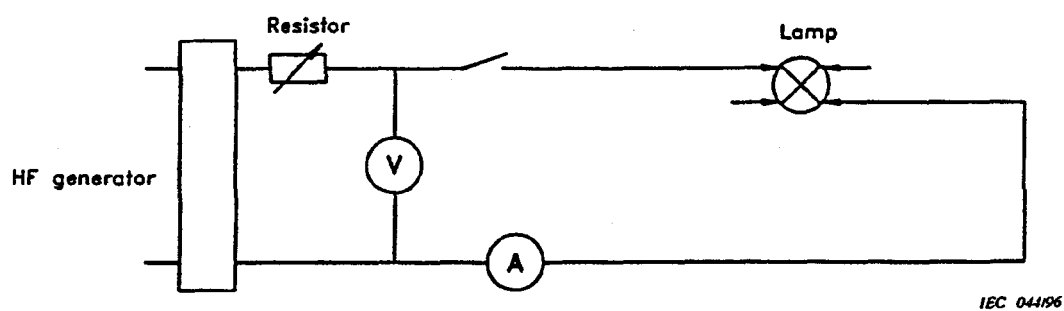


Figure A.5 – Circuit diagram for starting test for lamps with non-preheated cathodes for operating on high frequency

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 $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$, 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 c.1 for lamps with internal means of starting;
- figure c.2 for lamps with external means of starting;
- figure c.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 60921 for a.c. mains frequencies, or IEC 60929 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 $\pm 0,2\%$ 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.

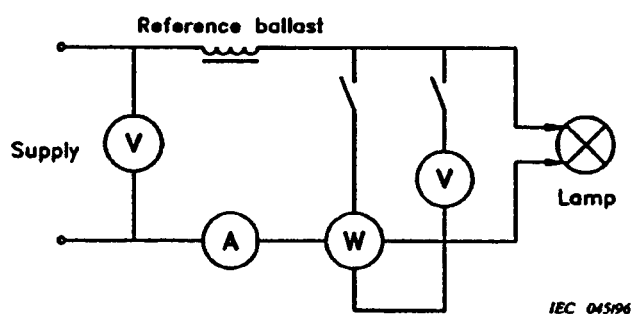


Figure B.1 – Circuit diagram for measurement of electrical and photometric characteristics for lamps with internal starter

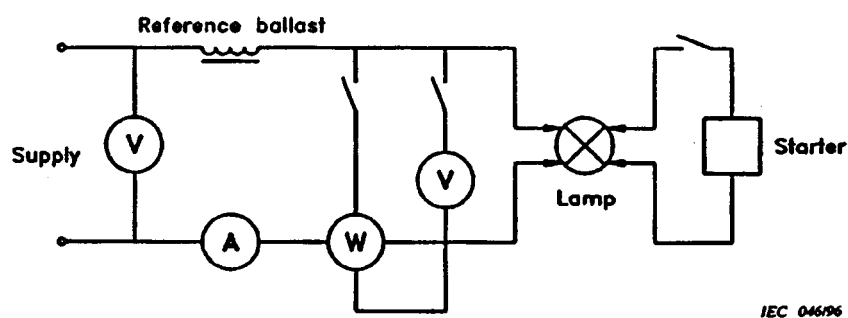


Figure B.2 – Circuit diagram for measurement of electrical and photometric characteristics for lamps with external starter

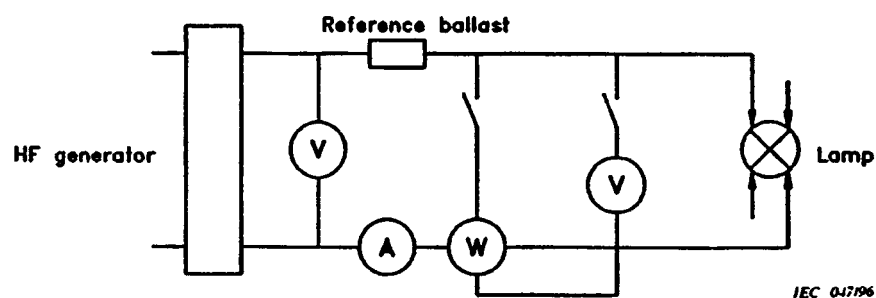


Figure B.3 - Circuit diagram for measurement of electrical and photometric characteristics for lamps for operation on high frequency

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.

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

E4.1 Lamps with an internal starter should not be operated on high-frequency circuits.

E4.2 Under normal operation test conditions, according to 12.4.1 of IEC 60591-1, 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.

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

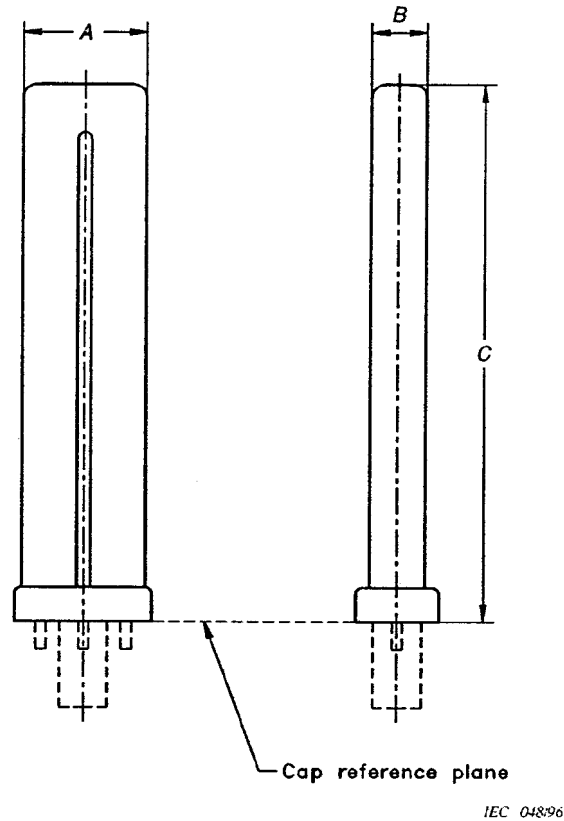
60901-IEC-06 Square-shaped lamps (cap 2G10)

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.



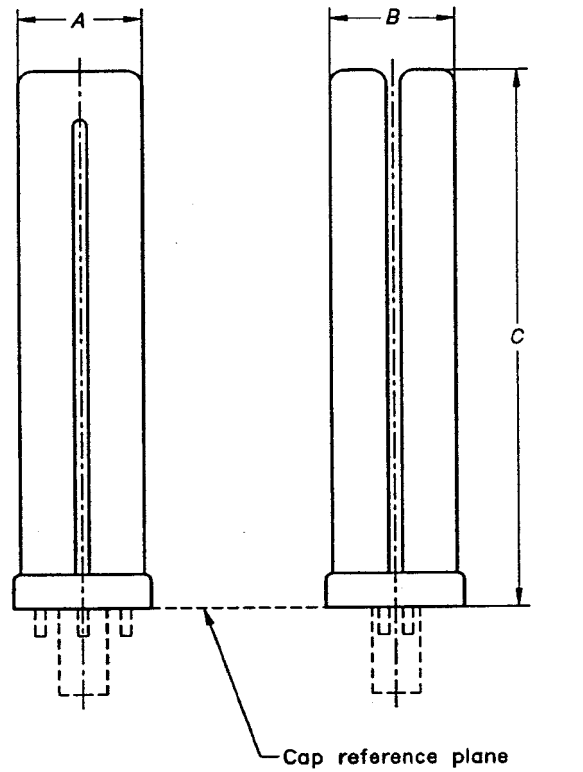
NOTE – Dimensions A and B refer to the glass parts of the lamp.

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.



IEC 049196

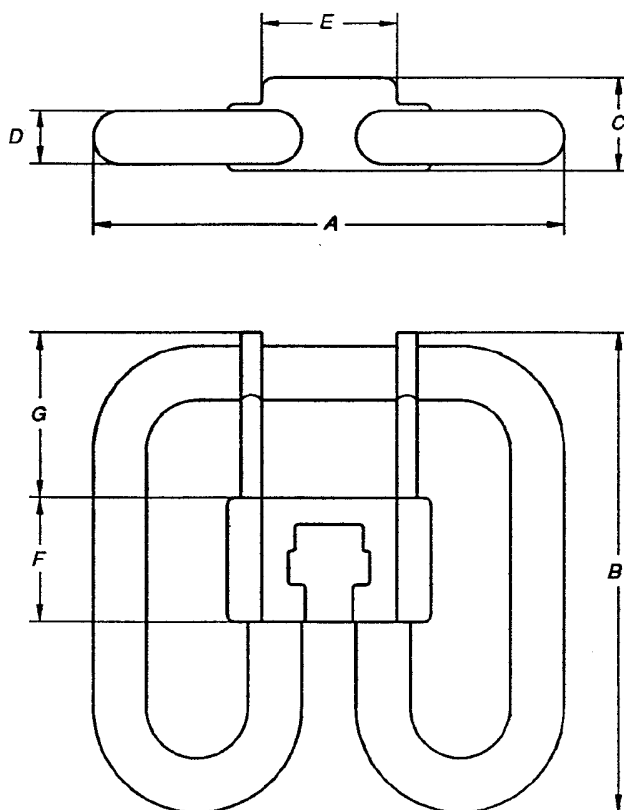
NOTE – Dimensions A and B refer to the glass parts of the lamp.

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.



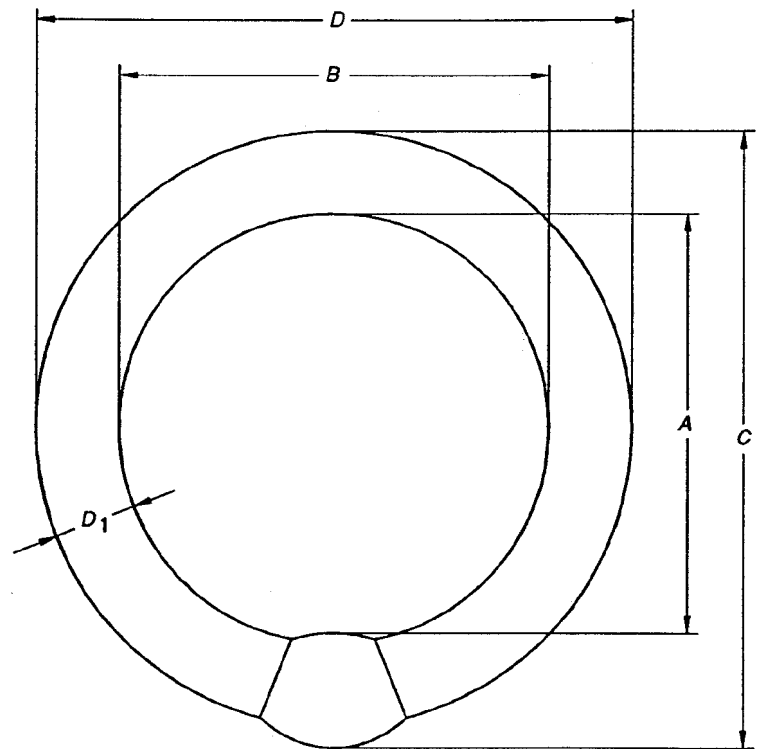
IEC 050/96

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.



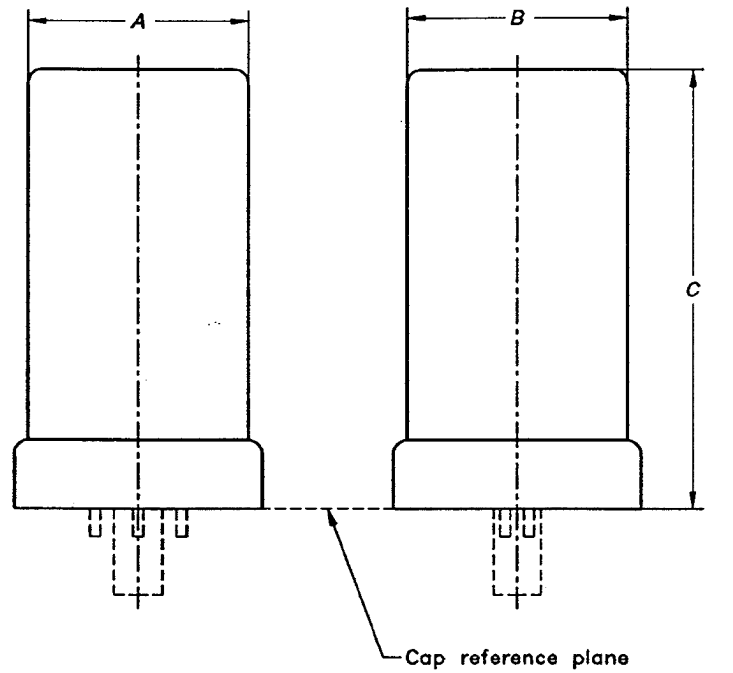
IEC 051/96

SINGLE-CAPPED FLUORESCENT LAMPS

DIAGRAMMATIC DATA SHEET FOR
LOCATION OF LAMP DIMENSIONS

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.



IEC 052/96

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

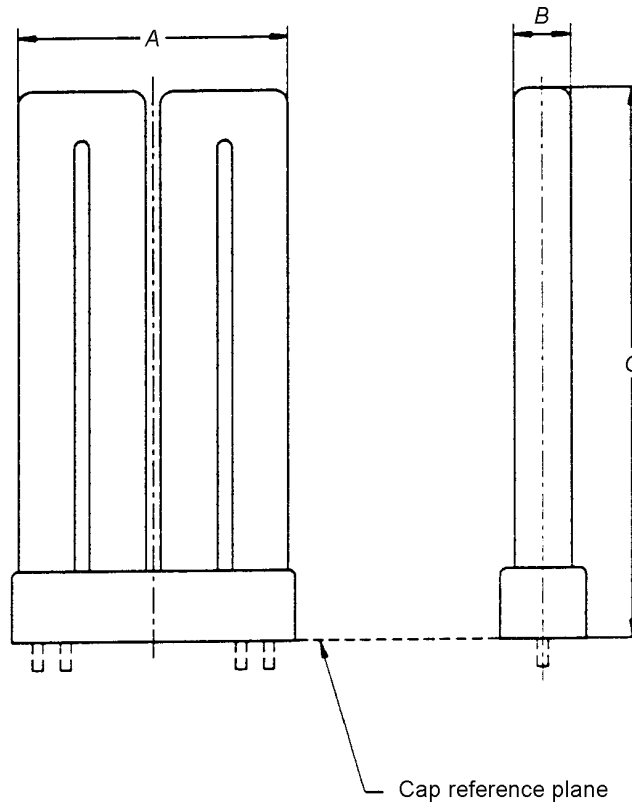
SINGLE-CAPPED FLUORESCENT LAMPS

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.



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

IEC 668/97

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
							AC 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	Multilimbed	GX24d-1	Internal	—	—	Preheated
1418	18	50	60	Multilimbed	GX24d-2	Internal	—	—	Preheated
1426	26	50	60	Multilimbed	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 (D29)	50	60	Circular	G10q	External	Starter	Starterless	Preheated
3231	32 (D29)	50	60	Circular	G10q	External	Starter	Starterless	Preheated
3232	32 (D32)	50	60	Circular	G10q	External	Starter	Starterless	Preheated
3239	40 (D29)	50	—	Circular	G10q	External	Starter	Starterless	Preheated
3240	40 (D32)	50	—	Circular	G10q	External	Starter	Starterless	Preheated
3413	13	50	60	Multilimbed	GX24q-1	External	Starter	Starterless	Preheated
3418	18	50	60	Multilimbed	GX24q-2	External	Starter	Starterless	Preheated
3426	26	50	60	Multilimbed	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 (D29)	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance
5232	32 (D32)	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance
5240	40 (D32)	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance
6240	40	≥20 k	—	Dual	2G11	External	—	Starterless	Preheated
6255	55	≥20 k	—	Dual	2G11	External	—	Starterless	Preheated
7432	32	≥20 k	—	Multilimbed	GX24q-3	External	—	Starterless	Preheated
7442	42	≥20 k	—	Multilimbed	GX24q-4	External	—	Starterless	Preheated
8240	40	≥20 k	—	Dual	2G11	External	—	Starterless	Non-preheated

2.3.2 List of lamp data sheets in order of wattage

Sheet No. 60901-IEC-	Nominal wattage W	Frequency Hz		Shape	Cap	Means of starting	Circuit		Cathode type
							AC 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	Multilimbed	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	Multilimbed	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	Multilimbed	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	Multilimbed	GX24q-2	External	Starter	Starterless	Preheated
0720	20	—	60	Quad	GX32d-2	Internal	—	—	Preheated
3021	21	50	—	Square	GR10q	External	Starter	—	Preheated
5021	21	50	—	Square	GR10q	External	Starterless	—	Preheated, high resistance
3222	22 (D29)	50	60	Circular	G10q	External	Starter	Starterless	Preheated
5222	22 (D29)	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance
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	Multilimbed	GX24d-3	Internal	—	—	Preheated
2526	26	50	60	Quad	G24q-3	External	Starter	Starterless	Preheated
3426	26	50	60	Multilimbed	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
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
3231	32 (D29)	50	60	Circular	G10q	External	Starter	Starterless	Preheated
3232	32 (D32)	50	60	Circular	G10q	External	Starter	Starterless	Preheated
5232	32 (D32)	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance
7432	32	≥20 k	—	Multilimbed	GX24q-3	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
3239	40 (D29)	50	—	Circular	G10q	External	Starter	Starterless	Preheated
3240	40 (D32)	50	—	Circular	G10q	External	Starter	Starterless	Preheated
5240	40 (D32)	—	60	Circular	G10q	External	Starterless	—	Preheated, low resistance
6240	40	≥20 k	—	Dual	2G11	External	—	Starterless	Preheated
8240	40	≥20 k	—	Dual	2G11	External	—	Starterless	Non-preheated
7442	42	≥20 k	—	Multilimbed	GX24q-4	External	—	Starterless	Preheated
6255	55	≥20 k	—	Dual	2G11	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 60061-1.

Starting characteristics			
Frequency Hz	Ballast rated voltage V	Test voltage (r.m.s.) V	Starting time s
50	220	198	10
60	118	106	10

Electrical characteristics						
Frequency Hz	Rated wattage W	Voltage (r.m.s.) at lamp terminals V			Rated lamp current A	Rated preheat current 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.

**SINGLE-CAPPED FLUORESCENT LAMP
DATA SHEET**

Page 2

Dual-shaped**ILCOS: FSD-5-I-G23**

Reference ballast characteristics					
Frequency Hz	Nominal wattage W	Rated voltage V	Calibration current A	Voltage/current ratio Ω	Power factor
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 60901-IEC-A010, with dimension H:	mm
Maximum cap-guidepost temperature	$^{\circ}\text{C}$

60901-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 60061-1.

Starting characteristics			
Frequency Hz	Ballast rated voltage V	Test voltage (r.m.s.) V	Starting time s
50	220	198	10
60	118	106	10

Electrical characteristics						
Frequency Hz	Rated wattage W	Voltage (r.m.s.) at lamp terminals V			Rated lamp current A	Rated preheat current A
		Rated	Minimum	Maximum		
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 Hz	Nominal wattage W	Rated voltage V	Calibration current A	Voltage/current ratio Ω	Power factor
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 60901-IEC-A010, with dimension H:	mm
Maximum cap-guidepost temperature	$^{\circ}\text{C}$

60901-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 60061-1.

Starting characteristics			
Frequency Hz	Ballast rated voltage V	Test voltage (r.m.s.) V	Starting time s
50	220	198	10
60	118	106	10

Electrical characteristics						
Frequency Hz	Rated wattage W	Voltage (r.m.s.) at lamp terminals V			Rated lamp current A	Rated preheat current A
		Rated	Minimum	Maximum		
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.**60901-IEC-0009-1**

SINGLE-CAPPED FLUORESCENT LAMP DATA SHEET

Page 2

Dual-shaped**ILCOS:** FSD-9-I-G23**Reference ballast characteristics**

Frequency Hz	Nominal wattage W	Rated voltage V	Calibration current A	Voltage/current ratio Ω	Power factor
50	9	220	0,170	1 180	0,12
60	9	118	0,180	515	0,075

Information for ballast design

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
Lamp operating current	A	Max.	0,190	0,190

Information for luminaire design

Maximum lamp outline: see sheet 60901-IEC-A010, with dimension H:	mm	145
Maximum cap-guidepost temperature	$^{\circ}\text{C}$	90

SINGLE-CAPPED FLUORESCENT LAMP

DATA SHEET

Page 1

Dual-shaped

ILCOS: FSD-11-I-G23

Nominal wattage	Circuit	Cathode	Cap
11 W	Internal starter	Preheated	G23

Dimensions (mm)		
A	B	C
Max.	Max.	Max.
28	13	215

Cap: see sheet 7004-69 of IEC 60061-1.

Starting characteristics			
Frequency Hz	Ballast rated voltage V	Test voltage (r.m.s.) V	Starting time s
50	220	198	10
60	—	—	—

Electrical characteristics						
Frequency Hz	Rated wattage W	Voltage (r.m.s.) at lamp terminals V			Rated lamp current A	Rated preheat current A
		Rated	Minimum	Maximum		
50	11,8	91	81	101	0,155	0,190
60	—	—	—	—	—	—

Test position: vertical, cap-up.

**SINGLE-CAPPED FLUORESCENT LAMP
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Dual-shaped**ILCOS: FSD-11-I-G23**

Reference ballast characteristics					
Frequency Hz	Nominal wattage W	Rated voltage V	Calibration current A	Voltage/current ratio Ω	Power factor
50	9	220	0,170	1 180	0,12
60	–	–	–	–	–

Information for ballast design				
Frequency		Hz	50	60
Preheat cathode current	A	Min.	0,153	–
		Max.	0,240	–
Open circuit voltage across lamp	V	Min. (r.m.s.)	198	–
		Max. (peak)	400	–
Substitution resistor for both cathodes in series		Ω	160	–
Lamp operating current	A	Max.	0,190	–

Information for luminaire design	
Maximum lamp outline: see sheet 60901-IEC-A010, with dimension H:	mm 215
Maximum cap-guidepost temperature	$^{\circ}\text{C}$ 90

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Dual-shaped**ILCOS: FSD-13-I-GX23**

Nominal wattage	Circuit	Cathode	Cap
13 W	Internal starter	Preheated	GX23

Dimensions (mm)		
A	B	C
Max.	Max.	Max.
28	13	170

Cap: see sheet 7004-86 of IEC600 60061-1.

Starting characteristics			
Frequency	Ballast rated voltage	Test voltage (r.m.s.)	Starting time
Hz	V	V	s
50	–	–	–
60	118	106	10

Electrical characteristics						
Frequency	Rated wattage	Voltage (r.m.s.) at lamp terminals			Rated lamp current	Rated preheat current
		V				
Hz	W	Rated	Minimum	Maximum	A	A
50	—	—	—	—	—	—
60	13,4	59	53	65	0,285	0,400

Test position: vertical, cap-up.**60901-IEC-0013-1**

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Dual-shaped**ILCOS: FSD-13-I-GX23****Reference ballast characteristics**

Frequency Hz	Nominal wattage W	Rated voltage V	Calibration current A	Voltage/current ratio Ω	Power factor
50	–	–	–	–	–
60	13	118	0,285	325	0,075

Information for ballast design

Information for ballast design				
Frequency		Hz	50	60
Preheat cathode current	A	Min.	–	0,270
		Max.	–	0,525
Open circuit voltage across lamp	V	Min. (r.m.s.)	–	106
		Max. (peak)	–	440
Substitution resistor for both cathodes in series		Ω	–	25
Lamp operating current	A	Max.	–	*

Information for luminaire design

Maximum lamp outline: see sheet 60901-IEC-A010, with dimension H:	mm	170
Maximum cap-guidepost temperature	°C	90

* Under consideration

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Quad-shaped**ILCOS:** FSQ-10-I-G24d=1

Nominal wattage	Circuit	Cathode	Cap
10 W	Internal starter	Preheated	G24d-1

Dimensions (mm)		
A	B	C
Max.	Max.	Max.
28	28	95

Cap: see sheet 7004-78 of IEC 60061-1.

Starting characteristics			
Frequency Hz	Ballast rated voltage V	Test voltage (r.m.s.) V	Starting time s
50	220	198	10
60	220	198	10

Electrical characteristics						
Frequency Hz	Rated wattage W	Voltage (r.m.s.) at lamp terminals V			Rated lamp current A	Rated preheat current A
		Rated	Minimum	Maximum		
50	10	64	58	70	0,190	0,210
60	10	64	58	70	0,190	0,210

Test position: vertical, cap-up.**60901-IEC-0510-1**

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Quad-shaped**ILCOS: FSQ-10-I-G24d=1****Reference ballast characteristics**

Frequency Hz	Nominal wattage W	Rated voltage V	Calibration current A	Voltage/current ratio Ω	Power factor
50	10	220	0,190	1 070	0,12
60	10	220	0,190	1 080	0,075

Information for ballast design

Information for ballast design				
Frequency		Hz	50	60
Preheat cathode current	A	Min.	0,153	0,153
		Max.	0,275	0,275
Open circuit voltage across lamp	V	Min. (r.m.s.)	198	198
		Max. (peak)	400	440
Substitution resistor for both cathodes in series		Ω	100	100
Lamp operating current	A	Max.	0,210	0,210

Information for luminaire design

Maximum lamp outline: see sheet 60901-IEC-A510, with dimension H:	mm	95
Maximum cap-guidepost temperature	$^{\circ}\text{C}$	90

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Quad-shaped**ILCOS:** FSQ-13-I-G24d=1

Nominal wattage	Circuit	Cathode	Cap
13 W	Internal starter	Preheated	G24d-1

Dimensions (mm)		
A	B	C
Max.	Max.	Max.
28	28	130

Cap: see sheet 7004-78 of IEC 60061-1.

Starting characteristics			
Frequency Hz	Ballast rated voltage V	Test voltage (r.m.s.) V	Starting time s
50	220	198	10
60	220	198	10

Electrical characteristics						
Frequency Hz	Rated wattage W	Voltage (r.m.s.) at lamp terminals V			Rated lamp current A	Rated preheat current A
		Rated	Minimum	Maximum		
50	13	91	81	101	0,175	0,210
60	13	91	81	101	0,175	0,210

Test position: vertical, cap-up.

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Quad-shaped**ILCOS:** FSQ-13-I-G24d=1**Reference ballast characteristics**

Frequency Hz	Nominal wattage W	Rated voltage V	Calibration current A	Voltage/current ratio Ω	Power factor
50	13	220	0,165	1 070	0,12
60	13	220	0,170	1 080	0,075

Information for ballast design

Information for ballast design					
Frequency		Hz	50	60	
Preheat cathode current	A	Min.	0,153	0,153	
		Max.	0,275	0,275	
Open circuit voltage across lamp	V	Min. (r.m.s.)	198	198	
		Max. (peak)	400	440	
Substitution resistor for both cathodes in series			Ω	100	100
Lamp operating current	A	Max.	0,190	0,190	

Information for luminaire design

Maximum lamp outline: see sheet 60901-IEC-A510, with dimension H:	mm	130
Maximum cap-guidepost temperature	$^{\circ}\text{C}$	90

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Quad-shaped**ILCOS:** FSQ-18-I-G24d=2

Nominal wattage	Circuit	Cathode	Cap
18 W	Internal starter	Preheated	G24d-2

Dimensions mm		
A	B	C
Max.	Max.	Max.
28	28	140

Cap: see sheet 7004-78 of IEC 60061-1.

Starting characteristics			
Frequency Hz	Ballast rated voltage V	Test voltage (r.m.s.) V	Starting time s
50	220	198	10
60	220	198	10

Electrical characteristics						
Frequency	Rated wattage	Voltage (r.m.s.) at lamp terminals V			Rated lamp current A	Rated preheat current A
Hz	W	Rated	Minimum	Maximum		
50	18	100	90	110	0,220	0,280
60	18	100	90	110	0,220	0,280

Test position: vertical, cap-up.

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Quad-shaped

ILCOS: FSQ-18-I-G24d=2

Reference ballast characteristics					
Frequency Hz	Nominal wattage W	Rated voltage V	Calibration current A	Voltage/current ratio Ω	Power factor
50	18	220	0,220	800	0,12
60	18	220	0,220	815	0,075

Information for ballast design				
Frequency		Hz	50	60
Preheat cathode current	A	Min.	0,190	0,190
		Max.	0,375	0,375
Open circuit voltage across lamp	V	Min. (r.m.s.)	198	198
		Max. (peak)	400	440
Substitution resistor for both cathodes in series			Ω	80
Lamp operating current	A	Max.	0,240	0,240

Information for luminaire design		
Maximum lamp outline: see sheet 60901-IEC-A510, with dimension H :	mm	140
Maximum cap-guidepost temperature	$^{\circ}\text{C}$	90

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Quad-shaped**ILCOS:** FSQ-26-I-G24d=3

Nominal wattage	Circuit	Cathode	Cap
26 W	Internal starter	Preheated	G24d-3

Dimensions mm		
A	B	C
Max.	Max.	Max.
28	28	160

Cap: see sheet 7004-78 of IEC 60061-1.

Starting characteristics			
Frequency Hz	Ballast rated voltage V	Test voltage (r.m.s.) V	Starting time s
50	220	198	10
60	220	198	10

Electrical characteristics						
Frequency	Rated wattage	Voltage (r.m.s.) at lamp terminals V			Rated lamp current A	Rated preheat current A
Hz	W	Rated	Minimum	Maximum		
50	26	105	95	115	0,325	0,420
60	26	105	95	115	0,325	0,420

Test position: vertical, cap-up.

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Quad-shaped

ILCOS: FSQ-26-I-G24d=3

Reference ballast characteristics					
Frequency Hz	Nominal wattage W	Rated voltage V	Calibration current A	Voltage/current ratio Ω	Power factor
50	26	220	0,315	540	0,10
60	26	220	0,315	546	0,075

Information for ballast design				
Frequency		Hz	50	60
Preheat cathode current	A	Min.	0,270	0,270
		Max.	0,550	0,550
Open circuit voltage across lamp	V	Min. (r.m.s.)	198	198
		Max. (peak)	400	440
Substitution resistor for both cathodes in series			Ω	25
Lamp operating current	A	Max.	0,360	0,360

Information for luminaire design		
Maximum lamp outline: see sheet 60901-IEC-A510, with dimension H :	mm	160
Maximum cap-guidepost temperature	$^{\circ}\text{C}$	90

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Quad-shaped**ILCOS:** FSQ-15-I-GX32d=1

Nominal wattage	Circuit	Cathode	Cap
15 W	Internal starter	Preheated	GX32d-1

Dimensions (mm)		
A	B	C
Max.	Max.	Max.
41	41	117

Cap: see sheet 7004-87 of IEC 60061-1.

Starting characteristics			
Frequency Hz	Ballast rated voltage V	Test voltage (r.m.s.) V	Starting time s
50	–	–	–
60	118	108	10

Electrical characteristics						
Frequency Hz	Rated wattage W	Voltage (r.m.s.) at lamp terminals V			Rated lamp current A	Rated preheat current A
		Rated	Minimum	Maximum		
50	–	–	–	–	–	–
60	15	53	*	*	0,325	*

Test position: vertical, cap-up.

* Under consideration

60901-IEC-0715-1