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SPECIFICATION FOR SINGLE CAPPED COMPACT FLUORESCENT LAMPS PART 1 – PERFORMANCE REQUIREMENTS

SRI LANKA STANDARDS INSTITUTION

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SRI LANKA STANDARD SPECIFICITON FOR SINGLE CAPPED COMPACT FLUORESCENT LAMPS PART 1 - PERFORMANCE REQUIREMENTS

FOREWORD

This standard was approved by the Sectoral Committee on Electrical Appliances and accessories and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2003-01-14.

This standard is published in two parts as follows:

Part 1 - Performance requirements

Part 2 - Safety requirements

This part of the standard specifies Performance requirements and methods of test for Single Capped fluorescent lamps. Part 2 of the Standard deals with safety requirements is a direct adoption of **IEC 1199. SLS 1231** deals with Compact fluorescent lamps of Self ballasted (Integral type) in two parts. Part 1 for Performance requirements and the other for safety.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or measurement shall be rounded off in accordance with **CS 102**. The number of significant figures to be retained in the rounded off value shall be the same as that of the specified value in this standard.

All the values given in this specification are in SI units.

The Sri Lanka Standards Institution gratefully acknowledges the use of **IEC 60901**: 1996 of International Electrotechnical Commission, in the preparation of this standard.

1. SCOPE

This Sri Lanka Standard specifies the performance requirements and methods of test for singlecapped fluorescent lamps for general lighting service.

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.

2. **REFERENCES**

- *CIE 84 Report on Measurement of Luminous flux
- CS 102 Presentation of Numerical values
- **SLS 882** Glow starters for tubular fluorescent lamps
- **SLS 1150** Ballasts for tubular fluorescent lamps
 - Part 2 Performance requirements
- SLS 1239 Electronic ballasts for fluorescent lamps

3. **DEFINITIONS**

For the purpose of this standard, the following definitions shall apply.

3.1 calibration current of a reference ballast: Value of the current on which the calibration and control of the reference ballast are based

3.2 compact fluorescent lamp : A fluorescent lamp which is shaped into a compact size by bending or connecting the glass tubes. These lamps may be with or without built in starter.

3.3 conditioning period : Time required after switching on a lamp to reach stabilization of the vapour pressure within the discharge tube.

3.4 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 ultraviolet radiation from the discharge.

3.5 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.

3.6 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.

3.7 nominal value : Approximate quantity value used to designate or identify a lamp

3.8 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.

3.9 reference ballast : Special ballast, either inductive for lamps for operation on a.c. mains frequencies, or resistive for a 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.

* International Technical Commission on Illumination.

3.10 single – capped fluorescent lamp : Fluorescent lamp having a single cap, for operation on external circuits with either and internal or an external means of starting.

3.11 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.

3.12 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.

3.13 type test sample : Sample consisting of one or more similar units submitted by the manufacturer or responsible vendor for the purpose of type test.

4. **REQUIREMENTS**

4.1 Lamp data sheets

Types of single capped lamps, commonly used in Sri Lanka are given in Table1. Lamp data sheets for Dual and Quad shapes are given in Appendix A.

4.2 Diagrammatic data sheets

Diagrammatic data sheets locates dimensions given in the lamp data sheets.

4.3 Starting characteristics

A lamp shall start fully within the time specified on the relevant lamp data sheet and remain alight. Method of test and test conditions are given in **6.1**.

4.4 Electrical and cathode 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.

- c) For a lamp having preheated cathodes for operation on a.c mains frequency 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.
- d) For a lamp having preheated cathodes for operation on high frequency, the initial reading of the resistance of each cathode shall comply with the values specified on the relevant lamp data sheet.

Methods of test and test conditions are given in **6.2**.

4.5 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 co-ordinates x and y of a lamp shall be within 5 SDCM (Standard Deviation of Colour Matching) from the rated values.
- 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.

See rated colour characteristics in Appendix **B**.

4.6 Lumen maintenance

The lumen maintenance of a lamp, a any time in its life, shall be not less than 90% of the rated value. Method of test and test conditions are given in **6.3**

4.7 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 Clause 6.11 of SLS 882.

TABLE 1 – Lamp data sheets

Nominal	Frequency	Shape	Сар	Means of	Cir	cuit	Cathode type
wattage W	Hz		Туре	starting	AC Mains	High	
••	112					nequency	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
5	50	Dual	G23	Internal			Preheated
5	50	Dual	2G7	External	Starter	Starterless	Preheated
7	50	Dual	2G7	External	Starter	Starterless	Preheated
7	50	Dual	G23	Internal			Preheated
9	50	Dual	G23	Internal	d		Preheated
9	50	Dual	2G7	External	Starter	Starterless	Preheated
10	50	Quad	G24d-1	Internal			Preheated
10	50	!Quad	G24q-1	External	Starter	Starterless	Preheated
10	50	Square	GR 10q	External	Starterless		Preheated, high resistance
10	50	Square	GR 10q	External	Starter		Preheated
11	50	Dual	2G7	External	Starter	Starterless	Preheated
11	50	Dual	G23	Internal			Preheated
13	50	Quad	G24d-1	Internal			Preheated
13	50	Multilimbed	GX24d-1	Internal			Preheated
13	50	Quad	G24q-1	External	Starter	Starterless	Preheated
13	50	Quad	GX10q-2	External	Starter		Preheated
13	50	Multilimbed	GX24q-1	Extenral	Starter	Starterless	Preheated
16	50	Square	GR8	Internal			Preheated
16	50	Square	GR10q	External	Starter		Preheated
16	50	Square	GR10q	External	Starterless		Preheated, high resistance
18	50	Quad	G24d-2	Internal			Preheated
18	50	Multilimbed	GX24d-2	Internal			Preheated
18	50	Dual	2G11	External	Starter	Starterless	Preheated
18	50	Quad	G24q-2	External	Starter	Starterless	Preheated
18	50	Multilimbed	GX24q-2	External	Starter	Starterless	Preheated
18	50	Quad	GX10q-3	External	Starter		Preheated
18	50	Square	2G10	External	Starter	Starterless	Preheated
21	50	Square	GR10q	External	Starter		Preheated
21	50	Square	GR10q	External	Starterless		Preheated, high resistance

 TABLE 1(Concluded)

Nominal	Frequency	Shape	Cap Type	Means of starting	Cir	cuit	Cathode type
wallage			туре	star ting	AC Mains	High	
W	Hz					frequency	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
22(D29)	50	Circular	G10q	Extrnal	Starter	Starterless	Preheated
24	50	Dual	2G11	External	Starter	Starterless	Preheated
24	50	Square	2G10	External	Starter	Starterless	Preheated
26	50	Quad	G24d-3	Internal			Preheated
26	50	Multilimbed	Gx24d-3	Internal			Preheated
26	50	Quad	GX24q-3	External	Starter	Starterless	Preheated
26	50	Multilimbed	GX24q-3	GX24q-3 External Starter Starter		Starterless	Preheated
27	50	Dual	GY10q-4	External	Starter		Preheated
27	50	Quad	GX10q-4	External	Starter		Preheated
28	50	Square	GR8	Internal			Preheated
28	50	Dual	GY10q-5	External	Starter		Preheated
28	50	Square	GR10q	External	Starter		Preheated
28	50	Square	GR10q	External	Starterless		Preheated, low resistance
30	50	Dual	GY10q-4	External	Starter		Preheated
32(D29)	50	Circular	G10q	External	Starter	Starterless	Preheated
32(D32)	50	Circular	G10q	External	Starter	Starterless	Preheated
32	20K	Multilimbed	GX24q-3	External		Starterless	Preheated
36	50	Dual	GY10q-6	External	Starter		Preheated
36	50	Dual	2G11	External	Starter	Starterless	Preheated
36	50	Square	2G10	External	Starter	Starterless	Preheated
38	50	Square	GR10q	External	Starter		Preheated
38	50	Square	GR10q	External	Starterless		Preheated, low resistance
40 (D29)	50	Circular	G10q	External	Starter	Starterless	Preheated
40(D32)	50	Circular	G10q	External	Starter	Starterless	Preheated
40	20 K	Dual	2G11	External		Starterless	Preheated
40	20 K	Dual	2G11	External		Starterless	Non-Preheated
42	20K	Multilimbed	GX24q-4	External		Starterless	Preheated
55	20K	Dual	2G11	External		Starterless	Preheated



FIGURE 1 - Diagrammatic data sheet for location of lamp dimensions for dual-shaped

Nominal	Frequency	Cap	Means of	Cir	·cuit	Cathode type
wattage W	Hz	Туре	starting	AC Mains	High frequency	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
5	50	G23	Internal	-	-	Preheated
7	50	G23	Internal	-	-	Preheated
9	50	G23	Internal	-	-	Preheated
11	50	G23	Internal	-	-	Preheated
5	50	2G7	External	Starter	Starterless	Preheated
7	50	2G7	External	Starter	Starterless	Preheated
9	50	2G7	External	Starter	Starterless	Preheated
11	50	2G7	External	Starter	Starterless	Preheated
18	50	2G11	External	Starter	Starterless	Preheated
24	50	2G11	External	Starter	Starterless	Preheated
27	50	GY10q-4	External	Starter	-	Preheated
28	50	GY10q-5	External	Starter	-	Preheated
30	50	GY10q-4	Externa	Starter	-	Preheated
36	50	GY10q-6	External	Starter	-	Preheated
36	50	2G11	External	starter	Starterless	Preheated
40	20K	2G11	External	-	Starterless	Preheated
40	20K	2G11	External	-	Starterless	Non-Preheated

TABLE 2 - Types of Dual shaped lamps



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

FIGURE 2 - Diagrammatic data sheet for location of lamp dimensions for quad-shaped

TABLE 3 - Types of Quad shaped lamps

Nominal	Frequency	Cap	Means of	Circuit		Cathode type
wattage W	Hz	Туре	starting	AC Mains	High frequency	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
10	50	G24d-1	Internal	-	-	Preheated
13	50	G24d-1	Internal	-	-	Preheated
18	50	G24d-2	Internal	-	-	Preheated
26	50	G24d-3	Internal	-	-	Preheated
10	50	G24q-1	External	Starter	Starterless	Preheated
13	50	G24q-1	External	Starter	Starterless	Preheated
18	50	G24q-2	External	Starter	Starterless	Preheated
26	50	G24q-3	External	Starter	Starterless	Preheated
13	50	GX10q-2	External	Starter	-	Preheated
18	50	GX10q-3	External	Starter	-	Preheated
27	50	GX10q-4	External	Starter	-	Preheated



FIGURE 3 - Diagrammatic data sheet for location of lamp dimensions for square-shaped

Nominal wattage	Frequency	Сар Туре	Means of starting	Circ	cuit	Cathode type
W	Hz			AC Mains	Frequency	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
10 16 18 24 36	50 50 50 50 50 50	GR10q GR10q 2G10 2G10 2G10	External External External External External	Starter Starter Starter Starter Starter	- Starterless Starterless Starterless	Preheated Preheated Preheated Preheated Preheated
10 16 21	50 50 50	GR10q GR10q GR10q	External External External	Starterless Starterless Starterless		Preheated, high .resistance Preheated ,high.
21 28 28 38	50 50 50 50	GR10q GR10q GR10q GR10q	External External External External	Starterless Starterless Starter Starter		resistance Preheated, high .resistance Preheated
38	50	GR10q	External	Starterless	-	Preheated Preheated Preheated Preheated, low .resistance
16 28	50 50	GR8 GR8	Internal Internal	-	-	Preheated Preheated

TABLE 4 - Type	s of Square	shaped	lamps
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FIGURE 4 - Diagrammatic data sheet for location of lamp dimensions for circular-shaped

TABLE 5 - Types of Circular shaped lamps

Nominal wattage W	Frequency	Сар Туре	Means of starting	Circuit		Cathode type
	Hz			AC Mains	Frequency	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
22 (D29)	50	G10q	External	Starter	Starterless	Preheated
32 (D29)	50	G10q	External	Starter	Starterless	Preheated
32(D32)	50	G10q	External	Starter	Starterless	Preheated
40 (D29)	50	G10q	External	Starter	Starterless	Preheated
40(D32)	50	G10q	External	Starter	Starterless	Preheated



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

FIGURE 5 - Diagrammatic data sheet for location of lamp dimensions for multi-limbed

Nominal wattage	Frequency	Сар Туре	Means of starting	Circuit		Cathode type
W	Hz			AC Mains	Frequency	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
13	50	GX24d-1	Internal	-	-	Preheated
18	50	GX24d-2	Internal	-	-	Preheated
26	50	GX24d-3	Internal	-	-	Preheated
13	50	GX24q-1	External	Starter	Starterless	Preheated
18	50	GX24q-2	External	Starter	Starterless	Preheated
26	50	GX24q-3	External	Starter	Starterless	Preheated
32	20K	GX24q-3	External	-	Starterless	Preheated
42	20K	GX24q-4	External	-	Starterless	Preheated

TABLE 6 - Types of Multi –limbed shaped lamps

5. MARKING

5.1 Lamps shall be marked with the following information.

- a) Rated wattage.
- b) Rated voltage and frequency
- c) Brand name

5.2 Rated average life and rated luminous flux shall be marked on the lamp or the container.

5.3 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.

NOTE

If necessary for proper identification, additional information should be included (for example the nominal tube diameter in millimetres).

6 TESTS

6.1 Methods of test for starting characteristics

6.1.1 General

Tests shall be made in a draught-free atmosphere at an ambient temperature in the range of 20 $^{\circ}$ C to 27 $^{\circ}$ C and a relative humidity of 65% maximum.

Electrical and Photometric tests should be carried out using an Integrating sphere.

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 in an ambient temperature in the range of 20 $^{\circ}$ C and 27 $^{\circ}$ C and a relative humidity of 65 % maximum for a period of at least 24 h.

6.1.2 Photometric equipment

The photometric equipment shall be as follows:

a) Integrating sphere: The inner diameter of the integrating sphere shall be at least 10 times the largest dimension of the light source. The inside surface of integrating sphere, screen, support of lamp to be measured, etc. shall be painted with white diffusion reflecting material having possible flat spectral reflecting characteristics in the visual region (for example barium sulphate powder) so that various parts have uniform reflectivity and form surfaces close to uniform diffusing plane.

The screen shall be a white diffusion reflecting plate painted same as the inner wall of the integrating sphere which screens the direct light radiated from the light emitting part of and the scattered light from the glass bulb of the lamp to be measured operated at the centre of the integrating sphere so that such light does not reach the photometric window.

b) Light receiver : The light receiver for total luminous flux measurement shall be those employing silicon photodiode or phototube as the photo electronic device.

6.1.3 Method of measurement

The test circuit for photometric and electrical measurements is shown in Figure 6.



FIGURE 6 - Operating Circuit of Lamps for Testing

Photometric characteristics shall be measured in accordance with the recommendations of **CIE 84**.

Total luminous flux shall be measured with an integrating sphere.

The lamp to be measured shall be operated with its test voltage applied, and the lamp wattage, luminous flux, power factor and total harmonic content shall be measured when the lamp is stabilized.

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

6.1.4.1 Test circuit

Lamps shall be tested with a 50 Hz supply in the circuits shown in Figure 7 and, Figure 8.



FIGURE 7 - Circuit diagram for starting test for lamps with internal starter



FIGURE 8 - Circuit diagram for starting test for lamps with external starter

6.1.4.2 Ballast

The ballast used shall comply with the requirements of **SLS 1150.** 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.

6.1.4.3 Starter

For lamps operated with an external starter, the type of glow starter to be used shall comply with the requirements of **SLS 882** and shall in any case be subject to agreement with the lamp manufacturer or responsible vendor.

6.1.4.4 Test voltage

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

6.1.5 Lamps having preheated cathodes for operation on a.c. mains supply starterless circuits.

6.1.5.1 Test circuit

Lamps shall be tested with a 50 Hz supply in the circuit shown in Figure 9.



FIGURE 9 – Circuit diagram for starting test for lamps with preheated cathodes for operation on starterless circuits

6.1.5.2 Ballast

The ballast used shall comply with the requirements of **SLS 1150**. 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 operating 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 .3 may make it necessary to supply it through an isolating transformer.

6.1.5.3 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.

6.1.5.4 Test voltage

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 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.

6.1.5.5 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 10 and Figure 11.



FIGURE 10 – Circuit diagram for starting test for lamps with preheated cathodes for operating on high frequency



FIGURE 11 – Circuit diagram for starting test for lamps with non-preheated cathodes for operating on high frequency

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 at 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.

6.2 Method of test for electrical, photometric and cathode characteristics

6.2.1 Electrical and photometric characteristics

6.2.1.1 General

Photometric characteristics shall be measured in accordance with the relevant recommendations of the (CIE (Commission International de 1'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 $^{\circ}C \pm 1 ^{\circ}C$, 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 at the terminals of the ballast, shall not be changed of the whole course for the tests.

Measurements shall be made after a sufficient period of stabilization of the lamp. An appropriate stabilization time is 15 minutes, 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.

6.2.1.2 Test circuit

Lamps shall be tested in the circuits shown in Figure 12, Figure 13 and Figure 14.



FIGURE 12 – Circuit diagram for measurement of electrical and photometric characteristics for lamps with internal starter

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FIGURE 13 – Circuit diagram for measurement of electrical and photometric characteristics for lamps with external starter



FIGURE 14 – Circuit diagram for measurement of electrical and photometric characteristics for lamps for operation on high frequency

In the test circuit for lamps for operation on high frequency, given in Figure 14 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.

6.2.1.3 Ballast

Ballasts used for these tests shall be reference ballasts as specified in **SLS 1150** for a.c mains frequencies, or **SLS 1239** for high frequency. The reference ballast electrical characteristics shall be as specified on the relevant lamp data sheet.

6.2.1.4 Supply voltage

The supply voltage shall be equal to the rated voltage of the reference ballast. During periods of stabilization, the supply voltage shall be stable within $\pm 0.5\%$, this tolerance being reduced to 0.2 % during measurement.

For a.c mains supplies, the frequency shall be equal to the rated frequency of the reference ballast with a tolerance of 0.5%. For high-frequency supplies, the frequency shall be between 20 kHz and 26 kHz.

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

NOTE

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

6.2.1.5 Electrical instruments

Instruments shall be of the true r.m.s. type, essentially free form 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 \dot{U} , 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 mad 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.

6.2.2 Cathode characteristics of lamps having preheated cathodes for operation on starterless circuits

6.2.2.1 Test circuit

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

6.2.2.2 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.

6.2.2.3 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.

6.3 Method of test for lumen maintenance and life

6.3.1 General Condition

The luminous flux at a given time in the life of a lamp shall be measured as specified in 6.2.

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 charged for the whole course of the tests.

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

The test voltage and frequency shall be equal to the rated voltage and frequency of the ballast.

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

6.3.2 Lamps for operation on a.c mains frequencies

The ballast used shall comply with the requirements of SLS 1150.

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 upon, 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 switch 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 **SLS 882** and shall in any case be subjected to agreement with the lamp manufacturer or responsible vendor.

6.3.3 *Lamps for operation on high frequency*

The ballast used shall comply with the requirements of SLS 1239

APPENDIX A DETAILED LAMP DATA SHEETS FOR SINGLE-CAPPED COMPACT FUORESCENT LAMPS

			FOI	R 5 W I	DUAL	SHAPE					
Nominal w	attage		Circuit			Catho	le		Сар		
5 W	r	In	ternal sta	rter		Preheated			G23		
				Dimens	ions (1	mm)					
]	A Max.		B Max.					C Max.			
	28				13			8	35		
			Sta	arting cl	haract	eristics					
Freque	Balla	st rated v	oltage	Т	est voltage	(r.m.s)	S	tarting time			
50 H	220 V			198 V	7 10 s						
Electrical characteristics											
Frequency	Rated wattage		Voltage	(r.m.s) a	t lamp	terminals	Rate	ed lamp irrent	Rated preheat current		
		I	Rated	Minir	num	Maximu	m				
50 Hz	5.4 W		35 V	30	V	40 V	0.180 A		0.190 A		
Test position:	vertical, cap	p-up									
			Referen	nce balla	ast cha	aracteristi	cs				
Frequency	Nom	inal	Rated v	oltage	Cal	libration	Voltage	current	Power factor		
50 Hz	9 V	N N	220	V	0.	170 A	118	0	0.12		
			Inform	nation f	or bal	llast desigr	1				
Frequency				Hz				5	0		
Preheat catho	ode current			А		Min.		0.1	53		
						Max.		0.2	40		
Open circuit	voltage acr	ross lamp)	V	Mi	n.(r.m.s)		19	98		
	-			_	Max	x. (peak)	400				
Substitution	resistor for	both cat	hodes in	series				16	50		
Lamp operat	ing current			А		Max.		0.1	90		

			FOI	7 W	DUAL	SHAPE				
Nominal w	vattage		Circuit			Cathoo	le			Сар
7 W	T	In	ternal sta	rter	-	Preheated			G23	
, ,,			torriar sta	1001		Tionout				020
				Dimens	sions (1	nm)				
	А			_	В				(С
	Max.			N	Aax.				M	ax.
	28				13				1	15
Starting characteristics										
Freque	ncy	Balla	st rated v	oltage	Т	est voltage	(r.m.	.s)	S	tarting time
50 H	50 Hz 220 V 198 V					Ι			10 s	
Electrical characteristics										
Frequency	Rated		Voltage (r.m.s) at lamp terminals					Rate	d lamp	Rated preheat
	wattage							cu	rrent	current
		I	Rated	Minir	num	Maximu	m			
50 Hz	7.1 W		47 V	42	V	52 V		0.1	75V	0.190V
Test position:	vertical, cap	p-up								
			Referen	ce ball	ast cha	aracteristi	cs			
Frequency	Nom	inal	Rated v	oltage	Cal	Calibration		Voltage/current		Power factor
	watt	age			C	urrent		rat	io	
50 Hz	9 \	N	220	V	0.	170 A		1.18	0	0.12
			Inform	nation f	for bal	last desigr	1			1
Frequency				Hz					5	0
Preheat catho		А	Min.				0.1	53		
				Max.				0.2	40	
Open circuit v	ss lamp		V	Min.	(r.m.s)	198		98		
					Max.	(peak)	400			
Substitution re	esistor for b	oth catho	odes in se	ries	2.4				16	0
Lamp operatin	ng current			А	Max.				0.1	90

			FOI	R 9 W I	DUAL	SHAPE				
Nominal w	vattage		Circuit			Cathod	e		Сар	
9 W	r	Int	ternal sta	rter		Preheate	ed G23			
Dimensions (mm)										
	A May			N	B Aay			M	C	
							ал.			
	28				13			1	45	
			Sta	arting cl	haract	eristics	1			
Freque	ncy	Balla	st rated v	oltage	Т	est voltage	(r.m.s)	S	tarting time	
50 Hz 220 V 1						198 V			10 s	
Electrical characteristics										
Frequency	Rated wattage		Voltage (r.m.s) at la			lamp terminals		d lamp rrent	Rated preheat current	
	-	F	Rated	Minir	num	Maximun	1			
50 Hz	8.7 W	(50 V	54	V	66 V	0.1	70 A	0.190 A	
Test position:	vertical, cap	o-up								
			Referen	ice balla	ast cha	aracteristic	S			
Frequency	Nom watt	iinal age	Rated	voltage	Ca	libration current	Voltage rat	/current io	Power factor	
50 Hz	9 \	N	220) V	0	.170 A	1.18	80	0.12	
			Inform	nation f	or bal	last design				
Frequency				Hz				5	0	
Preheat catho	de current			А	Min.			0.1	53	
					Max.			0.2	40	
Open circuit v	oltage acros	ss lamp		V	Min.(r.mr.s)		19	98	
		<u>a</u> a	1 .	•	Max.	(peak)		4(00	
Substitution re	esistor for be	oth catho	des in se	ries	N/				00	
Lamp operatin	ig current			A	iviax.			0.1	90	

FOR 11 W DUAL SHAPE											
Nominal wa	attage		Circuit		Cathode				Сар		
11 W		Int	ernal starte	r		Prehea	ted		G23		
				Di	mension	s (mn	I)				
	А			В					С		
Max.					Max.				Max.		
2	28				13				215		
			S	tart	ing char	acteri	stics				
Frequency Ballast rated voltage					Test	voltag	e (r.m.s)		Starting time		
50 Hz	50 Hz 220 V					198	V		10 s		
Electrical characteristics											
Frequency	Rate wattag	Rated Voltage (r.			s.) at lamp	o termi	nals	Rated lamp	Rated preheat current		
			Rated	Μ	Minimum Maximum			current			
50 Hz	11.8 \	W	91 V		81 V	10	1 V	0.155 A	0.190 A		
Test position:	vertical,	cap-up				1					
			Refere	ence	e ballast	chara	cteristi	cs			
Frequency	Nom watta	inal age	Rated voltage		Calibra curre	tion nt	Voltag 1	ge/current ratio	Power factor		
50 Hz	9 \	N	220 V		0.170	A	11	80 Ù	0.12		
			Infor	ma	tion for	ballas	t desigr	1			
Frequency			Hz						50		
Preheat catho	de currei	nt			Ν	/lin.			0.153		
					N	lax.			0.240		
Open circuit	voltage	across]	lamp V		Min.	(r.m.s.)	198			
Carland's st			41 1 '		Max	.(peak)		400		
Judstitution f	esistor fo	or DOth (nt	cathodes in	ser	ies U	lav			100		
Lamp Operation	ng cunci	11	А	1	IV	ал.			0.170		

			FOR	R 5 W I	DUAL	SHAPE			
Nominal w	vattage		Circuit			Cathod	e		Сар
5 W	r	Ex	xternal sta	rter		Preheat	ed		2G7
]	Dimens	sions (1	nm)			
	A				В				С
	Max.			Ν	Max.			Μ	ax.
	28				13			8	35
			Sta	rting c	haract	eristics			
Freque	ncy	Balla	st rated v	oltage	Т	est voltage	(r.m.s)	S	tarting time
50 H	Z		220 V			198 V	7		10 s
			Elec	ctrical o	charac	teristics			
Frequency	Rated wattage		Voltage	(r.m.s) a	at lamp	terminals	Ra	ted lamp surrent	Rated preheat current
	C]	Rated	Minii	mum	Maximur	n		
50 Hz	5.4 W		35 V	30	V	40 V	0	.180 A	0.190 A
Test position:	vertical, cap	p-up							
			Referen	ce balla	ast cha	aracteristi	cs		
Frequency	Nom watt	inal age	Rated v	oltage	Cal c	libration urrent	Voltag r	e/current atio	Power factor
50 Hz	9 \	N	220	V	0.	.170A	11	80	0.12
			Inforn	nation f	for bal	last design	l		
Frequency				Hz				5	0
Preheat catho	de current			А	Min.			0.1	53
On an airresit	- 140 o.c	aa a44		V	Max.	(0.2	40
Open circuit v	oltage acro	ss starte	r	V	Min.	(r.mr.s)		19	8
Open circuit v	oltage acro	ss lamp		V	Max.	(peak)		40	00
Substitution re	esistor for b	oth catho	odes in se	ries				16	50
Voltage across Lamp operatin	s starter wit	h lamp c	operating	V A	Max. Max.	(r.m.s)		* 0.1	« 90

TABLE (Concluded)

		Informatio	n for start	er d	esign			
Pulse voltage		Non-re	closure vol	ltage	\$		RIS ca	pacitor
Min.			Max.			M	lin.	Max.
* V			* V			*	nF	* nF
	Inforn	nation for hig	h-frequen	cy b	allast o	design		
		Typical la	mp charac	teri	stics			
Frequency	Lamj	p wattage	Lamp	volta	nge		Lamp	current
20 KHz		5 W	27	V			0.19	90 A
Current in any lead to ca	thodes		А		Max.			0.240
Lamp operating current			А		Min.			0.120
					Max.			0.190
		Current co	ntrolled p	ehe	ating			
Minimum preheat current	i_k (A) en	nission time t _e	(s)	a				0.025
$i_k = (a/t_e + i_m^2)^{0.5}$				im	(A)			0.135
Maximum preheat curren	ıt		А	t	0.4			0.400
				0.	4 < t < 2	2.0	0.430) – 0 . 090t
				t	2.0			0.250
Open circuit voltage acro	ss lamp		t t _e	Μ	ax.(r.m	.s)		120
(without starting aid)		V	t>t _e	Μ	in.(r.m.	s)		250
Substitution resistor for e	each catho	ode			Ù			50
		Voltage cor	ntrolled pr	ehe	ating			
			*					

			FOI	R 7 W	DUAL	SHAPE				
Nominal w	attage		Circuit			Catho	le			Сар
7 W	τ	Ех	xternal sta	urter		Preheat	ed			2G7
				Dimen	sions (1	mm)				
	Α				B	,				ſ
	Max.			Ν	Max.				М	ax.
	28				13				1	15
			Sta	arting c	haract	teristics				
Freque	ncy	Balla	ist rated v	oltage	Т	est voltage	(r.n	n.s)	S	tarting time
50 H	Z		220 V			198 V	Ι			10 s
		l	Ele	ctrical	charac	teristics				
Frequency	Rated wattage	2	Voltage	(r.m.s) a	at lamp	terminals		Rate cui	d lamp rrent	Rated preheat current
	C]	Rated	Mini	mum	Maximu	m			
50 Hz	7.1 W		47 V	42	V	52 V		0.1	75 A	0.190A
Test position:	vertical, car	o-up								
•	· · · · ·		Referen	nce ball	ast ch	aracteristi	cs			
Frequency	Nom watt	iinal age	Rated v	oltage	Cal c	libration urrent	V	'oltage/ rat	current	Power factor
50 Hz	9 \	N	220	V	0.	170 A		1.18	0	0.12
			Inform	nation	for bal	llast desigr	1			
Frequency				Hz		2	1		5	0
Preheat catho	de current			A	Min				01	53
i ionout outilo					Max.				0.2	240
Open circuit v	voltage acro	oss starte	r	V	Min.	(r.m.s)			19	98
Open circuit v	oltage acro	ss lamp		V	Max	(peak)			4(00
Substitution re	esistor for b	oth cath	odes in se	eries		<u> </u>			16	50
Voltage across	s starter wit	h lamp o	operating	V	Max.	(r.m.s)			X	k
Lamp operatir	ng current	*		А	Max.				0.1	90

TABLE (Concluded)

		Information	n for starte	er de	esign			
Pulse voltage		Non-re	eclosure vol	tage			RIS ca	pacitor
Min.			Max.		-	N	lin.	Max.
* V			* V			*	nF	* nF
	Inform	ation for hig	h-frequenc	cy b	allast d	lesign		
		Typical la	np charact	teris	tics			
Frequency KHz	Lamp	wattage W	Lamp v	volta V	ige		Lamp	current A
20		6.5	3	7			0.1	75
								0.040
Current in any lead to cath	nodes		A		Max.			0.240
Lamp operating current			А		Min.			0.120
		~			Max.			0.190
		Current co	ntrolled pro	ehea	ating			
Minimum preheat current	_k (A) emi	ssion time t _e ((s)	a				0.025
$i_k = (a/t_e + i_m^2)^{0.5}$. ,			im	(A)			0.135
Maximum preheat current			А	t	0.4			0.400
-				0.4	4 <t 2<="" <="" td=""><td>2.0</td><td>0.430</td><td>) - 0.090t</td></t>	2.0	0.430) - 0.090t
				t	2.0			0.250
Open circuit voltage acros	s lamp		t t _e	Μ	ax.(r.m	.s)		130
(without starting aid)		V	t>t _e	Μ	in.(r.m.	s)		270
Substitution resistor for ea	ch catho	de			Ù			50
		Voltage con	trolled pro	ehea	ting			
			*					

			ron		UAL	BIAL			
Nominal v	vattage		Circuit			Cathod	e		Сар
9 W	/	Ех	ternal sta	rter		Preheate	ed		2G7
				Dimons	ions (r	nm)			
				Dimensi	10115 (1	1111)			
	A				B			(2
	Max.			IV	lax.			IVI	ax.
	28				13			14	45
			Sta	rting ch	naract	eristics			
Freque	ency	Balla	st rated v	oltage	Т	est voltage	(r.m.s)	S	tarting time
50 H	Iz		220 V			198 V			10 s
			Elec	ctrical c	harac	teristics			
Frequency	Rated wattage		Voltage	(r.m.s) at	t lamp	terminals	Rate cu	d lamp rrent	Rated prehea current
]	Rated	Minin	num	Maximur	n		
50 Hz	8.7 W		60 V	54	V	66 V	0.1	70 A	0.190 A
Test position:	vertical, cap	-up							
			Referen	ce halla					
				ce Dana	st cha	racteristic	cs		
Frequency	Nom	inal	Rated v	oltage	st cha Cal	ibration	voltage	/current	Power factor
Frequency	Nom watta	inal 1ge	Rated v	oltage	i st cha Cal ci	ibration urrent	voltage rat	/current io	Power factor
Frequency 50 Hz	Nom watta 9 V	inal 1ge V	Rated v	oltage V	Cal Cal cu 0.1	ibration urrent 170 A	voltage rat	/current io	Power factor 0.12
Frequency 50 Hz	Nom watta 9 V	inal nge V	Rated volume	oltage V nation fo	Cal Cal cu 0.1	ibration urrent 170 A last design	voltage rat	/current io	Power factor 0.12
Frequency 50 Hz Frequency	Nom watta 9 V	inal ige V	Rated v 220 Inform	oltage V nation fo	Cal Cal Cl Cl Cl Cl Cl Cl Cl Cl Cl Cl Cl Cl Cl	ibration urrent 170 A last design	voltage rat	/current io 30 50	Power factor
Frequency 50 Hz Frequency Preheat catho	Nom watta 9 V de current	inal ige V	Rated v 220 Inform	oltage V nation fo Hz A	Cal Cal cr 0.1 or bal Min.	ibration urrent 170 A last design	voltage rat	/current io 30 50 0.1	Power factor 0.12 0 53
Frequency 50 Hz Frequency Preheat catho	Nom watta 9 V de current	inal ıge V	Rated v 220 Inform	v nation fo Hz A	or bal	ibration urrent 170 A last design	voltage rat	/current io 30 50 0.1 0.2	Power factor 0.12 0 53 40
Frequency 50 Hz Frequency Preheat catho Open circuit	Nom watta 9 V de current voltage acro	inal age V ss starte	Rated v 220 Inform	oltage V nation fo Hz A V	Cal Cal Cu O.1 Or bal Min. Max. Min.(ibration urrent 170 A last design	voltage rat	/current io 30 50 0.1 0.2 19	Power factor 0.12 0 53 40 8
Frequency 50 Hz Frequency Preheat catho Open circuit v	Nom watta 9 V de current voltage acros	inal ige V ss starte	Rated v 220 Inforn	oltage V nation fo Hz A V V	or bal	ibration ibration urrent 170 A last design (r.m.s) (peak)	voltage rat	/current io 30 50 0.1 0.2 19 40	Power factor 0.12 0 53 40 8 0
Frequency 50 Hz Frequency Preheat catho Open circuit v Substitution re	Nom watta 9 V de current voltage acros voltage acros	inal age V ss starte ss lamp oth catho	Rated v 220 Inform	oltage V nation fo Hz A V V ries	or bal	racteristic ibration urrent 170 A last design (r.m.s) (peak)	voltage rat	/current io 30 50 0.1 0.2 19 40 16	Power factor 0.12 0 53 40 8 0 0
Frequency 50 Hz Frequency Preheat catho Open circuit v Substitution re Voltage acros	Nom watta 9 V de current voltage acros voltage acros esistor for bo s starter with	ss starte	Rated v 220 Inform	oltage V nation fo Hz A V V ries V	or ball Min. Max. Max.	racteristic ibration urrent 170 A last design (r.m.s) (peak) (r.m.s)	voltage rat	/current io 30 50 0.1 0.2 19 40 16 *	Power factor 0.12 0 53 40 8 0 0

* Under consideration

TABLE (Concluded)

		Informatio	on for star	ter d	lesign			
Pulse voltage		Non-r	eclosure vo	oltage	;		RIS ca	pacitor
Min.			Max.			M	lin.	Max.
* V			* V			*	nF	* nF
	Inform	nation for hi	gh-freque	ncy l	oallast o	lesign		
		Typical la	mp chara	cteri	stics			
Frequency	Lamp	o wattage	Lamp	volta	nge		Lamp	current
20 KHz		8 W	4	8 V			0.1	70 A
Current in any lead to ca	thodes		А		Max.			0.240
Lamp operating current			А		Min.			0.120
					Max.			0.190
		Current co	ontrolled p	orehe	ating			
Minimum preheat current	i_k (A) en	nission time t _e	(s)	a				0.025
$i_{k} = (a/t_{e} + i_{m}^{2})^{0.5}$				im	(A)			0.135
Maximum preheat curren	ıt		А	t	0.4			0.400
_				0.	4 <t 2<="" <="" td=""><td>.0</td><td>0.43</td><td>0 - 0.090t</td></t>	.0	0.43	0 - 0.090t
				t	2.0			0.250
Open circuit voltage acro	ss lamp (v	without	t t _e	Μ	ax.(r.m.	s)		150
starting aid)		V	t>te	Μ	in.(r.m.s	5)		290
Substitution resistor for e	each catho	de			Ù			50
		Voltage co	ontrolled p	rehe	ating			
			*					

			FOR	11 W	DUAI	SHAP	E			
Nomina	al wattage	9	Ci	ircuit		(Cathoo	le		Сар
1	1 W		Exterr	nal star	ter	P	reheat	ed		2G7
			Star	ting cl	haract	eristics				
	А]	В				С	
Ν	Max.			Μ	ax.			Ν	Aax.	
	28			1	3			/	215	
			Star	ting cl	haract	eristics				
Freque	ncy	В	allast rate voltage	d	Test	t voltage	(r.m.s) 5	Startin	ng time
50 H	Z		220 V			198 \	1		1() s
			Elect	rical c	harac	teristics				
Frequency	Rated	_	Voltage (r.m.s) :	at lamp	o termina	ls	Rated		Rated
	wattage	Ra	nted	Minii	mum	Maxin	num	current		current
50 Hz	11.8 W	1	91 V	8	1 V	101	V	0.155 A		0.190 A
Test position	: vertical	, cap-u)							
.			Reference	e balla	ast cha	aracteri	stics			
Frequency	Nom	inal	Rated	1	Calib	ation	Volta	ge/current	Pe	ower factor
	watta W	age	voltag	e	curr	ent		ratio		
50 Hz	9 \	N	220 V	V	0.17	0 A	1	180 Ù		0.12
			Informa	ation f	or bal	last des	ign		•	
Frequency				Н	[z				5()
Preheat cath	ode curre	nt		A	A N	lin.			0.1	53
					Ν	lax.			0.24	40
Open circuit	voltage a	cross st	ross starter V Min. (r.m.s)			19	8			
Open circuit	voltage a	cross la	mp	V	Ν	lax. (pea	ık)		40	0
Substitution	resistor fo	or both o	cathodes i	n serie	es	Ú			16	0
Voltage acro	ss starter	with laı	np operat	ing	V N	lax. (r.m	.s)		*	
Lamp operat	ing currer	nt		А	N	lax.			0.1	90
			Informa	ation f	or sta	rter des	ign			
Pulse	e voltage		Non	-reclos	sure vo	oltage		RIS o	capac	itor
Mi	nimum			Max	imum		Ν	linimum	l	Maximum
	* V			*	V			* nF		* nF

*Under consideration

TABLE (Concluded)

Inf	ormation for high-fr	equency ba	allast design	
	Typical lamp	characterist	tics	
Frequency	Lamp wattage	Lamp	voltage	Lamp current
20 KHz	11 W	75	V	0.150 A
Current in any lead to cat	hodes	А	Max.	0.240
Lamp operating current		А	Min.	0.120
			Max.	0.190
	Current contro	lled prehea	ting	
Minimum preheat current	$i_k(A)$ emission time t_e	(s)	a	0.025
$i_k = (a/t_e + i_m^2)^{0.5}$			i _m (A)	0.135
Maixmum preheat current	t	А	t 0.4	0.400
			0.4 <t <2<="" td=""><td>.0 0.430 - 0.090t</td></t>	.0 0.430 - 0.090t
			t 2.0	0.250
Open circuit voltage acros	ss lamp (without	t t _e	Max.(r.m	.s) 170
starting aid)	V	t>te	Min.(r.m.	s) 330
Substitution resistor for e	ach cathode		Ù	50
	Voltage control	lled prehea	ting	
	*	:		

		FC	OR 18 W DU	JAL SHAP	£	
Nominal v	vattage		Circuit		Cathode	Сар
18 V	V	Ext	ternal starter		Preheated	2G11
			Dimensior	ns (mm)		
	A		В			С
Μ	lax.		Max.			Max.
4	10		20			225
		S	Starting char	racteristics		
Frequen	cy	Ballast rated voltage	Test	voltage (r.m	s)	Starting time
50 Hz		110 V		110 V		10 s
		Ε	lectrical cha	racteristics		
Frequency	Rated wattage	Voltage (r	.m.s.) at lamp	terminals	Rated lamp	Rated preheat current
		Rated	Minimum	Maximum	current	
50 Hz	18 W	58 V	52 V	64 V	0.375 A	0.540

Test position : horizontal, with the plane through the limbs horizontal.

NOTE – To reduce the time for testing, other positions may be used by agreement between the manufacturer and testing authorities. In cas eof dispute, the horizontal position shall be the reference test position.

		Reference	e ballas	t chara	cteristics		
Frequency	Nominal wattage	Rated voltage	Calibr curr	ration ent	Voltage/curr ratio	rent	Power factor
50 Hz	20 V	127 V	0.37	0 A	270 Ù		0.12
		Informa	tion for	[.] ballas	t design		
Frequency			Hz				50
Preheat catho	de current		А	Min.			0.315
				Max.			0.670
Open circuit v	voltage across st	tarter	V	Min.	(r.m.s)		103.5
Open circuit v	oltage across la	mp	V	Max.	(peak)		400
Substitution re	esistor for both	cathodes in ser	ies	Ù			50
Voltage across	s starter with lar	mp operating		Max.	(r.m.s)		68
Lamp operatir	ng current		А	Max.			0.425

			FOR	24 W I	DUAL	SHAPE			
Nominal w	vattage		Circuit			Cathode			Сар
24 W	V	Ex	ternal sta	rter		Preheated	1		2G11
]	Dimensi	ions (n	nm)			
	A Max.			Ν	B Iax.			(M	C ax.
	40			,	20			3	20
			Sta	rting ch	naract	eristics			
Freque	ncy	Ballas	t rated vo	oltage	Te	est voltage (r.	m.s)	S	tarting time
50 H	Z		220 V			198 V			10 s
			Elec	ctrical c	harac	teristics		•	
Frequency	Rated wattage		Voltage	(r.m.s) at	t lamp	terminals	Rate cu	d lamp rrent	Rated preheat current
		F	Rated	Minin	num	Maximum			
50 Hz	24 W	8	87 V	77	V	97 V	0.3	45 A	0.510 A
Test position: 1 NOTE	horizontal, w	vith the p	plane thro	ugh the l	limbs ł	norizontal.			

To reduce the time for testing, other positions may be used by agreement between the manufacturer and testing authorities, In case of dispute, the horizontal position shall be the reference test posit

TABLE (Concluded)

FrequencyNominal wattageRated voltageCalibration currentVoltage/current ratioPower factor50 Hz24 W220 V0.340 A5400.10Information for ballast designFrequencyHz50Preheat cathode currentAMin.0.315Max.0.6700198Open circuit voltage across starterVMax. (peak)400Substitution resistor for both cathodes in series5050Voltage across starter with lamp operating VMax.(r.m.s)128Lamp operating currentAMax.0.425Information for starter designInformation for starter design0.425
50 Hz24 W220 V0.340 A5400.10Information for ballast designFrequencyHz50Preheat cathode currentAMin.0.315Max.0.670Open circuit voltage across starterVMin.(r.mr.s)198Open circuit voltage across lampVMax. (peak)400Substitution resistor for both cathodes in series50128Voltage across starter with lamp operating VMax. (r.m.s)128Lamp operating currentAMax.0.425Information for starter design
Information for ballast designFrequencyHz50Preheat cathode currentAMin.0.315Max.0.670Max.0.670Open circuit voltage across starterVMin.(r.mr.s)198Open circuit voltage across lampVMax. (peak)400Substitution resistor for both cathodes in series5050Voltage across starter with lamp operating VMax.(r.m.s)128Lamp operating currentAMax.0.425Information for starter design
FrequencyHz50Preheat cathode currentAMin.0.315Max.0.670Max.0.670Open circuit voltage across starterVMin.(r.mr.s)198Open circuit voltage across lampVMax. (peak)400Substitution resistor for both cathodes in series5050Voltage across starter with lamp operatingVMax.(r.m.s)128Lamp operating currentAMax.0.425Information for starter design
Preheat cathode currentAMin.0.315Max.0.670Open circuit voltage across starterVMin.(r.mr.s)198Open circuit voltage across lampVMax. (peak)400Substitution resistor for both cathodes in series50Voltage across starter with lamp operatingVMax.(r.m.s)128Lamp operating currentAMax.0.425Information for starter design
Max.0.670Open circuit voltage across starterVMin.(r.mr.s)198Open circuit voltage across lampVMax. (peak)400Substitution resistor for both cathodes in series5050Voltage across starter with lamp operatingVMax.(r.m.s)128Lamp operating currentAMax.0.425Information for starter design
Open circuit voltage across starterVMin.(r.mr.s)198Open circuit voltage across lampVMax. (peak)400Substitution resistor for both cathodes in series50Voltage across starter with lamp operatingVMax.(r.m.s)128Lamp operating currentAMax.0.425Information for starter design
Open circuit voltage across lampVMax. (peak)400Substitution resistor for both cathodes in series50Voltage across starter with lamp operatingVMax.(r.m.s)128Lamp operating currentAMax.0.425Information for starter design
Substitution resistor for both cathodes in series50Voltage across starter with lamp operatingVMax.(r.m.s)Lamp operating currentAMax.Information for starter design0.425
Voltage across starter with lamp operatingVMax.(r.m.s)128Lamp operating currentAMax.0.425Information for starter design
Lamp operating current A Max. 0.425 Information for starter design
Information for starter design
Pulse voltage Non-reclosure voltage RIS capacitor
Min. Max. Min. Max.
800 V 140 V * nF * nF
Information for high-frequency ballast design
Typical lamp characteristics
Frequency Lamp wattage Lamp voltage Lamp current
20 KHz 22 W 75 V 0.300 A
Current in any lead to cathodes A Max. 0.640
Lamp operating current A Min. 0.260
Max. 0.425
Current controlled preheating
Minimum preheat current i_k (A) emission time t_e (s) a 0.290
$i_k = (a/t_e + i_m^2)^{0.5}$ $i_m(A)$ 0.310
Maximum preheat current A t 0.4 1.200
0.4 < t < 2.0 $1.350 - 0.350t$
t 2.0 0.650
Open circuit voltage across lamp (without t t Max.(r.m.s) 170
starting aid) V $t > t_{e}$ Min.(r.m.s) 320
Substitution resistor for each cathode U 12.5
Voltage controlled preheating
*

			FOR	27 W	DUAL	SHAPE				
Nominal w	attage		Circuit	-		Cathod	e		Сар	
27 W	7	Ex	ternal sta	arter		Preheate	ed	(GY10q-4	
				Dimens	sions (r	nm)			-	
	А			В						
I	Max.			N	Max.			(2	
							M	in.	Max.	
	44		Sto	nting of	21 horeat	origina	24	10	265	
	r		Sta	irung ci	naracı	eristics				
Frequer	псу	Balla	st rated v	oltage	Т	'est voltage	(r.m.s)	S	tarting time	
50 H	Z		100 V			94 V			10 s	
			Eleo	ctrical c	harac	teristics				
Frequency	Rated wattage		Voltage	(r.m.s) a	ıt lamp	terminals	Rated	d lamp rent	Rated preheat current	
50 Hz	27 W		Kated	Minii	num	Maximur	n 0.6	10 4	0.850 A	
30 HZ	50 V	50	v	02 V	0.0	10 A	0.830 A			
Test position:	vertical, cap-u	р								
			Referen	ce balla	ast cha	aracteristic	es			
Frequency	Nomina	1	Rated v	oltage	Ca	ibration	Voltage	current	Power factor	
	wattage	e		8-	C	urrent	rati	io		
50 Hz	27 W		100	V	0.620 A 118				0.075	
			Inform	nation	for bal	llast design	l		L	
Frequency				Hz	[Z				50	
Preheat cathoo	le current			А	Min.				0.640	
					Max.				1.100	
Open circuit v	oltage across	starter	ſ	V	Min.((r.mr.s)			97	
Open circuit v	oltage across 1	lamp		V	Max.	(peak)			400	
Substitution re	sistor for both	catho	odes in se	eries	1				30	
Voltage across	starter with l	amp o	perating	V	Max.	(r.m.s)		_	65	
Lamp operating current A									*	
Information						rter design				
Pulse voltage Non-rea					osure v	oltage		RIS ca	pacitor	
	Min.			Ν	Max.		M	in.	Max.	
7	00 V			7	70 V		5.0	nF	10.0 nF	

			FOR	28 W	DUAI	SHAPE					
Nominal w	attage		Circuit			Cathod	e		Сар		
28 W	7	Ex	ternal sta	urter		Preheate	ed		GY10q-5		
				Dimens	ions (1	nm)					
A			В			С					
Max.			Max.			Min.			Max.		
44			21			317			340		
		eristics									
Frequer	ncy	Ballas	t rated vo	oltage	Te	est voltage ((r.m.s)	S	tarting time		
50 H	Z		147 V			137 V			10 s		
	1		Elec	ctrical c	harac	teristics					
Frequency	Rated		Voltage	(r.m.s) a	ıt lamp	terminals	Rat	ed lamp	Rated preheat		
	wattage			1			CI	urrent	current		
5 0 H	00.433	F	Rated	Minir	num	Maximur	n	105.1	0.610.4		
50 Hz 28.4 W 83 V 7'						7 V 89 V 0.425 A 0.61					
Test position:	vertical, cap	-up		•							
			Referen	ce balla	ast cha	racteristic	2S				
Frequency	Nom	inal	Rated v	oltage	Cal	ibration	Power factor				
	watta	nge			C	urrent	ra	tio			
50 Hz	28 \	W	147	V	0.	435 A	24	1	0.075		
			Inforn	nation f	or ball	ast design					
Frequency				Hz					50		
Preheat cathoo	le current			А	Min.				0.450		
					Max.				0.800		
Open circuit v	oltage acros	ss startei	ſ	V	Min.((r.m.s)			140		
Open circuit v	oltage acros	s lamp		V	Max.	(peak)			400		
Substitution re	sistor for bo	oth catho	odes in se	ries					40		
Voltage across	s starter with	n lamp o	perating	V	Max.	(r.m.s)			93		
Lamp operatin	g current		TO	A	Max.				*		
			Inform	nation f	or star	ter design					
Pulse	e voltage		N	on-reclo	osure v	oltage		RIS ca	pacitor		
 	I VI III.			N	viax.		Ν	1in.	Max.		
	700 V			9	6 V		5.0) nF	10.0 nF		
							1				

			FOR	R 30 W	DUAI	SHAPE					
Nominal w	attage		Circuit	ţ		Catho	le			Cap	
30 W	7	Ex	ternal sta	arter		Preheat	ed			GY10q-4	
				Dimens	sions (mm)					
A			В					С			
Max			Max			Min Max					
54			25			270				280	
Starting characteristics											
Frequency Ballast rated voltage Test voltage							(r.m.	.s)	S	tarting time	
50 Hz 100 V						94 V				10 s	
			Ele	ctrical o	charac	teristics					
Frequency	Rated wattage		Voltage	(r.m.s) a	ıt lamp	terminals		Ratec	l lamp rent	Rated preheat current	
	U	F	Rated	Minii	num	Maximu	m				
50 Hz	29 W	49	V	61 V		0.62	20 A	0.850 A			
Test position:	vertical, cap	-up				1					
			Referen	nce ball	ast ch	aracteristi	cs				
Frequency	Nom	inal	Rated v	oltage	Ca	ibration	V	oltage/	current	Power factor	
	watta	age			c	urrent		rati	0		
50 Hz	30 \	W	100) V	0.620 A 118			118		0.075	
			Inform	mation f	for bal	last design	1				
Frequency				Hz						50	
Preheat cathoo	le current			А	Min.				0.640		
					Max.					1.100	
Open circuit v	oltage acro	ss startei	•	V	Min.	(r.m.s)				97	
Open circuit v	oltage acros	ss lamp		V	Max.	(peak)				400	
Substitution re	sistor for be	oth catho	des in se	eries						30	
Voltage across starter with lamp operating V						(r.m.s)				65	
Lamp operating current A										*	
	nation	lor sta	rter desigi	1							
Pulse voltage Non-rec						oltage			RIS ca	pacitor	
	Min.			Ν	Max.			Min.		Max.	
7	00 V			7	'0 V			5.0	nF	10.0 nF	

Nominal wattageCircuitCathode(36 WExternal starterPreheatedGY	Сар Y10q-6						
36 W External starter Preheated GY	Y10q-6						
Dimensions (mm)	sions (mm)						
A B C	С						
Max. Max. Min.	Max.						
44 21 405	430						
Starting characteristics							
FrequencyBallast rated voltageTest voltage (r.m.s)Starti	rting time						
50 Hz 200 V 180 V 1	10 s						
Electrical characteristics							
FrequencyRatedVoltage (r.m.s) at lamp terminalsRated lampRwattagecurrentcurrent	Rated preheat current						
Rated Minimum Maximum							
50 Hz 36 W 105 V 97 V 113 V 0.435 A	0.630 A						
Test position: vertical, cap-up							
Reference ballast characteristics							
Frequency Nominal Rated voltage Calibration Voltage/current I	Power factor						
wattage current ratio							
50 Hz 36 W 200 V 0.435 A 341	0.075						
Information for ballast design							
Frequency Hz 50	50						
Preheat cathode current A Min. 046	460						
Max. 0.83	830 85						
open cheart voltage across starter v Tvini.(1.11.3)	05						
Open circuit voltage across lamp V Max. (peak) 400	00						
Substitution resistor for both cathodes in series 40	40						
Voltage across starter with lamp operating V Max.(r.m.s) 119	19 *						
Information for starter design							
Pulse voltage Non-reclosure voltage RIS capac	acitor						
Min. Max. Min.	Max.						
800 V 134 V 5.0 nF	10.0 nF						

FOR 36 W DUAL SHAPE									
Nominal w	vattage		Circuit			Cathode			Сар
36 W	V	Ex	ternal sta	rter	Preheated 2G11				2G11
]	Dimensi	ons (r	nm)			
	A Max.			М	B lax.			M	C ax.
40						20 415			
Starting characteristics									
Freque	ncy	Ballas	t rated vo	oltage	Test voltage (r.m.s) Starti				tarting time
50 H	Z		220 V			198 V			10 s
			Elec	trical cl	narac	teristics			
Frequency Rated Voltage (r.m.s) at lamp terminals Rated lamp current Rated lamp current Rated Rated Minimum Movimum							Rated preheat current		
50 Hz	36 W	1	06 V	96 \	V	116 V	0.4	35 A	0.650 A
Test position:	horizontal, wi	th the p	lane thro	ugh the l	imbs ł	norizontal.	•		

Note – *To reduce the time for testing*, *other positions may be used by agreement between the manufacturer and testing authorities, In case of dispute, the horizontal position shall be the reference test position.*

		Reference balla	ast characteristi	cs					
Frequency	Nominal	Rated voltage	Calibration	Voltage/current	Power factor				
	wattage		current	ratio					
50 Hz	40 W	220 V	0.430 A	390	0.10				
		Information f	for ballast desig	<u> </u>	<u> </u>				
Frequency Hz 50									
Preheat cathode	current	А	Min.	().365				
			Max.	().775				
Open circuit vol	ltage across starte	er V	Min.(r.mr.s)	198					
Open circuit vol	ltage across lamp	V	Max. (peak)		400				
Substitution resi	stor for both cath	odes in series			40				
Voltage across s	starter with lamp	operating V	Max.(r.m.s)		128				
Lamp operating	current	A	Max.	().500				

TABLE (Concluded)

Information for starter design										
Pulse voltage		Non-re	eclosure vol	ltage	•		RIS c	capacitor		
Min.			Max.		-	Ν	lin.	Max.		
800 V			140 V			*	* nF * nF			
Information for high-frequency ballast design										
Typical lamp characteristics										
Frequency Lamp wattage Lamp voltage Lamp current										
20 KHz		32 W	90 V				0.360 A			
Current in any lead to cat	hodes		А	Max.				0.700		
Lamp operating current			А	Min.				0.300		
				Max.				0.500		
		Current co	ntrolled p	rehe	ating					
Minimum preheat current	i_k (A) en	nission time t _e	(s)	a				0.380		
$i_k = (a/t_e + i_m^2)^{0.5}$				im	(A)			0.360		
Maximum preheat curren	ıt		А	t	0.4			1.400		
				0.	4 <t 2<="" <="" td=""><td>2.0</td><td>1.5</td><td>50 - 0.400t</td></t>	2.0	1.5	50 - 0.400t		
				t	2.0			0.750		
Open circuit voltage across lamp (without t t _e Max.(r.m.s) 190										
starting aid)	V		t>t _e	Μ	lin.(r.m.	s)		340		
Substitution resistor for e	ach catho	ode			Ù			10		
		Voltage con	ntrolled pr	ehe	ating					
*										

			FOR	40 W D	UAL	SHAPE				
Nominal w	attage		Circuit			Catho	de			Сар
40 W	1	HF	starterle	ess]	Non-preheated				2G11
]	Dimensio	ons (n	ım)				
A B C										
1	Max.			Ma	ax.				Μ	lax.
	40			2	0				5	35
Starting characteristics										
Frequency Open circuit voltage Starting time										
20 26	(r.m.s)							0.1		
20 - 26	KHZ			475	• V					0.1 s
Electrical characteristics										
Frequency	Rated wattage	Voltage (r.m.s) at lamp terminalsRated lamp current							amp current	
	8	Ra	Rated Minimum Maximum							
20-26 kHz	40 W	12	26 V	116 V	V	136 V	7		0.3	320 A
Test position: h Note – To rea manufacturer reference test	norizontal, with duce the time j and testing a position	the pla for tes uthori	ane thro ting , of ties, In	ugh the lin ther positi case of d	mbs ho tions t	orizontal. may be u e, the hor	ised rizoi	by agreen ntal positio	nent on sh	between the all be the
		R	Referen	ce ballas	t cha	racterist	ics			
Frequency	Nomin wattag	al ge	Ra	ated volta	ge	Calib	ratic	on current		Resistance
20.26 kHz	40 W	T		254 V		(0.32	20 A		400
		Iı	nforma	tion for I	HF ba	llast des	ign			
Frequency					1	κHz				20
Open circuit voltage lamp V Min.(r.m.s) 800								800		
Current throug	h lamp substitu	ution re	esistor		Α		Mi	n.		0.200
Lamp substitut	tion resistor									1 000
Substitution re	sistor for each	cathoo	le							2
Cathode curre	nt						Ma	ax.		1.500
Current in any	lead to cathod	les			A	A	Ma	ax.		0.640
Lamp operatin	ig current				A	A	Mi	n.		0.260
							Ma	ax.		0.425

				FOR 40	W DUA	L SH	APE		
Nominal wa	ttage		Circu	it	С	athode	<u>,</u>		Сар
40 W		HF	starte	erless	Pr	eheate	d		2G11
				Din	nensions	(mm)			
l	A			I	3				С
Ma	Max. Ma								Max.
40 20						535			
Starting characteristics									
Frequency Preheat current Preheat time Open circuit Starting time									
				voltage (r.m.s.)					
20-26 KHz		0.470	4	2 s 350 V				0.1 s	
	Electrical characteristics								
Frequency	Ra	ted		Voltage	(r.m.s)at	lamp te	erminals		Rated lamp current
	wat	tage							-
<u> </u>	10		R	lated	Minim	num	Maxi	mum	0.000 4
20-26 KHz	40	W		26 V		V .	136	5 V	0.320 A
NOTE : To r manufactures In case of disp	educe t and te. pute, th	he time sting au e horizo	for te thorit ontal p	sting , ot ies. position si	h the mind her optio hall be th	ons ma ne refe	y be use rence te	ed by a est posit	greement between the tion.
				Catho	de chara	cterist	tics		
Test curre	nt				Resis	stance	of each	cathode	2
			Rate	d	Μ	linimun	n		Maximum
0.470 A			16 Ù	J		11 Ù			* Ù
			Re	ference	ballast cl	haract	teristics	5	
Frequency		Nomina	al	Rated	voltage	Ca	alibration	ı I	Resistance

Trequency	wattage	Tuilou Voltage	current	Teoristande
20-26 KHz	40 W	254 V	0.320 A	400 Ù
	I	nformation of HF b	oallast design	
Frequency		kHz	Z	20
Current in any lea	ad to cathodes	А	Max.	0.640
Lamp operating c	current	А	Min.	0.260
			Max.	0.425

TABLE (Concluded)

Current controlled	d preh	eatir	ng		
Minimum preheat current I_k (A) to emission time $t_e(s)$			а	(0.290
		im	(A)	().310
Maximum preheat current	t 0.	4		1 20	0
А	0.4 <	<t<2.< td=""><td>0</td><td>1 35</td><td>0-0.350 t</td></t<2.<>	0	1 35	0-0.350 t
	t 2	.0		0.65	0
Open circuit voltage across lamp	t t _o		Max.9r	.m.s)	220
(without starting aid) V	t>t _o		Min.(r.	m.s)	360
Substitution resistor for each cathode				Ù	12.5
Voltage controlle	d prel	neati	ng		
*					

			FOR	10 W	QUAL) SHAPE				
Nominal w	vattage		Circuit			Cathod	e			Сар
10 W	V	In	ternal sta	rter		Preheate	ed			G24d-1
			•	Dimens	ions (I	mm)				
	А			_	В				(2
	$\frac{Max}{29}$			N	$\frac{1}{12}$				<u> </u>	ax.
	28			15				9	5	
			Sta	rting cl	naract	eristics				
Frequency Ballast rated voltage Test voltage (r.m.s) Starting time									tarting time	
50 H	Z	220 V			198 V	r			10 s	
	Electrical characteristics									
Frequency	Rated watage		Voltage (r.m.s) at lamp terr					Rate cur	d lamp rent	Rated preheat current
		Ι	Rated	Minir	num	Maximur	n			
50 Hz	10 W		64 V	58	V	70 V	70 V 0.		90 A	0.210 A
Test position:	vertical, cap	-up				1				
			Referen	ce balla	st cha	aracteristic	es			
Frequency	Nom watt	inal age	Rated	voltage	Ca	Calibration current		oltage rat	current	Power factor
50 Hz	10	W	220) V	0	.190 A		1.07	0	0.12
		nation f	or bal	last design						
Frequency Hz 50										
Preheat catho		А	Min.				0.1	53		
			Max.				0.2	75		
Open circuit v		V	Min.	(r.mr.s)	198			8		
Carla etita di			Max.	(peak)	400					
Substitution re	esistor for be	oth catho	odes in se	ries	Moy				10	U 10
Lamp operatin	ig current			A	iviax.				0.2	10

FOR 13 W QUAD SHAPE													
Nominal w	vattage		Circuit			(Catho	de			Сар		
13 W	7	T	Internal start	tor		D	rehea	ted			G2/d-1		
15 V	/	1	internal start	Di	imer	nsion	ns (mi	m)			0240-1		
	Δ			1	D		Ì	Í			С		
N	A Max			M	B Aav					C Max			
1	28						130						
				Start	ing	char	acter	ristics					
FrequencyBallast rated voltageTest voltage (r.m.s)Starting time										Starting time			
50 Hz 220 V							198	V			10 s		
Electrical characteristics													
Frequency	equency Rated Voltage (r.m.s) at wattage Rated Minim						ermin Maxii	als num		Rated lamp current	Rated preheat current		
50 XX	10 111		04.11		4 4 7						0.010.4		
50 Hz	13 W	000 1	91 V	8.	IV	V 101 V 0.175 A			0.210 A				
	i. verticai,	cap-u	up —										
			Refe	erence	e bal	llast	char	acteris	stic	:S			
Frequency	Nom watta	inal age	Rated voltage	l e	Cal c	librati urren	ion 1t	Volta	ige, rat	/current io	Power factor		
50 Hz	13	W	220 V	/	0.	.165	А	1	07	′0 Ù	0.12		
			Inf	forma	tion	for	balla	st desig	gn				
Frequency				Н	Iz						50		
Preheat cath	1	Min	1.				0.153						
							х.				0.275		
Open circuit voltage across lamp V							1 (r.n	n.s)			198		
0.1		1 1				Max. (peak)				400			
Substitution resistor for both cathodes in series							s U			100			
Lamp operat		Max.				0.190							

FOR 18 W QUAD SHAPE												
Nominal v	vattage		Circuit			Catho	de			Сар		
18 W	J	In	ternal star	ter		Drehes	ited			G24d-2		
10 4	<u> </u>	111	ternar star	Dim	nensi	ons (mn	n)			0240-2		
	٨			F	B					C		
	A Max			 Ma	D Max				<u> </u>			
1	2	8					150					
			Ś	Startin	g ch	aracteri	stics					
Freque	ncv	F	Ballast rate	d		Test vo	ltage			Starting time		
1	-		(r.m.	s.)								
50 H			198	V			10 s					
			E	lectric	cal cl	haracter	istics					
Frequency Rated Voltage (r.m.s) at lamp terminals Rated Rated preheat										Rated preheat		
	wattage	•							lamp	current		
		R	ated	Minin	num	Maxi	mum	(current			
50 Hz	18 W		100 V	90) V	V 110 V		0	.220 A	0.280 A		
Test position	: vertical,	cap-up)	•		•						
			Refer	ence h	oalla	st chara	cterist	ics				
Frequency	Nom	inal	Rated	1	Cali	bration	Volta	age/	current	Power factor		
110400000	watta	age	voltag	e	cu	rrent		rati	0			
50 Hz	18	W	220		0.2	220 A	8	800	Ù	0.12		
			Info	ormati	on fo	or ballas	t desig	n				
Frequency				H	Z					50		
Preheat cath	А	. []	Min.				0.190					
			Max.				0.375					
Open circuit	V]	Min (r.r	n.s)			198					
]	Max. (peak)			400			
Substitution	n serie	s	Ù			80						
Lamp operat			Max.			0.240						

FOR 26 W QUAD SHAPE													
Nominal v	vattage		Circuit			С	atho	de			Cap		
26.11	T	La	4	4.0.00		D.,	-1	4 a d			C244.2		
20 V	V	111	ternar star	Din	neng	sions (enea (mm				6240-3		
			1			510115	(1111)	., 					
	A				B					C			
I		$\frac{1}{2}$						Max. 170					
		ng c	harac	teri	stics			170					
Freque	ncy	d	1	est vo	oltage	e (r.m.s	5)		Starting time				
50 Hz 220 V]	198 '	V			10 s		
	cal o	l characteristics											
Frequency	Rated		Voltage (r.m.s)	at la	mp te	rmin	als	R	lated	Rated preheat		
11010000	wattage	e	1 010000	voltage (1.11.3) at lamp terminals				1	amp	current			
		R	ated	Minii	mun	n N	Maxir	num	current				
50 II	0 < 11		10511						0		0.420.4		
50 Hz	26 W	000 18	105 V	93	5 V 115 V		0.	325 A	0.420 A				
Test position	i: vertical,	cap-u)										
			Refer	rence	ball	last ch	nara	cterist	ics				
Frequency	Nom	inal	Rated	1	Cal	libratio	on	Volta	nge/c	urrent	Power factor		
	watta	age	voltag	e	с	urrent	,		ratio				
50 H-	26	XX 7	220.1	7	0	215	•		- 40 1	T	0.10		
30 HZ	20	vv	220 \	V Info	U. rm	$\frac{1000}{2}$	1 for l	nallast	040 0 desi	ງ on	0.10		
Frequency				H	Iz	anon		Janast	ucor		50		
Preheat cath	1	Min.					0.270						
			Max	•				0.550					
Open circuit	voltage a	cross la	amp	V		Max. (r.m.s)					19		
						Max. (peak)				400			
Substitution resistor for both cathodes in series							Ù Ù			25			
Lamp operat			Max.				0.360						

			FOR	10 W	QUA	D SHAPE					
Nominal v	vattage		Circuit			Cathod	le		Сар		
10 V	V	Ex	xternal sta	urter		Preheat	ed		G24q-1		
				Dimens	sions (1	mm)					
	А				В				С		
	Max.			Ν	Max.			Max.			
	28				28				95		
Freque	ncy	Ballas	st rated vo	oltage	Te	est voltage	(r.m.s)		Starting time		
50 H	[z		220 V 198 V						10 s		
Electrical characteristics											
Frequency	Rated wattage	tage Voltage (r.m.s)				terminals	R	ated lamp current	Rated preheat current		
]	Rated	Minii	mum	Maximu	n				
50 Hz	10 W		64 V	58	V	70 V		0.190 A	0.210 A		
Test position:	vertical, cap	p-up									
			Referen	ice ball	ast cha	aracteristi	cs				
Frequency	Nom watta	inal age	Rated v	oltage	Cal c	libration urrent	Volta	age/current ratio	Power factor		
50 Hz	10	W	220	V	0.	190 A	1	070	0.12		
			Inform	nation	for ba	llast desig	1		·		
Frequency				Hz	-				50		
Preheat catho	de current			А	Min.			0	.153		
Open circuit v	r	V	Max. Min.((r.m.s)		0	.275 198				
Open circuit y	V	Max.	(peak)			400					
Substitution resistor for both cathodes in series						· /			100		
Voltage across starter with lamp operating V					Max.(r.m.s)		*				
Lamp operation	Lamp operating current							0	.210		

TABLE (Concluded)

Information for starter design											
Pulse voltage		Non-re	eclosure vo	ltage	;		RIS ca	pacitor			
Min.			Max.			N	lin.	Max.			
* V			* V			*	nF	* nF			
Information for high-frequency ballast design											
Typical lamp characteristics											
Frequency Lamp wattage Lamp voltage Lamp current											
20 KHz		0.190 A									
Current in any lead to ca	thodes		А		Max.			0.240			
Lamp operating current			А		Min.			0.135			
					Max.			0.210			
		Current co	ontrolled p	rehe	eating						
Minimum preheat current	t i _k (A) en	nission time t _e	(s)	a				0.045			
$i_k = (a/t_e + i_m^2)^{0.5}$				im	(A)			0.140			
Maximum preheat currer	nt		А	t	0.4			0.460			
				0.	4 < t < 2	2.0	0.50	00 - 0.110t			
				t	2.0			0.280			
Open circuit voltage acro	oss lamp (without	t t _e	Μ	lax.(r.m.	.s)		180			
starting aid) V t>t _e Min.(r.m.s) 340											
Substitution resistor for e	each catho	ode			Ù			35			
		Voltage co	ntrolled p	rehe	ating						
*											

	FOR 13 W QUAD SHAPE											
Nominal w	attage		Circuit			Cathode	è		Сар			
13W	7	Ex	ternal sta	arter		Preheate	d		G24q-1			
				Dimens	sions (r	nm)						
	А				В			(C			
]	Max.		Max.					Max.				
	28		28					1	30			
			Sta	rting cl	haract	eristics						
Freque	ncy	Ballas	t rated vo	oltage	Te	est voltage (1	:.m.s)	S	tarting time			
50 H	Z		220 V 198					10 s				
			Ele	ctrical o	harac	teristics						
Frequency	Rated		Voltage	(r.m.s) a	ıt lamp	terminals	Rate	d lamp	Rated preheat			
	wallage	F	Rated	Minii	num	Maximum	1 Cu	ment	current			
50 Hz	13 W		91 V	81	V	101 V	0.175 A		0.210 A			
Test position:	vertical car	-un										
	verueai, ea _f	-up	D									
			Keierer	ice ball	ast cha	aracteristic	S		-			
Frequency	Nom watta	inal age	Rated v	oltage	Cal c	ibration urrent	Voltage/current ratio		Power factor			
50 Hz	13	W	220	V	0.	165 A	107	0	0.12			
			Inform	nation	for bal	last design						
Frequency				Hz					50			
Preheat cathoo	le current			А	Min.			0	.153			
Open circuit y	oltage acro	ee etartar	•	V	Max.	(rmrs)		0	.275 198			
Open encunt v	onage acto	55 5141101		v	141111.((1.1111.5)			170			
Open circuit v	oltage acros	ss lamp		V	Max.	(peak)		4	400			
Substitution re	sistor for b	oth catho	des in se	eries	м				100			
Voltage across	s starter wit	n lamp o	perating Inform	V nation f	Max. for sta	(r.m.s) rter design			Т			
Pulse voltage				on-reclo	osure v	oltage	RIS ca		apacitor			
	Min.		Max.				Min.		Max.			
	* V		* V				*	nF	*nF			

TABLE (Concluded)

Information for high-frequency ballast design											
Typical lamp characteristics											
Frequency	Lamp wattage	Lamp	voltag	ge	Lamp current						
20 KHz	12.5 W	77	77 V		0.165 A						
Current in any lead to cathodes A Max. 0.240											
Lamp operating current A Min. 0.120											
Max. 0.190											
	Current co	ontrolled p	rehea	ting							
Minimum preheat current	i_k (A) emission time t_e	(s)	а		0.025						
$i_k = (a/t_e + i_m^2)^{0.5}$			$i_m(A)$	A)	0.135						
Maximum preheat curren	t	А	t C).4	0.400						
			0.4	< t < 2.0	0.430 - 0.090 t						
			t	2.0	0.250						
Open circuit voltage acros	ss lamp (without	t t _e	Ma	x.(r.m.s)	190						
starting aid)	V	t>t _e	Mir	n.(r.m.s)	380						
Substitution resistor for each cathodeÙ50											
Voltage controlled preheating											
*											

	FOR 18 W QUAD SHAPE												
Nominal v	wattage		Circuit				Cath	ode			Сар		
18 V	V	Ext	ernal star	ter			Prehe	ated			G24q-2		
				Di	men	sion	s (mn	1)					
	А				В						С		
	Max.			I	Max.						Max.		
	28				28	150					150		
			5	Starti	ing c	har	acteri	stics					
Frequ	uency		Ballast	ratec	l vol	tage			Test	voltage	Starting time		
									(r.1	n.s)			
50	Hz			220	V				19	8 V	10 s		
Electrical characteristics													
FrequencyRated wattageVoltage (r.m.s) at lamp terminalsRated lampRated preheat current													
	Rated						Maxi	mum	n ci	urrent			
50 Hz	18 W	10	0 V	90	V	110 V 0.220 A 0			0.280 A				
Test position	n: vertical,	cap-up											
			Refer	ence	bal	last	chara	cter	istics				
Frequency	Nom watta	inal age	Rateo voltag	l e	Ca	alibr curre	ation ent	Vo	oltage rat	/current io	Power factor		
50 Hz	18	W	220 1	I	0	122	0.4	80() ÌI	0.12		
J0 112	10	••	Info	rma	tion	for	ballas	t des	sign	/ 0	0.12		
Frequency					<u>Ц</u> 7						50		
Preheat cath	node curre	nt			A	M	in.				0.190		
						M	ax.				0.375		
Open circuit	t voltage a	cross st	arter	Ι	/	Μ	in. (r.n	n.s)			198		
						Μ	ax. (pe	eak)			400		
Substitution	resistor fo	or both c	athodes i	n ser	ies		Ù				80		
Voltage across starter with lamp operating V						Μ	ax.(r.n	1.S)			*		
Lamp operating current						Μ	ax.				0.240		
Informat						for	starte	r des	sign				
Pulse voltage Non-reclo						osure voltage				S capacitor			
М	Minimum M						aximum			mum	Maximum		

TABLE (Concluded)

Information for high-frequency ballast design											
Typical lamp characteristics											
Frequency	Lamp wattage	Lamp	voltage	Ι	Lamp current						
20 KHz	16.5 W	80 V			0.210 A						
Current in any lead to cathodes A Max. 0.330											
Lamp operating current A Min. 0.160											
Max. 0.240											
	Current con	ntrolled pr	eheating								
Minimum preheat current	t i_k (A emission time t_e ((s)	а		0.044						
$i_k = (a/t_e + i_m^2)^{0.5}$			$i_{m}(A)$		0.170						
Maximum preheat currer	nt	А	t 0.4		0.500						
			0.4 <t <<="" td=""><td>2.0</td><td>0.5500.115t</td></t>	2.0	0.5500.115t						
			t 2.0		0.320						
Open circuit voltage acro	oss lamp (without	t t _e	Max.(r.n	n.s)	220						
starting aid)	V	t>t _e	Min.(r.m	.s)	400						
Substitution resistor for each cathode Ù 30											
	Voltage controlled preheating										
*											

			FOR	26 W	QUAL) SHAPE				
Nominal w	attage		Circuit			Cathoo	le			Сар
26 W	/	Ex	kternal sta	urter		Preheat	ed			G24q-3
				Dimens	sions (r	nm)				
	A				В				(C
]	Max.			Ν	Max.				Μ	ax.
	28				28				1′	70
Starting characteristics										
Freque	ncy	Ballas	st rated vo	oltage	Te	est voltage	(r.m.	.s)	S	tarting time
50 11				100 V				10 -		
30 H			198 V				10.8			
Electrical characteristics										
Frequency	Frequency Rated Voltage (r.m.s) a wattage							Rated lamp		Rated preheat current
	C]	Rated	Minii	mum Maximum]		
50 Hz	26 W	-	105 V	95	V	115 V		0.3	25 A	0.420 A
Test position:	vertical, cap	p-up								
			Referen	ce ball	ast cha	aracteristi	cs			
Frequency	Nom	inal	Rated v	oltage	Ca	ibration	V	oltage	/current	Power factor
	watt	age		-	с	urrent		rat	io	
50 Hz	26	W	220	V	0.	315 A		540)	0.10
			Inform	nation f	for bal	last desigr	1			
Frequency				Hz						50
Preheat cathoo	de current			А	Min.					0.270
										0.550
Open circuit v	V	Min.((r.m.s)				198			
Open circuit v	oltage acro	ss lamp		V	Max.	(peak)				400
Substitution re	sistor for b	oth catho	odes in se	ries						25
Voltage across	s starter wit	h lamp o	operating	V	Max.	(r.m.s)				*
Lamp operatin	ig current			А	Max.					0.360

TABLE (Concluded)

Information for starter design											
Pulse voltage		Non-re	eclosure vol	tage	2		RIS c	capacitor			
Min.			Max.				Min.	Max.			
* V			* V * nF * r								
Information for high-frequency ballast design											
Typical lamp characteristics											
Frequency Lamp wattage Lamp voltage Lamp current											
20 KHz	24 W		80 V				0.	300 A			
Current in any lead to ca	thodes		А		Max.		0.480				
Lamp operating current			А		Min.			0.220			
					Max.			0.360			
	Cur	rent co	ntrolled pr	ehe	ating						
Minimum preheat current	i_k (A) emission	time t _e	(s)	a				0.130			
$i_k = (a/t_e + i_m^2)^{0.5}$				im	(A)			0.250			
Maximum preheat curren	ıt		А	t	0.4			0.850			
				0.	4 < t < 2	2.0	0.9	940.0,230 t			
				t	2.0			0.480			
Open circuit voltage acro	ss lamp (withou	ıt	t t _e	Μ	lax.(r.m	.s)		240			
starting aid) V t>t _e Min.(r.m.s) 420											
Substitution resistor for e	each cathode				Ù			10			
	Volt	age cor	ntrolled pr	ehe	ating						
*											

FOR 13 W QUAD SHAPE											
Nominal w	attage		Circuit			Cathod	e		Сар		
13 W	/	Ex	ternal sta	rter		Preheat	ed		GX10q-2		
				Dimens	sions (1	nm)					
	А				В				С		
]	Max.			Ν	Aax.			Min.	Max.		
	39				39			105	120		
Starting characteristics											
Freque	ncy	Ballas	t rated vo	oltage	Te	est voltage ((r.m.s)	S	starting time		
50 H	100 V			94 V			10 s				
			Ele	ctrical o	charac	teristics		I			
FrequencyRatedVoltage (r.m.s) at lamp terminalsRated lampRated preheawattagecurrentcurrentcurrent									Rated preheat current		
	U	F	Rated	Minir	num	Maximur	n				
50 Hz	13.3 W	-	54 V	48	V	60 V		0.300 A	0.440 A		
Test position:	vertical, cap	-up									
			Referen	ice ball	ast ch	aracteristi	cs				
Frequency	Nom watta	inal age	Rated v	oltage	Cal c	ibration urrent	Volta	age/current ratio	Power factor		
50 Hz	13	W	100	V	0.	300 A	,	244	0.075		
	I		Inform	nation f	for bal	last design	l		1		
Frequency				Hz					50		
Preheat cathoo	de current			A	Min.				0.320		
					Max.				0.580		
Open circuit v	oltage acro	ss starter		V	Min.((r.m.s)			97		
Open circuit v	oltage acros	ss lamp		V	Max.	(peak)			400		
Substitution re	ries					50					
Voltage across	V	Max.	(r.m.s)			65					
Lamp operatin	g current			A	Max.				*		
			Inform	nation f	for sta	rter design	l				
Puls	e voltage		N	on-reclo	closure voltage			RIS ca	apacitor		
Min.					Max.				Max.		
7	'00 V		70 V					5.0 nF	10.0 nF		

FOR 18 W QUAD SHAPE												
Nominal wattage		Circuit			Cathode		de		Сар		Сар	
18 W Ext		ternal starter			Preheated		GX10q-3					
	Dimensions (mm)											
	А		В									С
]	Max.			IX.	X.			Max.				
	39			39	9					128		
	Starting characteristics											
Freque	ncy	B	allast rated voltage]	Test voltage (r.m		e (r.m.:	s)	Starting time		
50 H	Z		100 V				94 V	1				10 s
				Electri	ca	l ch	aracte	ristics				
Frequency	ncy Rated V wattage		Voltage (r.m.s) at la			lamp terminals			Rated lamp	R	Rated preheat current	
			Kateu Iviimii		nu			mum		, and the		
50 Hz	Hz 17.5 W 55 V		49 V			61 V		(0.375 A		0.530 A	
Test position: vertical, cap-up												
	Reference ballast characteristics											
Frequency	Frequency Nominal wattage		Rated Ca voltage		Ca	Calibration V current		Volt	Voltage/current ratio			Power factor
50 Hz	18	W	100 0		0.375 A			190 Ù			0.075	
	Info	rmatio	n for bal	last des	sig	'n						
Frequency				Hz	Z			50				
Preheat cath	ode curre	nt	А			Min.						0.380
						Max.			0.730			
Open circuit	voltage a	cross st	arter	• •	Min (r.m.s)			97				
Open circuit	voltage a	cross	othodogi	V	Max. (peak)			400				
Substitution resistor for both cathodes in series U 50												
voltage across starter with lamp operating V					M	ax .(r.n	1.S)		65			
Lamp operating current					Max. *			*				
Information for starter design												
Pulse voltage Non-reclosu				sure voltage			RIS capacitor		apacitor			
Mi	nimum		Maximum			Ν	/lin	imum		Maximum		
700 V			70 V				5.0) nF		10.0 nF	

FOR 27 W QUAD SHAPE										
Nominal wattage			Circuit			Cathode		Сар		
27 W		Ex	External starter			Preheated		GX10q-4		
	Dimensions (mm)									
	A				В			С		
Ν	Max.			Ν	Max.		Min.		Max.	
	39				39		120		142	
			Sta	rting cl	haract	eristics				
Frequen	юу	Ballas	t rated vo	oltage	Test voltage (r.		.m.s) S		tarting time	
50 Hz	Z		100 V			94 V			10 s	
			Elec	ctrical o	harac	teristics				
Frequency	Rated wattage		Voltage	(r.m.s) a	t lamp terminals		Rate	ed lamp irrent	Rated preheat current	
	U	ŀ	Rated Minir		num	Maximum	l			
50 Hz	26.8 W		56 V 50		V	62 V	62 V 0.6		0.850 A	
Test position: vertical, cap-up										
	Reference ballast characteristics									
Frequency Nominal wattage		inal age	Rated voltage		Cal c	Calibration current		e/current tio	Power factor	
50 Hz 27 W		100 V		0.	0.620 A		8	0.075		
				Info	rmatio	n for ballas	t design			
Frequency				Hz					50	
Preheat cathod	le current		Α		Min.				0.640	
					Max.		1.10		1.100	
Open circuit vo	oltage acro	ss startei	ſ	V	Min.((r.m.s)		97		
Open circuit vo	oltage acros	ss lamp		V	Max.	(peak)	400			
Substitution resistor for both cathodes in				ries			30			
Voltage across starter with lamp of			perating	<u> </u>	Max.(r.m.s)		<u> </u>		65 *	
Lamp operating current A Max. *										
Pulse voltage			N	on-reclo	osure v	oltage	RIS capacitor			
1	Min.			N	Max.		N	lin.	Max.	
700 V				7	70 V		5.0	nF	10.0 nF	

APPENDIX B METHOD OF MEASURING LAMP CHARACTERISTICS

B.1 GENERAL

This Appendix covers the standardized rated values and tolerance areas for the chromaticity coordinates \mathbf{x} and \mathbf{y} applying to fluorescent lamps.

NOTE

The chromaticity co-ordinates x and y are specified according to the CIE 1931 Standard Colorimetric System (see CIE Publication 15-2)^{-1.} The tolerance areas are based on the ellipses defined by D.L. MacAdam in the paper "Specification of small chromaticity differences". Published in the journal of the Optical Society of America Vol. 1, No. 1, Jan. 1943, pp 18-26.

The tolerance areas are defined by MacAdam ellipses of 5 SDCM (Standard deviation of colour matching). 5 SDCM away from the rated values are given by the equation.

 $g_{11}\ddot{A} x^2 + 2 g_{12} \ddot{A} x \ddot{A} y + g_{22} \ddot{A} y^2 = 5^2$

In which $\ddot{A} x$ and $\ddot{A}y$ represent the deviations with respect to the rated co- ordinates, while the coefficients g_1 , g_{12} and g_2 depend on these rated values. These coefficient are the basis for calculating \dot{e} , a and b, where \dot{e} is the angle between the major axis of the ellipse and the X axis and a and b are the major and minor semi axis of an ellipse of 1 SDCM.

B.2 STANDARD CHROMATICITY CO-ORDINATES

For the standardized chromaticity co-ordinates the following rated values x and y apply for the different lamp "colours (with the correlated colour temperatures T_c in kelvin given as extra information):

"Colour"	T _c	X	Y
(1)	(2)	(3)	(4)
F 6500	6400	0.313	0.337
F 5000	5000	0.346	0.359
F 4000	4040	0.380	0.380
F 3500	3450	0.409	0.394
F 3000	2940	0.440	0.403
F 2700	2720	0.463	0.420

TABLE 7 –	Rated	values of	f x and	y for	standardized	chromaticity	coordinates
				•		•	

"Colour"	G ₁₁	G ₁₂	G ₂₂
(1)	(2)	(3)	(4)
F 6500	86 x 10 ⁴	$-40 \ge 10^4$	$45 \ge 10^4$
F 5000	$56 \ge 10^4$	-25×10^4	28×10^4
F 4000	39.5 x 10 ⁴	-21.5x 10 ⁴	$26 \ge 10^4$
F 3500	38×10^4	$-20 \text{ x} 10^4$	$25 \ge 10^4$
F 3000	39×10^4	-19.5x 10 ⁴	27.5×10^4
F 2700	$44 \ge 10^4$	-18.6x 10 ⁴	$27x \ 10^4$

TABLE 8 – Values of coefficient of g_{11} g_{12} and g_{22} for standardized chromaticity coordinates

TABLE 9 – Values of è, a and b for standardized chromaticity coordinates

"Colour"	È	Α	В
(1)	(2)	(3)	(4)
F 6500	58° 23	0.00223	0.00095
F 5000	59° 37 [°]	0.00274	0.00118
F 4000	54° 00 [°]	0.00313	0.00134
F 3500	52° 58 [°]	0.00317	0.00139
F 3000	53° 10 [°]	0.00278	0.00136
F 2700	57° 17 [°]	0.00258	0.00137

For an example the tolerance area is shown in Figure B_1 for standard colour F 6500, together with the rated values, a part of the black body locus, and lines of constant correlated colour temperature.

B.3 SHIFTED CHROMATICITY CO-ORDINATES

For some lamps, as specified on the relevant lamp data sheet, slightly, shifted chromaticity coordinates apply, but only for types having a general colour rendering index less than 80.

The same tolerance areas as given in Figure B_1 in shall be used, but centred on the rated values given in the following Table **5**:

"Colour"	X	Y
(1)	(2)	(3)
F 6500	0.309	0.337
F 5000	0.342	0.359
F 4000	0.375	0.380
F 3500	0.403	0.394
F 3000	0.433	0.403
F 2700	-	-

 TABLE 10 - Rated values of x and y for standardized chromaticity coordinates



FIGURE 15 - Tolerance area for standard colour F 6500

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