

**LED-LUMINAIRES FOR GENERAL LIGHTING****Part 2 Performance requirements**

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## FOREWORD

(Formal clause will be added later)

This standard (part 2) specifies the performance requirements for LED-luminaires for general lighting services for supply voltages up to and including 250 V ac.

The general and safety requirements have been covered in part 1 of this standard (under preparation)

The provisions in the standard represent the technical knowledge of experts from the fields of the semiconductor (LED chip) industry and of those of the traditional electrical light sources.

Three types of LED-luminaires are covered in this standard namely, with an integral LED-module, with a built-in LED-module and with a LED-lamp.

This standard is based on IEC document LUMAX (EG) 47F 'LED-luminaires for general lighting services, Performance requirements issued IEC/SC 34A of International Electrotechnical Commission (IEC) with following modifications:

- a) Schedule of type test and acceptance test has been incorporated;
- b) Ambient test condition changed to 27°C;

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2: 1960 '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.

## LED-LUMINAIRES FOR GENERAL LIGHTING

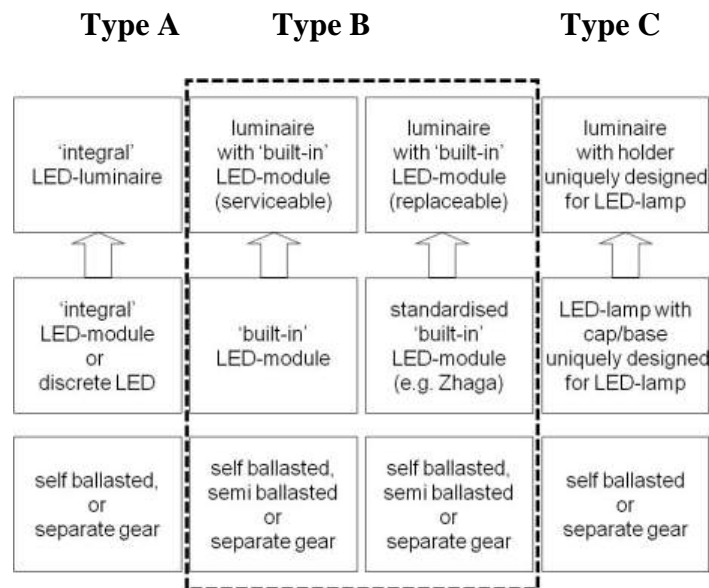
### Part 2 Performance requirements

#### 1 SCOPE

**1.1** This standard (part 2) specifies the performance requirements for LED-luminaires, together with the test methods and conditions, required to show compliance with this standard. It applies to LED-luminaires for general lighting purposes, where claims of operational performance are made.

The following types of LED-luminaires have been covered in this standard (See Fig. 1):

- a) Type A – Integral LED-luminaire, with integral LED-module or discrete LED and with either self ballasted or separate control gear;
- b) Type B – Luminaire with built-in LED-module. The module may be serviceable as a built-in LED-module (self- or semi-ballasted or with separate control gear) or replaceable with a standardised built in LED-module (self- or semi-ballasted or with separate control gear).
- c) Type C – Luminaire with LED-lamp and with self ballasted or separate control gear.



**Figure 1 Types of LED Luminaire**

**1.2** This standard does not cover LED-Luminaires that intentionally produce coloured light; neither does it cover modules based on OLEDs (organic LEDs).

These performance requirements are additional to the requirements given in IS xxxxx/IEC PAS 62XXX-1 Performance Standard for Luminaires. Where appropriate the

provisions of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting – Performance requirements shall apply.

Life time of LED-luminaires is in most cases much longer than the practical test times. Consequently, verification of manufacturer's life time claims cannot be made in a sufficiently confident way. For that reason the acceptance or rejection of a manufacturer's life time claim is out of the scope of this standard.

Instead of life time validation this standard has opted for lumen maintenance categories at a defined finite test time. Therefore, the category number does not imply a prediction of achievable life time. The categories are lumen-depreciation character categories showing behaviour in agreement with manufacturer's information which is provided before the test is started.

In order to validate a life time claim, an extrapolation of test data is needed. A general method of projecting measurement data beyond limited test time is under consideration.

The acceptance or rejection criterion of the life time test as defined in this standard is different from the life time metrics claimed by manufacturers. Explanation of recommended life time metrics is given in Annex E of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting – Performance requirements.

It may be expected that LED-luminaires 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 within the declared range of the manufacturer.

## 2 REFERENCES

The following Indian standards are necessary adjunct to this standard.

<i>IS No.</i>	<i>Title</i>
10322 (Part 1):2010	Luminaire : Part 1 General requirements and test
IS xxxxx/IEC PAS 62XXX-1*	Luminaire Performance: Part 1 General requirements
IS xxxxx/IEC PAS 62XXX*	LED-modules for general lighting: Performance requirements
IS xxxxx/IEC PAS 62612*	Self-ballasted LED-lamps for general lighting services Part 2 Performance requirements
IS xxxxx/IEC TR 61341*	Method of measurement of centre beam intensity and beam angle(s) of reflector lamps

\* Indian standards are under preparation

## 3 TERMINOLOGY

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For the purposes of this standard, the provisions of Section 3 of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements shall apply. In addition the following definitions shall apply:

### **3.1 LED-Luminaire**

Luminaire with either integral LED-modules or with built-in LED-modules or designed to accept caps or bases originally developed for LED-lamps.

### **3.2 Integral LED-Luminaire**

Luminaire which cannot be dismantled without being permanently damaged, and incorporating a LED light source and any additional elements necessary for starting and stable operation of the light source.

### **3.3 LED-Luminaire with built-in (self-ballasted or semi-ballasted) LED-module**

Luminaire incorporating a built-in self- or semi-ballasted LED-module. A built-in LED-module can be serviceable or replaceable.

### **3.4 Serviceable LED-module**

LED – module that can be changed during life by the same type of LED-module enabling at least the same luminous intensity distribution.

### **3.5 Replaceable LED-module**

LED – module that can be replaced during life by any type of LED-module with same interfaces enabling at least the same luminous intensity distribution.

### **3.6 Family**

Under consideration (only required if different from LED module).

### **3.7 Ambient temperature range**

Range of ambient temperature for which the LED-luminaire safeguards that the recommended maximum LED module operating temperature ( $T_p$ ) is not exceeded.

### **3.8 Type Test**

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**

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.

## 4 GENERAL REQUIREMENTS

LED-luminaires shall meet the requirements of IS xxxxx/IEC PAS 62XXX-1 Luminaire Performance: Part 1 General requirements. The requirements of this standard shall apply in addition to the IS xxxxx/IEC PAS 62XXX-1 Luminaire Performance: Part 1 General requirements.

## 4 MARKING

### 4.1 General Requirements for marking

The following data shall be provided visible in addition to the mandatory marking given in IS 10322-1 by the manufacturer or responsible vendor and placed as specified in Table 1.

**Table 1**  
**Required markings and places of marking**  
(Clause 4.1)

Parameters	Product	Product datasheets, leaflets or website
a) Luminaire power (W)	X	X
b) Photometric code	-	X
c) Rated luminous flux (lm).	-	X <sup>1)</sup>
d) Rated life (h) and the related lumen maintenance factor ( $L_x$ )	-	X
e) Failure fraction ( $F_y$ ), corresponding to the rated life	-	X
f) Lumen maintenance category 1 to 3 <sup>2)</sup> including	-	X
Lifetime specification ( $L_x B_y$ ) for gradual light output degradation <sup>3)</sup>	-	on request
Lifetime specification ( $L_0 C_y$ ) for abrupt light output degradation <sup>4)</sup>	-	on request
g) Rated chromaticity co-ordinate values both initial and maintained expressed as tolerance categories “D” to “A” <sup>5)</sup>	-	X
h) Rated Colour Rendering Index	-	X
i) Ageing time (h), if different to 0 h	-	X
j) Ambient temperature ( $T_a$ ) range for luminaire <sup>6)</sup>	-	X

**NOTE-** X=required, - = not required

<sup>1)</sup> For luminaires with directional output, centre beam intensity and beam angle are measured according to IS xxxxx/IEC TR 61341 and marked;

<sup>2)</sup> See Table 3 of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements;

<sup>3)</sup> See Appendix E.3 and E.6 of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance

requirements;

<sup>4)</sup> See Appendix E.4 and E.6, IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements. F luminaires with LED-modules the failure rate of the external control gear shall be included in the overall assessment of total life / failure rate of the LED-luminaire (under consideration);

<sup>5)</sup> See Table 2 of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements;

<sup>6)</sup> See last paragraph Annex A1 to understand the relation between Ta and Tp.

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## 4.2 BIS Certification Marking

The LED-luminaire may also be marked with the Standard Mark.

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

## 5 VOID

## 6 TEST CONDITIONS

### 6.1 Test Duration

Testing duration shall be 6 000 h or 25 percent of the rated life.

**NOTE-** Other methods providing more advanced insight in the life of the product with shorter test duration are under consideration.

Measurements shall be made with the luminaire as delivered. If the luminaire is delivered without light source or control gear, measurements shall be done with any light source and control gear complying with the performance requirements of the relevant Indian standard. The type of light source and or control gear shall be specified wherever the photometric data are declared by manufacturer.

### 6.2 General Conditions of Test

Test conditions for testing electrical and photometric characteristics, lumen maintenance and life are given in Annex A.

All tests are measured on “n” LED-luminaires of the same type. The number “n” shall be a minimum of products as given in Table 3. LED luminaires used in the endurance tests shall not be used for other tests.

### 6.3 Identification of a Family

Requirements for the identification of a family of LED luminaires for type testing are given in 3.6 and used in Table 3.

### 6.4 Performance Requirements

The performance criteria mentioned below apply to LED-luminaires. The testing only applies to luminaires as indicated in Table 2.

**Table 2**  
**Performance Criteria**  
(Clause Table 1 and 6.4)

Clause or Sub-clause	Test	Integral LED-module (Type A)	Type of Luminaire with Built in LED-module (Type B) <sup>1)</sup>	LED lamp (Type C) <sup>2)</sup>
b) of Table 1	Photometric code	x	-	-
d) of Table 1	Rated life	x	-	-
i) of Table 1	Ageing time, if different to 0 h	x	-	-
7	Power	x	-	-
8.1	Rated luminous flux	x	-	-
8.2	Intensity	x	x	x
8.3	Angular beam distribution <sup>3)</sup>	x	x	x
8.4	Luminous intensity distribution	x	x	x
9.1	Chromaticity tolerance initial	x	-	-
9.1	Chromaticity tolerance maintained	x	-	-
9.2	CRI initial	x	-	-
9.2	CRI maintained	x	-	-
10.2	Lumen maintenance factor $L_x$ <sup>4)</sup>	x	-	-
10.3.1a) <sup>5)</sup>	Temp. cycling, energised	x	-	-
10.3.1b) <sup>5)</sup>	Supply voltage switching	x	-	-
10.3.2	Accelerated operation life test	x	-	-

**NOTE**- X=required, - = not required

<sup>1)</sup> Testing requirements for LED-luminaires with built-in LED-modules (Type B) will depend on requirements of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements. It is not the intention to re measure the values of a product complying with its own standard. However where luminaires combine different modules in one luminaire, certain parameters may be required to be measured e.g. if there is a mixing of colours the final CRI and CCT needs to be measured in the luminaire;

<sup>2)</sup> Many testing requirements for LED-luminaires using LED-lamps (Type C) are already covered by the

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requirements of IS xxxxx/IEC PAS 62612 Self Ballasted LED-lamps: Performance requirements;

<sup>3)</sup> Applicable to luminaires which modify the light distribution of the light from the LED-module or LED-lamp

<sup>4)</sup> For luminaires with LED-modules the failure rate of the external control gear shall be included in the overall assessment of total life/failure rate of the luminaire (under consideration);

<sup>5)</sup> The clause refers to IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements.

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LED-luminaires with built-in LED-modules shall comply with the requirements of the IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements. Built-in LED-modules which comply with the requirements of the IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements and are marked with individual ratings checked to establish that they suit the conditions which may occur in use. Aspects of use not covered by the respective standard shall require them to satisfy the additional relevant requirements of this standard.

Compliance is checked by inspection and the relevant tests.

LED-luminaires with integral LED-modules shall comply as far as is reasonable with the IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements, as part of the luminaire.

**NOTE-** This does not imply that components need to be separately tested before approval of the luminaire.

## 7 LUMINAIRE POWER

Total luminaire power should be measured as mentioned in Annex A, expressed in Watts. Power should be measured at the supply to the luminaire or in case of remote control gear, at the supply to the control gear. The initial power consumed by the LED-luminaire in the measured sample shall not exceed the rated wattage by more than 15 percent for a luminaire with a LED lamp and 10 percent for a luminaire with a LED module.

The 97.5 percent one-sided upper confidence limit for the mean of luminaire power shall not exceed the rated power value. The 97.5 percent upper confidence limit for sample size  $n$  according Table 4 is calculated by the following formula.

$$x + s \times 0.468,$$

where  $x$  and  $s$  are the sample average and standard deviation of lamps respectively.

### NOTES-

1. The value of 97.5 percent is under consideration.
2. Efficacy is in general the ratio luminous flux / module power. Calculation methods are under consideration.

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## 8 LIGHT OUTPUT

### 8.1 Luminous Flux

The provisions of **8.1** of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements shall not be applied to the LED-module but to the LED-luminaire.

### 8.2 Intensity

The provisions **8.2** of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements shall not be applied to the LED-module but to the LED-luminaire.

### 8.3 Angular Beam Distribution

The provisions of **8.3** of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements are applied not to the LED-module but to the LED-luminaire.

**NOTE-** The text of clause 8.2 and 8.3 is subject to modification on the basis of decision taken in respect of document on IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements

### 8.4 Luminous Intensity Distribution

In case luminous intensity distribution values are provided by the manufacturer or responsible vendor, the luminous intensity distribution values of each individual LED luminaire in the measured sample shall not deviate by more than 5 percent of the rated value for all luminous intensity distribution.

Test condition are specified in Annex A

#### NOTES-

1. Average value and confidence level are under consideration.
2. The value of 5 percent is under consideration.

### 8.5 Luminaire Efficacy

The luminaire efficacy shall be calculated from the luminous flux divide by the input power. Luminaire efficacy shall not be less than 90 percent of the rated luminaire efficacy as declared by the manufacturer or responsible vendor.

**NOTE-**Efficacy is in general the ratio luminous flux / module power.

## 9 CHROMATICITY CO-ORDINATES, CORRELATED COLOUR TEMPERATURE & COLOUR RENDERING

### 9.1 Chromaticity co-ordinates and Correlated Color Temperature (CCT)

The provisions of **9.1** of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements shall not be applied to the LED-module but to the LED-luminaire.

## **9.2 Color Rendering Index (CRI)**

The provisions of **9.2** of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements shall not be applied to the LED-module but to the LED-luminaire.

## **10 LIFE**

### **10.1 General**

The provisions of **10.1** of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements shall not be applied to the LED-module but to the LED-luminaire.

### **10.2 Lumen Maintenance**

The provisions of **10.2** of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements are applied not to the LED-module but to the LED-luminaire.

### **10.3 Endurance Test**

The provisions of **10.3** of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements are applied not to the LED-module but to the LED-luminaire. Endurance test shall be performed only on integral LED luminaire. For accelerated operation life test, integral LED luminaire shall be operated at a temperature corresponding to 20 K above maximum rated ambient temperature.

**NOTE-** Other methods providing more advanced insight in the life of the product with shorter test duration are under consideration

## **11 VERIFICATION**

The minimum sampling size for type testing shall be as given in Table 3. The sample shall be representative of a manufacturer's production.

The results of the test shall comply with the requirements given in Table 3. If the test results do not comply with these requirements, the manufacturer's test records shall be requested.

**Table 3**  
**Sampling**  
(Clause Table 1, 6.3 and 11)

Clause or Sub-clause	Test	Permitted accumulation of test records between luminaire groups <sup>1)</sup>	Minimum number of samples <sup>2)</sup>
b) of Table 1	Photometric code		
c) of Table 1	Rated life		
i) of Table 1	Ageing time, if different to 0 h		
7	Power		
8.1	Rated luminous flux		
8.2	Intensity		
8.3	Angular beam distribution		
8.4	Luminous intensity distribution		
9.1	Chromaticity tolerance initial		
9.1	Chromaticity tolerance maintained		
9.2	CRI initial		
9.2	CRI maintained		
10.2	Lumen maintenance factor $L_x$		
10.3.1a) <sup>3)</sup>	Temperature cycling energised		
10.3.1b) <sup>3)</sup>	Supply voltage switching		
10.3.2	Accelerated operation life test		

The definition of families as to be used in column 3 is under consideration;

Number of samples is under consideration.

Clause refers to IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements

## 19 TESTS

### 19.1 Classification of Tests

#### 19.1.1 Type Tests

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

- a) Marking (*see 5*),
- b) Luminaire Power (*see 7*),
- c) Luminous Flux (*see 8.1*),
- d) Lighting Intensity (*see 8.2*),
- e) Angular Beam Distribution (*see 8.3*),
- f) Luminaire Intensity Distribution (*see 8.4*),
- g) Luminaire Efficacy (*see 8.5*)
- h) Chromaticity co-ordinates and Correlated Color Temperature (CCT) (*see 9.1*)
- i) Colour Rendering Index (CRI) (*see 9.2*),
- j) Life (*see 10.1*)

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- k) Lumen maintenance (*see 10.2*), and
- k) Endurance (*see 10.3*)

## **19.2 Acceptance Test**

The following shall constitute as acceptance tests:

- a) Marking (*see 5*),
- b) Luminaire Power (*see 7*),
- c) Luminous Flux (*see 8.1*),
- d) Lighting Intensity (*see 8.2*),
- e) Angular Beam Distribution (*see 8.3*),
- f) Luminaire Intensity Distribution (*see 8.4*),
- g) Luminaire Efficacy (*see 8.5*)
- h) Chromaticity co-ordinates and Correlated Color Temperature (CCT) (*see 9.1*)
- i) Colour Rendering Index (CRI) (*see 9.2*),

## Annex A (6.2 and 8.4)

### Method of measuring luminaire characteristics

#### A1 GENERAL

The provisions of Section A.1 of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements are applied not to the LED-module but to the LED-luminaire.

Where a declared ambient air temperature other than 27 °C is advised by the manufacturer a correction factor will need to be established to correct the measured luminous flux value at 27 °C to the luminous flux value at the declared ambient. This shall be done using relative photometry in a temperature controlled cabinet.

For the luminaire designer, the information for luminaire design given in IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements Annex D, **D1**, requires that it shall be safeguarded that then LED-module performance temperature  $T_p$  is not exceeded with the declared maximum ambient temperature ( $T_a \text{ max}$ ). This will be checked.

Compliance criteria are under consideration.

#### A2 ELECTRICAL CHARACTERISTICS

The provisions of **A.2** of IEC PAS 62XXX LED-modules for general lighting – Performance requirements are applied not to the LED-module but to the LED-luminaire.

#### A3 PHOTOMETRIC CHARACTERISTICS

The provisions of **A.3** of IS xxxxx/IEC PAS 62XXX LED-modules for general lighting: Performance requirements are applied not to the LED-module but to the LED-luminaire.

##### A.3.1 Luminaire Efficacy

Properly measured, Luminaire Efficacy combines both the light source system efficacy and luminaire efficiency, allowing for a true comparison of a luminaire regardless of the light source. Luminaire efficacy is the preferred metric for LEDs because it measures the net light output from the luminaire divided by power into the system, accounting for driver, optical, and thermal losses.

In some applications such as Street Lighting, other luminaire characteristics may be defined that allow a better appreciation of the luminaire performance.

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