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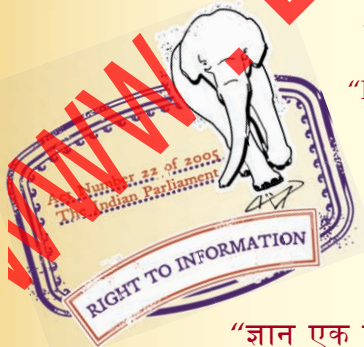
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IS 16102-1 (2012): Self - Ballasted LED Lamps for General Lighting Services, Part 1: Safety Requirements [ETD 23: Electric Lamps and their Auxiliaries]



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Indian Standard

SELF-BALLASTED LED LAMPS FOR GENERAL
LIGHTING SERVICES
PART 1 SAFETY REQUIREMENTS

ICS 29.140.99

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (Part 1) was adopted by the Bureau of Indian Standards, after the draft finalized by the Electric Lamps and Their Auxiliaries Sectional Committee had been approved by the Electrotechnical Division Council.

This standard specifies the general and safety requirements for self-ballasted lamps for general lighting services for d.c. supplies up to 250 V or a.c. supplies up to 1 000 V at 50 Hz.

The performance requirements have been covered in Part 2 of this standard.

This standard is published in two parts. The other part in the series is:

Part 2 Performance requirements

There are already LED products in the market which substitute existing lamps, either as retrofit mains voltage incandescent or self-ballasted fluorescent lamps or as replacement for tungsten halogen lamps below 50 V.

Future work will also consequently comprise performance standards for all kind of LED lamps, including minimum photometric requirements for type testing.

This standard is based on IEC 62560 : 2011 'Self-ballasted LED lamps for general lighting services by voltage above 50 V — Safety specifications', issued by the International Electrotechnical Commission (IEC) with the following modifications:

- a) Made applicable for d.c. supplies up to 250 V or a.c. supplies up to 1 000 V at 50 Hz;
- b) Schedule of type test and acceptance test has been incorporated;
- c) Selection of samples incorporated;
- d) Conditions of compliances incorporated, and
- e) Marking of rated lumen and danger symbol on high temperature added.

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 analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard***SELF-BALLASTED LED LAMPS FOR GENERAL LIGHTING SERVICES****PART 1 SAFETY REQUIREMENTS****1 SCOPE**

This standard (Part 1) specifies the safety and interchangeability requirements, together with the test methods and conditions, required to show compliance of LED lamps with integrated means for stable operation (self-ballasted LED lamps), intended for domestic and similar general lighting purposes, having,

- a) a rated wattage up to 60 W;
- b) a rated voltage of d.c. supplies up to 250 V or a.c. supplies up to 1 000 V at 50 Hz; and
- c) caps according to Table 1.

Recommendations for batch testing are given in Annex C of IS 16103 (Part 1) : 2012 'LED modules for general lighting: Part 1 Safety requirements'.

NOTES

- 1 Where in this standard the term "lamp(s)" is used, it is understood to stand for "self-ballasted LED lamp(s)", except where it is obviously assigned to other types of lamps.
- 2 Higher wattage lamp is under consideration.

Annex A provides an overview of systems composed of LED system and control gear.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed as follows.

<i>IS No.</i>	<i>Title</i>
4261 : 2001	Glossary of terms relating to paper and pulp based packaging materials
8913 : 1978	Standard method of measurement of lamp cap temperature rise
9206 : 1979	Dimensions of caps for tungsten filament general service electric lamps
10322 (Part 1) : 2011	Luminaires: Part 1 General requirements and tests
11000 (Part 2/ Sec 1) : 2008	Fire hazard testing: Part 2 Test method, Section 1 Glow-wire

*IS No.**Title*

	apparatus and common test procedure
12063 : 1987	Classification of degrees of protection provided by enclosures of electrical equipment
15518 (Part 1) : 2004	Safety requirements for incandescent lamps: Part 1 Tungsten filament lamps for domestic and similar general lighting purposes
15687 (Part 1) : 2006	Single-capped fluorescent lamps: Part 1 Safety requirements
15885 (Part 1) : 2011	Safety of lamp control gear: Part 1 General requirements
16101 : 2012	Terms and definitions of LEDs and LED modules in general lighting
16102 (Part 2) : 2012	Self-ballasted LED lamps for general lighting services: Part 2 Performance requirements
16103 (Part 1) : 2012	LED modules for general lighting: Part 1 Safety requirements
16108 : 2012	Photobiological safety of LED and LED systems

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 16103 (Part 1) and IS 16101 along with the following shall apply.

3.1 Self-Ballasted LED Lamp — Unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a LED light source and any additional elements necessary for stable operation of the light source.

NOTE — Lamp caps are given in IS 9206 .

3.2 Type — Lamps that, independent of the type of cap or base, have an identical photometric and electrical rating.

3.3 Rated Voltage — Voltage or voltage range marked on the lamp.

3.4 Rated Wattage — Wattage marked on the lamp.

3.5 Rated Frequency — Frequency marked on the lamp.

3.6 Cap Temperature Rise (Δt_s) — Surface

IS 16102 (Part 1) : 2012

temperature rise (above ambient) of a standard test lampholder fitted to the lamp, when measured in accordance with the standard method, in case of an Edison screw cap or a bayonet cap.

NOTE — The standard method for Edison screw cap or Bayonet cap is given in IS 8913.

3.7 Live Part — Conductive part which may cause an electric shock in normal use.

3.8 Type Test — A test or 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.

3.9 Type Test Sample — A sample consisting of one or more similar units submitted by the manufacturer or responsible vendor for the purpose of the type test.

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

3.11 Inspection Test Quantity (ITQ) — The number of lamps selected for the purpose of determining the acceptability of a batch as to marking, interchangeability, protection against electric shock, insulation resistance, electric strength, mechanical strength, cap temperature rise, resistance to heat, resistance to flame and ignition, fault conditions and creepage distances and clearances.

3.12 Batch — All the lamps of one type put forward at one time for acceptance test.

4 GENERAL REQUIREMENT AND GENERAL TEST REQUIREMENTS

4.1 The lamps shall be so designed and constructed that in normal use they function reliably and cause no danger to the user or surroundings.

In general, compliance is checked by carrying out all the tests specified.

4.2 Self-Ballasted LED

Lamps are non-repairable, factory-sealed units. They shall normally not be opened for any tests. In the case of doubt based on the inspection of the lamp and the examination of the circuit diagram, and in agreement with the manufacturer or responsible vendor, either the output terminals shall be short-circuited or, in agreement with the manufacturer, lamps specially prepared so that a fault condition can be simulated shall be submitted for testing (*see 13*).

4.3 In general, all tests are carried out on each type of lamp or, where a range of similar lamps is involved, for each wattage in the range or on a representative selection from the range, as agreed with the manufacturer.

4.4 When the lamp fails safely during one of the tests, it is replaced, provided that no fire, smoke or flammable gas is produced. Further requirements on failing safe are given in **12**.

5 MARKING

5.1 Lamps shall be clearly and durably marked with the following mandatory markings:

- Mark of origin (this may take the form of a trade-mark, the manufacturer's name or the name of the responsible vendor);
- Rated voltage or voltage range (marked 'V' or 'Volt');
- Rated wattage (marked 'W' or 'Watts');
- Rated lumen;
- Rated frequency (marked in 'Hz');
- Country of manufacture; and
- Mark of symbol on high temperature.

5.2 In addition, the following information shall be given by the lamp manufacturer on the lamp or immediate lamp wrapping or container or in installation instructions:

- Burning position, if restricted, shall be marked with the appropriate symbol. Symbol examples are shown in Annex B.
- Rated current (marked 'A' or 'ampere').
- For lamps with a weight significantly higher than that of the lamps for which they are a replacement, attention should be drawn to the fact that the increased weight may reduce the mechanical stability of certain luminaires and lampholders and may impair contact making and lamp retention.
- Special conditions or restrictions which shall be observed for lamp operation, for example operation in dimming circuits. Where lamps are not suitable for dimming, the following symbol in Fig. 1 may be used.
- For eye protection, see requirements of IS 16108.



FIG. 1 DIMMING NOT ALLOWED

5.3 Compliance is checked by the following:

Presence and legibility of the marking required in **5.1** shall be checked by visual inspection.

The durability of the marking is checked by trying to remove it by rubbing lightly for 15 s with a piece of cloth soaked with water and, after drying, for a further

15 s with a piece of cloth soaked with hexane. The marking shall be legible after the test.

Availability of information required in 5.2 is checked by visual inspection.

5.4 BIS Certification Marking

The self-ballasted LED lamps may also be marked with the Standard Mark.

5.4.1 The use of the Standard Mark is governed by the provisions of the *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 the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

6 INTERCHANGEABILITY

6.1 Cap Interchangeability

Interchangeability shall be ensured by the use of caps in accordance with IS 9206 (*see* Table 1).

Compliance is checked by the use of the relevant gauges specified in IS 9206.

6.2 Bending Moment, Axial Pull and Mass

The value of the bending moment, imparted by the lamp at the lampholder shall not exceed the value given in Table 2.

The bending moment shall be determined by measuring the weight of the lamp, for example by means of a balance at the tip of the bulb of the horizontally held lamp and multiplying this force by the distance between the tip of the bulb and the pivot line. The pivot line shall lie at the bottom end of the cylindrical part (for Edison and bayonet caps) or at the end of the contact pins (for pin caps). It shall be supported by an upright held thin metal sheet or a similar means.

The lamp construction shall withstand externally applied axial pull and bending moment.

For the measurement method, *see* A-2.1 of IS 15687 (Part 1).

The mass as given in Table 2 shall not be exceeded.

Table 1 Interchangeability Gauges and Lamp Cap Dimensions

(Clauses 1 and 6.1)

Sl No.	Lamp Cap	Cap Sheet No. from IS 9206	Cap Dimensions to be Checked by the Gauge	Gauge Sheet No. from IS 9206
(1)	(2)	(3)	(4)	(5)
i)	B15d	7004-11	A, <i>Max</i> and A, <i>Min</i> D1, <i>Max</i> N, <i>Min</i>	7006-10 and 7006-11
ii)	B22d	7004-10	Diametrical position of the pins Insertion in lampholder Retention in lampholder	7006-4A 7006-4B
iii)	E11	7004-6	"Go"	7006-6
iv)	E12	7004-28	"Go" Additional "Go" "Not Go" Contact-making	7006-27H 7006-27J 7006-28C 7006-32
v)	E14	7004-23	Maximum dimensions of the screw thread Minimum major diameter of the screw thread Dimension S1 Contact making	7006-27F 7006-28B 7006-27G 7006-54
vi)	E17	7004-26	Maximum dimensions of the screw thread Minimum major diameter of the screw thread Contact making	7006-27K 7006-28F 7006-26D
vii)	E26	7004-21A	Maximum dimension of the screw thread Minimum major diameter of the screw thread	7006-27D 7006-27E
viii)	E27	7004-21	Maximum dimension of the screw thread Minimum major diameter of the screw thread Dimension S1 Contact making	7006-27B 7006-28A 7006-27C 7006-50
ix)	GU10	7004-121	"Go" and "Not Go"	7006-121
x)	GZ10	7004-120	"Go" and "Not Go"	7006-120
xi)	GX 53	7004-142	"Go" and "Not Go" "Not Go" "Go" and "Not Go" for checking keyways "Not Go" for checking keyways	7006-120 7006-142 7006-142D 7006-142E 7006-142F

Table 2 Bending Moment and Masses
(Clause 6.2)

SI No.	Cap	Bending Moment	Mass
(1)	(2)	Nm (3)	kg (4)
i)	B15d	1) ¹⁾
ii)	B22d	2	1
iii)	E11	0.5) ¹⁾
iv)	E12	0.5) ¹⁾
v)	E14	1) ¹⁾
vi)	E17	1) ¹⁾
vii)	E26	2) ¹⁾
viii)	E27	2	1
ix)	GU10	0.1) ¹⁾
x)	GZ10	0.1) ¹⁾
xi)	X53	0.3) ¹⁾

NOTES

1 For lamps with caps different to those in Table 2, the effect of the bending moment should be regarded and limited. A measurement method for these lamps with these caps is under consideration.

2 It should be taken care that the luminaire surface where the lampholder is fixed to can withstand the bending moment. For the calculation of this bending moment, the length of the lampholder needs to be taken into account when measuring the overall length. This should be made sure for the elevated temperature during operation in order to check the possible softening of the surface material.

¹⁾ Under consideration.

7 PROTECTION AGAINST ACCIDENTAL CONTACT WITH LIVE PARTS

The lamps shall be so constructed that, without any additional enclosure in the form of a luminaire, no internal metal parts, basic insulated external metal parts or live metal parts of the lamp cap or of the lamp itself are accessible when the lamp is installed in a lampholder according to the relevant lampholder data sheet given in IS 9206.

Compliance is checked by means of the test finger specified in Fig. 2, if necessary, with a force of 10 N.

Both joints shall permit movement in the same plane and the same direction through an angle of 90° with a 0° to +10° tolerance.

Lamps with Edison screw caps shall be so designed that they comply with the requirements for inaccessibility of live parts for general lighting service (GLS) lamps.

Compliance is checked with the aid of a gauge in accordance with the IS 9206.

Lamps with B22, B15, GU10 or GZ10 caps are subject to the same requirements as normal incandescent lamps with this cap.

Requirements for lamps with GX53 caps are under consideration.

External metal parts other than current-carrying metal parts of the cap shall not be or become live. For testing,

any movable conductive material shall be placed in the most onerous position without using a tool.

Compliance is checked by means of the insulation resistance and electric strength test (*see* 8).

8 INSULATION RESISTANCE AND ELECTRIC STRENGTH AFTER HUMIDITY TREATMENT

8.1 Insulation resistance and electric strength shall be adequate between live parts of the lamp and accessible parts of the lamp.

8.1.1 Insulation Resistance

The lamp shall be conditioned for 48 h in a cabinet containing air with a relative humidity between 91 percent and 95 percent. The temperature of the air is maintained within 1°C of any convenient value between 25°C and 35°C.

Insulation resistance shall be measured in the humidity cabinet with a d.c. voltage of approximately 500 V, 1 min after application of the voltage.

The insulation resistance between live parts of the cap and accessible parts of the lamp (accessible parts of insulating material are covered with metal foil) shall be not less than 4 MΩ. The requirements of IS 15885 (Part 1), Annex A, shall be complied with.

NOTE — The insulation resistance of bayonet caps between shell and contacts is under consideration.

8.2 Electric Strength

Immediately after the insulation resistance test, the same parts as specified above shall withstand a voltage test for 1 min with an a.c. voltage as follows.

During the test, the supply contacts of the cap are short-circuited. Accessible parts of insulating material of the cap are covered with metal foil. Initially no more than half the voltage prescribed in Table 10.2 of IS 10322 (Part 1) for Class II luminaires is applied between the contacts and the metal foil. It is then gradually raised to the full value.

No flashover or breakdown shall occur during the test. Measurements shall be carried out in the humidity cabinet.

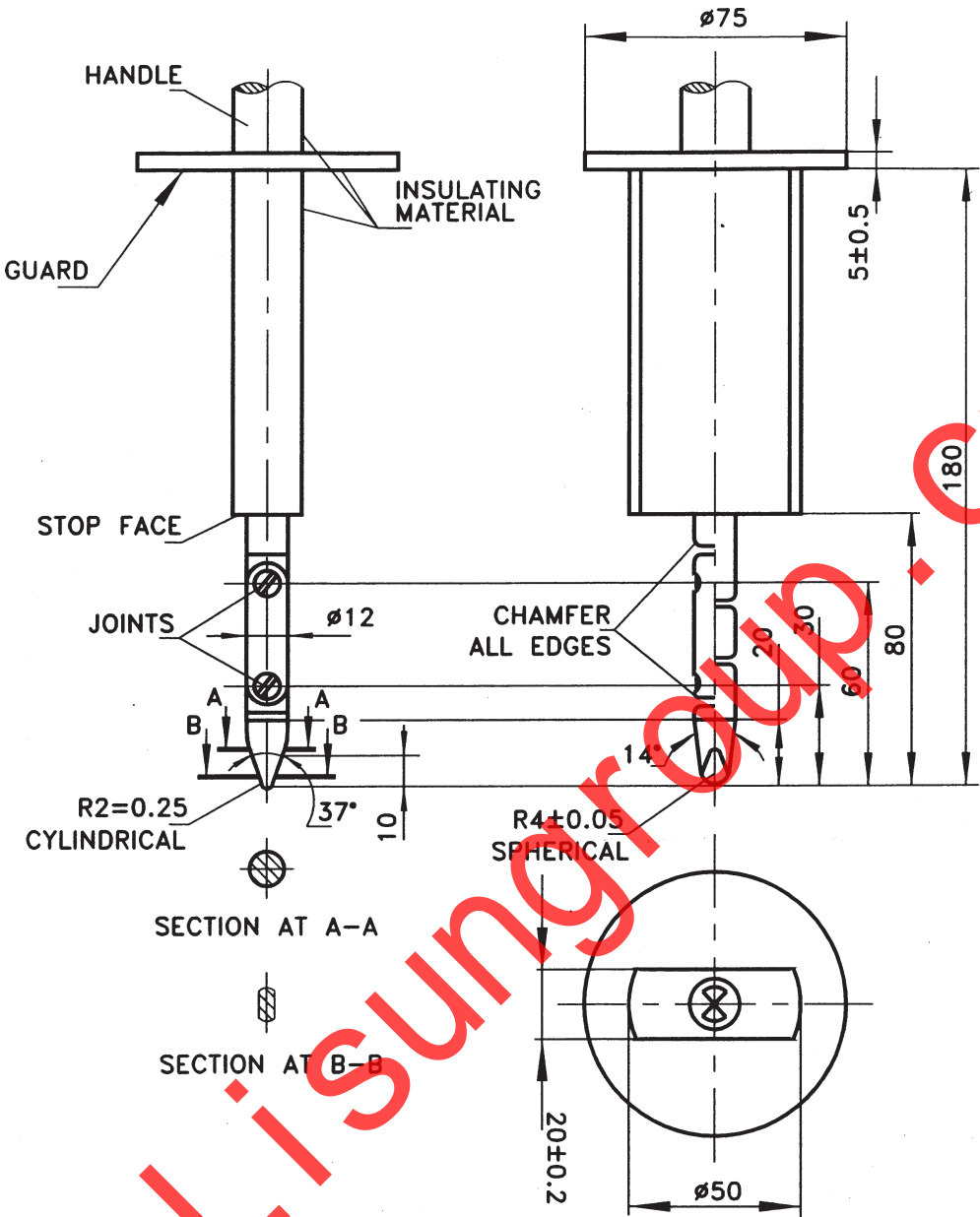
NOTE — The distance between the foil and the live parts is under consideration.

9 MECHANICAL STRENGTH

9.1 Torsion Resistance of Unused Lamps

The torsion resistance of unused lamps is tested as follows:

The cap shall remain firmly attached to the bulb or that part of the lamp, which is used for screwing the lamp in or out when subjected to the torque levels listed in Table 3.



Material — metal, except where otherwise specified.
 Tolerances on dimensions without specific tolerance:

- a) On angles: $\begin{matrix} +0 \\ -10 \end{matrix}$
- b) On linear dimensions:
- c) Up to 25 mm: $\begin{matrix} +0 \\ -0.05 \end{matrix}$
- d) Over 25 mm: ± 0.2 mm

Linear dimensions in millimetres.

FIG. 2 STANDARD TEST FINGER

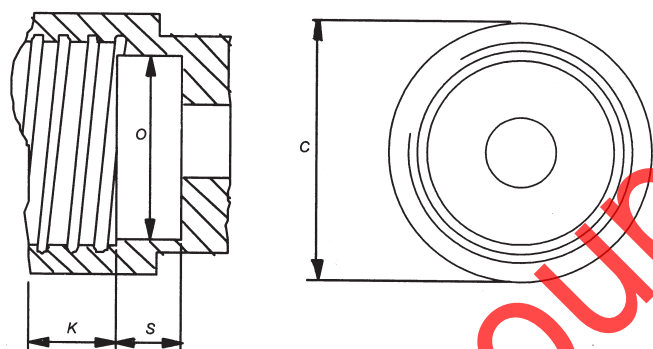
Table 3 Torque Test Values for Unused Lamps
(Clause 9.1)

Sl No.	Cap	Torsion Moment Nm (3)
(1)	(2)	(3)
i)	B15d	1.15
ii)	B 22 d	3
iii)	E 11	0.8
iv)	E 12	0.8
v)	E 14	1.15
vi)	E 17	1.5
vii)	E 27	3
viii)	GX 53	3 (under consideration)

Tests are made according to the description of the relevant lamp standard per lamp type in IS 15518 (Part 1) by means of the test holders shown in Fig. 3 and Fig. 4.

The torque shall not be applied suddenly, but shall be increased continuously from zero to the specified value.

In the case of un-cemented caps, relative movement between cap and bulb is permitted provided it does not exceed 10°.



Detail of thread

Surface finish of screw thread $R_a = 0.4 \mu\text{m}$ Min (see Note).

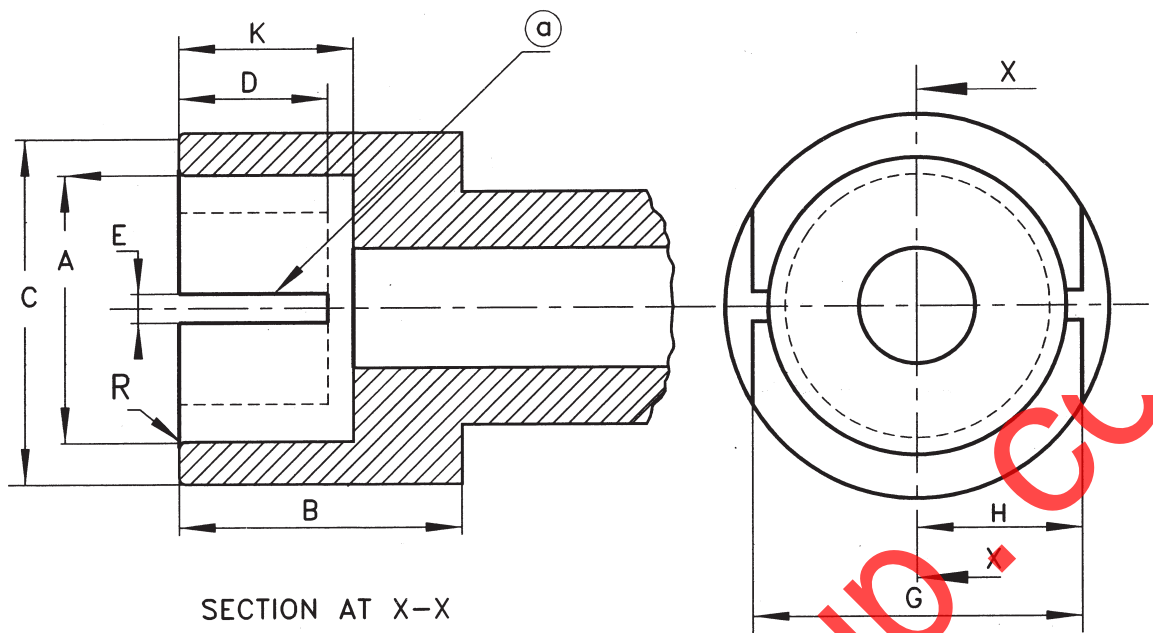
NOTE — A smoother surface might result in mechanical overloading of the cap (see also C-1.2 of IS 15518).

Dimension (1)	E12 (2)	E14 (3)	E17 (4)	E26 and E26d (5)	E27 (6)	Tolerance (7)
C	15.27	20.0	20.0	32.0	32.0	Min
K	9.0	11.5	10.0	11.0	13.5	0.0 -0.3
O	9.5	12.0	14.0	23.0	23.0	+0.1 -0.1
S	4.0	7.0	8.0	12.0	12.0	Min
d	11.89	13.89	16.64	26.492	26.45	+0.1 0.0
d ₁	10.62	12.29	15.27	24.816	24.26	+0.1 0.0
P	2.540	2.822	2.822	3.629	3.629	—
r	0.792	0.822	0.897	1.191	1.025	—

NOTE — The drawing illustrates the essential dimensions of the holder which need only be checked if doubt arises from the application of the test.

All dimensions in millimetres.

FIG. 3 HOLDER FOR TORQUE TEST ON LAMPS WITH SCREW CAPS



Dimension (1)	B15 (2)	B22 (3)	Tolerance (4)
A	15.27	22.27	+0.03
B	19.0	19.0	Min
C	21.0	28.0	Min
D	9.5	9.5	Min
E	3.0	3.0	+0.17
G	18.3	24.6	±0.3
H	9.0	12.5	Min
K	12.7	12.7	±0.3
R	1.5	1.5	Approximate

NOTE — The drawing illustrates the essential dimensions of the holder which need only be checked if doubt arises from the application of the test.

All dimensions in millimetres.

FIG. 4 HOLDER FOR TORQUE TEST ON LAMPS WITH BAYONET CAPS

9.2 Torsion Resistance of Lamps after a Defined Time of Usage

The torsion resistance of used lamps is under consideration.

9.3 Verification

After the mechanical strength test the sample shall comply with the requirements of accessibility (see 7).

10 CAP TEMPERATURE RISE

The surface temperature rise (above ambient) of a lampholder fitted to the lamp shall not be higher than that of the lamp type which is being replaced by the lamp.

The cap temperature rise $A t_s$ of the complete lamp shall not exceed 120 K. The value of $A t_s$ corresponds

to an incandescent lamp of 60 W maximum. The operating position and ambient temperature are detailed in IS 8913.

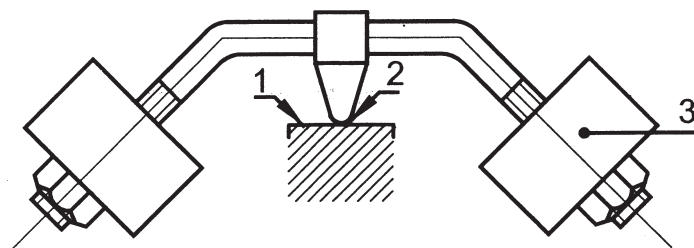
Measurement shall be carried out at rated voltage. If the lamp is marked with a voltage range it shall be measured at the maximum voltage of that range.

11 RESISTANCE TO HEAT

The lamp shall be sufficiently resistant to heat. External parts of insulating material providing protection against electric shock, and parts of insulating material retaining live parts in position shall be sufficiently resistant to heat.

Compliance is checked by subjecting the parts to a ball-pressure test by means of the apparatus shown in Fig. 5.

The test is made in a heating cabinet at a temperature



- Key
- 1 Test Specimen
 - 2 R 2.5 Spherical
 - 3 Weight

All dimensions in millimetres.

FIG. 5 BALL PRESSURE TEST APPARATUS

of $(25 \pm 5)^\circ\text{C}$ in excess of the operating temperature of the relevant part according to 10, with a minimum of 125°C for parts retaining live parts in position and 80°C (value 80°C under consideration) for other parts. The surface of the part to be tested is placed in the horizontal position and a steel ball of 5 mm diameter pressed against this surface with a force of 20 N.

The test load and the supporting means are placed within the heating cabinet for a sufficient time to ensure that they have attained the stabilized testing temperature before the test commences.

The part to be tested is placed in the heating cabinet, for a period of 10 min, before the test load is applied.

The surface where the ball presses should not bend, if necessary the surface shall be supported. For this purpose if the test cannot be made on the complete specimen, a suitable part may be cut from it.

The specimen shall be at least 2.5 mm thick, but if such a thickness is not available on the specimen then two or more pieces are placed together.

After 1 hour the ball is removed from the specimen, which is then immersed for 10 s in cold water for cooling down to approximately room temperature. The diameter of the impression is measured, and shall not exceed 2 mm.

In the event of curved surfaces the shorter axis is measured, if the indent is elliptical.

In case of doubt, the depth of the impression is measured and the diameter calculated using the following formula:

$$\phi = 2p(5 - p)$$

where

p = depth of impression.

The test is not made on parts of ceramic material.

12 RESISTANCE TO FLAME AND IGNITION

12.1 Parts of insulating material retaining live parts in position and external parts of insulating material providing protection against electric shock are subjected to the glow-wire test in accordance with IS 11000 (Part 2/Sec 1), subject to the following details:

- a) The test specimen is a complete lamp. It may be necessary to take away parts of the lamp to perform the test, but care is taken to ensure that the test conditions are not significantly different from those occurring in normal use.
- b) The test specimen is mounted on the carriage and pressed against the glow-wire tip with a force of 1 N, preferably 15 mm, or more, from the upper edge, into the centre of the surface to be tested. The penetration of the glow-wire into the specimen is mechanically limited to 7 mm.

If it is not possible to make the test on a specimen as described above because the specimen is too small, the above test is made on a separate specimen of the same material, 30 mm square and with a thickness equal to the smallest thickness of the specimen.

The temperature of the tip of the glow-wire is 650°C . After 30 s the specimen is withdrawn from contact with the glow-wire tip.

The glow-wire temperature and heating current are constant for 1 min prior to commencing the test. Care is taken to ensure that heat radiation does not influence the specimen during this period. The glow-wire tip temperature is measured by means of a sheathed fine-wire thermocouple constructed and calibrated as described in IS 11000 (Part 2/Sec 1).

Any flame or glowing of the specimen shall extinguish

within 30 s of withdrawing the glow-wire, and any flaming drop shall not ignite a piece of the tissue paper, spread out horizontally 200 ± 5 mm below the specimen. The tissue paper is specified in IS 4261.

The test is not made on parts of ceramic material.

13 FAULT CONDITIONS

13.1 General

Lamps shall not impair safety when operated under fault conditions, which may occur during the intended use. Each of the following fault conditions is applied in turn, as well as any other associated fault conditions that may arise from them as logical consequence.

13.2 Extreme Electrical Conditions (Dimmable Lamps)

If lamps are marked with a voltage range, rated voltage is taken as the maximum and minimum of the voltage range marked unless the manufacturer declares another voltage as the most critical one. The lamp is switched on at ambient temperature (definition given in IS 16001 and conditions as given in H-1 of IS 15885 (Part 1) and adjusted to the most critical electrical conditions as indicated by the manufacturer or the power is increased until 150 percent of the rated power is reached. The test is continued until the lamp is thermally stabilized. A stable condition is reached, if the lamp cap temperature does not change by more than 1 K as specified in IS 8913. The lamp shall withstand the extreme electrical conditions for at least 15 min, after stabilization is reached.

A lamp which fails safe and has withstood the extreme electrical conditions for 15 min, has passed the test, provided, the compliance (*see* 4.1 and 13.6) is fulfilled.

If the lamp contains an automatic protective device or circuit which limits the power, it is subjected to a 15 min operation at this limit. If the device or circuit effectively limits the power over this period, the lamp has passed the test, provided, the compliance (*see* 4.1 and 13.4) is fulfilled.

13.3 Extreme Electrical Conditions (Non-dimmable Lamps)

Lamps, which according to the marking, are not suitable for dimming, shall be tested as far as possible according to 13.2 under the most adverse electrical conditions as indicated by the manufacturer. If lamps are marked with a voltage range, rated voltage is taken as the maximum and minimum of the voltage range marked unless the manufacturer declares another voltage as the most critical one.

13.4 Short-Circuit Across Capacitors

Only one component at a time is subjected to a fault condition.

13.5 Fault Conditions Across Electronic Components

Open or bridge points in the circuit where the diagram indicates that such a fault condition may impair safety.

Only one component at a time is subjected to a fault condition.

13.6 Compliance

During the tests 13.2 to 13.5 the lamp shall not catch fire, or produce flammable gases or smoke and live parts shall not become accessible.

To check if gases liberated from component parts are flammable or not, a test with a high-frequency spark generator is made.

To check if accessible parts have become live, a test in accordance with 7 is made.

After testing in 13.2 to 13.5, the lamp shall meet the insulation resistance requirements of 8.1 except the applied voltage shall be a d.c. voltage of approximately 1 000 V.

14 CREEPAGE DISTANCES AND CLEARANCES

The requirements of IS 15885 (Part 1) shall apply.

15 SELECTION OF LAMPS FOR TESTS (SAMPLING)

15.1 Method of Selection

The inspection test quantities (ITQ) shall be selected in a mutually agreed manner such as to ensure proper representation of the batch. 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 25 lamps required.
- b) *Over 20 Containers per Batch* — Out of 20 containers, every distributed over the whole batch, one lamp shall be selected at random from each container to obtain the 25 lamps required.

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

15.2 Inspection Test Quantity (ITQ)

Inspection test quantity shall consist of 25 lamps.

15.3 Accidentally Broken and/or in Corrected Operated Lamps

15.3.1 Lamps, which are accidentally broken, shall, when necessary, be replaced to ensure that the required number of lamps for performance requirements completed the test. Any such broken or incorrectly operated lamps shall be neglected in the evaluation of life test results specified in IS 16002 (Part 2).

NOTE — In order to avoid unnecessary delay, it is recommended that spare lamps be available for carrying out other tests of this standard including tests specified in Part 2 of this standard.

16 CONDITIONS OF COMPLIANCE

16.1 General Conditions

A batch shall be considered as confirming to this standard, if the requirements contained in this standard are fulfilled. If the batch fails to satisfy the requirements of any of these requirements, it shall be deemed not to comply with this standard.

16.2 Test for Inspection Test Quantity

16.2.1 Following shall constitute inspection tests:

- a) Marking;
- b) Interchangeability;
- c) Protection against electric shock;
- d) Insulation resistance and electric strength after humidity treatment; and
- e) Mechanical strength.

A batch shall be considered to comply, if the number of lamps failing does not exceed qualifying limits given below:

- a) For any single requirement: 2, *Max*; and
- b) For all requirements taken together: 4, *Max*.

17 TESTS

17.1 Classification of Tests

17.1.1 Type Tests

The following shall constitute the type tests to be

carried out on selected sample of self-ballasted lamps, sample being drawn preferably from regular production lot. The tests are carried out in order of the clauses:

- a) Marking (*see 5*);
- b) Interchangeability (*see 6*);
- c) Protection against electric shock (*see 7*);
- d) Insulation resistance and electric strength after humidity treatment (*see 8*);
- e) Mechanical strength (*see 9*);
- f) Cap temperature rise (*see 10*);
- g) Resistance to heat (*see 11*);
- h) Resistance to flame and ignition (*see 12*);
- j) Fault conditions (*see 13*); and
- k) Creepage distances and clearances (*see 14*).

17.1.2 The number of sample shall be as given for ITQ in respect of tests for **5** to **9** and their criteria for acceptance is given in **16.2**.

17.1.3 The number of samples for temperature rise when tested in accordance with **10** shall be five from which not more than one shall fail.

17.1.4 The number of samples for resistance to heat (*see 11*), resistance to flame and ignition (*see 12*) and fault condition (*see 14*) shall be one and no failures are allowed in any of these tests.

17.2 Acceptance Test

The following shall constitute as acceptance tests:

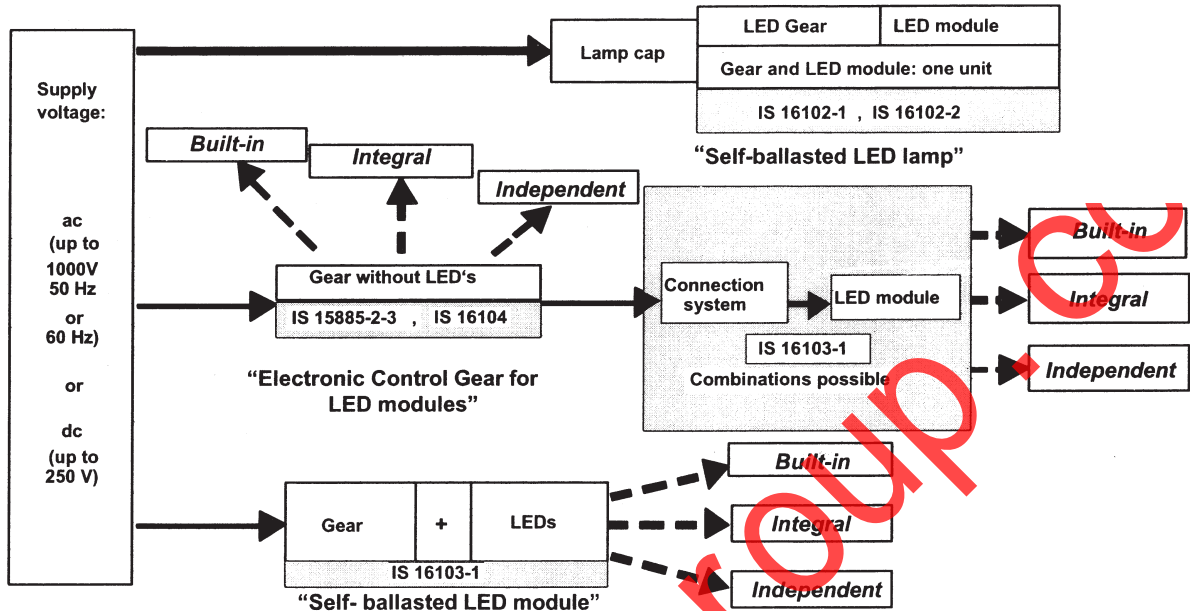
- a) Marking (*see 5*);
- b) Interchangeability (*see 6*);
- c) Protection against electric shock (*see 7*);
- d) Insulation resistance and electric strength after humidity treatment (*see 8*);
- e) Mechanical strength (*see 9*); and
- f) Cap temperature rise (*see 10*).

17.2.1 Sampling shall be the same as given against ITQ in respect of test of **5** to **9** and five in respect of test of **10**. Criteria for acceptance shall be as given in **16.2** for cap temperature rise the number of failure shall not exceed one.

ANNEX A
(Clause 1)

OVERVIEW OF SYSTEMS COMPOSED OF LED MODULES AND CONTROL GEAR

A-1 An overview of systems composed of LED system and control gear is given below:



ANNEX B
(Clause 5.2)

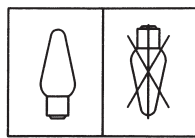
LAMPS WITH OPERATING POSITION LIMITATIONS

B-1 These symbols are to indicate that only cap-down to horizontal operation is permitted because of possible overheating.

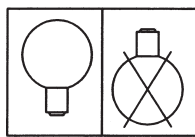
to avoid it being read upside down.

The symbols for candle and round bulb lamps shown in Fig. 6 are given as examples.

There shall be text in the vicinity of the symbol in order



Candle lamps



Round bulb lamps

Bulb Lamps

FIG. 6 OPERATING AND NON-OPERATING POSITIONS

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