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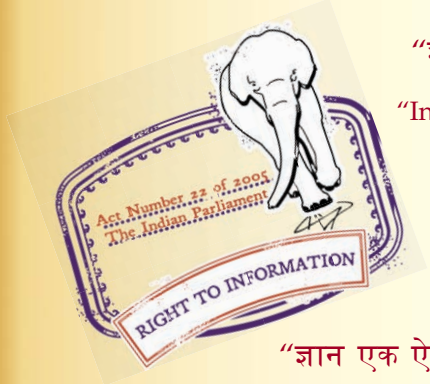

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Indian Standard

SPECIFICATION FOR TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE

PART I REQUIREMENTS AND TESTS

(First Revision)

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SPECIFICATION FOR TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE

PART I REQUIREMENTS AND TESTS

(First Revision)

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Indian Standard

SPECIFICATION FOR TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE

PART I REQUIREMENTS AND TESTS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part I) (First Revision) was adopted by the Indian Standards Institution on 24 February 1977, after the draft finalized by the Electric Lamps and Accessories Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard was first published in 1964. This revision has been undertaken with a view to upgrade many of the essential characteristics of tubular fluorescent lamps and bringing it in line with the revision of the corresponding International Standard, namely, IEC Publication 81 (1974) ' Tubular fluorescent lamps for general lighting service '.

0.3 This standard specifies the requirements and testing methods to be used in determining the quality and interchangeability of tubular fluorescent lamps, including sampling and conditions of compliance applicable to type testing and testing of lamp batches.

0.4 This standard shall be read in conjunction with the following Indian Standards:

IS : 2418 (Part II) - 1977 Specification for tubular fluorescent lamps for general lighting service: Part II Standard lamp data sheets

IS : 2418 (Part III) - 1977 Specification for tubular fluorescent lamps for general lighting service: Part III Dimensions of G-5 and G-13 bi-pin caps

IS : 2418 (Part IV) - 1977 Specification for tubular fluorescent lamps for general lighting service: Part IV Go and no-go gauges for G-5 and G-13 bi-pin caps

0.5 It may be expected that lamps which comply with this specification, when operated with a starter complying with IS : 2215-1968* and with ballasts complying with IS : 1534 (Part I)-1967† will start and operate satisfactorily at 90 percent of rated voltage and for ambient temperatures between 10 to 15°C. However, at 50°C, only starting may be secured and not immediate re-starting.

0.6 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, shall be rounded off in accordance with IS : 2-1960‡. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard (Part I) specifies the requirements and tests for tubular fluorescent lamps for general lighting service operated at 50 Hz. Lamps of the following types are covered:

a) Lamps with preheated cathodes operated with the use of a starter, and

b) Lamps with preheated cathodes operated without the use of a starter.

NOTE — It may happen that the same lamp can be 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) 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.

2. TERMINOLOGY

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

2.1 Tubular Fluorescent Lamps — A low pressure mercury discharge lamp of tubular form either straight 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.

2.2 Lumen Maintenance — The ratio of the luminous flux of an individual lamp after 2 000 hours of operation, or 70 percent of its rated life, as appropriate, to that found in the rating test.

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*Specification for starters for fluorescent lamps (*second revision*).

†Specification for ballasts for fluorescent lamps: Part I For switch start circuit (*first revision*).

‡Rules for rounding off numerical values (*revised*).

2.3 Colour Characteristics — The colour characteristics of a lamp are defined by the colour appearance and the colour rendition.

2.3.1 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).

2.3.2 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 rendition.

2.4 Rated Colour Temperature — The rated colour temperature is the colour temperature marked on the lamp.

2.5 Rated Wattage — The rated wattage is the wattage marked on the lamp.

2.6 Rated Luminous Flux — The rated luminous flux is the luminous flux marked on the lamp or declared by the supplier.

2.7 Group — Lamps of the same rated electrical characteristics and physical dimensions.

2.8 Type — Lamps of the same group having the same photometric ratings and colour characteristics.

2.9 Batch — All the lamps of one type put forward at one time for acceptance tests.

2.10 Initial Readings — The initial readings are the measurements of the luminous and electrical characteristics, excluding the checking of starting voltages, made at the end of the 100 hours ageing period.

2.11 Test Quantities

2.11.1 *Inspection Test Quantity* (*ITQ*) — The number of lamps selected for the purpose of determining the acceptability of a batch as to marking, mechanical and physical requirements, and starting characteristics.

2.11.2 *Rating Test Quantity* (*RTQ*) — The number of lamps selected for the purpose of determining the acceptability of a batch as to initial readings and colour.

2.11.3 *Life Test Quantity* (*LTQ*) — The number of lamps selected for the purpose of determining the acceptability of a batch as to life performance.

2.11.4 *Type Test Quantity* (*TTQ*) — The number of lamps selected for the purpose of determining the acceptability of a lamp type.

2.12 Life — The life of a lamp is the number of hours it operates to ' burn out ' or to any other criterion of life performance laid down in this specification.

2.13 Rated Life — The rated life is the declared life.

2.14 Routine Tests — Tests carried out on each lamp to check requirements which are likely to vary during production.

2.15 Type Tests — Tests carried out to prove conformity with the specification. These are intended to prove the general qualities and design of a given type of lamp.

2.16 Acceptance Tests — Tests carried out on samples taken from a lot for the acceptance of the lot.

3. SELECTION OF LAMPS FOR TESTS (SAMPLING)

3.1 Method of Selection — The inspection, rating life and type test quantities specified in the following clauses shall be selected in a mutually agreed manner such as to ensure proper representation of the batch.

3.1.1 The selection of lamps for individual batches should be made as follows:

a) *Up to and including 20 containers per batch* — Out of every container an equal number of lamps (or as near to equal as possible) shall be selected at random in order to obtain the 20 lamps required.

b) *Over 20 containers per batch* — Out of 20 containers, evenly distributed over the whole batch, one lamp shall be selected at random from each container to obtain the 20 lamps required.

NOTE — Methods for the selection of lamps for type testing are under consideration.

3.2 Inspection Test Quantity (ITQ) — Inspection test quantity shall consist of 20 lamps.

3.3 Rating Test Quantity (RTQ) — Rating test quantity consisting of 15 lamps, shall be selected at random from the lamps which have passed the inspection test. The RTQ for determining the acceptability as to colour appearance may, however, be restricted to three (*see* **7.3.2**).

3.4 Life Test Quantity (LTQ) — Life test quantity consisting of 10 lamps shall be selected at random from the lamps which have passed rating test.

3.5 Accidentally Broken and/or Incorrectly Operated Lamps — Lamps which are accidentally broken and/or have been operated in conjunction with incorrect controlgear before the life test is completed shall, when necessary, be replaced to ensure that the required number of ten lamps completes the test.

Any such broken or incorrectly operated lamps shall be neglected in the calculation of life test results.

NOTE — In order to avoid unnecessary delay it is recommended that spare lamps be available through the tests.

4. MECHANICAL, PHYSICAL AND STARTING REQUIREMENTS

4.1 Mechanical and Physical Requirements

4.1.1 *Glass Tubing* — The glass tubes of the lamps shall be free from defects detrimental to service (*see also* IS : 5081-1969*).

4.1.2 *Caps* — The dimensions of lamp caps shall be in accordance with IS : 2418 (Part III)-1977†.

4.1.2.1 The maximum angular displacement of the plane of the cap pins at one end of the lamps with respect to the similar plane at the other end of the lamp shall not exceed 6°.

4.1.2.2 The shells of caps may be of any suitable material, provided the caps are ordinarily resistant to atmospheric corrosion and withstand the tests specified.

4.1.2.3 Contacts shall be evenly soldered or welded to ensure satisfactory engagement and electrical contact in the appropriate holder.

4.1.2.4 *Attachment of caps to glass tubes* — Caps shall be attached to the tubes so strongly as to comply with the torsion test carried out in accordance with **6.4**, with the following torsional moments, both during the inspection tests and at the end of life test:

Type of Cap	*Torsional Moments*
G-13	1·2 Nm
G-5	Under consideration

4.1.2.5 The insulation resistance between the shell and the contacts of the caps shall be not less than 50 megohms, when measured in accordance with **6.5**.

4.1.3 *Dimensions* — The lamp dimensions shall be as specified on the individual lamp data sheet in IS : 2418 (Part II)-1977‡.

*Specification for glass tubes for fluorescent lamps.

†Specification for tubular fluorescent lamps for general lighting service: Part III Dimensions of G-5 and G-13 bi-pin caps.

‡Specification for tubular fluorescent lamps for general lighting service: Part II Standard lamp data sheets.

4.2 Starting Requirements — The starting characteristics of the lamps shall be tested before ageing as specified in **6.7**:

a) *Lamps operated with starter* — The lamp shall start fully within one minute and remain alight, and

b) *Lamps operated without starter* — The lamp shall start fully within 10 seconds and remain alight.

5. MARKING

5.1 The lamps shall be clearly and indelibly marked with the following information:

a) Name or trade-mark of the manufacturer or supplier;

b) Rated watts (marked 'W');

c) Colour temperature;

d) Starting conditions (for lamps to be used as starterless); and

e) Country of manufacture.

NOTE — Compliance is checked by rubbing the marking with a piece of cloth soaked with water for 15 seconds.

5.1.1 The lamps may also be marked with the Standard Mark.

5.1.2 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

6. TESTS

6.1 Classification of Tests

6.1.1 *Type Tests* — The following shall constitute the type tests to be carried out on selected samples of tubular fluorescent lamps, samples being drawn preferably from regular production lot:

a) Visual examination and checking for marking (*see* **6.3**);

b) Torsion test (*see* **6.4**);

c) Insulation resistance test (*see* **6.5**);

d) Burning test (*see* **6.6**);

e) Starting characteristics test (*see* **6.7**);

f) Test for electrical, luminous and colour characteristics (*see* **6.8**); and

g) Life-test (*see* **6.9**).

6.1.1.1 The number of samples shall be as given against ITQ, RTQ and LTQ and the criterion of acceptance as given in **7.**

6.1.2 *Acceptance Tests* — The following shall constitute as acceptance tests:

a) Visual examination and checking for marking (*see* **6.3**);
b) Torsion test (*see* **6.4**);
c) Insulation resistance test (*see* **6.5**);
d) Burning test (*see* **6.6**);
e) Starting characteristics (*see* **6.7**); and
f) Test for electrical, luminous and colour characteristics (*see* **6.8**).

6.1.2.1 Sampling should be the same as given against ITQ and RTQ, and the criterion of acceptance as given in **7.**

6.1.3 *Routine Tests* — The following shall constitute the routine tests:

a) Visual examination and checking for marking (*see* **6.3**), and
b) Burning test (*see* **6.6**).

6.2 Conditions of Tests

6.2.1 *Operating Position and Lamp Connections*

a) For the rating and life tests, lamps shall burn in the horizontal position.
b) *Lamps operated with a starter* — For the duration of the tests, including the life test, the connections of the lamp contacts, with reference to the terminations of the ballast, shall not be changed.

By convention, the arrangement given in Fig. 1 is used, the symbol 'B' on the diagram indicates the contacts to be connected to the main circuit.

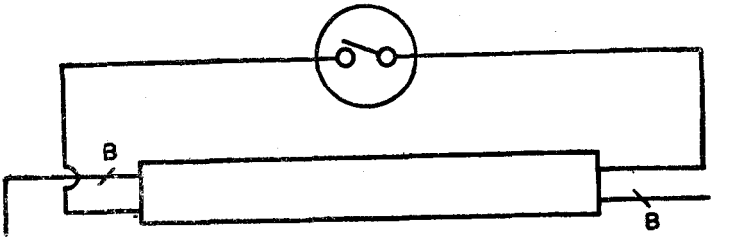

FIG. 1 POSITION OF LAMP CONNECTIONS

c) Lamps with preheated cathodes operated without a starter — the conditions of (b) shall be followed for measurements of initial readings with a reference ballast, and for life tests.

In cases where a reference ballast has not been established, the contact arrangement can be chosen arbitrarily but if the lamp is temporarily removed it shall be replaced without changing the contact arrangements.

6.2.2 *Ageing* — Before the lamps are subjected to the rating tests for the first time, they shall be aged for 100 hours of normal operation, preferably in a circuit for which they are designed.

6.2.3 *Lamp Wattage* — The initial readings for the power consumed by the lamp shall not exceed from the objective wattage indicated in the relevant lamp data sheet in IS : 2418 (Part II)-1977*, by more than 5 percent + 0·5 watt, when tested under the conditions specified in Appendix A.

6.2.3.1 *Objective wattage* — Objective wattage is the wattage consumed by the lamp when tested with reference ballast as specified in Appendix A.

6.2.4 *Lamp Voltage* — In the test conditions specified in **6.2.3** the initial readings of the voltage at the lamp terminals shall comply with the conditions specified in the relevant lamp data sheet in IS : 2418 (Part II)-1977*.

NOTE — Cathode watts due to supplementary heating are not included in the objective lamp wattage unless otherwise stated on the lamp data sheet in IS : 2418 (Part II)-1977*.

6.2.5 *Luminous Flux and Colour Characteristics*

6.2.5.1 The initial luminous flux of individual lamps shall be not less than 90 percent of the rated value which shall be not less than the value specified in the relevant lamp data sheet in IS : 2418 (Part II)-1977*. Initial readings shall be measured as specified in Appendix A.

6.2.5.2 *Colour appearance*

a) *Nominal colours* — The nominal values of the chromaticity co-ordinates shall be specified as in Table 1 of Appendix B.

b) *Tolerance for chromaticity co-ordinates* — The chromaticity co-ordinates of the lamps under test shall fall within the area on the chromaticity chart bounded by straight lines joining the 12 points indicated for the nominal colours as specified in Table 2.

*Specification for tubular fluorescent lamps for general lighting service: Part II Standard lamp data sheets.

For other nominal chromaticity co-ordinate values given in Table 1 which deviate slightly from those indicated in Table 2, the co-ordinates of the relevant area are shifted accordingly.

6.2.6 *Cathode Characteristics of Lamps Operated Without Starter* — The initial readings of the cathode characteristics shall be in accordance with the values in the relevant lamp data sheet in IS : 2418 (Part II)-1977* when tested under the conditions specified in Appendix A.

6.3 Visual Examination and Checking for Marking — Each lamp of ITQ shall be examined visually as well as checked for marking requirements detailed in **5**.

6.4 Torsion Test — Each lamp of ITQ shall be examined for this test. Lamps shall be inserted in a holder having the shape and dimensions given in Appendix C and fixed to a suitable torsion testing machine. The torque shall not be applied suddenly but increased gradually to the torsional moment specified in **4.1.2.4**.

6.4.1 This test shall be carried out during inspection tests as well as after the life test.

6.5 Insulation Resistance Test — Each lamp of ITQ shall be examined for this test. Insulation resistance between the shell and contacts of the cap shall be measured before ageing. Before testing the lamps shall be stored in dry atmospheres for approximately 48 hours and the external surface of their insulation shall be wiped with a dry cloth. In case the insulation, when first measured, is found to be less than the specified value, the lamps shall be stored in a warm, dry atmosphere for a week and then retested for insulation.

6.5.1 Insulation resistance shall be measured with 500 V dc applied for a period of one minute.

NOTE — This test is not applicable in case of lamps when the cathode is electrically connected to the shell of the cap to aid starting.

6.6 Burning Test — The lamp shall be checked for its burning by supplying it with the rated voltage. The lamp shall burn and give uniform light.

6.7 Testing of Starting Characteristics — The testing of starting characteristics shall be measured as specified in Appendix D.

6.8 Test for Electrical Luminous and Colour Characteristics — The methods of tests for measuring electrical, luminous and colour characteristics of lamps shall be as given in Appendix A.

*Specification for tubular fluorescent lamps for general lighting service: Part II Standard lamp data sheets.

6.9 Life Test — After 2 000 hours operation, including the ageing period of 100 hours, the lumen maintenance shall be not less than the value indicated in the relevant lamp data sheet in IS : 2418 (Part II) - 1977*. It shall be measured as specified in Appendix A.

NOTE — In the event of tests being required to assess the rated life of the lamps, after complying with the above, the tests shall be extended to 70 percent of the rated life. The luminous flux of individual lamps shall be not less than the value indicated on the relevant lamp data sheet in IS : 2418 (Part II)-1977*.

Lamps shall be operated in the circuit for which they are preferably designed. For example:

a) A circuit including a starter,

b) A circuit without a starter (starterless).

1) With low resistance cathodes.

2) With high resistance cathodes.

The characteristics of the ballast and the starter, if any, shall comply with the requirements of Appendix E.

The life test shall be carried out on an ac supply with a declared frequency of 50 Hz which shall be the rated frequency of the ballast. The test voltage shall be equal to the rated voltage of the ballast.

The life test shall be made at an ambient temperature between 15°C and 50°C.

The momentary fluctuation of the test voltage and frequency during the life test shall not exceed ± 2 percent in each case.

6.9.1 *Switching On and Switching Off During Life Tests* — Lamps on test shall be switched off eight times in every 24 hours operation. The 'on' and 'off' periods shall each be at least 10 minutes. A lamp which fails to restart shall be tested under the same conditions as those for the initial starting test (*see* Appendix D) and if it fails to comply shall be deemed to have failed.

NOTE 1 — *Lamps Operated With Starter* — A lamp is considered as failing to restart, if it does not start within one minute and subsequently does not start in conjunction with another starter. Individual attention shall be given to each lamp on test at least once each day.

NOTE 2 — *Lamps Operated Without Starter* — A lamp is considered as failing to restart if it does not start within a period not exceeding 10 seconds. Individual attention shall be given to each lamp on test at least once each day.

*Specification for tubular fluorescent lamps for general lighting service: Part II Standard lamp data sheets.

7. CONDITIONS OF COMPLIANCE

7.1 General Conditions — A batch shall be considered as conforming to this standard if the requirements contained in **7.2**, **7.3** and **7.4** are fulfilled. If the batch fails to satisfy the requirements of any of these clauses, it shall be deemed not to comply with the standard.

7.2 Mechanical, Physical, Starting and Marking Requirements — A batch shall be considered to comply with the requirements of **4** and **5**, if the number of lamps failing does not exceed qualifying limits given below:

	Qualifying Limit
a) For any single requirement	2
b) For all requirements taken together	4

7.3 Initial Readings and Colour

7.3.1 *Initial Readings* — A batch shall be considered to comply with the requirements of initial readings, if the number of lamps failing does not exceed the qualifying limits given below:

	Qualifying Limit
a) For initial luminous flux of individual lamps	4
b) For wattage of individual lamp and voltage at lamp terminals	4
c) For all the requirements taken together	5

NOTE — Conditions of compliance for cathode characteristics are under consideration.

7.3.2 *Colour* — Compliance shall be considered to be achieved if all the three lamps of the RTQ (*see* **3.3**) meet the colour appearance requirement of Appendix B.

In the event of one or more failures the remaining lamps of RTQ shall be tested, from which not more than four shall fail.

7.4 Lumen Maintenance — A batch shall be considered to comply with the requirements of life if the lotal number of lamps having lives shorter than 2 000 hours, together with those failing to meet the requirements given in **6.9** does not exceed two.

NOTE — In the event of the life test being extended to 70 percent of the rated life, compliance shall be considered to be achieved if the number of lamps of LTQ having lives less than 70 percent of the rated life, together with those failing to meet the requirements of **6.9** does not exceed four.

APPENDIX A

(*Clauses* 6.2.3, 6.2.3.1, 6.2.5.1, 6.2.6, 6.8 *and* 6.9)

METHOD OF MEASURING ELECTRICAL LUMINOUS AND COLOUR CHARACTERISTICS OF THE LAMP

A-1. TESTS COMMON TO LAMPS OPERATED WITH OR WITHOUT STARTER

A-1.1 General — Electrical, luminous and colour characteristics of lamps operated without starter, with the exception of additional tests for checking the cathodes, will be determined by exactly the same methods as for those operated with starters.

A-1.1.1 Ballasts used for these tests shall be reference ballasts as specified in IS : 1534 (Part I) - 1967*.

A-1.1.2 Before the lamps are subjected to rating test for the first time, they shall be aged for a period of 100 hours of normal operation.

NOTE — Normal operating condition shall be condition similar to that for life test.

A-1.1.3 Tests shall be made in a draught-free atmosphere, at an ambient temperature of 25 ± 1°C. The frequency shall be 50 Hz with a tolerance of ± 0·5 percent.

A-1.1.4 During the period of stabilization, the supply voltage should be stable within ± 0·5 percent, this tolerance being reduced to ± 0·2 percent at the moment of measurement.

A-1.1.5 The total harmonic content of the supply voltage shall not exceed 3 percent. The harmonic content is defined as the root-mean-square (rms) summation of the individual harmonic components, using the fundamental as 100 percent.

NOTE — This implies that the source of supply shall have sufficient power and that the supply circuit shall have a sufficiently low impedance compared with the ballast impedance and care should be taken that this applies under all conditions that occur during the measurements.

A-1.2 Lamp Running Current Waveshape — The maximum ratio of peak value to root-mean-square (rms) value shall not exceed 1·7.

A-1.3 Electrical, Luminous and Colour Characteristics of the Lamps — These characteristics shall be measured after stabilization† using the circuit shown in Fig. 2.

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*Specification for ballasts for fluorescent lamps: Part I For switch start circuits (*first revision*).

†The approximate stabilization period is 15 minutes. If a pre-warming position is used, from which the lamp is moved to the test position, a further stabilization period is necessary in the test position. The interruption of the supply should be as short as possible, and the additional stabilization period should be at least five minutes.

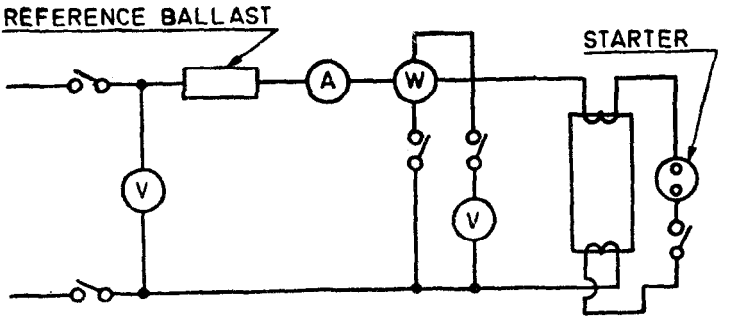

FIG. 2 TEST CIRCUIT FOR INITIAL RATING TESTS

A-1.3.1 The voltage at the supply terminals shall be adjusted to the rated value of the reference ballast being used and the wattage, voltage at lamp terminals, current, luminous flux and colour, shall be measured.

A-1.3.2 Potential circuit of instruments connected across a lamp shall not draw more than 3 percent of the nominal running current of the lamps.

A-1.3.3 Instruments connected in series with the lamp shall have a sufficiently low impedance such that the voltage drop shall not exceed 2 percent of the nominal running lamp voltage.

A-1.3.4 Instruments snall be essentially free from waveform errors. When measuring the voltage or power of the lamp, the potential circuit of the instruments not in use shall be open. During the measuring of the lamp wattage, no correction shall be made for the wattmeter consumption (the circuit connection being made on the lamp side of the current coil).

A-1.3.5 When measuring the luminous flux, the potential circuits of the voltmeter and of the wattmeter shall be open.

NOTE — The reference to the absence of a correction of the consumption of the voltage circuit of the wattmeter arises from an empirical observation which shows that in most cases, at the same supply voltage, the said consumption compensates approximately for the reduction of the power consumption of the lamp caused by the parallel connection of the voltage circuit of the wattmeter.

A-2. ADDITIONAL TEST FOR LAMPS OPERATED WITHOUT STARTERS

A-2.1 Determination of Cathode Characteristics — For this test only that part of Fig. 5 which includes the cathode circuits shall be used.

The voltages at the cathode terminals shall be adjusted to the values given on the relevant lamp data sheet in IS : 2418 (Part II) - 1977*, and the currents shall be measured. From these, after deduction of the consumption of the voltmeters, the cathode resistances shall be determined.

A-3. MEASUREMENT OF COLOUR CHROMATICITY CO-ORDINATES

A-3.1 Procedure — Measurement of colour may be made with a five-cell type colorimeter and a calibrated lamp of the same spectral energy distribution as the lamp to be tested. This type of colorimeter is most commonly used due to its simplicity and speed of operation.

The five-cell type colorimeter usually consists of an assembly of photo-cells, colour filters and diaphragms shielded by a box-like enclosure. The external resistance of photo-cell circuit shall be preferably less than 1 ohm. The filtered cells and diaphragms are mounted in the enclosure, approximately 50 cm from its viewing aperture. The aperture should be such that the cells' view the full diameter of the fluorescent tube under test and about 25 cm of its centre section. The distance from the plane of the aperture to the centre line of the lamps is of the order of 5 cm. Y and Z components can be measured with one filtered cell each. The X component requires three such cells in parallel to obtain the theoretical X values. Diaphragms in front of the cells permit adjustment of the ratio of their responses. Cell output for the X, Y and Z values may be read on a micrometer of a current balance.

NOTE — The calibrated lamp should be checked before testing by comparing with another stored spare calibrated lamp (same colour and wattage) and the difference of each value should be less than 2 percent.

APPENDIX B

(*Clauses* 6.2.5.2 *and* 7.3.2)

RATED COLOUR CHARACTERISTICS

B-1. The values for chromaticity co-ordinates are given in Table 1.

B-2. Values for colour tolerance are given in Table 2.

B-3. Colour — Under consideration.

*Specification for tubular fluorescent lamps for general lighting service: Part II Standard lamp data sheets.

TABLE 1 CHROMATICITY CO-ORDINATES

(*Clauses* 6.2.5.2 *and* B-1)

Rated Wattage	Nominal Colour					
	6 500 K		4 300 K		2 900 K	
	X	Y	X	Y	X	Y
(1)	(2)	(3)	(4)	(5)	(6)	(7)
W						
20	0·313	0·337	0·368	0·371	0·438	0·401
40	0·313	0·337	0·368	0·371	0·438	0·401
65	0·314	0·338	0·368	0·371	0·435	0·402
80	0·311	0·341	0·365	0·373	0·432	0·403

TABLE 2 COLOUR TOLERANCE

(*Clauses* 6.2.5.2 *and* B-2)

Nominal Colour					
6 500 K ($X = 0·313$, and $Y = 0·337$)		4 300 K ($X = 0·368$, and $Y = 0·371$)		2 900 K ($X = 0·438$, and $Y = 0·401$)	
X	Y	X	Y	X	Y
(1)	(2)	(3)	(4)	(5)	(6)
0·319 0	0·346 7	0·377 1	0·383 9	0·446 3	0·411 9
0·320 2	0·344 1	0·378 5	0·380 3	0·447 9	0·408 5
0·319 5	0·339 7	0·377 2	0·374 3	0·446 8	0·402 9
0·317 1	0·334 5	0·373 4	0·367 2	0·443 5	0·397 0
0·313 5	0·330 0	0·368 2	0·361 2	0·438 5	0·391 9
0·309 9	0·327 4	0·362 8	0·358 0	0·433 5	0·389 5
0·307 0	0·327 3	0·359 0	0·358 1	0·429 6	0·390 0
0·305 8	0·329 9	0·357 5	0·361 7	0·428 1	0·393 7
0·306 5	0·334 3	0·358 9	0·367 7	0·429 1	0·399 1
0·308 9	0·339 5	0·362 7	0·374 7	0·432 7	0·405 1
0·312 5	0·344 0	0·367 9	0·380 7	0·437 5	0·410 1
0·316 1	0·346 6	0·373 3	0·384 0	0·442 5	0·412 5

APPENDIX C

(*Clause* 6.4)

HOLDERS FOR TORSION TEST

C-1. The dimensions of holders for torsion test on lamps fitted with G-13 caps shall be as given in Table 3 read with Fig. 3.

TABLE 3 DIMENSIONS OF HOLDERS FOR TORSION TEST FOR G-13 CAPS

(*Clause* C-1)

All dimensions in millimetres.

Reference Letter	Dimension	Tolerance
C	36·0	Min
D	12·7	± 0·03
E	2·8	+ 0·3
G	1·5	Approx
H	4·0	Approx
K	7·8	Min

Note 1 — In order to ensure appropriate engagement between the cap and the holder during the test, a locating device shall be fixed at a suitable distance from the holder to provide adequate support for the lamp.

Note 2 — The face of the cap shall be in close contact with the face of the torsion test holder.

Note 3 — The torque shall not be applied suddenly but shall be increased continuously from zero to the amount specified.

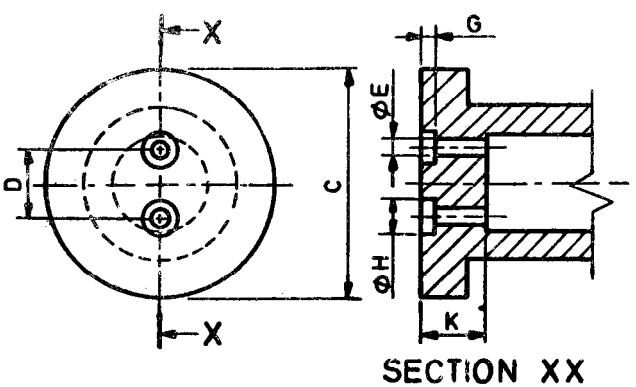

Fig. 3 Holders for Torsion Test for Bi-Pin Cap G-13

APPENDIX D

(*Clauses* 6.7 *and* 6.9.1)

TEST FOR STARTING CHARACTERISTICS

D-1. GENERAL

D-1.1 Tests for starting requirements shall be made in still air at an ambient temperature between 20°C and 30°C in a maximum relative humidity of 65 percent.

D-1.2 Metallic parts and wires, except starting aids when required, in the vicinity of the lamp shall be avoided as far as possible.

D-1.3 The lamps shall be kept inoperative in an ambient temperature, between 20°C and 30°C and a relative humidity not greater than 65 percent for period of at least 24 hours immediately prior to the starting test.

D-2. LAMPS OPERATED WITH STARTER

D-2.1 Test Circuit — Lamps shall be tested with a 50 Hz supply with tolerance of ± 0·5 percent in the circuit shown in Fig. 4.

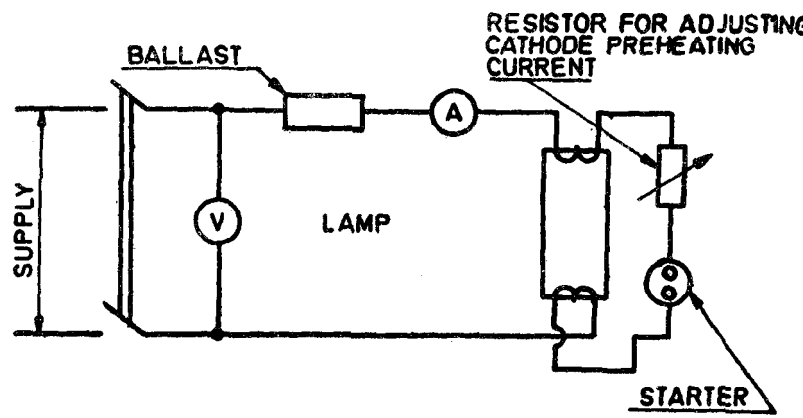

FIG. 4 CIRCUIT DIAGRAM FOR STARTING TEST WITH STARTER

D-2.2 Ballast — The ballast shall comply with the requirement of clauses **E-1.1.1** and **E-1.1.2** of Appendix E unless otherwise stated on the relevant lamp data sheet in IS : 2418 (Part II) - 1977*. It shall be rated at the voltage as given on the relevant lamp data sheet.

*Specification for tubular fluorescent lamps for general lighting service: Part II Standard lamp data sheets.

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

D-2.3 Starter — The type of the starter used shall be in accordance with IS : 2215-1968* and appropriate to the wattage of the lamp under test.

D-2.4 Test Voltage — The voltage applied to the circuit shall be as given in the relevant lamp data sheet in IS : 2418 (Part II) - 1977†.

D-3. LAMPS WITH PREHEATED CATHODES OPERATED WITHOUT STARTER

D-3.1 Test Circuit — The lamps shall be tested in the circuit shown in Fig. 5. The supply voltage shall be steady and free from sudden changes. The frequency of supply shall be 50 Hz with tolerance of ± 0·5 percent.

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

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

The metal plate shall be 40 mm wide, positioned 20 mm from the lamp and have a length not less than that of the lamp under test and shall be, together with one lamp cap bonded to earth.

For lamps not requiring a separate starting aid, this strip shall be removed.

NOTE — The manufacturer shall specify whether or not the lamps require an external starting aid and whether the cap shall be connected to the earth side of the circuit.

D-3.2 Ballast — The ballast shall be an inductive type and shall comply with the requirements of clauses **E-1.1.1** and **E-1.1.2** of Appendix E. It shall be rated as specified on the relevant lamp data sheet in IS : 2418 (Part II) - 1977†.

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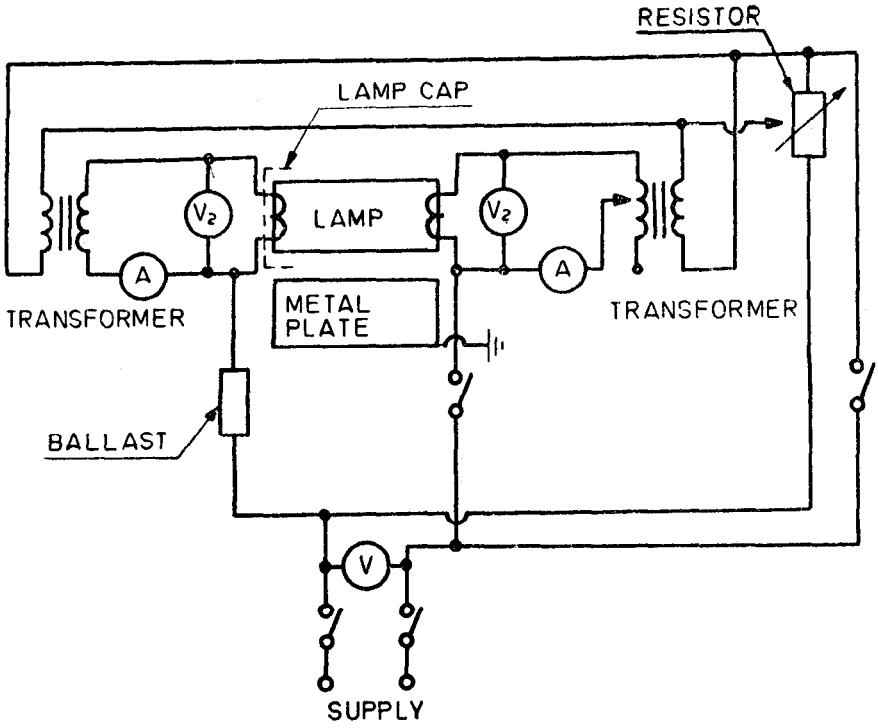
*Starters for fluorescent lamps (*second revision*).

†Specification for tubular fluorescent lamps for general lighting service: Part II Standard lamp data sheets.



NOTE — The earthing of the circuit as shown may be made if necessary to supply it through an isolating transformer.

FIG. 5 CIRCUIT DIAGRAM FOR STARTING TEST OF LAMP WITHOUT STARTER

D-3.3 Test Voltage

D-3.3.1 *Voltage at the Cathode Terminals* — The voltage of the heating circuit to be applied to the cathode terminals shall be:

3·0 V for low resistance cathodes, and

8·0 V for high resistance cathodes.

NOTE — These values of the cathode heating voltages have been chosen in order to ensure reproducability of the starting test.

D-3.3.2 *Voltage at Lamp Terminals* — The open-circuit voltage at the lamp terminals for the starting test shall be as given on the relevant lamp data sheet in IS : 2418 (Part II) - 1977*.

*Specification for tubular fluorescent lamps for general lighting service: Part II Standard lamp data sheets.

D-3.4 The voltage of the main circuit and of the heating circuits shall be applied simultaneously.

D-3.5 If the lamp does not start at the specified voltage, this voltage shall be gradually increased up to a maximum of 110 percent of the test value and if the lamp 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 hours.

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.

APPENDIX E

(*Clause* 6.9)

BALLASTS AND STARTERS TO BE USED FOR TESTS

E-1. BALLASTS FOR STARTING TESTS AND LIFE TESTS

E-1.1 A ballast used for the starting tests shall comply with the requirements of **E-1.1.1** and **E-1.1.2** and life testing shall comply with the following requirements of **E-1.1.1** to **E-1.1.4**.

E-1.1.1 It shall be of a type that complies with IS : 1534 (Part I) - 1967*, except where otherwise stated on the relevant lamp data sheet in IS : 2418 (Part II) - 1977†, and shall correspond with the starting conditions of the lamp.

E-1.1.2 When at its rated voltage, it is associated with a lamp whose voltage at lamp terminals does not deviate by more than ± 2 percent from the objective value specified on the relevant lamp data sheet in IS : 2418 (Part II) - 1977†, the lamp shall absorb a power which does not differ from its objective value by more than ± 4 percent.

E-1.1.3 For lamps operating with a starter, the preheating current (short-circuit current) at rated voltage, shall not differ by more than ± 10 percent from the nominal value specified in the appropriate data sheet in IS : 2418 (Part II) - 1977†.

E-1.1.4 For lamps with preheated cathodes operating without starter, requirements are under consideration.

E-2. STARTERS

E-2.1 Starters used for life testing of lamps shall comply with IS : 2215-1968‡.

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*Specification for ballasts for fluorescent lamps: Part I For switch start circuits (*first revision*).

†Specification for tubular fluorescent lamps for general lighting service: Part II Standard lamp data sheets.

‡Specification for starters for fluorescent lamps (*second revision*).

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AMENDMENT NO. 2 NOVEMBER 1987

TO

IS:2418(Part 1)-1977 SPECIFICATION FOR TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE

PART 1 REQUIREMENTS AND TESTS

(First Revision)

(Page 7, clause 4.1.2.3, line 1) - Substitute 'soldered, crimped' for 'soldered'.

(Page 8, clause 5.1) - Add the following in the end:

'f) The rated lumen output.

Note - The manufacturer may declare a higher value of rated lumen output than the minimum specified in the standard. Due to limitation of space on lamps this information may, however, be marked on the carton only.'

(ETDC 23)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 DECEMBER 1996

TO

IS 2418 (Part 1) : 1977 SPECIFICATION FOR TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE

PART 1 REQUIREMENTS AND TESTS

(First Revision)

(*General*) — Substitute 'IS 1534 (Part 1) : 1977 Specification for ballast for fluorescent lamps : Part 1 For switch start circuit (*second revision*)' *for* 'IS 1534 (Part 1) : 1967 Specification for ballasts for fluorescent lamps : Part 1 For switch start circuit (*first revision*)' wherever it appears in this standard.

(*Page* 4, *clause* **0.5**) — Insert the following at the end of the existing clause:

"It is also expected that lamps which comply with this specification when operated with electronic type ballast complying with IS 13021 (Part 1) : 1991 'Specification for ac supplied electronic ballast for tubular fluorescent lamps : Part 1 General and safety requirement' and IS 13021 (Part 2) : 1991 'Specification for ac supplied electronic ballast for tubular fluorescent lamps : Part 2 Performance requirements' will start satisfactorily between 92 percent and 106 percent of the rated supply voltage."

(*Page* 4, *clause* **1.1**, *excluding the Note*) — Substitute the following for the existing matter:

'**1.1** This standard (Part 1) covers the requirements and tests for a range of tubular fluorescent lamps for general lighting services which are operated on ac mains. Lamps of the following types are included:

a) Lamps with preheated cathodes operated for operation on ac mains with the use of a starter,

b) Lamps with preheated cathodes for operation on ac mains without the use of a starter,

c) Lamps with preheated cathodes for operation on ac mains with the use of a starter and additionally for operation on high frequency supplies with or without the use of a starter,

Price Group 1

d) Lamps with preheated cathodes for operation on high frequency supplies, with or without the use of a starter,

e) Lamps with non-preheated cathodes for operation on high frequency supplies without the use of a starter, and

f) Lamps having a rated life of at least 5 000 h.'

(*Page* 4, *clause* **1.1**, *Note*) — Insert the following Note 2 and renumber the existing note as Note 1:

'NOTE 2 — A manufacturer can nominate any type of lamps to be in compliance with any one or more of the above groupings. If a lamp is nominated for 50 Hz and high frequency operation, the frequency to be used in the assessment of the lamp shall be declared by the manufacturer.'

(*Page* 11, *clause* **6.7**) — Substitute the following for the existing matter:

'**6.7 Testing of Starting Characteristics** — The starting characteristics of the lamps shall be measured as specified in Appendix D, before ageing:

a) **Lamps operated with starter on ac mains**. The lamp shall start fully within 1 min, and remain alight;

b) **Lamps operated without starter on ac mains**. The lamps shall start fully within 10 s and remain alight;

c) **Lamps for use on preheated high frequency supplies**. The lamp shall start within 0.13 min after the prescribed preheating period and remain alight; and

d) **Lamps for use on non-preheated high frequency supplies**. The lamp shall start within 0.13 min and remain alight.'

(*Page* 12, *clause* **6.9**, *para after the note*) — Substitute the following for the existing matter:

'Lamps shall be operated in the circuit for which they are preferably designed, for example:

a) A circuit including a starter,

b) A circuit without a starter (starterless) and with preheating of the cathode:

1) with low resistance cathodes; and

2)' with high resistance cathodes.

c) A high frequency circuit without a starter (starterless)·

1) without preheating of the cathode; and

2) with preheating of the cathode.'

(*Page* 16, *clause* **A-3.1**) — Insert the following new matter at the end of the Note:

"**A-4 TEST FOR HIGH FREQUENCY OPERATED LAMPS**

A-4.1 General

Tests shall be made in a drought free atmosphere at an ambient temperature of 25 ± 1°C and a relative humidity of 65 percent maximum. Lamps to be tested shall have been aged for a period of 100 h of normal operation. Lamps shall be tested in a horizontal position.

A-4.2 Test Circuits

Lamps shall be tested in a circuit shown in Fig. 6.

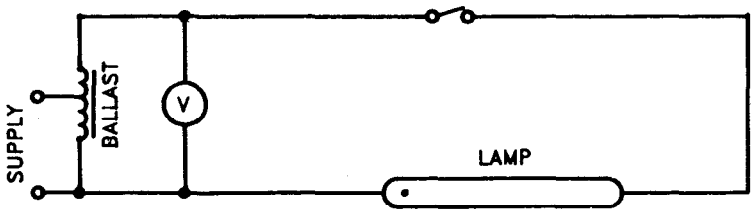

FIG. 6 CIRCUIT DIAGRAM FOR STARTING TEST FOR LAMPS NON-PREHEATED CATHODES OPERATED WITHOUT STARTER

A-4.3 Supply Voltage

a) *Test Voltage*

The test voltage shall be equal to the rated value of the reference ballasts;

b) *Voltage Regulation*

The supply voltage shall be stable within ±0.5 percent during periods

of stabilization, this tolerance being reduced to ±0.2 percent at the moment of measurement;

c) *Frequency*

The frequency of the supply voltage shall be between 20 kHz and 26 kHz; and

d) *Wave Shape*

The wave shape shall be a sine wave (the harmonic content requirement is under consideration).

A-4.4 Ballasts

The ballast used for the test shall be the reference ballast as specified in IS 13021 (Part 2) : 1991 'Specification for ac supplied electronic ballast for tubular fluorescent lamps : Part 2 Performance requirement'.

A-4.5 Instrumentation and Circuitary

All instruments shall be suitable for high frequency operation connecting cables and shall be as short and as straight as possible to avoid parasitic capacitance. The parasitic capacitance parallel to the lamp shall be less than 1 nF.

A-4.6 Lamp Ignition

Lamp shall be started by laboratory means.

A-4.7 Lamp Stabilization

Before any photometric or electrical measurements are taken, lamps shall be burned long enough to obtain arc stabilization and temperature equilibrium. A period of 15 min continuous burning before measurement is usually sufficient.

A-4.8 Determination of Cathodic Characteristics

For this test each cathode shall be connected to a current of 50 Hz ac or to a dc voltage supply. The supply voltage shall be adjusted so that the cathode current equals the value given in the relevant lamp data sheets and the voltage shall be measured. From there the cathode resistance shall be determined."

(*Page* 22, *clause* **D-3.5**) — Insert the following new clauses after this clause:

'**D-4** Lamps with non-preheated cathode operated without starter.

D-4.1 The lamps shall be tested with a 50 Hz supply in the circuit shown in Fig. 7.

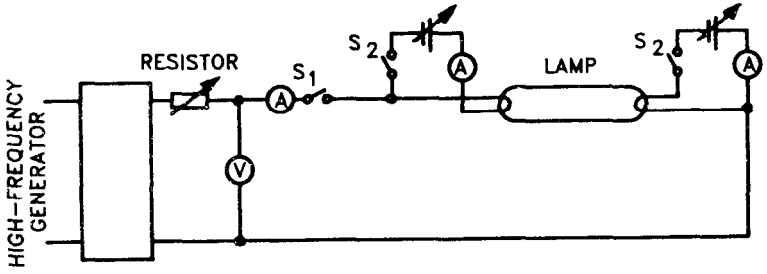

FIG. 7 CIRCUIT DIAGRAM FOR STARTING TEST FOR HIGH FREQUENCY OPERATED LAMPS

D-4.2 The ballast shall be of an inductive type, having a suitable open circuit voltage.

D-4.3 Voltage at Lamp Terminals

The voltage at the lamp terminals for starting tests shall be as given on the relevant lamp data sheet in IS 2418 (Part 2) : 1977 'Specification for tubular fluorescent lamps for general lighting service : Part 2 Standard lamp data sheets'

If the lamp does not start at the specified voltage; this voltage shall be gradually increased up to a maximum of 125 percent of the test value and, if the lamp does not 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.

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 ballast.

D-5 HIGH FREQUENCY OPERATED LAMPS

D-5.1 Test Circuits

Lamps shall be tested with an ac supply with a frequency between 20 and 26 kHz, in the circuit shown in Fig. 8.

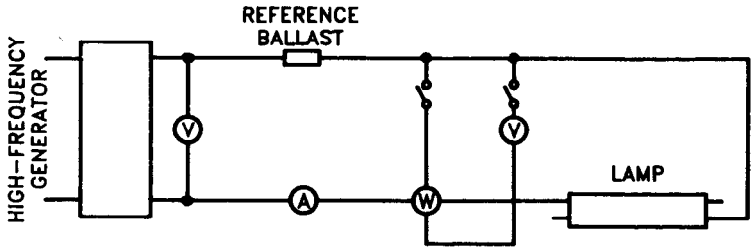

FIG. 8 CIRCUIT DIAGRAM FOR MEASUREMENT OF LAMP CHARACTERISTICS (HIGH-FREQUENCY OPERATED LAMPS)

D-5.2 Resistor

The resistor shall be so adjusted that the high frequency lamp current shall be equal to the value as given in the relevant lamp data sheet. The cathode heating supplies shall be adjusted to supply a cathodic current equal to the value given in the relevant lamp data sheet.

D-5.3 Test Voltage

The voltage applied to the circuit shall be as given in the relevant lamp data sheet.

D-5.4 Preheat Time

During preheating the switch S_1 shall be kept open and the switch S_2 shall be closed when the cathodes are sufficiently heated. The switch S_2 shall be opened simultaneouly and the switch S_1 shall be closed. The lamp shall start as specified in **6.7**(c).'

(*Page* 22, *clause* **E-2.1**) — Insert the following new clause after this clause:

"**E-3 BALLASTS FOR HIGH FREQUENCY LUMEN MAINTENANCE TEST**

For lamps which can only be operated on high frequency supplies, the ballasts shall comply with IS 13021(Part 2) : 1991 'Specification for ac supplied electronic ballasts for tubular fluorescent lamps : Part 2 Performance requirements'."

(ETD 23)

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AMENDMENT NO. 4 MAY 2002
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IS 2418 (PART 1) : 1977 SPECIFICATION FOR TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE

PART 1 REQUIREMENTS AND TESTS

(First Revision)

(*Page* 10, *clause* **6.2.5.1**, *line* 2) — Substitute '92 percent' *for* '90 percent'.

(ET 23)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 5 MARCH 2006
TO
IS 2418 (PART 1) : 1977 SPECIFICATION FOR TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE

PART 1 REQUIREMENTS AND TESTS

(First Revision)

[*Page* 8, *clause* 5.1(e) (*see also Amendment No.* 2)] — Insert the following after (e)

'**f) High lumen for 18 HL and 36W HL.**'

[(*Page* 17, *Appendix* B, *Table* 1 (*see also Amendment No.* 1)] — Insert the following new Table 1A after Table 1:

Table 1A

Rated Wattage	Nominal Colour									
	6 500 K		4 300 K		4 000 K		2 900 K		2 700 K	
	X	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
W										
18	0.313	0.337	0.368	0.371	-	-	0.438	0.401	-	-
36	0.313	0.337	0.368	0.371	-	-	0.438	0.401	-	-
18 HL	0.313	0.337	-	-	0.380	0.380	-	-	0.463	0.420
36 HL	0.313	0.337	-	-	0.380	0.380	-	-	0.463	0.420

(*Page* 17, *Appendix* B, *Table* 2) — Add the following columns for colour tolerances:

4 000 K (χ = 0.380 and γ = 0.380)		2 700 K (χ = 0.463 and γ = 0.420)	
χ	γ	χ	γ
(7)	(8)	(9)	(10)
0.369 3	0.371 9	0.454 1	0.414 9
0.372 9	0.381 5	0.457 1	0.423 2
0.376 5	0.386 4	0.460 4	0.427 1
0.380 2	0.390 0	0.463 1	0.429 7
0.383 8	0.392 3	0.466 2	0.431 2
0.387 4	0.393 2	0.469 2	0.431 2
0.390 4	0.386 2	0.471 7	0.423 7
0.386 8	0.378 0	0.468 7	0.416 5
0.383 2	0.373 3	0.465 6	0.412 6
0.379 3	0.369 8	0.462 6	0.410 1
0.373 9	0.367 5	0.459 6	0.408 8
0.372 3	0.366 8	0.456 6	0.408 9

(ET 23)

Reprograptry Unit, BIS, New Delhi, India

AMENDMENT NO. 6 OCTOBER 2008
TO
IS 2418 (PART 1) : 1977 SPECIFICATION FOR TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE

PART 1 REQUIREMENTS AND TESTS

(First Revision)

[*Page* 9, *clause* 5.1(e)] — Add 'f) Rated life' at the end.

(ET 23)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 7 OCTOBER 2010
TO
IS 2418 (PART 1): 1977 SPECIFICATION FOR TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE

PART 1 REQUIREMENT AND TESTS

(First Revision)

[Page 8, *clause* 5.1 *(see also Amendments No.* 2, 5 *and* 6)**]** — Substitute the following for the existing clause:

'The lamps shall be clearly and indelibly marked with the following information:

a) Name or trade-mark of the manufacturer or supplier;
b) Rated watts (marked 'W');
c) Colour temperature;
d) Starting conditions (for lamps to be used as starterless);
e) Country of manufacture;

NOTE — Compliance is checked by rubbing the marking with a piece of cloth soaked with water for 15 seconds.

f) High lumen for 18 HL and 36W HL; and
g) The rated lumen output.

NOTE — The manufacturer may declare a higher value of rated lumen output than the minimum specified in the standard. Due to limitation of space on lamps this information may, however, be marked on the carton only.'

h) Rated life.'

(ETD 23)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 8 SEPTEMBER 2012
TO
IS 2418 (PART 1) : 1997 SPECIFICATION FOR TUBULAR FLUORESCENT LAMPS FOR GENERAL LIGHTING SERVICE

PART 1 REQUIREMENTS AND TESTS

(First Revision)

[*Page* 8, *clasue* **5.1**(h) Rated life (*see also Amendment No* 7)] — Insert the following note at the end:

'NOTE : Due to limitation of space on lamps this information may, however, be marked on the carton only.'

(ET 23)

Reprography Unit, BIS, New Delhi, India