

Specification for

Tubular fluorescent lamps for general lighting service

The European Standard EN 60081:1989, with the incorporation of its
Amendment A3:1993 has the status of a British Standard

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This British Standard, having been prepared under the direction of the Electrical Illuminations Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 March 1994

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National foreword

This British Standard has been prepared under the direction of the Consumer and Process Products Standards Committee and is the English language version of EN 60081:1989 and its Amendment A5 *Tubular fluorescent lamps for general lighting service* published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 81:1984 plus Amendment 1 (1987), Amendment 2 (1988), Amendment 3 (1992), Amendment 4 (1993) and Amendment 5 (1994) published by the International Electrotechnical Commission (IEC).

This standard supersedes BS 1853-1:1990 which is withdrawn. Some sections of BS 1853-2:1979 are also superseded by this standard and will be withdrawn; the sections not affected will be published as a new edition of BS 1853.

The foreword of the EN makes reference to “date of withdrawal (dow) of conflicting national standards” as “1996-02-15”. In this case the relevant national standard is BS EN 60081 but the date of withdrawal relates only to those parts of the British Standard subject to Amendment A5. Certificates and marks will not be awarded after this date with respect to the British Standard not incorporating Amendment A5. They will be awarded only to the amended British Standard. However, such certificates and marks already awarded with respect to the British Standard not incorporating Amendment A5 may continue to apply for production until 2001-02-15.

The following print types are used in this standard:

requirements: in roman type

test specifications: in italic type

explanatory matter: in smaller roman type

National annex NA gives the constitution of the committees responsible for UK participation in the preparation of this standard.

National annex NB gives those British Standards which correspond to the International Standards quoted in this publication.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 202, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Tubular fluorescent lamps for general lighting service

(IEC 81:1984 edition 4/A1:1987/A2:1988/A3:1992)

(includes amendments A3:1993 + A4:1994 + A5:1995)

Lampes tubulaires à fluorescence pour
l'éclairage général

(CEI 81:1984 edition 4/A1:1987/A2:
1988/A3:1992)

(inclut les amendements A4:1994 + A5:1995)

Röhrenförmige Leuchtstofflampen für
allgemeine Beleuchtungszwecke

(IEC 81:1984 edition 4/A1:1987/A2:
1988/A3:1992)

(enthält Änderungen A4:1994 + A5:1995)

This European Standard was approved by CENELEC on 1 November 1989. CENELEC members are bound to comply with the CEN/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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, 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 CENELEC questionnaire procedure, performed for finding out whether or not IEC 81 (4th edition: 1984) + Amendment 1 (1987) and Amendment 2 (1988) could be accepted without textual changes, has shown that no common modifications were necessary for the acceptance as European Standard (EN). The Reference Document was submitted to the CENELEC members for formal vote and acceptance by CENELEC.

The text of the International Standard IEC 81 (4th edition: 1984) + Amendment 1 (1987) and Amendment 2 (1988), was approved by CENELEC on 1 November 1989 as a European Standard (confirmed by 62 BT).

Annex designated “normative” are part of the body of the standard. In this standard, Annex ZA is normative.

The following dates are applicable:

- latest date of announcement of the EN at national level (doa): 1990-06-01
- date of latest publication of a new harmonized standard (dop): 1990-12-01
- date of withdrawal of conflicting national standards (dow): 1990-12-01

Foreword of EN 60081:1989/A3:1993

The CENELEC questionnaire procedure, performed for finding out whether or not the Amendment 3:1992 to the International Standard IEC 81:1984 could be accepted without textual changes, has shown that no common modifications were necessary for acceptance as a European Standard.

The reference document was submitted to the CENELEC members for formal vote and was approved by CENELEC as Amendment A3 to EN 60081 on 22 September 1993.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1994-10-01
- latest date of withdrawal of conflicting national standards (dow) 1994-10-01

For products which have complied with EN 60081:1989 before 1994-10-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1999-10-01.

Annexes designated “normative” are part of the body of the standard. In this standard, Annex ZA is normative.

Foreword of EN 60081:1989/A4:1994

At the request of the CENELEC Reporting Secretariat SR 34A, the Amendment 4:1993 to the International Standard IEC 81:1984 was submitted to the CENELEC Unique Acceptance Procedure (UAP) in October 1993 for acceptance as a European Standard.

The text of the International Standard was approved by CENELEC as amendment A4 to EN 60081 on 5 July 1994.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1995-07-15
- latest date of withdrawal of conflicting national standards (dow) 1995-07-15

For products which have complied with EN 60081:1989 and its Amendment A3:1993 before 1995-07-15, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2000-07-15.

Foreword of EN 60081:1989/A5:1995

The text of document 34A(CO)703, future amendment 5 to IEC 81:1984, 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 A5 to EN 60081:1989 on 1995-02-15.

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) 1996-02-15
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1996-02-15

For products which have complied with EN 60081-1:1989 and its Amendments A3:1993 and A4:1994 before 1996-02-15, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2001-02-15.

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Foreword

- 1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

Preface

This standard has been prepared by Sub-Committee 34A: Lamps, of IEC Technical Committee No. 34: Lamps and related equipment.

It forms the fourth edition of IEC Publication 81 and replaces the third edition, 1974, Amendment 1, 1976 and Amendment 2, 1980.

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

Six Months' Rule	Reports on Voting
34A(CO)140	34A(CO)157
34A(CO)141	34A(CO)162
34A(CO)142	34A(CO)158
34A(CO)143	34A(CO)159
34A(CO)153	34A(CO)172
34A(CO)163	34A(CO)173
34A(CO)170	34A(CO)192
34A(CO)174	34A(CO)208
34A(CO)186	34A(CO)217
34A(CO)187	34A(CO)218
34A(CO)188	34A(CO)219
34A(CO)189	34A(CO)220
34A(CO)190	34A(CO)221
34A(CO)191	34A(CO)207
34A(CO)227	34A(CO)244
34A(CO)194	34A(CO)230
34A(CO)201	34A(CO)248

Further information can be found in the relevant Reports on Voting indicated in the above table.

The following IEC Publications are quoted in this standard:

Publications Nos.	61:	<i>Lamp caps and holders together with gauges for the control of interchangeability and safety.</i>
	155:1983:	<i>Starters for tubular fluorescent lamps.</i>
	584-1:1977:	<i>Thermocouples. Part 1: Reference tables.</i>
	921:1988:	<i>Ballasts for tubular fluorescent lamps. Performance requirements.</i>
	925:1989:	<i>D.C. supplied electronic ballasts for tubular fluorescent lamps. Performance requirements.</i>
	927:1988:	<i>Starting devices (other than glow starters). Performance requirements.</i>
	929:1990:	<i>A.C. supplied electronic ballasts for tubular fluorescent lamps. Performance requirements.</i>

Introduction

This edition introduces new co-ordinates for the standard colours as a result of improvements in the accuracy of colour measurement together with a new standard colour “white” (see Appendix D).

In the system for whole production testing, emphasis is placed on checking a manufacturer’s claim of compliance with this standard in preference to establishing precise levels of quality. As a result considerable reliance is placed on:

- a) confidence between the test authority and the manufacturer based on past testing experience;
- b) reference to the manufacturer’s own test results;
- c) the verification of the manufacturer’s test results by comparing them with the results obtained by testing a reduced market sample. There is as yet limited experience with such a verification (comparability test) in this field. Possible difficulties due to imperfections of the procedure should be solved by mutual agreement between the test authority and the manufacturer.

This “new” system provides, in practice, the same assurances for consumer safeguards as the former system. It should also enable reciprocal recognition of licensing or certification to be achieved by the testing authorities concerned.

Section 1. General

1.1 General

1.1.1 Scope

This standard covers a range of tubular fluorescent lamps for general lighting service which are operated on a.c. mains. Lamps of the following types are included:

1. Lamps, with pre-heated cathodes, for operation on a.c. mains with the use of a starter.
2. Lamps, with pre-heated cathodes, for operation on a.c. mains without the use of a starter.
3. Lamps, with pre-heated cathodes, for operation on a.c. mains with or without the use of a starter.
4. Lamps, with pre-heated cathodes, for operation on a.c. mains with the use of a starter and additionally for operation on high frequency supplies with or without the use of a starter.
5. Lamps, with pre-heated cathodes, for operation on high frequency supplies, with or without the use of a starter.
6. Lamps, with non pre-heated cathodes, for operation on a.c. mains without the use of a starter.
7. Lamps, with non pre-heated cathodes, for operation on high frequency supplies without the use of a starter.

NOTE A manufacturer can nominate any type of lamp to be in compliance with any one or more of the above groupings. If a lamp is nominated for 50 Hz/60 Hz and high frequency operation, the frequency to be used in the assessment of the lamp shall be declared by the manufacturer.

The additional requirements for vapour-pressure controlled (amalgam) lamps are given in Appendix J.

For pre-heat low-voltage cathode lamps operated without a starter, provision is included for two alternative methods of measurement of electrical and luminous characteristics:

- 1) Measurement of lamp electrical and luminous characteristics *without* additional cathode heating.
- 2) Measurement of lamp electrical and luminous characteristics *with* additional cathode heating.

Differences in characteristics specified are dependent only on the method of testing which shall be stated by the manufacturer.

Section 2 consists of a series of lamp data sheets, each giving the characteristics of a specific lamp type. In the case of general service lamps, complete characteristics are given together with reference to Sections 3, 4, 5 and 6.

In the case of some new lamps, or lamps not yet in general demand, only limited characteristics are given and limited reference to testing requirements is made.

Sections 3, 4 and 5 cover the technical requirements with which lamps shall comply and the testing methods to be used for checking quality and interchangeability for individual lamp batches or for the whole production of a manufacturer, in an endeavour to maintain the community of interest of user and manufacturer.

Section 6 covers the compliance requirements.

NOTE It may be expected that lamps which comply with this standard, when operated with a starter complying with IEC Publication 155: Starters for Tubular Fluorescent Lamps, and with ballasts complying with IEC Publication 921: Ballasts for Tubular Fluorescent Lamps, will start satisfactorily at 90 % of rated voltage and at temperatures between 10 °C and 35 °C and will operate satisfactorily at voltages between 90 % and 110 % of rated voltage and at an ambient air temperature of between 10 °C and 50 °C.

1.1.2 Object

Whole production testing is recommended as the preferred system of assessing the quality of a manufacturer's production.

Batch testing should preferably be used only in those cases where whole production testing is not possible.

1.2 Definitions

1.2.1

tubular fluorescent lamp

a low-pressure mercury-discharge lamp of tubular form either straight or U-shaped or curved in which most of the light is emitted by a layer of fluorescent material excited by the ultra-violet radiation from the discharge

NOTE 1 This standard takes into consideration three methods of starting:

- a) Cathodes pre-heated with the use of a starter;
- b) Cathodes pre-heated without the use of a starter
- c) Non pre-heated cathodes without the use of a starter.

Some lamps are suitable for both methods of operation a) and b) given above. In normal operation the cathodes are continuously heated, in the case of lamps of type a) and c) by the arc current only, and in the case of lamps of type b), supplementary heating by a current supplied by the ballast may be added.

NOTE 2 Definitions for types of cathodes in relation to their resistance are under consideration.

1.2.2

lumen maintenance

the ratio of the luminous flux of an individual lamp after 2 000 h of operation or 70 % of its rated life, as appropriate, to that found in the rating test

1.2.3

life

the number of hours the lamp operates to "burn-out" or to any other criterion of life performance laid down in this specification

1.2.4

colour

the colour characteristics of a lamp are defined by the colour appearance and the colour rendering

- a) The actual colour of the lamp is called colour appearance and is defined in terms of the spectral tristimulus values according to the recommendations of the International Commission on Illumination (CIE).
- b) The effect which the spectral characteristics of the light emitted by the lamp have on the appearance of the objects illuminated by it is called colour rendering.

1.2.5

rated colour

the colour defined by the markings on the lamp

NOTE The characteristics of the standard colours are given in Appendix D. Other colours, such as declared by the manufacturer, are called special colours.

1.2.6

rated wattage

the wattage marked on the lamp or, alternatively, declared by the supplier. It is expressed in watts

1.2.7

rated luminous flux

the luminous flux marked on the lamp or declared as such by the supplier. It is expressed in lumens

1.2.8**rated life**

the declared life

1.2.9**group**

denotes lamps as represented by a single data sheet of Section 2, having the same rated electrical and cathode characteristics, the same physical dimensions and the same starting method

1.2.10**type**

denotes lamps of the same group having the same photometric ratings and colour characteristics

1.2.11**batch**

denotes all the lamps of one type put forward at one time for acceptance tests

1.2.12**whole production**

the production during a period of twelve months of all types of lamps within the scope of this standard and nominated in a list of the manufacturer for inclusion in the certificate

1.2.13**test quantities**

- a) Inspection test quantity (I.T.Q.) is the number of lamps selected for testing the mechanical, physical and starting characteristics.
- b) Rating test quantity (R.T.Q.) is the number of lamps selected for testing the initial readings and colour.
- c) Lumen maintenance test quantity (M.T.Q.) is the number of lamps selected for testing the lumen maintenance performance.

1.2.14**initial readings**

the measurements of the luminous and electrical characteristics, excluding the checking of starting voltages, made at the end of the 100-hour ageing period

1.2.15**comparability test**

a test to check the consistency between the market sample and the manufacturer's own test data

1.2.16**market sample**

a specified number of lamps selected by the test authority for the comparability test

1.2.17**short-circuit power**

the Short-circuit power of a cathode heating transformer defined by the formula:

$$\frac{(\text{required voltage at cathode terminals})^2}{\text{internal impedance of the source}}$$

1.3 General principles of layout of data sheets

Numbering system for lamp data sheets:

The first number represents the number of this publication "81" followed by the letters "IEC".

The second number represents the lamp 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.

1.3.1 Diagrammatic data sheet

81-IEC-0001-3 Diagrammatic data sheet for location of tubular fluorescent lamp dimensions — Linear lamps.

This sheet follows at the end of Section 1.

1.3.2 Grouping of lamp data sheets

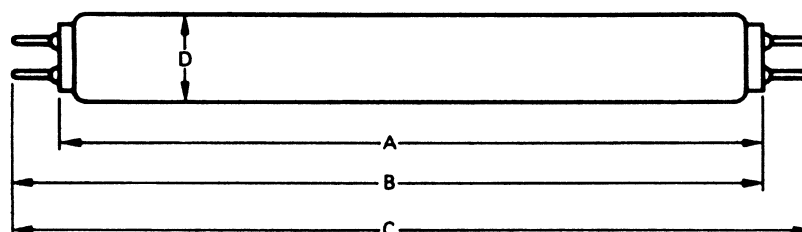
Sheet numbers	Method of starting on a.c. mains	Method of starting on high frequency supplies	Cathode	
			Type	Resistance
81-IEC-1000-1999	Starter	Starterless	pre-heated	—
81-IEC-2000-2999	Starter	Starterless	pre-heated	—
81-IEC-4000-4999	Starterless	—	pre-heated	High
81-IEC-5000-5999	Starterless	Starterless	pre-heated	Low
81-IEC-6000-6999	Starter and starterless	—	pre-heated	High
81-IEC-7000-7999	—	Starterless	pre-heated	—
81-IEC-8000-8999	Starterless	—	Non pre-heated	—
81-IEC-9000-9999	—	Starterless	Non pre-heated	—

**DIAGRAMMATIC DATA SHEET FOR LOCATION OF
TUBULAR FLUORESCENT LAMP DIMENSIONS**
Linear lamps

Page 1

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

G5, G13, G20 Caps*



For lamps with G5 and G13 Caps

The values for dimensions A, B and C are derived from a basic value, designated X.

A = base face to base face

A max. = X

B = base face to end of opposite pins

B max. = X + 7.1 mm

B min. = X + 4.7 mm (in some countries, B min. = X + 4.6 mm)

C = overall length of the lamp between pin ends

C max. = X + (2 × 7.1) = X + 14.2 mm

C min. = not specified

The dimensions given on the lamp data sheets comply with the above system.

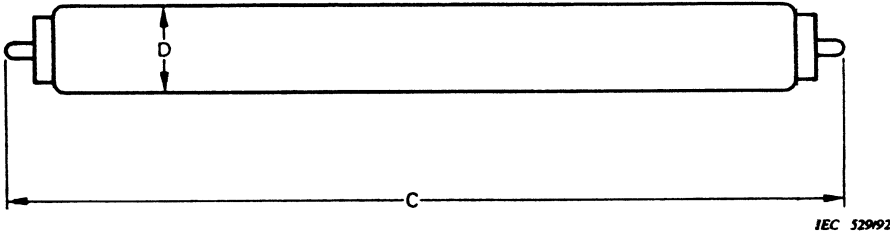
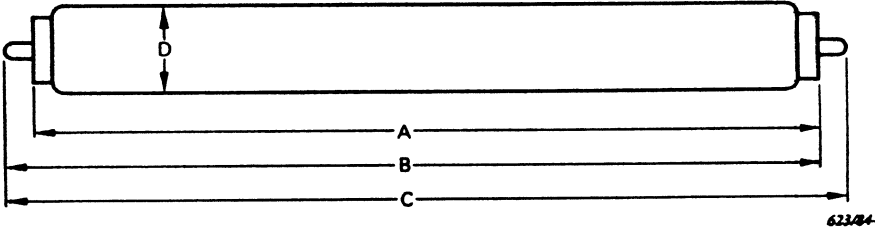
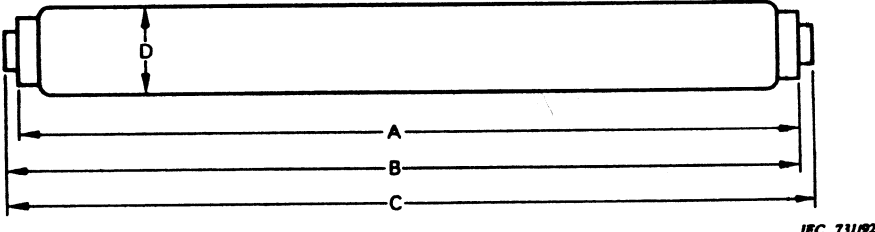
NOTE 1 When converting the thus calculated values to inches it is obvious that the consistency between the rounded off converted values is lost.

NOTE 2 In some instances the dimensions in national specification differ slightly from those in the data sheets. Because these specifications are well established, it is not intended that they should be changed. The dimensions in the data sheets are quoted as a desirable objective.

NOTE 3 Original USA types are sometimes designated by the nominal overall length in inches of the lamp assembled in two lampholders, each $\frac{9}{16}$ inch thick for G5 caps and $\frac{3}{8}$ inch thick for G13 caps.

* See IEC Publication 61: Lamp Caps and Holders Together with Gauges for the Control of Interchangeability and Safety.

81-IEC-0001-2

	DIAGRAMMATIC DATA SHEET FOR LOCATION OF TUBULAR FLUORESCENT LAMP DIMENSIONS Linear lamps	Page 2
These drawings are intended only to indicate dimensions to be controlled and are to be used in conjunction with the relevant lamp standard sheets. Fa 6 cap *  IEC 529/92 Fa 8 cap *  623/84 R 17 d cap *  IEC 731/92 * See IEC Publication 61: Lamp caps and holders together with gauges for the control of interchangeability and safety.		
81-IEC-0001-3		Publication CEI 81 IEC Publication 81

Section 2. Lamp data sheets

2.1 List of specific lamp types included in this publication

Sheet No.	Lamp rating		Cap	Method of starting		Cathode type
	A.C. mains	High frequency		A.C. mains	High frequency	
81-IEC-1021	4 W	d	G5	Starter	d	Pre-heated
81-IEC-1031	6 W	d	G5	Starter	d	Pre-heated
81-IEC-1041	8 W	d	G5	Starter	d	Pre-heated
81-IEC-1051	13 W	d	G5	Starter	d	Pre-heated
81-IEC-1104	15 W	—	G13	Starter	—	Pre-heated
81-IEC-1105	18 W	16 W	G13	Starter	Starterless	Pre-heated
81-IEC-1110	20 W	—	G13	Starter	—	Pre-heated
81-IEC-1115	20 W	—	G13	Starter	—	Pre-heated
81-IEC-1150	25 W	—	G13	Starter	—	Pre-heated
81-IEC-1210	30 W (T8)	—	G13	Starter	—	Pre-heated
81-IEC-1220	30 W (T12)	—	G13	Starter	—	Pre-heated
81-IEC-1305	36 W	32 W	G13	Starter	Starterless	Pre-heated
81-IEC-1307	38 W	32 W	G13	Starter	Starterless	Pre-heated
81-IEC-1310	40 W	—	G13	Starter	—	Pre-heated
81-IEC-1315	40 W	—	G13	Starter	—	Pre-heated
81-IEC-1545	58 W	50 W	G13	Starter	Starterless	Pre-heated
81-IEC-1550	65 W	—	G13	Starter	—	Pre-heated
81-IEC-1555	65 W	—	G13	Starter	—	Pre-heated
81-IEC-1610	70 W	60 W	G13	Starter	Starterless	Pre-heated
81-IEC 1650	75 W	—	G13	Starter	—	Pre-heated
^c 81-IEC-1710	80 W	—	G13	Starter	—	Pre-heated
^c 81-IEC-1780	85 W	—	G13	Starter	—	Pre-heated
81-IEC-1910	100 W	—	G13	Starter	—	Pre-heated
^c 81-IEC-1930	125 W	—	G13	Starter	—	Pre-heated
81-IEC-2810	90 W	—	G20	Starter	—	Pre-heated
81-IEC-4020	4 W	—	G5	Starterless	—	Pre-heated High resistance
81-IEC-4030	6 W	—	G5	Starterless	—	Pre-heated High resistance
81-IEC-4040	8 W	—	G5	Starterless	—	Pre-heated High resistance
81-IEC-4110	20 W	—	G13	Starterless	—	Pre-heated High resistance
81-IEC-4210	30 W (T8)	—	G13	Starterless	—	Pre-heated High resistance
81-IEC-4220	30 W (T12)	—	G13	Starterless	—	Pre-heated High resistance
81-IEC-4310	40 W	—	G13	Starterless	—	Pre-heated High resistance
81-IEC-4550	65 W	—	G13	Starterless	—	Pre-heated High resistance
81-IEC-4650	75 W	—	G13	Starterless	—	Pre-heated High resistance
^c 81-IEC-4710	80 W	—	G13	Starterless	—	Pre-heated High resistance
^c 81-IEC-4780	85 W	—	G13	Starterless	—	Pre-heated High resistance
81-IEC-4930	125 W	—	G13	Starterless	—	Pre-heated High resistance
81-IEC-5110	20 W	—	G13	Starterless	—	Pre-heated Low resistance
81-IEC-5115	20 W	—	G13	Starterless	—	Pre-heated Low resistance
81-IEC-5210	30 W (T8)	—	G13	Starterless	—	Pre-heated Low resistance
81-IEC-5220	30 W (T12)	—	G13	Starterless	—	Pre-heated Low resistance

^a Subject to type testing only.

^b Low starting voltage lamps (L.S.V.) with internal conducting layer.

^c Mainly intended for replacement purposes.

^d See page 3 of lamp data sheet.

Sheet No.	Lamp rating		Cap	Method of starting		Cathode type
	A.C. mains	High frequency		A.C. mains	High frequency	
81-IEC-5310	40 W	35,5 W	G13	Starterless	Starterless	Pre-heated Low resistance
^a 81-IEC-5311	40 W	—	G13	—	—	Pre-heated
81-IEC-5315	40 W	—	G13	Starterless	—	Pre-heated Low resistance
^{ab} 81-IEC-5330	40 W	—	G13	Starterless	—	Pre-heated Low resistance
^a 81-IEC-5520	60 W	—	R17d	Starterless	—	Pre-heated Low resistance
81-IEC-5550	65 W	—	G13	Starterless	—	Pre-heated Low resistance
^a 81-IEC-5760	85 W	—	G13	Starterless	—	Pre-heated Low resistance
^a 81-IEC-5770	87 W	—	R17d	Starterless	—	Pre-heated Low resistance
^a 81-IEC-5920	112 W	—	R17d	Starterless	—	Pre-heated Low resistance
81-IEC-7010	—	16 W	G13	—	Starterless	Pre-heated
81-IEC-7210	—	32 W	G13	—	Starterless	Pre-heated
81-IEC-7510	—	50 W	G13	—	Starterless	Pre-heated
^a 81-IEC-8110	20 W		Fa6	Starterless	—	Non pre-heated
^a 81-IEC-8290	39 W		Fa8	Starterless	—	Non pre-heated
^a 81-IEC-8310	40 W		Fa6	Starterless	—	Non pre-heated
^a 81-IEC-8470	57 W		Fa8	Starterless	—	Non pre-heated
^a 81-IEC-8510	65 W		Fa6	Starterless	—	Non pre-heated
^a 81-IEC-8650	75 W		Fa8	Starterless	—	Non pre-heated
81-IEC-9210	—	32 W	G13	—	Starterless	Non pre-heated
81-IEC-9220	—	34 W	G13	—	Starterless	Non pre-heated
81-IEC-9510	—	50 W	G13	—	Starterless	Non pre-heated
^a Subject to type testing only.						
^b Low starting voltage lamps (L.S.V.) with internal conducting layer.						

TUBULAR FLUORESCENT LAMP DATA SHEET

Page 1

Rating	Circuit	Cap	Nominal dimensions
4 W	With starter	G5	150 mm × 15 mm

Mechanical, physical and starting requirements

For lamp marking, tubes, dimensions, caps and starting requirements, Clauses 4.1 to 4.5 of this publication apply.
For conditions of compliance, Clause 6.4 applies.

Lamp dimensions (mm) — See sheet 81-IEC-0001-				
A	B		C	D
Max.	Max.	Min.	Max.	Max.
135,9	143,0	140,6	150,1	16

Lamp starting test				
Circuit	Starting test level		Electrical characteristics of ballast	
	Voltage (V)	Clause	Wattage (W)	Voltage (V)
With starter	103,5	4.5 a)	4 – 6 – 8	110/120

Initial readings and colour

For lamp voltage, wattage and luminous characteristics, Clauses 5.3 and 5.4 of this publication apply. For conditions of compliance, Clause 6.5 applies.

Lamp electrical characteristics							
Frequency (Hz)	Rated wattage (W)	Objective wattage (W)	Voltage (r.m.s.) at lamp terminals (V)			Nominal current (A)	
			Objective	Max.	Min.	Running	Pre-heat
50	4	4,5	29	34	24	0,170	0,205
60	4	4,5	29	34	24	0,170	0,205

Luminous and colour characteristics		
Colour	Minimum rated luminous flux, in lumens	Chromaticity coordinates
Daylight	100	See Appendix D
Cool white	120	
White	*	
Warm white	120	

* Under consideration

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Page 2

Lumen maintenance

For the lumen maintenance test, Clause 5.6 of this publication applies. For conditions of compliance, Clause 6.6 applies.

Minimum lumen maintenance (%)	
at 2 000 h	at 70 % of rated life
70	65

Ballast

The requirements of IEC Publication 921 apply.

Reference ballast characteristics					
Frequency (Hz)	Rated wattage (W)	Rated voltage (V)	Calibration current (A)	Voltage/current ratio (Ω)	Power factor
50	6	127	0,160	700	0,12
60	6	118	0,160	650	0,075

Information for ballast design

With starter			
Open-circuit voltage (V)		Pre-heating current (A)	
Min. (rms) at starter	Max. (peak) at lamp	Min.	Max.
103,5	400	0,144	0,275
Max. (rms) voltage across starter terminals with lamp operating (V)		Equivalent resistance of both cathodes in series (Ω)	
68		140	

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TUBULAR FLUORESCENT LAMP DATA SHEET

Page 3

Information for ballast design

The requirements of IEC Publication 925 apply.

High-frequency operation					
Open-circuit voltage at lamp terminals (V)		Voltage to starting aid (V)		Pre-heat cathode voltage (V)	
Min. (r.m.s.)	Max. (peak)*	Min. (peak)		Min.	Max.
100	550 700	290		6,5	11,0
Maximum current in any lead to cathode (A)			Objective dummy load resistance of each cathode (Ω)		
0,290			70		

* The left value applies to symmetric inverters.
The right value applies to asymmetric inverters.

Starter

The requirements of IEC Publication 155 apply.

Information for starter design	
Non-reclosure voltage (V)	Minimum pulse voltage (V)
70	250

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Page 1

Rating	Circuit	Cap	Nominal dimensions
6 W	With starter	G5	225 mm × 15 mm

Mechanical, physical and starting requirements

For lamp marking, tubes, dimensions, caps and starting requirements, Clauses 4.1 to 4.5 of this publication apply. For conditions of compliance, Clause 6.4 applies.

Lamp dimensions (mm) — See sheet 81-IEC-0001-				
A	B		C	D
Max.	Max.	Min.	Max.	Max.
212,1	219,2	216,8	226,3	16

Lamp starting test				
Circuit	Starting test level		Electrical characteristics of ballast	
	Voltage (V)	Clause	Wattage (W)	Voltage (V)
With starter	103,5	4.5 a)	4 – 6 – 8	110/120

Initial readings and colour

For lamp voltage, wattage and luminous characteristics, Clauses 5.3 and 5.4 of this publication apply. For conditions of compliance, Clause 6.5 applies.

Lamp electrical characteristics							
Frequency (Hz)	Rated wattage (W)	Objective wattage (W)	Voltage (r.m.s) at lamp terminals (V)			Nominal current (A)	
			Objective	Max.	Min.	Running	Pre-heat
50	6	6	42	48	36	0,160	0,205
60	6	6	42	48	36	0,160	0,205

Luminous and colour characteristics		
Colour	Minimum rated luminous flux, in lumens	Chromaticity coordinates
Daylight	190	See Appendix D
Cool white	240	
White	*	
Warm white	240	

* Under consideration

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TUBULAR FLUORESCENT LAMP DATA SHEET

Page 2

Lumen maintenance

For the lumen maintenance test, Clause 5.6 of this publication applies. For conditions of compliance, Clause 6.6 applies.

Minimum lumen maintenance (%)	
at 2 000 h	at 70 % of rated life
70	65

Ballast

The requirements of IEC Publication 921 apply.

Reference ballast characteristics					
Frequency (Hz)	Rated wattage (W)	Rated voltage (V)	Calibration current (A)	Voltage/current ratio (Ω)	Power factor
50	6	127	0,160	700	0,12
60	6	118	0,160	650	0,075

Information for ballast design

With starter			
Open-circuit voltage (V)		Pre-heating current (A)	
Min. (rms) at starter	Max. (peak) at lamp	Min.	Max.
103,5	400	0,144	0,275
Max. (rms) voltage across starter terminals with lamp operating (V)		Equivalent resistance of both cathodes in series (Ω)	
68		140	

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Page 3

Information for ballast design

The requirements of IEC Publication 925 apply.

High-frequency operation					
Open-circuit voltage at lamp terminals (V)			Voltage to starting aid (V)	Pre-heat cathode voltage (V)	
Min. (r.m.s.)	Max. (peak)*		Min. (peak)	Min.	Max.
100	550	700	290	6,5	11,0
Maximum current in any lead to cathode (A)			Objective dummy load resistance of each cathode (Ω)		
0,28			70		

* The left value applies to symmetric inverters.
The right value applies to asymmetric inverters.

Starter

The requirements of IEC Publication 155 apply.

Information for starter design	
Non-reclosure voltage (V)	Minimum pulse voltage (V)
70	250

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Page 1

Rating	Circuit	Cap	Nominal dimensions
8 W	With starter	G5	300 mm × 15 mm

Mechanical, physical and starting requirements

For lamp marking, tubes, dimensions, caps and starting requirements, Clauses 4.1 to 4.5 of this publication apply.
For conditions of compliance, Clause 6.4 applies.

Lamp dimensions (mm) — See sheet 81-IEC-0001-				
A	B		C	D
Max.	Max.	Min.	Max.	Max.
288,3	295,4	293,0	302,5	16

Lamp starting test				
Circuit	Starting test level		Electrical characteristics of ballast	
	Voltage (V)	Clause	Wattage (W)	Voltage (V)
With starter	103,5	4.5 a)	4 – 6 – 8	110/120

Initial reading and colour

For lamp voltage, wattage and luminous characteristics, Clauses 5.3 and 5.4 of this publication apply. For conditions of compliance, Clause 6.5 applies.

Lamp electrical characteristics							
Frequency (Hz)	Rated wattage (W)	Objective wattage (W)	Voltage (r.m.s.) at lamp terminals (V)			Nominal current (A)	
			Objective	Max.	Min.	Running	Pre-heat
50	8	7,1	56	64	48	0,145	0,205
60	8	7,2	57	64	48	0,145	0,205

Luminous and colour characteristics		
Colour	Minimum rated luminous flux, in lumens	Chromaticity coordinates
Daylight	280	See Appendix D
Cool white	350	
White	*	
Warm white	350	

* Under consideration

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TUBULAR FLUORESCENT LAMP DATA SHEET

Page 2

Lumen maintenance

For the lumen maintenance test, Clause 5.6 of this publication applies. For conditions of compliance, Clause 6.6 applies.

Minimum lumen maintenance (%)	
at 2 000 h	at 70 % of rated life
70	65

Ballast

The requirements of IEC Publication 921 apply.

Reference ballast characteristics					
Frequency (Hz)	Rated wattage (W)	Rated voltage (V)	Calibration current (A)	Voltage/current ratio (Ω)	Power factor
50	6	127	0,160	700	0,12
60	6	118	0,160	650	0,075

Information for ballast design

With starter			
Open-circuit voltage (V)		Pre-heating current (A)	
Min. (rms) at starter	Max. (peak) at lamp	Min.	Max.
103,5	400	0,144	0,275
Max. (rms) voltage across starter terminals with lamp operating (V)		Equivalent resistance of both cathodes in series (Ω)	
68		140	

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Page 3

Information for ballast design

The requirements of IEC Publication 925 apply.

High-frequency operation					
Open-circuit voltage at lamp terminals (V)			Voltage to starting aid (V)	Pre-heat cathode voltage (V)	
Min. (r.m.s.)	Max. (peak)*		Min. (peak)	Min.	Max.
100	550	700	290	6,5	11,0
Maximum current in any lead to cathode (A)			Objective dummy load resistance of each cathode (Ω)		
0,28			70		

* The left value applies to symmetric inverters.
The right value applies to asymmetric inverters.

Starter

The requirements of IEC Publication 155 apply.

Information for starter design	
Non-reclosure voltage (V)	Minimum pulse voltage (V)
70	250

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IEC Publication 81

TUBULAR FLUORESCENT LAMP DATA SHEET

Page 1

Rating	Circuit	Cap	Nominal dimensions
13 W	With starter	G5	525 mm × 15 mm

Mechanical, physical and starting requirements

For lamp marking, tubes, dimensions, caps and starting requirements, Clauses 4.1 to 4.5 of this publication apply.
For conditions of compliance, Clause 6.4 applies.

Lamp dimensions (mm) — See sheet 81-IEC-0001-				
A	B		C	D
Max.	Max.	Min.	Max.	Max.
516,9	524,0	521,6	531,1	16

Lamp starting test				
Circuit	Starting test level		Electrical characteristics of ballast	
	Voltage (V)	Clause	Wattage (W)	Voltage (V)
With starter	198	4.5 a)	13	220

Initial readings and colour

For lamp voltage, wattage and luminous characteristics, Clauses 5.3 and 5.4 of this publication apply. For conditions of compliance, Clause 6.5 applies.

Lamp electrical characteristics							
Frequency (Hz)	Rated wattage (W)	Objective wattage (W)	Voltage (r.m.s.) at lamp terminals (V)			Nominal current (A)	
			Objective	Max.	Min.	Running	Pre-heat
50	13	13	95	105	85	0,165	0,225
60	13	13	94	—	—	0,165	0,225

Luminous and colour characteristics		
Colour	Minimum rated luminous flux, in lumens	Chromaticity coordinates
Daylight	620	See Appendix D
Cool white	770	
White	*	
Warm white	770	

* Under consideration

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TUBULAR FLUORESCENT LAMP DATA SHEET

Page 2

Lumen maintenance

For the lumen maintenance test, Clause 5.6 of this publication applies. For conditions of compliance, Clause 6.6 applies.

Minimum lumen maintenance (%)	
at 2 000 h	at 70 % of rated life
70	65

Ballast

The requirements of IEC Publication 921 apply.

Reference ballast characteristics					
Frequency (Hz)	Rated 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	236	0,165	1 200	0,075

Information for ballast design

With starter			
Open-circuit voltage (V)		Pre-heating current (A)	
Min. (r.m.s) at starter	Max. (peak) at lamp	Min.	Max.
198	400	0,146	0,279
Max. (rms) voltage across starter terminals with lamp operating (V)		Equivalent resistance of both cathodes in series (Ω)	
128		140	

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81-IEC-1051-2

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IEC Publication 81

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Page 3

Information for ballast design

The requirements of IEC Publication 925 apply.

High-frequency operation					
Open-circuit voltage at lamp terminals (V)			Voltage to starting aid (V)	Pre-heat cathode voltage (V)	
Min. (r.m.s.)	Max. (peak)*		Min. (peak)	Min.	Max.
100	550	700	290	6,5	11,0
Maximum current in any lead to cathode (A)			Objective dummy load resistance of each cathode (Ω)		
0,290			70		

* The left value applies to symmetric inverters.
The right value applies to asymmetric inverters.

Starter

The requirements of IEC Publication 155 apply.

Information for starter design	
Non-reclosure voltage (V)	Minimum pulse voltage (V)
140	400

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TUBULAR FLUORESCENT LAMP DATA SHEET

Page 1

Rating	Circuit	Cap	Nominal dimensions
15 W	With starter	G13	450 mm × 25 mm

Mechanical, physical and starting requirements

For lamp marking, tubes, dimensions, caps and starting requirements, Clause 4.1 to 4.5 of this publication supply. For conditions of compliance, Clause 6.4 applies.

Lamp dimensions (mm) — See Sheet 81-IEC-0001-				
A	B		C	D
Max.	Max.	Min.	Max.	Max.
437.4	444.5	442.1*	451.6	28.0

* 442.0 in North America.

Lamp starting test ¹⁾	
Test voltage (V)	Ballast voltage rating (V)
103.5	110/120

Initial readings and colour

For lamp voltage, wattage and luminous characteristics, Clauses 5.3 and 5.4 of this publication apply. For conditions of compliance, Clause 6.5 applies.

Lamp electrical characteristics ¹⁾							
Frequency (Hz)	Rated wattage (W)	Objective wattage (W)	Voltage (r.m.s.) at lamp terminals (V)			Nominal current (A)	
			Objective	Max.	Min.	Running	Pre-heat
50	15	15	55	64	43	0.31	0.44
60	15	15	55	64	46	0.305	0.55

Luminous and colour characteristics		
Colour	Minimum rated luminous flux, in lumens	Chromaticity co-ordinates
Daylight	700	} See Appendix D
Cool white	820	
White	*	
Warm white	850	

* Under consideration.

¹⁾ Different values may apply in some countries.

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TUBULAR FLUORESCENT LAMP DATA SHEET

Page 2

Lumen maintenance

For lumen maintenance test, Clause 5.6 of this publication applies. For conditions of compliance, Clause 6.6 applies.

Minimum lumen maintenance (%)	
at 2 000 h	at 70 % of rated life
80	70

Ballast

The requirements of IEC Publication 82 apply.

Reference ballast characteristics ¹⁾					
Frequency (Hz)	Rated wattage (W)	Rated voltage (V)	Calibration current (A)	Voltage/current ratio (Ω)	Power factor
50	15	127	0.31	325	0.12
60	15	118	0.30	305	0.075

Information for ballast design			
Open circuit voltage (V)		Pre-heating current (A)	
Min. (r.m.s.) at starter	Max. (peak) at lamp	Min.	Max.
103.5	400	0.28	0.65
Max. (r.m.s.) voltage across starter terminals with lamp operating (V)		Equivalent resistance of both cathodes in series (Ω)	
68		50	

Starter

The requirements of IEC Publication 155 apply.

Information for starter design	
Non-reclosure voltage (V)	Minimum pulse voltage (A)
70	250

¹⁾ In some countries, a 50 Hz or 60 Hz reference ballast with different characteristics is used.

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TUBULAR FLUORESCENT LAMP DATA SHEET

Page 3

Information for electronic circuit design

Circuit A — Starterless pre-heated cathode ballasts for high frequency operation (IEC Publication 929 — See Appendix A and Appendix D).

Circuit B — Electronic starters with electronic switching element (IEC Publication 927).

Typical lamp operating characteristics at high frequency — Circuit A only

Frequency of operation (kHz)	Lamp wattage (W)	Lamp voltage (V)	Lamp current (A)
≥ 20	13,5	45	0,31
Maximum current in any lead to a cathode (A)		*	

Prestarting conditions — Current controlled pre-heating — Circuits A and B

Cathode pre-heating conditions			
Minimum		Maximum	
Emission time $t_e = a (i_k^2 - i_m^2)^{-1}$ (s)		Time (s)	Current (A)
Cathode constant a	0,13	$t \leq 0,4$	1,4
Absolute min. current i_m (A)	0,26	$0,4 < t < 2,0$	$1,58 - 0,45 t$
Min. heating current to t_e (A)		$t \geq 2,0$	0,68
$i_k = (a/t_e + i_m^2)^{0,5}$			
Substitution resistor (Ω)		12,5	

Open-circuit voltages					
Time	Starting aid	With		Without	
	Circuit type	A	B	A	B
$t \leq t_e$	Voltage across lamp (V)	*	*	*	*
	Voltage to starting aid (V_{pk})	*	*		*
$t > t_e$	Voltage across lamp (V)	*	*	*	
	Voltage to starting aid (V_{pk})	*	*		*

* Under consideration

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TUBULAR FLUORESCENT LAMP DATA SHEET

Page 1

Rating	Circuit	Cap	Nominal dimensions
18 W	With starter	G13	600 mm × 15 mm

Mechanical, physical and starting requirements

For lamp marking, tubes, dimensions, caps and starting requirements, Clause 4.1 to 4.5 of this publication supply. For conditions of compliance, Clause 6.4 applies.

Lamp dimensions (mm) — See Sheet 81-IEC-0001-				
A	B		C	D
Max.	Max.	Min.	Max.	Max.
589,8	596,9	594,5	604,0	28

Lamp starting test	
Test voltage (V)	Ballast voltage rating (V)
103,5	110

Initial readings and colour

For lamp voltage, wattage and luminous characteristics, Clauses 5.3 and 5.4 of this publication apply. For conditions of compliance, Clause 6.5 applies.

Lamp electrical characteristics							
Frequency (Hz)	Rated wattage (W)	Objective wattage (W)	Voltage (r.m.s.) at lamp terminals (V)			Nominal current (A)	
			Objective	Max.	Min.	Running	Pre-heat
50	18	18	57	64	50	0,37	0,55

Luminous and colour characteristics		
Colour	Minimum rated luminous flux, in lumens	Chromaticity coordinates
Daylight	800	See Appendix D
Cool white	1 020	
White	*	
Warm white	1 060	

* Under consideration.

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IEC Publication 81

TUBULAR FLUORESCENT LAMP DATA SHEET

Page 2

Lumen maintenance

For lumen maintenance test, Clause 5.6 of this publication applies. For conditions of compliance, Clause 6.6 applies.

Minimum lumen maintenance (%)	
at 2 000 h	at 70 % of rated life
80	70

Ballast

The requirements of IEC Publication 82 apply.

Reference ballast characteristics					
Frequency (Hz)	Rated wattage (W)	Rated voltage (V)	Calibration current (A)	Voltage/current ratio (Ω)	Power factor
50	20	127	0.37	270	0.12

Information for ballast design			
Open circuit voltage (V)		Pre-heating current (A)	
Min. (r.m.s.) at starter	Max. (peak) at lamp	Min.	Max.
103.5	400	0.333	0.800
Max. (r.m.s.) voltage across starter terminals with lamp operating (V)		Equivalent resistance of both cathodes in series (Ω)	
68		50	

Starter

The requirements of IEC Publication 155 apply.

Information for starter design	
Non-reclosure voltage (V)	Min. pulse voltage (V)
70	800

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TUBULAR FLUORESCENT LAMP DATA SHEET

Page 3

Information for electronic circuit design

Circuit A — Starterless pre-heated cathode ballasts for high frequency operation (IEC Publication 929 — See Appendix A and Appendix D).

Circuit B — Electronic starters with electronic switching element (IEC Publication 927).

Typical lamp operating characteristics at high frequency — Circuit A only

Frequency of operation (kHz)	Lamp wattage (W)	Lamp voltage (V)	Lamp current (A)
≥ 20	16	55	0,290
Maximum current in any lead to a cathode (A)		0,65	

Prestarting conditions — Current controlled pre-heating — Circuits A and B

Cathode pre-heating conditions			
Minimum		Maximum	
Emission time $t_e = a (i_k^2 - i_m^2)^{-1}$ (s)		Time (s)	Current (A)
Cathode constant a	0,24	$t \leq 0,4$	1,8
Absolute min. current i_m (A)	0,315	$0,4 < t < 2,0$	$2,1 - 0,3 t$
Min. heating current to t_e (A)		$t \geq 2,0$	0,90
$i_k = (a/t_e + i_m^2)^{0,5}$			
Substitution resistor (Ω)		12,5 (under consideration)	

Open-circuit voltages					
Time	Starting aid	With		Without	
	Circuit type	A	B	A	B
$t \leq t_e$	Voltage across lamp (V)	≤ 270	•	•	•
	Voltage to starting aid (V_{pk})	•	•		
$t > t_e$	Voltage across lamp (V)	≥ 280	•	•	
	Voltage to starting aid (V_{pk})	•	•		

• Under consideration

Prestarting conditions — Voltage control pre-heating — Circuit A only

(Data under consideration.)

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Page 1

Rating	Circuit	Cap	Nominal dimensions
20 W	With starter	G13	600 mm × 38 mm

Mechanical, physical and starting requirements

For lamp marking, tubes, dimensions, caps and starting requirements, Clause 4.1 to 4.5 of this publication supply. For conditions of compliance, Clause 6.4 applies.

Lamp dimensions (mm) — See Sheet 81-IEC-0001-				
A	B		C	D
Max.	Max.	Min.	Max.	Max.
589.8	596.9	594.5	604	40.5

Lamp starting test	
Test voltage (V)	Ballast voltage rating (V)
103.5	110

Initial readings and colour

For lamp voltage, wattage and luminous characteristics, Clauses 5.3 and 5.4 of this publication apply. For conditions of compliance, Clause 6.5 applies.

Lamp electrical characteristics							
Frequency (Hz)	Rated wattage (W)	Objective wattage (W)	Voltage (r.m.s.) at lamp terminals (V)			Nominal current (A)	
			Objective	Max.	Min.	Running	Pre-heat
50	20	19.3	57	64	50	0.37	0.55
60	20	20.5	57	64	50	0.38	0.55

Luminous and colour characteristics		
Colour	Minimum rated luminous flux, in lumens	Chromaticity co-ordinates
Daylight	880	} See Appendix D
Cool white	1 020	
White	*	
Warm white	1 060	

* Under consideration.

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Page 2

Lumen maintenance

For lumen maintenance test, Clause 5.6 of this publication applies. For conditions of compliance, Clause 6.6 applies.

Minimum lumen maintenance (%)	
at 2 000 h	at 70 % of rated life
85	70

Ballast

The requirements of IEC Publication 82 apply.

Reference ballast characteristics					
Frequency (Hz)	Rated wattage (W)	Rated voltage (V)	Calibration current (A)	Voltage/current ratio (Ω)	Power factor
50	20	127	0.37	270	0.12
60	20	118	0.38	240	0.075

Information for ballast design			
Open circuit voltage (V)		Pre-heating current (A)	
Min. (r.m.s.) at starter	Max. (peak) at lamp	Min.	Max.
103.5	400	0.333	0.800
Max. (r.m.s.) voltage across starter terminals with lamp operating (V)		Equivalent resistance of both cathodes in series (Ω)	
68		50	

Starter

The requirements of IEC Publication 155 apply.

Information for starter design	
Non-reclosure voltage (V)	Min. pulse voltage (V)
70	250

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Rating	Circuit	Cap	Nominal dimensions
20 W	With starter	G13	600 mm × 32 mm

Mechanical, physical and starting requirements

For lamp marking, tubes, dimensions, caps and starting requirements, Clause 4.1 to 4.5 of this publication supply. For conditions of compliance, Clause 6.4 applies.

Lamp dimensions (mm) — See Sheet 81-IEC-0001-				
A	B		C	D
Max.	Max.	Min.	Max.	Max.
589.8	596.9	594.5	604.0	34.1

Lamp starting test	
Test voltage (V)	Ballast voltage rating (V)
95	110

Initial readings and colour

For lamp voltage, wattage and luminous characteristics, Clauses 5.3 and 5.4 of this publication apply. For conditions of compliance, Clause 6.5 applies.

Lamp electrical characteristics							
Frequency (Hz)	Rated wattage (W)	Objective wattage (W)	Voltage (r.m.s.) at lamp terminals (V)			Nominal current (A)	
			Objective	Max.	Min.	Running	Pre-heat
50	20	19.0	58	64	52	0.36	0.55
60	20	19.0	58	64	52	0.36	0.55

Luminous and colour characteristics		
Colour	Minimum rated luminous flux, in lumens	Chromaticity co-ordinates
Daylight	800	} See Appendix D
Cool white	1 020	
White	*	
Warm white	1 060	

* Under consideration.

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Lumen maintenance

For lumen maintenance test, Clause 5.6 of this publication applies. For conditions of compliance, Clause 6.6 applies.

Minimum lumen maintenance (%)	
at 2 000 h	at 70 % of rated life
85	70

Ballast

The requirements of IEC Publication 82 apply.

Reference ballast characteristics					
Frequency (Hz)	Rated wattage (W)	Rated voltage (V)	Calibration current (A)	Voltage/current ratio (Ω)	Power factor
50	20	127	0.37	270	0.12
60	20	118	0.38	240	0.075

Information for ballast design			
Open circuit voltage (V)		Pre-heating current (A)	
Min. (r.m.s.) at starter	Max. (peak) at lamp	Min.	Max.
95	400	0.333	0.800
Max. (r.m.s.) voltage across starter terminals with lamp operating (V)		Equivalent resistance of both cathodes in series (Ω)	
68		50	

Starter

The requirements of IEC Publication 155 apply.

Information for starter design	
Non-reclosure voltage (V)	Minimum pulse voltage (V)
70	800

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Page 1

Rating	Circuit	Cap	Nominal dimensions
25 W	With starter	G13	970 mm × 38 mm

Mechanical, physical and starting requirements

For lamp marking, tubes, dimensions, caps and starting requirements, Clauses 4.1 to 4.5 of this publication apply. For conditions of compliance, Clause 6.4 applies.

Lamp dimensions (mm) — See sheet 81-IEC-0001-				
A	B		C	D
Max.	Max.	Min.	Max.	Max.
970	977,1	974,7	984,2	40,5

Lamp starting test	
Test voltage (V)	Ballast voltage rating (V)
198	220

Initial readings and colour

For lamp voltage, wattage and luminous characteristics, Clauses 5.3 and 5.4 of this publication apply. For conditions of compliance, Clause 6.5 applies.

Lamp electrical characteristics							
Frequency (Hz)	Rated wattage (W)	Objective wattage (W)	Voltage (r.m.s.) at lamp terminals (V)			Nominal current (A)	
			Objective	Max.	Min.	Running	Pre-heat
50	25	24,5	94	104	84	0,29	0,45
60	—	—	—	—	—	—	—

Luminous and colour characteristics		
Colour	Minimum rated luminous flux, in lumens	Chromaticity co-ordinates
Daylight	1 250	See Appendix D
Cool white	1 650	
White	*	
Warm white	1 720	

* Under consideration.

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Page 2

Lumen maintenance

For the lumen maintenance test, Clause 5.6 of this publication applies. For conditions of compliance, Clause 6.6 applies.

Minimum lumen maintenance (%)	
at 2 000 h	at 70 % of rated life
85	70

Ballast

The requirements of IEC Publication 921 apply.

Reference ballast characteristics					
Frequency (Hz)	Rated wattage (W)	Rated voltage (V)	Calibration current (A)	Voltage/current ratio (Ω)	Power factor
50	25	220	0,29	605	0,10
60	—	—	—	—	—

Information for ballast design			
Open circuit voltage (V)		Pre-heating current (A)	
Min. (r.m.s.) at starter	Max. (peak) at lamp	Min.	Max.
198	400	0,261	0,609
Max. (r.m.s.) voltage across starter terminals with lamp operating (V)		Equivalent resistance of both cathodes in series (Ω)	
128		50	

Starter

The requirements of IEC Publication 155 apply.

Information for starter design	
Non-reclosure voltage (V)	Min. pulse voltage (V)
140	400

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Page 1

Rating	Circuit	Cap	Nominal dimensions
30 W (T8)	With starter	G13	900 mm × 25 mm

Mechanical, physical and starting requirements

For lamp marking, tubes, dimensions, caps and starting requirements, Clauses 4.1 to 4.5 of this publication apply. For conditions of compliance, Clause 6.4 applies.

Lamp dimensions (mm) — See sheet 81-IEC-0001-				
A	B		C	D
Max.	Max.	Min.	Max.	Max.
894,6	901,7	899,3	908,8	28

Lamp starting test	
Test voltage (V)	Ballast voltage rating (V)
198	220

Initial readings and colour

For lamp voltage, wattage and luminous characteristics, Clauses 5.3 and 5.4 of this publication apply. For conditions of compliance, Clause 6.5 applies.

Lamp electrical characteristics							
Frequency (Hz)	Rated wattage (W)	Objective wattage (W)	Voltage (r.m.s.) at lamp terminals (V)			Nominal current (A)	
			Objective	Max.	Min.	Running	Pre-heat
50	30	30	96	106	86	0,365	0,55
60	30	30,5	99	109	89	0,355	0,53

Luminous and colour characteristics		
Colour	Minimum rated luminous flux, in lumens	Chromaticity coordinates
Daylight	1 650	See Appendix D
Cool white	1 940	
White	*	
Warm white	2 020	

* Under consideration.

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Page 2

Lumen maintenance

For the lumen maintenance test, Clause 5.6 of this publication applies. For conditions of compliance, Clause 6.6 applies.

Minimum lumen maintenance (%)	
at 2 000 h	at 70 % of rated life
80	70

Ballast

The requirements of IEC Publication 921 apply.

Reference ballast characteristics					
Frequency (Hz)	Rated wattage (W)	Rated voltage (V)	Calibration current (A)	Voltage/current ratio (Ω)	Power factor
50	30	220	0,36	480	0,10
60	30	236	0,355	548	0,075

Information for ballast design

Open circuit voltage (V)		Pre-heating current (A)	
Min. (r.m.s.) at starter	Max. (peak) at lamp	Min.	Max.
198	400	0,328	0,766
Max. (r.m.s.) voltage across starter terminals with lamp operating (V)		Equivalent resistance of both cathodes in series (Ω)	
128		50	

Starter

The requirements of IEC Publication 155 apply.

Information for starter design	
Non-reclosure voltage (V)	Min. pulse voltage (V)
140	400

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