भारतीय मानक

Indian Standard

IS 16102 (Part 2) : 2026

सामान्य प्रकाश सेवाओ के लिए स्वत: जलने वाले एलईडी लैंप

भाग 2 कार्यकारिता अपेक्षाएँ

(दूसरा पुनरीक्षण)

Self-Ballasted LED Lamps for General Lighting Services

Part 2 Performance Requirements

(Second Revision)

ICS 29.140.99

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

February 2026

Price Group 11

Lamps and Related Equipments Sectional Committee, ETD 23

FOREWORD

This Indian Standard (Part 2) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Lamps and related equipments Sectional Committee had been approved by the Electrotechnical Division Council.

This standard specifies the performance requirements for self-ballasted LED lamps for general lighting services for supplies from above 50V ac up to 250V ac at 50 Hz and 1 000 V d.c.

This standard was first published in 2012 and first revised in 2017. This revision has been brought out to align with the latest IEC.

The following major modifications have been incorporated to the revision of the standard:

a) To incorporate higher wattage LED lamps under the scope;

b) To specify minimum requirements for performance requirements *for example* life, efficacy, CRI;

c) Modifications in required markings (*see* Table 1);

d) Inclusion and use of LM-80 data for lumen maintenance and maintained chromaticity coordinates related tests; and

e) Inclusion of light flicker and stroboscopic effect related parameters to address negative impact of light modulation on human health.

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

Part 1 Safety requirements

While preparing this standard, considerable assistance has been taken from the following standards and technical specifications:

a) IEC 62612: 2018 (edition 1.2) ‘self-ballasted LED lamps for general lighting services with supply voltages > 50 V — Performance requirements’;

b) International energy agency’s (IEA) 4E SSL annex: quality and performance requirements for LED lighting products;

c) US energy star program for LED lamps; and

d) LM 80 ‘Measuring lumen maintenance of LED light sources’.

The composition of the Committee responsible for the revision of this standard is given in Annex F.

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 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. 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 2 PERFORMANCE REQUIREMENTS

(Second Revision)

1 SCOPE

This standard (Part 2) specifies the performance requirements, together with the test methods and conditions, required to show compliance of LED lamps with integral ballast meant for stable operation, intended for domestic and similar general lighting purposes, having:

a) A rated power up to 60 W;

b) A rated voltage above 50 V a.c. up to and including 250 V ac at 50 Hz and a d. c. voltage up to 1 000 V; and

c) A lamp cap as listed in IS 16102 (Part 1).

These performance requirements are additional to the safety requirements in IS 16102 (Part 1).

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 This standard also includes lamp(s) incorporated with rechargeable batteries (replaceable and non-replaceable).

3 This standard applies also to lamps which incorporate additional functions, like but not limited to: communication technologies and/or sensors, and/or speakers, and/or energy storage (battery charging).

LED lamps, on which compliance with this standard is claimed, shall comply with the safety requirements of IS 16102 (Part 1).

The only feature provided by this standard, when applied for replacement purposes, is information on maximum lamp outlines.

The requirements of this standard relate to acceptance and type testing.

This standard covers LED lamps that intentionally produce white light, based on inorganic LEDs. This standard does not cover self-ballasted LED-lamps that intentionally produce tinted or colored light neither does it covers OLEDs.

This standard specifies test requirements for a maximum rated life (declared) of up to 50 000 h. The verification of manufacturer's life time claims beyond rated life of 50 000 h cannot be made in a sufficiently confident way, because projecting test data further in time is not available.

It can be expected that self-ballasted LED lamps, which comply with this standard will start and operate satisfactorily at voltages between 90 percent and 110 percent of rated supply voltage and at an ambient air temperature between − 10 °C and 50 °C and in a luminaire complying with the relevant provisions of IS 10322 (Part 1).

If a supplier claims suitability for operation at different conditions (for instance, at higher voltage, temperature or humidity) then:

a) Lamps shall be tested under claimed different conditions;

b) Lamps shall start and operate satisfactorily under claimed different conditions; and

c) Lamps shall meet the performance claims under the claimed different conditions, which may differ from the general conditions for measurement specified in **B-1**.

2 REFERENCES

The standards listed in Annex A 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 edition of these standards.

3 TERMINOLOGY

For the purposes of this standard, the terms and definitions given in IS 1885 (Part 16/Sec 1) and IS 16101 as well as the following shall apply.

3.1 Rated Value — Quantity value for a characteristic of an LED lamp for specified operating conditions.

NOTE — the value and the conditions specified in this standard, or assigned by the manufacturer or responsible vendor.

3.2 Test Voltage — Voltage at which tests are carried out.

NOTE — the voltage for conducting the relevant tests is given in B-2.

3.3 Lumen Maintenance (LED Lamp) — Ratio of the luminous flux emitted by an LED lamp at a given time in its life to its initial luminous flux, the lamp being operated under specified conditions.

NOTES

1 This ratio *x* is generally expressed in percentage.

2 The lumen maintenance of an LED lamp is the effect of decrease of the lumen output of the LED(s) or a combination of this with failure(s) of LED(s) if the lamp contains more than one LED. The lumen maintenance is also termed as luminous flux maintenance.

3.4 Initial Value — Photometric, colorimetric and electrical characteristics at the end of the ageing period and stabilisation time.

3.5 Maintained Value — Photometric, colorimetric and electrical characteristics at an operational time, including stabilization time.

NOTE — the operational time shall be as specified in 7.1.

3.6 Life (of an Individual LED Lamp) (*L*x) — Length of time during which an LED lamp provides at least claimed percentage of the initial luminous flux, under standard test conditions.

NOTES

1 A LED lamp is considered to have reached its end of life, when it no longer provides claimed percentage of the initial luminous flux. Life shall be always published in combination of life (*L*x) at lumen maintenance (*x*) and the failure fraction (*F*y) (*see* 3.8).

2 Any built-in electronic control gear, however, may show a sudden end of life failure. The definition given in 3.6 implies that an LED lamp giving no light at all, due to an electronic failure, has actually reached end of life, since it no longer complies with the minimum luminous flux level as declared by the manufacturer or responsible vendor.

3.7 Rated Lamp Life — Length of time during which a population of LED lamps provides at least the claim for luminous flux percentage *x* and less or equal the claim for failure fraction percentage *y*, as declared by the manufacturer or responsible vendor.

NOTES

1 For sample size *see* 13.

2 Note 1 and Note 2 of 3.6 shall apply.

3 Rated lamp life is expressed in hours.

3.8 Failure Fraction at Rated Life (F_y) — Percentage *y* of a number of LED lamps of the same type that at their rated life designates the percentage (fraction) of failures.

NOTES

1 This failure fraction expresses the combined effect of all components of an LED lamp including mechanical components, as far as the light output is concerned. The effect of the LED could either be less light than claimed or no light at all.

2 For self-ballasted LED lamps normally a failure fraction of 10 percent or/and 50 percent are being applied, indicated as *F*10 or/and *F*50.

3.9 Photometric Code — Colour designation of an LED lamp giving white light as defined by the correlated colour temperature and the general colour rendering index.

NOTES

1 The definition of photometric code is given in IS 16101 as light colour designation.

2 An example of the construction of the photometric code is given in Annex C.

3.10 Stabilization Time — Time, which the LED lamp requires to obtain stable photometric conditions with constant electrical input for each measurement.

NOTE — An LED lamp may be regarded as stable under stable thermal conditions.

3.11 Ageing — Preconditioning period of the LED lamps before initial values are taken.

3.12 Type — LED lamp, representative of the production.

3.13 Family — Group of LED lamps that have same design characteristics, distinguished by common features of materials, components, construction and/or method of processing.

3.14 Type Test — A test or series of tests made on one or more sample of LED lamp representative of production, for the purpose of checking compliance of the design of a given product with the requirements of the relevant standard.

3.15 Type Test Sample — One or more LED lamps submitted by the manufacturer or responsible vendor for the purpose of the type test.

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

3.17 Batch — All the lamps of one type put forward once for acceptance test.

3.18 LED Lamp Efficacy (lm/W) — Quotient of the luminous flux emitted by the power consumed by the LED lamp.

3.19 LED Die — Block of semi-conducting material on which a given functional circuit is fabricated. *See* Fig. 1 for a schematic built-up of an LED die.

3.20 LED Package — Single electrical component encapsulating principally one or more LED dies, possibly with optical elements and thermal, mechanical, and electrical interfaces.

NOTES

1 The component does not include the control unit of the control gear, does not include a cap, and is not connected directly to the supply voltage.

2 An LED package is a discrete component and part of the LED lamp. For a schematic built-up of an LED package, *see* Fig. 2.

3.21 T_{LED} Point — Designated location of the point where to measure the performance temperature T_{LED} at the surface of the LED package.

3.22 Power Factor — The ratio of the measured active input power to the product of the supply voltage (rms) and the supply current (rms).

Expressed by cos ϕ, where ϕ is the phase angle between the fundamental of the mains supply voltage and the fundamental of the mains current.

3.23 Directional Lamp — Lamp having at least 80 percent luminous flux within a solid angle of π sr (corresponding to a cone with angle of 120°).

3.24 Peak Intensity — The highest value of the luminous intensity regardless of whether or not it occurs on the optical beam axis.

NOTE — The peak intensity is expressed in candela.

3.25 Centre Beam Intensity — The value of the luminous intensity measured on the optical beam axis.

NOTE — The centre beam intensity is expressed in candela.

3.26 Beam Angle — The angle between two imaginary lines in a plane through the optical beam axis, such that these lines pass through the centre of the front face of the lamp and through points at which the luminous intensity is 50 percent of the centre beam intensity.

3.27 Short-term Flicker (P_{st}^{LM}) — Short term flicker quantifies the likelihood of perception of a visual unsteadiness caused by cyclical variations in light output (both in total luminous flux or in chromatic characteristics) as viewed fluctuating brightness and/or colour perception by a stationary observer of a static environment (that is no movement by either).

3.28 Stroboscopic Effect Visibility Measure (SVM) — Stroboscopic Effect Visibility Measure quantifies the likelihood of perceived change in motion caused by cyclical variations in light output (both in total luminous flux or in chromatic characteristics) as viewed by a stationary observer of a non-static environment (that is moving object).

4 GENERAL REQUIREMENTS ON TESTS

The LED lamps for which compliance with this standard is claimed shall comply with the safety requirements specified in IS 16102 (Part 1). Method of measurement of lamp characteristics is given in Annex B.

Self-ballasted LED lamps shall be able to start and operate satisfactorily at any voltages between 90 percent and 110 percent of rated supply voltage and at an ambient air temperature between – 10 °C and 50 °C and also in a luminaire complying with IS 10322 (Part 1).

5 MARKING

5.1 General Requirements for Marking

In addition to the marking specified in IS 16102 (Part 1), marking as specified in Table 1 shall be provided by the manufacturer or responsible vendor.

5.2 Places of Marking

The required information to be provided on the product, packaging or product leaflets, product datasheet and website shall be as specified in Table 1.

5.3 The LED lamps conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the LED lamps may be marked with the Standard Mark.

6 DIMENSIONS

The LED lamp dimensions shall comply with the requirements as indicated by the manufacturer or responsible vendor.

NOTE — If the luminaire itself or any covering (if applicable) does not interfere with the dimensions of LED lamps, such lamps are also suitable as replacement provided the lamp cap is the same.

Compliance is checked by inspection.

Table 1 Required Marking

(*Clauses Foreword,* 5.2 *and* 10.1, 10.2)

Sl No.	Parameter	Product	Packaging	Product Datasheets, Leaflets or Website
(1)	(2)	(3)	(4)	(5)
i)	Rated luminous flux (lm),	x	x	x
ii)	photometric code (*see* Annex C)	–	x	x
iii)	Beam angle (for directional lamps only)	x	x	x
iv)	Rated life (*h*) and the related lumen maintenance (*x*)	x	x	x
v)	Failure fraction (*Fy*), corresponding to the rated life	–	x	x
vi)	Rated correlated colour temperature (CCT)	x	x	x
vii)	Peak intensity (cd) (for directional lamps only)	–	x	x
viii)	Rated colour rendering index (CRI)	–	x	x
ix)	Ageing time (*h*), if different to 0 h	–	–	x
x)	Rated efficacy (lm/W)	x	x	x
xi)	Dimensions, including dimensional tolerances	–	–	x
xii)	Power factor	x	x	x

NOTE — Luminous intensity distribution of an LED lamp may be specific for an application.

Key: x = required, – = not required

7 TEST CONDITIONS

7.1 General Test Conditions

Testing duration shall be 6 000 h.

Additional LED lamps within the same family (*see* **3.13**) may be subjected to decreased testing duration (*see* **7.2**). For identification of a family *see* Table 2, for details on sample sizes for family testing *see* Table 10.

For LED lamps using LED modules where compliance with IS 16103 (Part 2) has been demonstrated, the test duration of 6 000 h may be avoided, provided that the LED module operates in its temperature and current limits as tested according to IS 16103 (Part 2). The data for chromaticity and the lumen maintenance at 6 000 h from IS 16103 (Part 2) test report, shall be taken and used to fulfil the maintained value requirements of **10.1** and **11.2**, respectively.

Alternatively, test data from IS 16105 shall be used for the derivation of maintained values at 6 000 h, together with related compliance criteria, as specified in Annex E.

NOTE — The Indian Standard IS 16105 is based on the ANSI/IES LM 80-2008. Therefore, wherever IS 16105, its test reports, or its data are referenced in this document, equivalent ANSI/IES LM 80-2008 test reports or data may be considered to fulfil those requirements.

Test conditions for testing T_{LED}, electrical and photometric characteristics, lumen maintenance and life are given in Annex B.

All tests are conducted on *n* LED lamps of the same type. The number *n* shall be a minimum of products as given in Table 9. LED lamps used in the endurance tests shall not be used in other tests.

LED lamps with dimming control shall be adjusted to maximum light output for all tests.

LED lamps with adjustable colour point shall be adjusted/set to one fixed value as indicated by the manufacturer or responsible vendor.

7.2 Creation of Lamp Families to Reduce Test Effort

7.2.1 *General*

Lamp families have been created with the aim of guiding LED lamp manufacturers towards platform designs and thus allowing the possibility to use data of the existing baseline product that has already been tested for an operational period as stated in The baseline product is considered to be the first LED lamp complying with this standard and designated to be part of the family.

7.2.2 *Variations within a Family*

Each family of LED lamps requires a case-by-case consideration. The range of LED lamps should be manufactured by the same manufacturer, under the same quality assurance system. The type variations of the range [for example Correlated Colour Temperature (CCT) given in **10.1**] should be essentially identical with respect to materials used, components and construction applied.

Requirements for the identification of a family of LED lamps for type testing are given in definition **3.13** and used in Table 2.

The testing time may be reduced within a family down to 1 000 h in case variations of part characteristics are within the conditions given in Table 2.

Table 2 Variations Allowed within a Family

(*Clauses* 7.1, 7.2.2 *and* E-2.2.2)

Sl No.	Components Where Variations Are Allowed (*see* Note 2)	Conditions for Acceptance
(1)	(2)	(3)
i)	Housing/chassis and heat sink/heat management	T_{LED} (location and value given by the LED lamp supplier) and other components remain at the same or at a lower value, if the rated life time is the same or higher than the baseline product, as indicated and specified by the manufacturer or responsible vendor (*see* also Note 1 and Note 3).
ii)	Optics (*see* Note 1)	The test results showing the effect of optical material change shall be documented in the manufacturer's record.
iii)	LED package	T_{LED} remains at the same or at a lower value, if the rated life time is the same or higher than the baseline product as indicated and specified by the manufacturer or responsible vendor (*see* Note 3).
iv)	Control gear	T_{LED} remains at the same or at a lower value, if the rated life time is the same or higher than the baseline product, as indicated and specified by the manufacturer or responsible vendor. A statistical failure rate calculation based on an MTBF (mean time between failures) calculation by the manufacturer shall show equal or lower failure rate of the electronic control gear.

NOTES

1 Optics includes for instance secondary optics (lenses), reflectors, trims and gaskets and their interconnections. The results relate to changes in luminous flux, peak luminous intensity, luminous intensity distribution, beam angle, shift in colour co-ordinates, shift in CCT (*see* **10.1**) and shift in colour rendering index (CRI) (*see* **10.2**).

2 Any change on part tolerances are documented in the manufacturer's record.

3 No additional tests are required for claimed lower rated life time, provided T_{LED} is same or lower than baseline product.

7.2.3 *Compliance Testing of Family Members*

The following performance characteristics of members within a family at initial and after reduced testing time shall be in line with the values provided by the manufacturer or responsible vendor of the lamp:

a) Chromaticity co-ordinates;

b) Colour rendering index;

c) Lumen maintenance code; and

d) Results of accelerated operational life test.

For all of the tested units in a sample, the measured values of an LED lamp (the initial and maintained value) shall not vary beyond the values indicated by the manufacturer or responsible vendor.

The measured values shall be of the same category or code as per the declared values or better. The maximum number of LED lamps in a sample which can fail in individual tests and in the groups is given in Table 10.

8 LAMP INPUT

8.1 Lamp Power

The test conditions for the measurement of lamp power shall be as given in Annex B.

Compliance:

The initial power consumed by each individual LED lamp in the measured sample shall not exceed the rated power by more than 10 percent.

The average of initial power consumed by the LED lamps in the measured sample shall not exceed the rated power by more than 7.5 percent.

8.2 Power Factor

The measured power factor for each individual lamp of the sample shall not be less than 0.9 for lamp rated wattages 5 W and above.

For lamp rated wattages less than 5 W, minimum measured power factor should be 0.5.

8.3 Harmonics

The harmonics of the input current when measured in accordance with IS 14700 (Part 3/Sec 2) shall be as given in **8.3.1** and **8.3.2**.

8.3.1 Compliance to harmonics of input current is not applicable for lamp rated wattages below and equal to 5 W.

8.3.2 For lamps having an active rated input power more than 5 W, the harmonic current shall comply with one of the following two sets of requirements:

a) The harmonic currents shall not exceed the power-related limits of Table 3; or

b) The third harmonic current, expressed as a percentage of the fundamental current, shall not exceed 86 percent and the fifth shall not exceed 61 percent. Moreover, the wave form of the input current shall be such that it begins to flow before or at 60°, has its last peak (if there are several peaks per half period) before or at 65° and does not stop flowing before 90°, where the zero crossing of the fundamental supply voltage is assumed to be at 0°.

Table 3 Limits for Harmonic Current

(*Clause* 8.3.2)

Sl No.	Harmonic Order	Maximum Permissible	Harmonic Current
	n	*mA/W*	*A*
(1)	(2)	(3)	(4)
i)	3	3.4	2.3
ii)	5	1.9	1.14
iii)	7	1.0	0.77
iv)	9	0.5	0.40
v)	11	0.35	0.33
vi)	$13 \leq n \leq 39$ (odd harmonics only)	3.85/*n*	0.15 15/*n*

NOTE — Harmonic current less than 0.6 percent of the input current measured under test conditions or less than 5 mA whichever is greater are to be disregarded.

8.4 Emission of Radio Frequency Disturbances

The emission (radiated and conducted) of radio frequency disturbances when measured in accordance with IS 6873 (Part 5) shall be as given in **8.4.1** and **8.4.2**.

8.4.1 LED lamp shall comply with the mains terminal voltage limits given in Table 4.

8.4.2 Where the LED lamp is operated at a frequency exceeding 100 Hz, the lamp shall comply with the field strength limits given in Table 5.

Table 4 Disturbance Voltage Limits at Mains Terminals

(*Clause* 8.4.1)

Sl No.	Frequency Range	Limits[1] dB (µV)	
		Quasi-Peak	Average
(1)	(2)	(3)	(4)
i)	9 kHz to 50 kHz	110	—
ii)	50 kHz to 150 kHz	90 to 80[2]	—
iii)	150 kHz to 0.5 MHz	66 to 56[2]	56 to 46[2]
iv)	0.5 MHz to 5.0 MHz	56	46
v)	5.0 MHz to 30 MHz	60	50

[1] At the transmission frequency the lower limit applies.

[2] The limit decreases linearly with the logarithm of the frequency in the ranges of 50 kHz to 150 kHz and 150 kHz to 0.5 MHz

Table 5 Radiated Disturbance Limits

(*Clause* 8.4.2)

Sl No.	Frequency Range	Limits for Loop Diameter (dB µA)		
		2 m	3 m	4 m
(1)	(2)	(3)	(4)	(5)
i)	9 kHz to 70 kHz	88	81	75
ii)	70 kHz to 150 kHz	88 to 58[1]	81 to 51[1]	75 to 45[1]
iii)	150 kHz to 3.0 MHz	58 to 22[1]	51 to 15[1]	45 to 9[1]
iv)	3.0 MHz to 30 MHz	22	15 to 16[2]	9 to 12[2]

[1] Decreasing linearly with the logarithm of the frequency.

[2] Increasingly linearly with the logarithm of the frequency.

8.5 Flicker and Stroboscopic Effects

Flicker and stroboscopic effect (also called temporal light artefacts — TLA) can lead to undesired effects such as reducing visual comfort and reducing task performance and can lead to physiological effects such as fatigue or headaches. LED light bulbs shall be designed to avoid the negative effects of flicker and stroboscopic effect throughout the full dimming range.

8.5.1 *Flicker*

Flicker is specified by using the IEC short-term flicker indicators and associated test methods as described in IEC TR 61547-1. For LED bulbs short-term flicker indicator value ≤ 1 is desired when measured at 100 percent light out-put (as well as at 50 percent light out-put, if product is dimmable).

NOTE — Short-term flicker indicator value ≤ 1 shall be achieved in both the situations, 'with the application of voltage fluctuations' and 'without the application of voltage fluctuations'.

8.5.2 *Stroboscopic Effect*

Stroboscopic effect perceived by individuals in indoor environment can be objectively quantified using the Stroboscopic visibility measure (SVM). The SVM can be used to quantify the visibility of this effect. For LED bulbs SVM ≤ 1 is desirable. The test method is described in IEC TR 63158.

9 PHOTOMETRIC CHARACTERSTICS

9.1 Luminous Flux

Rated luminous flux of the lamps shall be declared by the manufacturer or responsible vendor.

Luminous flux shall be measured according to Annex B.

The initial luminous flux of each individual LED lamp in the measured sample shall not be less than the rated luminous flux by more than 10 percent.

The average initial luminous flux of the LED lamps in the measured samples shall not be less than the rated luminous flux by more than 7.5 percent.

9.2 Luminous Intensity Distribution, Peak Intensity and Beam Angle

9.2.1 *General*

The requirements of **9.2.4** and **9.2.5** are to be only to LED lamps having a directional (spot) distribution commonly known as directional lamps measurement.

9.2.2 *Measurement*

The intensity of light emitted from the LED lamp in different directions is measured using a goniophotometer. All photometric data shall be declared for the LED lamp operating at a temperature given in **B-1**.

The allowed photometric variations, detailed in **9.2.3**, **9.2.4** and **9.2.5** are to take into account the manufacturing tolerances.

9.2.3 *Luminous Intensity Distribution*

The initial distribution of luminous intensity shall not vary ± 5 percent with that declared by the manufacturer or responsible vendor.

Compliance is checked according to Annex B.

9.2.4 *Peak Intensity Value*

Where a peak intensity value is provided by the manufacturer or responsible vendor, the initial peak intensity of each individual LED lamp in the measured sample shall not be less than 75 percent of the rated intensity.

The test shall be carried out in accordance with Annex B.

NOTE — Compliance criteria for the average value of the peak intensity is under consideration.

9.2.5 *Beam Angle Value*

Where a beam angle value is provided by the manufacturer or responsible vendor, the initial beam angle value of each individual LED lamp in the measured sample shall not deviate by more than 25 percent of the rated value.

The test shall be carried out in accordance with Annex B.

NOTE — Compliance criteria for the average value of the beam angle value is under consideration.

9.3 Luminous Efficacy

LED lamp efficacy shall be calculated from the measured initial luminous flux of the individual LED lamp divided by the measured initial input power of the same individual LED lamp. For measurement of luminous flux, *see* **B-3.3**. The manufacturer or responsible vendor shall declare a rated efficacy value (lm/W) of not less than 90 lm/W.

10 COLORIMETRIC CHARACTERSTICS

10.1 Rated Colour and Colour Variation Categories

Reference is made to IS 2418 (Part 2). The rated colour of a lamp shall preferably be one of the following seven values:

F 2 700, F 3000, F 3 500, F 4 000, F 5 000, F 5 700 or F 6 500

The standardised chromaticity co-ordinates and CCT values corresponding to these colours are given in Table 6.

For lamps, with non-standard chromaticity coordinates, the rated values shall be assigned by the manufacturer or responsible vendor.

The initial chromaticity co-ordinates are measured. A second measurement of maintained chromaticity co-ordinates is made at an operational time as stated in **7.1**. The measured actual chromaticity co-ordinate values (both initial and maintained) shall fit within 1 of 4 categories (*see* Table 7), which correspond to a particular MacAdam ellipse around the rated chromaticity co-ordinate value, whereby the size of the ellipse (expressed in *n* steps) is a measure for the tolerance or deviation of an individual LED lamp.

For all of the tested units in a sample, the measured chromaticity co-ordinate values of an LED lamp (the initial value and maintained value) shall not move beyond the chromaticity co-ordinate tolerance category as indicated by the manufacturer or responsible vendor (*see* Table 1). The measured values shall be of the same category as the rated values or better. The sample units for the chromaticity coordinate measurement shall be selected from four different batches.

NOTE — the colour variation between the units in a sample from different production runs resembles the variation within longer periods of production.

For compliance of family members, the requirements given in **7.2.3** shall be followed. The CCT and chromaticity co-ordinates shall be measured according to Annex B.

10.2 Colour Rendering Index (CRI)

The rated CRI declared by the manufacturer or responsible vendor shall not be less than 80.

The initial CRI shall be measured in accordance with **B-3.7**.

For all tested units in a sample, the measured CRI values shall not be lower than three points from the rated CRI value (*see* Table 1).

Table 6 Colour

(*Clause* 10.1)

Sl No.	Colour	CCT (T_c)	Chromaticity Co-ordinates	
			X	*Y*
(1)	(2)	(3)	(4)	(5)
i)	F 6 500	6 400	0.313	0.337
ii)	F 5 700	5 700	0.329	0.342
iii)	F 5 000	5 000	0.346	0.359
iv)	F 4 000	4 040	0.380	0.380
v)	F 3 500	3 450	0.409	0.394
vi)	F 3 000	2 940	0.440	0.403
vii)	F 2 700	2 720	0.463	0.420

NOTE — The letters in the colour marking designation stands for:

F = Values from Annex C of IS 2418 (Part 2).

11 LAMP LIFE

11.1 General

Life of an LED lamp as defined in **3.6** is the combined effect of:

a) Gradual light output degradation, mostly caused by material degradation (*see* **11.2**); and

b) Abrupt light output degradation, mostly caused by electrical components failure (*see* **11.3**, endurance tests as an indication for reliability and life).

For ensuring life of LED lamps, both gradual light output degradation and abrupt light output degradation shall be checked by measuring lumen reduction over life at L_{70} (*see* **11.2**) and carrying out endurance tests (*see* **11.3**) respectively.

The rated life of the LED lamps shall be at least 15 000 h.

The fraction of tested lamps of a sample (F_y) that may fail to comply with the requirements of the tests under **11.2** and **11.3** are defined in **3.3** and **3.8**.

All tested units shall be operational at all applicable lumen maintenance measurement points designated in **11.2**.

11.2 Lumen Maintenance

The lumen maintenance figure may vary depending on the application of the LED lamp. This standard specifies a minimum value of 70 percent of the initial luminous flux as the end of life criteria for the applications covered under the scope of this standard that is, L_{70}.

NOTES

1 As the typical life of an LED lamp is (very) long compared to other light sources, it is regarded as impractical and time consuming within the scope of this standard to measure the actual lumen reduction over life at L_{70}. This standard therefore relies on test results at 6 000 h to determine the expected lumen maintenance of any LED lamp.

2 The actual LED behaviour with regard to lumen-maintenance can differ considerably per type and per manufacturer. It is therefore not possible to express the lumen-maintenance of all LEDs in simple mathematical relations. A fast initial decrease in lumen output does not automatically imply that a particular LED will not make its rated life.

3 Other methods providing more advanced insight into lumen depreciation over LED lamp life are under consideration.

The initial luminous flux of all the lamps under test shall be measured as per the method described in Annex B. The initial luminous flux value measured shall be normalized to 100 percent and shall be used as the first data point for determining lamp life. All the lamps under test are then operated continuously in normal environmental temperature between 15 ˚C to 40 ˚C for an operational time as stated in **7.1**. The measurement of luminous flux shall be repeated at 1 000 h intervals for a total equal to an operational time as stated in **7.1**. The measured luminous flux value 1 lm shall be expressed as maintained value which is equal to the percentage of the initial value.

NOTES

1 The measurement of lumen output values at 1 000 h intervals will give additional insight as to the reliability of the measured values.

2 In case during testing, the maintained value of luminous flux at any 1 000 h interval falls below the maintained value at 6 000 h (as specified in Table 7), the test shall be discontinued and the lamps shall be deemed to have failed the test for lumen maintenance.

Compliance at 6 000 *h duration:*

LED Lamp shall maintain minimum percentage of initial luminous flux after completion of the 6 000 h test duration as per Table 7.

Table 7 Tolerance (Categories) on Rated Chromaticity Co-ordinate Values

(*Clauses* 10.1, 11.2 *and* E-3.1)

Sl No.	Size of Macadam Ellipse, (Centred at the Chromaticity Co-ordinate at the Corresponding Rated Colour)	Colour variation category	
		Initial	Maintained
(1)	(2)	(3)	(4)
i)	3 to step	3	3
ii)	5 to step	5	5
iii)	7 to step	7	7
iv)	> 7 to step ellipse	Absolute values	Absolute values

NOTE — The behaviour of the chromaticity co-ordinates is expressed by marking the two measurement results of both the initial chromaticity co-ordinates and the maintained chromaticity co-ordinates. An example is given in Annex C. This standard applies mainly to retrofit LED lamps for which it is important that the chromaticity corresponds as much as possible to the lamps to be replaced. Tolerance areas are based on the ellipses defined by MacAdams normally applied for (compact) fluorescent lamps and other discharge lamps.

Table 8 Minimum Lumen Maintenance after Test Duration

(*Clauses* 11.2 *and* E-3.2)

Sl No.	Maximum Life Claim (hours to L_{70})	Minimum Lumen Maintenance After Test Duration (6 000 h) (*Percent*)
(1)	(2)	(3)
i)	15 000	86.7
iii)	25 000	91.8
viii)	50 000	95.8

Given a sample of '*n*' pieces (individuals) of LED lamps according to Table 9 being subjected to 6 000 h testing, it is deemed to have passed the test, if at the end of the test, the number of failed units is smaller or equal to the number claimed by the manufacturer. This standard gives the following guide for calculation:

a) When F_{50} is specified, at least '*n*-2' individual lamps shall have passed; and

b) When F_{10} is specified, at least '*n*' individual LED lamps shall have passed.

NOTES

1 Calculation, based on 25 percent of claimed failure fraction F_y:

a) Claimed failure fraction F_{50} gives 25 percent × F_{50} (= 50 percent) × n (= 20) = 2.5, rounded off to next lower integer gives 2 LED lamps allowed to fail;

b) Claimed failure fraction F_{10} gives 25 percent × $F10$ (= 10 percent) × n (= 20) = 0.5, rounded off to next lower integer gives 0 LED lamps allowed to fail; and

c) In order to assess the pass or fail criteria of reasonable quality this standard has chosen for a linear relation of the claimed failure fraction with the specified test time, being 6 000 h.

2 Assuming that the test time is lower than the claimed life time, failure fraction at the end of the test will be lower than the failure fraction at rated life. There is also no general relation between the failures at the end of the test in relation to the claimed failure fraction.

For compliance of family members, conditions given in **7.2.3** shall be followed.

11.3 Endurance Tests

11.3.1 *General*

LED lamps shall be subjected to the tests specified in **11.3.2** to **11.3.4**.

NOTE — All tests can be carried out in parallel with different sets of new LED lamps.

11.3.2 *Temperature Cycling Test*

The temperature cycling test shall be conducted according to IS/IEC 60068-2-14 with specified rate of change as given below:

The LED lamp shall be tested for initial luminous flux and then placed in a test chamber in which the temperature is varied between - 10 °C to + 50 °C over a period of 4 h and for a test duration of 250 periods corresponding to 1 000 h. A 4 h period consists of 1 h holding at each extreme temperature and 1 h transfer time (at the rate of 1 °C/minute) between the extreme temperatures. The LED lamp shall be switched on at test voltage for 34 minutes and switched off for 34 minutes.

If a manufacturer claims suitability for operation at extended conditions (in respect of voltages or temperatures outside of normal operating conditions, including high humidity), then:

a) The lamps shall be tested under claimed extended condition;

b) The lamps shall be able to start and operate satisfactorily under these extended conditions; and

c) Lamps shall meet all performance claims for operation under claimed extended conditions, which may differ from the performance claims under the general conditions for measurement specified in Annex B.

Compliance:

At the end of the test all the LED lamps shall operate and have a luminous flux which stays within the claimed lumen maintenance for a period of at least 15 min and shall show no physical effects of temperature cycling such as cracks or delaminating of the label.

NOTE — The switching period of 68 min is chosen to get a phase shift between temperature and switching period.

The temperature requirements given in **B-1** however shall not apply.

NOTE — The purpose of this test is to check the mechanical strength of the assembly.

11.3.3 *Supply Switching Test*

At test voltage, the lamp shall be switched on and off for 30 s each. The cycling shall be repeated for a number equal to half the rated life in hours, for example, 20 k cycles if rated life is 40 000 h.

The temperature requirements of **B-1** shall apply.

NOTE — The purpose of this test is to check the endurance of the built-in electronic components.

Compliance:

At the end of the test all the LED lamps shall operate and have a luminous flux which stays within the claimed lumen maintenance for a period of at least 15 minutes.

11.3.4 *Operational High Temperature Stress Test*

The LED lamp shall be tested for initial luminous flux and then operated continuously without switching at the test voltage and at a temperature corresponding to 10 °C (*see* last paragraph and the note) above the maximum specified operating temperature, if declared by the manufacturer and over an operational time of 1 000 h. If there is no declared value then the test shall be performed at 50 °C. Any thermal protecting devices, solely applied for their function of switching at certain temperature, that would switch off the LED lamp or reduce the light output shall be bypassed.

Compliance:

For compliance of family members, *see* **7.2.3**.

At the end of this test, and after cooling down to room temperature and being stabilized, all the lamps shall have at least a luminous flux of 70 percent compared to the initial value for at least 15 minutes.

The temperature requirements of B-1 do not apply.

An accelerated test should not evoke fault modes or failure mechanisms which are not related to normal life effects. For example, a too high temperature increase would lead to chemical or physical effects from which no conclusions on real life can be made.

NOTE — This test is to check for catastrophic failures.

12 DIMMING

Performance testing of dimmable (step/continuous dimming)/colour changing lamps is under consideration.

13 PERFORMANCE TEST FOR LED LAMPS WITH BATTERIES

Under consideration.

14 SCHEDULE OF TESTS

14.1 Type Tests

The minimum sampling size for type testing and the acceptance criteria shall be as given in Table 9 and Table 10. The sample shall be representative of a manufacturer’s production. A minimum number of 40 lamps are required for baseline product and 20 samples for each family product for type test.

14.2 Acceptance Tests

The method of selection of lamps for tests is given in 15 of IS 16102 (Part 1). Sample Size and acceptance criteria for acceptance test is 15 lamps (Table 11).

Table 9 Sample Sizes for Type Tests

(*Clauses* 7.1, 11.2 *and* 14.1)

Sl No.	Clause or Sub-clause	Test	Minimum Number of Units in a Sample for an Operational Time as Stated in 7.1	AQL – Maximum Number of Units that are Allowed to Fail	
				In Individual Tests	In the Group of Tests
(1)	(2)	(3)	(4)	(5)	(6)
i)	7.2[1)]	t_{LED} -point	1 unit for each test[2)]	Not applicable	Not applicable
ii)	9.2.3[1)]	Luminous intensity distribution			
iii)	8.3	Harmonics	1 unit for each test[2)]	0	0
iv)	8.4	Emission of radio frequency disturbance			
v)	8.5.1	Flicker			
vi)	8.5.2	Stroboscopic effect			
vii)	5	Marking	5 units for all tests	0	2
viii)	6	Dimensions		1	
ix)	9.2.4	Peak intensity value			
x)	9.2.5	Beam angle value			
xi)	8.2	Power factor			
xii)	8.1	Lamp power	Same 20 units for all tests	4	5
xiii)	9.1	Luminous flux			
xiv)	9.3	Efficacy			
xv)	10.1	Chromaticity tolerance (initial and maintained)			
xvi)	10.2	Colour rendering index (initial and maintained)		2	
xvii)	11.2	Lumen maintenance		0 or 2[3)]	
xviii)	11.3.2	Temperature cycling, energized	5	1	2
xix)	11.3.3	Supply voltage switching			
xx)	11.3.4	Accelerated operational life test			

[1)] t_{LED}-point and luminous intensity distribution to be tested and recorded. Measurement of t_{LED}-point is only for reference purpose for family compliance.

[2)] The sample need not be the same for all the tests.

[3)] The failures in lumen maintenance test is related to failure function (F_{10}/F_{50}) as defined in 11.2.

Table 10 Sample Size for Testing of Family

(*Clauses* 7.1, 7.2.3 *and* 14.1)

Sl No.	Clause or Sub-clause	Test	Minimum Number of Units in a Sample for Testing a Family at Reduced Test Duration According to 7.2	AQL-Maximum Number of Units That are Allowed to Fail	
				In Individual Tests	In the Group of Tests
(1)	(2)	(3)	(4)	(5)	(6)
i)	7.2[1)]	t_{LED}-point	1 unit for each test[2)]	Not applicable	Not applicable
ii)	9.2.3[1)]	Luminous intensity distribution			
iii)	8.3	Harmonics	1 unit for each test[2)]	0	0
iv)	8.4	Emission of radio frequency disturbance			
	8.5.1	Flicker			
	8.5.2	Stroboscopic effect			
v)	5	Marking	Same 5 units for all tests	0	2
vi)	6	Dimensions		1	
vii)	9.2.4	Peak intensity value			
viii)	9.2.5	Beam angle value			
ix)	8.2	Power factor			
x)	8.1	Lamp power			1
xi)	9.1	Luminous flux			
xii)	9.3	Efficacy			
xiii)	10.1	Chromaticity tolerance (initial and maintained)			
xiv)	10.2	Colour rendering index (initial and maintained)			

Table 10 (*Concluded*)

Sl No.	Clause or Sub-clause	Test	Minimum Number of Units in a Sample for Testing a Family at Reduced Test Duration According to 7.2	AQL-Maximum Number of Units That are Allowed to Fail	
				In Individual Tests	In the Group of Tests
(1)	(2)	(3)	(4)	(5)	(6)
xv)	11.2	Lumen maintenance			
xvi)	11.3.2	Temperature cycling, energised	3	1	1
xvii)	11.3.3	Supply voltage switching			
xviii)	11.3.4	Accelerated operational life test			

[1] t_{LED}-point and luminous intensity distribution to be tested and recorded. Measurement of t_{LED}-point is only for reference purpose for family compliance.

[2] The sample need not be the same for all the tests.

Table 11 Sample Sizes for Acceptance Tests[1)]

(*Clause* 14.2)

Sl No.	Clause or Sub-clause	Test	Minimum Number of Units in a Sample	AQL – Maximum Number of Units that are Allowed to Fail	
				In Individual Tests	In the Group of Tests
(1)	(2)	(3)	(4)	(5)	(6)
i)	5	Marking	5 units for all tests[2)]	0	0
ii)	6	Dimensions		1	
iii)	8.2	Power factor			
iv)	8.1	Lamp power	Same 10 units for all tests	2	3
v)	9.1	Luminous flux			
vi)	9.3	Efficacy			
vii)	10.1	Chromaticity tolerance (initial)			
viii)	10.2	Colour rendering index (initial)			

[1)] Acceptance tests are defined in 14.2.

[2)] The sample need not be the same for all the tests.

14.3 Accidentally Broken Lamps

Lamps which are accidentally broken before any test is started shall be replaced to ensure that the required number of test lamps completes the test.

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

15 TESTS

15.1 Type Tests

The following shall constitute the type tests to be carried out on selected sample of self-ballasted LED lamps, sample being drawn preferably from regular production lot:

a) Marking (*see* **5**);

b) Dimension (*see* **6**);

c) Lamp power (*see* **8.1**);

d) Power factor (*see* **8.2**);

e) Harmonics (*see* **8.3**);

f) Emission of radio frequency disturbances (*see* **8.4**);

g) Flicker (*see* **8.5.1**);

h) Stroboscopic effect (*see* **8.5.2**);

j) Luminous flux (*see* **9.1**);

k) Luminous intensity distribution (*see* **9.2.3**) Peak intensity (*see* **9.2.4**);

m) Beam angle (*see* **9.2.5**);

n) Luminous efficacy (*see* **9.3**);

p) Colour chromaticity and colour rendering index (CRI) (*see* **10.1** and **10.2**);

q) Life (*see* **11**); and

r) Dimming (under consideration).

15.2 Acceptance Tests

The following shall constitute as acceptance tests:

a) Marking (*see* **5**);

b) Dimension (*see* **6**);

c) Lamp power (*see* **8.1**);

d) power factor (*see* **8.2**);

e) Luminous flux (*see* **9.1**);

f) Luminous efficacy (*see* **9.3**); and

g) Colour chromaticity and colour rendering index (CRI) (*see* **10.1** *and* **10.2**).

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 1885 (Part 16) : 2023/IEC 60050-845 : 2020	Electrotechnical vocabulary: Part 16 Lighting, Section 1 General aspects
IS 2418 (Part 2) : 2018	Double-capped fluorescent lamps for general lighting service — Specification: Part 2 Performance requirements
IS 6873 (Part 5) : 2019	Limits and methods of measurement of radio disturbance characteristics: Part 5 Electrical lighting and similar equipment
IS 10322 (Part 1) : 2025	Luminaires: Part 1 General requirements and tests (*second revision*)
IS/IEC 60068-2-14 : 2023	Environmental testing: Part 2 Tests, Section 14 Test N: Change of temperature (*first revision*)
IS 14700 (Part 3/ Sec 2) : 2020	Electromagnetic compatibility (EMC): Part 3 Limits, Section 2 Limits for harmonic current emissions (equipment input current 16 A per phase) (*third revision*)
IS 16101 : 2012	General lighting — LEDS and LED modules — Terms and definitions
IS 16102 (Part 1) : 2012	Self-ballasted led lamps for general lighting services: Part 1 safety requirements
IS 16103 (Part 2): 2025	LED modules for general lighting: Part 2 Performance requirements (*first revision*)
IS 16105 : 2012	Method of measurement of lumen maintenance of solid state light (LED) sources
IS 16106 : 2012	Method for the electrical and photometric measurements of solid-state lighting products
IS/IEC/TR 61341 : 2010	Method of measurement of centre beam intensity and beam angle(s) of reflector lamps
IEC TR 61547-1 : 2020	Equipment for general lighting purposes — EMC immunity requirements — Part 1: Objective light flickermeter and voltage fluctuation immunity test method
IEC TR 63158 : 2018	Equipment for general lighting purposes — Objective test method for stroboscopic effects of lighting equipment

ANNEX B

(*Clauses* 7.1, 8.1, 9.1, 9.2.3, 9.2.4, 9.2.5, 10.1, 11.3.2 *and* E-2.2.2)

METHOD OF MEASURING LAMP CHARACTERISTICS

B-1 GENERAL

Unless otherwise specified, all measurements shall be made in a draught-free room at a temperature of 27 °C with a tolerance of ± 1 °C, a relative humidity of 65 percent *Max* and steady state operation of the LED lamp.

For air movement requirements *see* IS 16106. For general conditions of measurement IS 16106 applies.

Measurement results shall be expressed for steady state operation of the lamps at rated test conditions.

For stabilization before measurements **7** of IS 16106 applies:

a) Operate the lamp and record the luminous flux or luminous intensity and the lamp power as temperature/time depending variables;

b) During the stabilization, measurements of luminous flux or luminous intensity and electrical lamp power are made at least at an interval of 1 min; and

The LED lamp shall be operated for at least 30 min and it is considered stable and suitable for test purpose, if the relative difference of maximum and minimum readings of light output and electrical power observed over the last 15 min is less than 0.5 percent of the minimum reading. If the LED lamp is pre-burned, it does not need to be operated for 30 min, and it is considered stable if the readings of the last 15 min meet above requirement.

If the LED lamp exhibit large fluctuations and stabilization conditions are not achieved within 45 min of operation due to the fluctuations, the measurement may be started and the observed fluctuations shall be reported. However, if instead of random fluctuations, a slow decrease of gradient in the measured values is still observed, then the measurements should be started only when the stabilization criteria are met.

NOTE — Normally the observed stabilization process is a slow decrease in light output until thermal stability is reached. However, due to the electronics, fluctuations can still occur near thermal stability.

c) The stabilization is strongly related to thermal equilibrium of the components. A pre-burning (operation of the light source prior to mounting in the measurement system) may be applied to reduce the stabilization time in the measurement system. In particular, for measurement of a number of products of the same type, measurement time may be reduced if it has been demonstrated that the pre-burning method produces the same stabilized condition as when using the normal procedure.

NOTE — Normally the observed stabilisation process is a slow decrease in luminous flux or luminous intensity until thermal stability. However due to the electronics, fluctuations can still occur near thermal stability and stabilisation criteria not met.

Over life tests and at measurement, in order to avoid any measurement disturbance, the test sample shall be free from pollution (dust, etc) that can occur during the testing period.

Temperature cycling test (**11.3.2**) and accelerated operational life tests (**11.3.4**) shall be conducted in the temperature specified in **11.3.2** and **11.3.4** respectively, with a tolerance of (+ 0 °C, − 5 °C).

B-2 TEST VOLTAGE AND TEST FREQUENCY

B-2.1 General

The test voltage shall be stable within ± 0.5 percent, during stabilization periods, this tolerance being ± 0.2 percent at the moment of measurements. For ageing and luminous flux maintenance testing, the tolerance is 2 percent. The total harmonic content of the supply voltage shall not exceed 3 percent. The harmonic content is defined as the r.m.s. summation of the individual harmonic components using the fundamental as 100 percent.

The test voltage shall be as specified in **B-2.2**.

B-2.2 Relation of Rated Voltage to Test Voltage

The test voltage shall be the rated voltage or the mid-point of the voltage range as specified in Table 12.

B-2.3 Tests

B-2.3.1 *Initial Tests*

For the purpose of this standard, initial tests shall be as given in Table 13.

B-2.3.2 *Lifetime Tests and Endurance Tests*

For the purpose of this standard, lifetime and endurance tests are defined in Table 14.

Table 12 Relation of Rated Voltage to Test Voltage

(*Clause* B-2.2)

Sl No.	Rating	*U*test (V)
(1)	(2)	(3)
i)	240 V	240
ii)	220-240 V	230

Table 13 Initial Tests

(*Clause* B-2.3.1)

Sl No.	Clause/Sub-clause	Test
(1)	(2)	(3)
i)	8.1	Lamp power
ii)	8.2	Power factor
iii)	9.1	Luminous flux
iv)	9.2.3	Luminous intensity distribution
v)	9.2.4	Peak intensity value
vi)	9.2.5	Beam angle value
vii)	9.3	Efficacy
viii)	10.1	Correlated colour temperature (initial)
ix)	10.1	Chromaticity tolerance (initial)
x)	10.2	Colour rendering index (initial)

Table 14 Lifetime and Endurance Tests

(*Clause* B-2.3.2)

Sl No.	Clause/Sub-clause	Test
(1)	(2)	(3)
i)	10.1	Correlated colour temperature (maintained)
ii)	10.1	Chromaticity tolerance (maintained)
iii)	10.2	Colour rendering Index (maintained)
iv)	11.2	Lumen maintenance
v)	11.3.2	Temperature cycling, energised
vi)	11.3.3	Supply voltage switching
vii)	11.3.4	Operational high temperature stress test

B-2.4 Requirements

The test voltage shall be the rated voltage or the mid-point of the voltage range.

B-3 ELECTRIC AND PHOTOMETRIC CHARACTERISTICS

B-3.1 Test Voltage

The test voltage shall be the voltage as determined in B-2.4.

B-3.2 Ageing

LED lamps normally do not require any ageing prior to testing. However, the manufacturer may specify an ageing period of up to 1 000 h.

B-3.3 Luminous Flux

The initial and maintained luminous flux shall be measured after stabilisation of the LED lamp. In case of directional lamps the luminous flux shall be measured in a solid angle of 120° (π sr).

NOTE — Measurement of luminous flux shall be made in accordance to IS 16106.

B-3.4 Luminous Intensity Distribution

Luminous intensity distribution data shall be made available by the manufactures for all variations of the LED lamp and any optical attachments or accessories that the LED lamp has been specified for use with and shall be tested in accordance with IS/IEC TR 61341.

B-3.5 Peak Intensity

The peak intensity shall be measured in accordance with IS/IEC TR 61341.

B-3.6 Beam Angle

The beam angle shall be measured in accordance with IS/IEC TR 61341. The beam angle is not determined by the half peak, but by the half centre beam intensity.

B-3.7 Colour Rendering Index

Measurement of colour rendering index shall be made in accordance with IS 16106.

B-3.8 Chromaticity Co-ordinate Values

Chromaticity co-ordinates shall be in accordance with the values given in Annex D of IS 2418 (Part 2).

If the chromaticity is only related to a given direction, the radiation angle shall be declared by the manufacturer.

If the radiation angle is not mentioned, the chromaticity is considered as the spatial chromaticity 4π (2π for reflector lamps).

The manufacturer shall provide information on the method used.

ANNEX C

(*Clause* 3.9, *Table* 1 *and* *Table* 7)

EXPLANATION OF THE PHOTOMETRIC CODE

Example of a lamp photometric code like 830/359, meaning:

8	3 0	/	3	5	9
'8', rated CRI of for example, 87	'30', rated CCT of 3 000 K		'3', Initial spread of chromaticity co-ordinates within a 3-step MacAdam ellipse	'5', Maintained spread of chromaticity co-ordinates at an operational test duration as stated in **7.1** within a 5-step MacAdam ellipse	'9', lumen maintenance code at an operational time as stated in **7.1**

NOTE — (Explanation of the number from left to right).

The colour rendering value is expressed as one figure, which is obtained by using the intervals as mentioned below:

CRI = 80 to 89 → code 8

CRI = ≥ 90 → code 9

The highest value is 9.

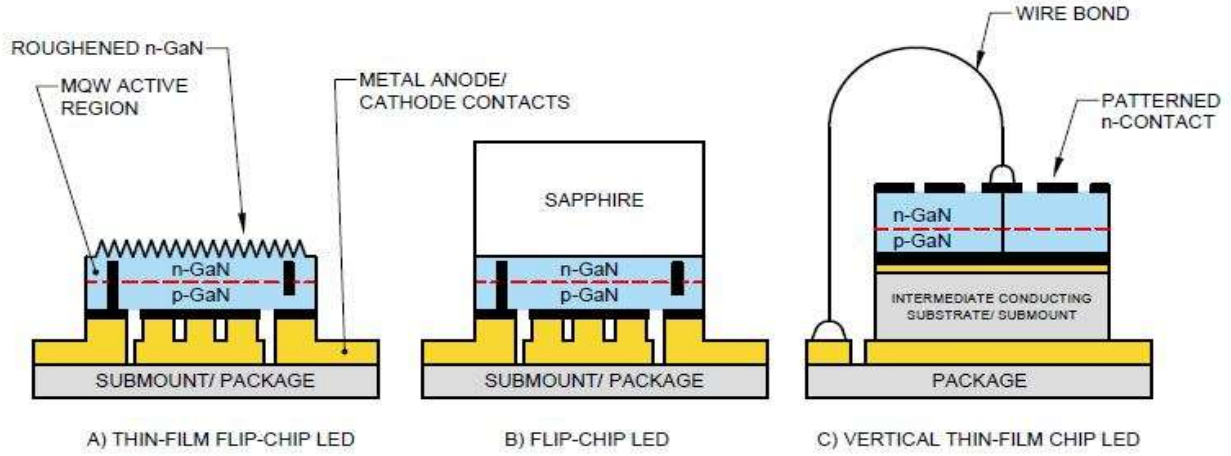
ANNEX D

(*Informative*)

EXAMPLES OF LED DIES AND LED PACKAGES

D-1 LED DIE

Schematic examples of LED dies are given in Fig. 1.



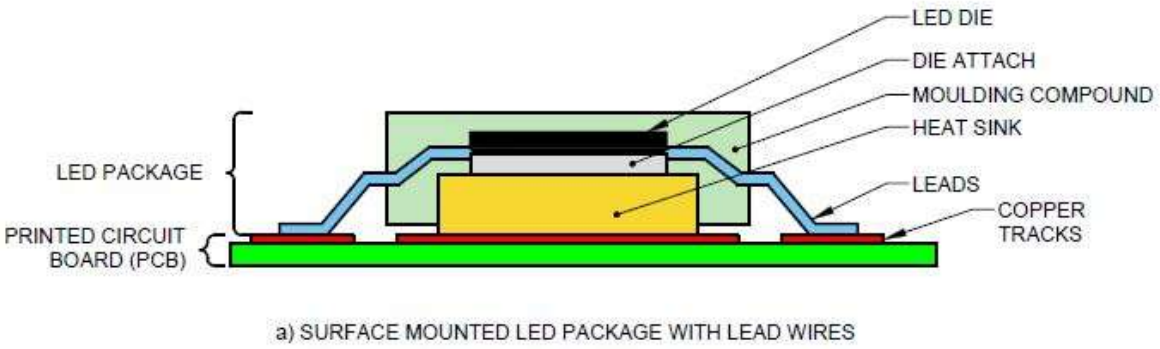
Key

MQW = Multi Quantum Well

FIG. 1 SCHEMATIC DRAWINGS OF LED DIES

D-2 LED PACKAGE

Schematic examples of LED packages are given in Fig. 2.



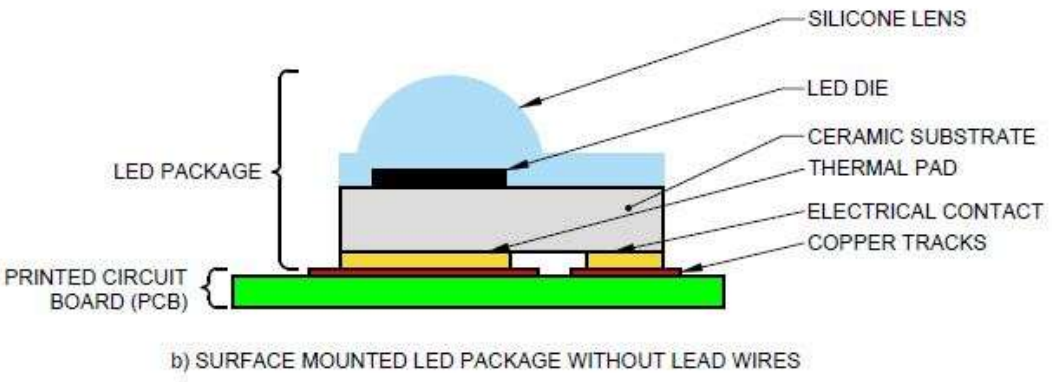


FIG. 2 SCHEMATIC DRAWINGS OF LED PACKAGES

ANNEX E

(*Clause* 7.1)

USE OF IS 16105 FOR LUMEN MAINTENANCE AND MAINTAINED CHROMATICITY COORDINATES DATA

(*Normative*)

E-1 GENERAL

According to **10.1** (colour variation categories) and **11.2** (lumen maintenance), both initial and maintained values for the LED lamp are measured. In order to reduce the test time for obtaining maintained values, data from IS 16105 shall be used given that the conditions in **E-2** and the compliance criteria in **E-3** are met.

E-2 CRITERIA FOR THE USE OF IS 16105

E-2.1 LED Package Data Used for LED Lamps

Data from an IS 16105 test report applied to an LED package is available, the test conditions in **7.1** are applicable for LED lamps with a test duration of 1 000 h.

For compliance criteria after 1 000 h testing, *see* **E-3**.

E-2.2 Boundary Conditions

E-2.2.1 *General*

The combination of the selected maximum r.m.s input current and maximum case temperature from the IS 16105 report shall equal or exceed the LED package current and temperature under worst case conditions of the LED lamp.

E-2.2.2 *Temperature*

With the LED lamp operating according to the conditions in Annex B, the LED package case temperature, T_s, as defined by IS 16105, shall be measured. The highest measured value of T_s, inside the LED lamp, shall not exceed the limit temperature T_s taken from the IS 16105 report.

In the case of an LED lamp family according to Table 2, the T_s temperature measurement shall be performed with the LED lamp configuration that results in the highest T_s temperature.

E-2.2.3 *LED Package Input Current*

The maximum r.m.s. input current of the LED package in the LED lamp shall not exceed the r.m.s. input current that was tested as part of IS 16105.

Where IS 16105 is used for achieving lumen maintenance and maintained chromaticity coordinates data, any controlgear control circuits for automated compensation of the light output degradation over time shall be disabled.

E-3 COMPLIANCE CRITERIA

E-3.1 Chromaticity Coordinates

LED lamps evaluated according to **10.1** with a test duration as specified in **E-2.1** shall meet the initial colour variation category as declared by the manufacturer or responsible vendor according to Table 7.

E-3.2 Luminous Flux Maintenance

LED lamps evaluated according to **11.2** with a test duration as specified in **E-2.1** shall meet the lumen maintenance value according to Table 8.

ANNEX F

(*Foreword*)

COMMITTEE COMPOSITION

Lamps and Related Equipment Sectional Committee, ETD 23

Organization	*Representative*(*s*)
Gautam Buddha University, Greater Noida	DR RAVINDRA KUMAR SINHA **(*Chairperson*)**
Bajaj Electricals Limited, Mumbai	SHRI HRISHIKESH T. A. SHRI RAZI KHAN (*Alternate*)
Binay Opto Electronics Private Limited, Kolkata	SHRI VINEET K. ROHATGI SHRI RAJEEV ROHATGI (*Alternate*)
Bureau of Energy Efficiency, New Delhi	SHRI ABHISHEK SHARMA SHRI REWTI RAMAN (*Alternate*)
Central Electricity Authority, New Delhi	MS SHIVANI SHARMA MS VANDANA SINGHAL (*Alternate*)
Central Power Research Institute, Bengaluru	SHRI R. SUDHIR KUMAR SHRI N. RAJKUMAR (*Alternate*)
Central Public Works Department, New Delhi	SHRI VIMAL KUMAR SHRI UJJWAL KUMAR (*Alternate*)
Consumer Association, Palakkad	SHRI R. C. MATHEW SHRI AD P.A SURENDRAN (*Alternate*)
Crompton Greaves, Mumbai	MS UMA LANKA
CSIR - National Physical Laboratory, New Delhi	SHRI V. K. JAISWAL SHRI PARAG SHARMA (*Alternate*)
Delhi Metro Rail Corporation Limited, Delhi	SHRI AMIT RASTOGI SHRI PERVEZ ALAM KHAN (*Alternate*)
Development Commissioner Micro-Small and Medium Enterprises, New Delhi	SHRI MANOJ KHUNEKAR SHRI DATTA A. POTDUKHE (*Alternate*)
Electric Lamp and Component Manufacturers Association of India, New Delhi	SHRI AMAL SENGUPTA SHRI SANTOSH AGNIHOTRI (*Alternate*)
Electrical Research and Development Association, Vadodara	SHRI N. L. PATEL SHRI RAVI SINGH (*Alternate*)
Energy Efficiency Services Limited, New Delhi	SHRI ANIL KUMAR CHOUDHARY SHRI ASHISH MALVIYA (*Alternate*)
Halonix Technologies Private Limited, Noida	SHRI RAJEEV CHHABRA SHRI MUKESH CHATURVEDI (*Alternate*)
Havells India Limited, Noida	SHRI PANKAJ MITTAL SHRIMATI SUDESHNA MUKHOPADHYAY (*Alternate* I) SHRI SOUMO GHOSHAL (*Alternate* II)

Organization	*Representative*(*s*)
Indian Society of Lighting Engineers, New Delhi	DR PRAKASH BARJATIA SHRI GIRJA SHANKAR (*Alternate* I) SHRI S. M. ALI (*Alternate* II)
International Centre of Automotive Technology, Manesar	SHRI KUNWAR GIRISH SINGH SHRI AKASH BISWAS (*Alternate*)
Intertek India Private Limited, New Delhi	SHRI HARI OM
Jadhavpur University, Kolkata	DR SASWATI MAZUMDAR SHRI B. ROY CHAKRAVERTY (*Alternate*)
Ledvance India Private Limited, Gurugram	SHRI VISHAL BHARDWAJ SHRI DHIRENDRA AGRAHARI (*Alternate*)
Ministry of Electronics and Information Technology, New Delhi	SHRIMATI ASHA NANGIA SHRI BHARAT KUMAR YADAV (*Alternate* I) SHRI SAURABH RANJAN (*Alternate* II)
NTPC Limited, New Delhi	SHRI ALLUPATI BALAJI SHRI SAMEER GARG (*Alternate*)
Signify Innovations India Limited, Gurugram	SHRI NITISH POONIA SHRI MURLI OMPRAKASH TOSHNIWAL (*Alternate*)
Surya Roshni Limited, Delhi	SHRI TAPAN KUMAR BANDYOPADHYAY SHRI AMIT TYAGI (*Alternate*)
The Brihanmumbai Electricity Supply and Transport, Mumbai	SHRI M. M. SHAIKH SHRI N. N. SAMUAL (*Alternate*)
UL India Private Limited, Bengaluru	SHRI GAUTAM BRAHMBHATT SHRI RICHIE STEPHEN (*Alternate*)
Voluntary Organisation in Interest of Consumer Education (VOICE), New Delhi	SHRI K. C. CHAUDHARY SHRI HARBANS WADHWA (*Alternate*)
In Personal Capacity (*S-110, Ground floor Uppal southend Sona Road Sector - 49 Gurgaon,* 122018)	MS BHAVNA KASTURIA
BIS Directorate General	SHRI ASIT KUMAR MAHARANA SCIENTIST 'E'/DIRECTOR AND HEAD (ELECTROTECHNICAL) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
MS. NEHA AGARWAL
SCIENTIST 'D'/JOINT DIRECTOR
(ELECTROTECHNICAL), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: ETD 23 (26233).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: 5th Floor/MTNL CETTM, Technology Street, Hiranandani Gardens, Powai Mumbai 400076	25700030 25702715

Branches : AHMEDABAD, BENGALURU, BHOPAL, BHUBANESHWAR, CHANDIGARH, CHENNAI, COIMBATORE, DEHRADUN, DELHI, FARIDABAD, GHAZIABAD, GUWAHATI, HARYANA (CHANDIGARH), HUBLI, HYDERABAD, JAIPUR, JAMMU, JAMSHEDPUR, KOCHI, KOLKATA, LUCKNOW, MADURAI, MUMBAI, NAGPUR, NOIDA, PARWANOO, PATNA, PUNE, RAIPUR, RAJKOT, SURAT, VIJAYAWADA.

Published by BIS, New Delhi