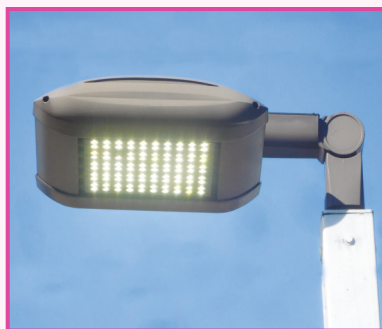


Inspection and Testing Manual For LED Street Lighting Luminaire



About EESL



ENERGY EFFICIENCY SERVICES LIMITED
A JV of PSUs under the Ministry of Power

Efficiency Services Limited (EESL), a Joint Venture of Company of Public Sector Undertaking (PSU) of Ministry of Power to facilitate implementation of energy efficiency projects. It is registered under the companies Act, 1956 on 10 December 2009 and the commencement of business certificate was obtained on 11 February 2010. EESL functions as an Energy Service Company (ESCO), as Consultancy Organization and as a Resource Centre.

About CLASP



CLASP is an international 501© 3 non-profit organization headquartered in Washington DC, USA, with the mission to improve the energy and environmental performance of the appliances & equipment we use every day, accelerating our transition to a more sustainable world. CLASP has been supporting the development and implementation of appliance standards and labeling programs in India since its inception in 1999.

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**Inspection And Testing
Manual For
LED Street Lighting Luminaire**



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ENERGY EFFICIENCY SERVICES LIMITED
(A Joint Venture of PSUs of Ministry of Power, Govt. of India)



Foreword

Energy Efficiency Services Limited (EESL) is a publicly owned energy services company with the mission of delivering energy efficiency across India. Established in 2009, EESL is promoted by Ministry of Power, Government of India as a Joint Venture company of four Central Power Sector undertakings viz NTPC Ltd. PFC, REC and Power Grid.

EESL is set up to create and sustain markets for energy efficiency in the country. EESL works closely with Bureau of Energy Efficiency (BEE) and is leading the market related activities of the National Mission for Enhanced Energy Efficiency (NMEEE), one of the eight national missions under the Prime Minister's National Action Plan on Climate Change

Based on the success of *Unnat Jyoti by Affordable LEDs for All (UJALA)*, the world's largest LED programme for domestic consumers, EESL has established itself as a super Energy Service Company (ESCO). EESL and UJALA have paved the way for large-scale energy efficiency implementation in India. It has shown government stakeholders that energy efficiency can deliver multiple benefits within a short time period to all sectors, and importantly, with limited or no costs to the government. Recognising the potential for replication with other high efficient appliances and equipment to trigger investment, innovation and best-in class manufacturing, EESL is expanding its programs to scale up deployment of energy efficient appliances such as energy efficient fans, air conditioners, induction motors and agricultural pumps for which demand is projected to grow significantly.

The success of bulk procurement & distribution program is based on a robust quality assurance framework and build credibility of the program amongst consumers such that it provides a level playing field for the participants, and deliver the projected energy savings.

Quality assurance is a key element to all aspects of energy efficiency programs: program design, implementation and evaluation. It provides a framework to ensure program standards are met and closes the feedback loop in order to assess and improve program processes. To ensure that the products procured through EESL's program meet the quality standards, EESL, in partnership with CLASP, has developed 'Inspection and Quality Assurance Manuals' for its bulk procurement programs. This manual provides stepwise guidelines, and defines the quality assurance criteria and inspection process that include the relevant test methods, sampling criteria, schedule of tests and levels of control at the manufacturers' end. This is to ensure compliance of the procured products with the requirements prescribed by EESL, thereby building credibility of the program and ensuring the quality of the product.

EESL is making every effort toward this, and the inspection and testing manual is a key milestone in that direction. It reflects our commitment and sincerity in ensuring that only quality products are procured and delivered to the consumers.

I would like to commend & congratulate CLASP and EESL teams for their efforts in the development of this manual. I am convinced that this manual will be integral to EESL's quality assurance program and demonstrate our commitment and sincerity in ensuring the procurement of quality products.

(Saurabh Kumar)

Date: 23.07.19

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MANUAL FOR TESTING AND INSPECTION OF LED STREET LIGHTING LUMINAIRE

1. SCOPE

1.1 This manual highlights the key elements essential for the field inspection officers to ensure the quality for LED street lighting luminaire procured by EESL in compliance with the requirements laid out in the tender/bid document, thereby building credibility of the program and ensuring the quality of the product.

This manual specifies guidelines for the bid evaluation, pre-delivery, and post-delivery/verification inspection including the sampling methodology in carrying out the type, acceptance and routine tests of LED street lighting luminaire covered under the scope of IS 16107 (Part 2/Section 2). This manual also prescribes the levels of control at the manufacturers end for specifies the performance requirements for LED-street lighting luminaire, suitable for outdoor use on dc supplies up to 250 V or on ac supplies up to 1 000 V at 50 Hz.

Stepwise guidelines for the inspection of LED street lighting luminaire are given in Annex A of this manual.

2 REFERENCE

2.1 The following standard shall be referred while using this manual:

IS No	Title
1885 (Part 16/Sec 1)	Electrotechnical vocabulary: Part 16 Lighting
2500 (Part 1)	Sampling procedure for inspection by attributes: Part 1 Sampling schemes indexed by Acceptance Quality Limit (AQL) for lot-by-lot inspection
4905	Method of random sampling
6873 (Part 5)	Limits and methods of measurement of radio disturbance characteristics: Part 5 Electrical lighting and similar equipment
10322 (Part 1)	Luminaires: Part 1 General requirements and tests
10322 (Part 5/Sec 3)	Luminaires: Part 5 Particular requirements Section 3 Street lighting luminaire
13383 (Part 2)	Method of photometry, Part 2 Road and street lighting
16101	Terms and definitions of LEDs and LED modules in general lighting
16103 (Part 2)	LED-modules for general lighting: Part 2 Performance requirements
16106	Method of electrical and photometric measurement of solid state lighting (LED) products
16107 (Part 1)	Luminaire Performance: Part 1 General requirements

16107 (Part 2/Sec 2)	Luminaire Performance: Part 2 Particular Requirements Section 2 LED street lighting luminaire
14700 (Part 3)	Electromagnetic compatibility: Limits, Section 2 Limits for harmonic current emissions
SP 72	National lighting code
IS/IEC 60529	Classification of degree of protection provided by enclosures for electrical equipment
IS 16108	Photobiological safety of lamps and lamp systems
IS/IEC 62778	Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires

3. DEFINITIONS

All definitions given in 1885 (Part 16/Sec 1), IS 16101, IS 16107 (Part 1), IS 16107 (Part 2/Section 1) and Part 1 of SP 72 shall apply. Some of the important definitions relevant to this manual are given below.

3.1 LED-Street Lighting Luminaire

Street lighting Luminaire incorporating LED as the light sources.

3.2 Rated Median Useful Life (of LED Luminaire)

Length of time during which 50 percent (B50) of a population of operating LED Luminaires of the same type have parametrically failed, under standard test conditions as declared by the manufacturer or responsible vendor.

3.3 Type

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

3.4 Rated Voltage

Voltage or voltage range marked on the lamp.

3.5 Rated Wattage

Wattage marked on the lamp.

3.6 Rated Frequency

Frequency marked on the lamp.

3.7 Rated value

Quantity value for a characteristic of a LED lamp for specific operating conditions. The value and the conditions as specified in this standard, or assigned by the manufacturer or responsible vendor.

3.8 Test Voltage

Voltage at which tests are carried out.

3.9 Lumen Maintenance (L_x)

Luminous Flux at a given time in the life of a led lamp divided by the initial value of the luminous flux of the lamp and expressed as a percentage x of the initial luminous flux.

3.10 Initial Values

Photometric and electrical characteristics at the end of the ageing period and/or stabilization time.

3.11 Rated Lamp Life (h)

Length of time during which a LED lamp provides more than 70 percent of the rated luminous flux, published in combination with the failure rate, as declared by the manufacturer or responsible vendor.

3.12 Total Luminous Flux

It is the measure of the total energy radiated from a light source in all directions, taking into account the varying sensitivity of the human eye to different wavelengths of light.

3.13 Luminous Efficacy

It is the measure of luminous flux with respect to the energy consumed to produce it i.e. it is the ratio of luminous flux to power.

3.14 Correlated Colour Temperature (CCT)

A measure of the colour of a light source relative to a black body at a particular temperature. It is based on the Kelvin Colour Temperature Scale and is measured in degrees Kelvin (K).

3.15 Colour Rendering Index

It gives measure of the light source's ability to reveal colours of an object realistically or naturally with respect to a natural or an ideal light source. CRI is measured by the international standard CIE Ra.

3.16 Lot

The number of pumps of the same size, type and duty point offered for inspection at one time shall constitute a lot.

3.17 Sampling

The selection of a portion of a lot with a view to taking a decision about the quality of the lot on the basis of results obtained by inspecting the selected portion.

3.18 Sample Size

The number of pumps selected for inspection and/or testing from a lot.

3.19 Routine test

Routine tests are intended to check the quality of the individual test unit. These tests are done to ensure the reliability of test objects and consistency of the material used in their manufacture, which are likely to vary during production.

3.20 Type Test

A test or series of tests made on the type test sample for the purpose of checking compliance of the design of a given product with the requirements of the relevant standard.

3.21 Acceptance Test

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

3.22 Verification test

Verification tests are the evaluation of whether or not a product, service, or system complies with a regulation, requirement, or imposed conditions.

4 QUALITY CONTROL MEASURES BY THE MANUFACTURER

The manufacturer shall exercise suitable levels of control as described in 4.1 to 4.6 below:

4.1 In House Test Laboratory

The manufacturer shall have the requisite test facilities in house, which shall be suitably equipped and staffed where various tests, specified in the relevant standard, shall be carried out in accordance with the test methods prescribed in the relevant standard.

4.2 Maintenance of Test Records

The manufacturer shall maintain all records of tests, inspection and calibration. All testing equipment and measuring instruments shall be periodically checked and calibrated and records of such checks/calibration shall be maintained. Copies of any records and other connected papers that may be required by the EESL representatives shall be made available during the visit at the manufacturing premises.

4.3 Quality System in the Organization

The manufacturer should implement proper Quality Management System in their organization in accordance with IS/ISO 9001 as applicable to various day-to-day activities of the organization.

4.4 Marking on the Product

The marking on the LED street lighting luminaire shall be furnished in a permanent and legible manner on either the product and/or packaging or product data sheet/leaf-let. The information on the meters shall be in accordance with IS 16107 (Part 2/section 2).

In addition, the luminaires may carry BIS certification mark.

Any other additional information may be provided on the rating plate subject to agreement between the manufacturer and EESL.

- a) Rated Input Power (W);
- b) Photometric Code;
- c) Rated Luminous Flux (Lm);
- d) Rated Median Useful Life (h) and the associated rated lumen maintenance factor (x);
- e) Rated abrupt failure fraction (5);
- f) Lumen Maintenance Code;
- g) Rated Chromaticity Coordinates both initial and maintained;
- h) Correlated Color Temperature in K (CCT);
- i) Rated Color Rendering Index (CRI);
- j) Operating Temperature Range of Luminaire;
- k) Luminaire Efficacy (lm/W);
- l) Rated ambient temperature related to performance for a luminaire;
- m) Date of manufacture, batch number/Serial No.;
- n) Luminous intensity distribution;
- o) Photobiological safety risk group;
- p) BIS standard mark and BIS License number, if any; and
- q) BEE star label, if any.

4.5 Raw Materials and Components

As far as possible, each consignment of the raw material and components should be accompanied by a test certificate certifying its conformity to the relevant Indian Standard wherever exists or else each lot of raw material shall be checked for its conformity as per the relevant standard, if any.

4.6 Sampling and Frequency of Testing

The tests, as specified in Table 1 and Table 2 and the levels of control specified therein, shall be carried out on the entire production of the factory. Table 1 specifies the levels of control for safety requirements as specified in IS 10322 (Part 5/Section 3). Table 2 specifies the levels of control for performance requirements as described in IS 16107 (Part 2/Section 2).

LED Street lighting luminaire shall be tested complete with the light source and control gear specified by the manufacturer. Except where otherwise specified, the luminaire, light source and control gear shall be tested as new and installed as for normal use as per the manufacturer's installation instructions.

All tests are carried out on '*n*' LED street lighting luminaires of the same type. The number '*n*' shall be a minimum of products as given in Table 1 and Table 2. LED Street lighting luminaires used in the endurance tests shall not be used for other tests (Table 2).

Table 1
Sampling and Frequency of Testing
(Safety Requirements)

S. No.	Test Requirements	Test methods		Number of samples	Frequency of Testing
		Clause	Reference Standard		
1	Construction	7	10322 (Part 5/sec 3)	One	Each luminaire
2	Creepage distances and clearances	8	-do-	One	Each luminaire
3	Provisions for earthing	9	-do-	One	Each luminaire
4	Terminals	10	-do-	One	Each luminaire
5	External and Internal wiring	11	-do-	One	Each luminaire
6	Protection against electric shock	12	-do-	One	Each day
7	Thermal test (normal operation)	13	-do-	One	Once in a month for each type and size
8	Endurance tests and thermal tests (abnormal operation)	13	-do-	One	Once in a six month for each type and size
9	Resistance to dust and moisture	14	-do-	One	Once in a six month for each type and size
10	Insulation resistance and electric strength	15	-do-	one	Each luminaire
11	Resistance to heat, fire and tracking	16	-do-	one	Once in a six month for each type and size
12	Mechanical strength test	Clause 4.13	-do-	One	Once a month for each type and size

S. No.	Test Requirements	Test methods		Number of samples	Frequency of Testing
		Clause	Reference Standard		
13	Resistance to corrosion	Clause 4.18	-do-	One	Once in a six month for each type and size
14	Photobiological safety	-	IS/IEC 62778 and IS 16108	One	Once in six month

NOTE: In case of failure, the particular type of luminaire for road and street lighting shall be resumed and the original frequency of testing adopted only after obtaining desired factory results on the luminaires for road and street lighting drawn from a day's production of improved design.

Table 2
Sampling and Frequency of Testing
(Performance Requirements)

S. No.	Test Requirement	Test Method		Number of samples		Frequency of Testing
		Clause	Referred Standard	Type A*	Type B **	
1	Total power Input	7	IS 16103 (Part 2)	5	1	Each type and ratings
2	Luminous flux	8.1	-do-	5	1	-do-
3	Luminaire Efficacy	8.3	-do-	5	1	-do-
4	Luminous intensity distribution	8.2 & 8.2.2	-do-	5	1	-do-
5	Photometric test	-	16106	1	1	-do-
		17.1 to 17.4	10322 (Part 5/Sec 3)			
		-	13383 (Part 2)			
6	Chromaticity co-ordinates	9.1	IS 16103 (Part 2)	5	-	-do-
7	Correlated color temperature (CCT)	9.2	-do-	5	-	-do-
8	Color rendering index (CRI)	9.3	-do-	5	-	-do-

S. No.	Test Requirement	Test Method		Number of samples		Frequency of Testing
		Clause	Referred Standard	Type A*	Type B **	
9	Lumen maintenance	6.2 & 10.2	-do-	3	-	-do-
10	Endurance Test	10.3	-do-	3	-	-do-
11	Operating temperature (range °C)	11	IS 16107 (Part 2/Sec2)	3	1	-do-
12	Power Factor Test	-	14700 (Part 3/section 2)	5	1	-do-
13	Harmonics	13 - Table 5	16107 (Part 2/Sec 2) 14700 (Part 3/section 2) 16103 (Part 2)	5	1	-do-
14	Surge protection	14	16107 (Part 2/Sec 2)	1	1	-do-
15	Reverse polarity (for DC supply only)	15.1	IS 16107 (Part 2/Sec 2)	3	1	-do-
16	Ingress Protection	-	10322 (Part 1) & IS/IEC 60529	1	1	-do-

In case the manufacture does not have requisite test facilities for any of the tests shown in Table 1 and 2 above, the same may be tested from any independent NABL accredited test labs except for the tests, which are to be carried out on each luminaire.

In case of failure of any luminaire in respect of tests carried out on each luminaire, cause of failure shall be identified and corrective action shall be taken to remove the non-conformity.

In the event of failure of any sample, in respect of the tests conducted on each lot manufactured, double the number of samples shall be taken for testing and no failure in those samples shall be permitted. Otherwise, the lot shall be rejected. After corrective actions two consecutive lots shall be tested as per the sample size and frequency indicated in the table 1 and table 2 and then original frequency shall be restored if both the samples pass.

5. INFORMATION TO BE FURNISHED BY THE PURCHASER/BUYER

5.1 When enquiring or ordering LED street lighting luminaire to the prescribed standard as specified in the contract, the following information may be furnished by EESL to the suppliers/manufacturers:

General information:

- a) Name of the purchaser;
- b) Address of the purchaser;
- c) Name of the contact person and the contact details;
- d) BIS certification Mark on the product and the copy of licence document;
- e) In case of BEE star labelled product, relevant documents relating to approval of model registration;
- f) Total number of street luminaire required; and
- g) Location where the luminaire required to be supplied.

Technical Information

- a) Type of luminaire;
- b) Rated Input Power;
- c) Photometric Code;
- d) Rated Luminous Flux (Lm);
- e) Rated Median Useful Life (h) and the associated rated lumen maintenance factor (x);
- f) Rated abrupt failure fraction;
- g) Lumen Maintenance Code;
- h) Rated Chromaticity Coordinates both initial and maintained;
- i) Correlated Color Temperature in K (CCT);
- j) Rated Color Rendering Index (CRI);
- k) Operating Temperature Range of Luminaire;
- l) Luminaire Effect (lm/W);
- m) Rated ambient temperature related to performance for a luminaire;
- n) Photobiological risk group;
- o) Date of manufacture, batch number/Serial No.;
- p) Luminous intensity distribution;
- q) Country of manufacture; and

- r) BIS certification and product covered BIS certification marks licence.

6. INFORMATION TO BE FURNISHED BY THE MANUFACTURER OR THE SUPPLIER

6.1 EESL may ask the manufacturer/supplier to furnish the following information while supplying the LED street lighting luminaire complying with the relevant standard specified in the contract.

- a) Name of the manufacturer;
- b) Address of the manufacturer;
- c) Organization structure;
- d) Location of different manufacturing units, if manufacturing is done at more than one locations;
- e) Name and contact details of the responsible person in each units;
- f) Details of the testing personnel;
- g) Availability of complete test facilities at the manufacturing premises;
- h) List of test equipment, measuring instruments and their accuracy class;
- i) Details of calibration of each equipment/measuring instruments including their validity period;
- j) Whether any arrangements made with any outside test labs where test facilities for any particular test (s) are not available with the manufacturer;
- k) Whether the manufacturers lab is accredited by NABL and if yes what is the scope of accreditation and its validity;
- l) Accreditation of outsourced lab and the validity period;
- m) Declaration in uncertainty in measurement; and
- n) Whether the product (s) covered are BIS certified. If BIS certified what is the validity of the licence and the varieties/types covered in the licence.

7 STAGES OF INSPECTION AND CONTROL

The inspection activities shall be undertaken in three different stages as follows:

Stage 1 – Bid Evaluation through document verification and Type Testing

Stage 2 – Production/Pre-Delivery

Stage 3 – Post-Delivery/Verification Testing

The detail procedure in respect of all the above three stages are described in 7.1 to 7.3.

7.1 Bid Evaluation

Bid evaluation shall comprise of type test certificate and the verification of relevant documents. Manufacturers or bidders shall submit a declaration about the product details supported by type test certificate from an independent third party NABL accredited laboratory against the specified test standard. During the bidding phase, the pre-qualification of any manufacturer or bidder shall be subject to verification of the documents and test certificates submitted. In case of any change in any design parameter, the complete type test shall be repeated. The

manufacturer shall submit the type test report along with other necessary supporting documents while submitting their bid, which are subject to evaluation and scrutiny by EESL.

All the necessary information submitted by the bidder, as confirmation and declaration of quality should comply with the prescribed guidelines of EESL and the stipulation of the prescribed test standard. In case of non-compliance in any of the parameter, the bid shall be rejected.

7.1.1 Type Test

Manufacturer and/or the bidder shall get their product tested on two samples in an independent accredited laboratory or in the manufacturers own lab accredited by NABL.

Before commencement of the tests, the luminaires meters shall be visually examined including the components, parts and their assembly, constructions, mechanical hazards, marking provision of suitable terminals for supply connections, earthing and the effectiveness of screws and connection. The external surface finish shall be even and free from finishing defects. The luminaires shall be subjected to the following type test as given in Table 3 for safety and Table 4 for performance.

Table 3
List of Type Tests for Bid Evaluation
(Safety Requirements)

S. No.	Test Requirements	Clause reference as per IS 10322 (Part 5/Sec 3)	Test methods	
			Clause	Reference Standard
1	Construction	7	7	10322 (Part 5/sec 3)
2	Creepage distances and clearances	8	8	-do-
3	Provisions for earthing	9	9	-do-
4	Terminals	10	10	-do-
5	External and Internal wiring	11	11	-do-
6	Protection against electric shock	12	12	-do-
7	Thermal test (normal operation)	13	13	-do-
8	Endurance tests and thermal tests (abnormal operation)	13	13	-do-
9	Resistance to dust and moisture	14	14	-do-
10	Insulation resistance and electric strength	15	15	-do-
11	Resistance to heat, fire and tracking	16	16	-do-

S. No.	Test Requirements	Clause reference as per IS 10322 (Part 5/Sec 3)	Test methods	
			Clause	Reference Standard
12	Mechanical strength test	Clause 4.13	Clause 4.13	-do-
13	Resistance to corrosion	Clause 4.18	Clause 4.18	-do-
14	Photobiological safety	-	-	IS/IEC 62778 and IS 16108

Table 4
List of Type Tests for Bid Evaluation
(Performance Requirements)

S. No.	Test Requirement	Clause reference as per IS 16107 (Part 2/Sec 2)	Test Method	
			Clause	Referred Standard
1	Total power Input	7	7	IS 16103 (Part 2)
2	Luminous flux	8.1	8.1	-do-
3	Luminaire Efficacy	8.2	8.3	-do-
4	Luminous intensity distribution	8.3	8.2 & 8.2.2	-do- IEC 62717
5	Photometric test	8.4	- 17.1 to 17.4 -	16106 10322 (Part 5/Sec 3) 13383 (Part 2)
6	Chromaticity co-ordinates	9.1	9.1	IS 16103 (Part 2)
7	Correlated color temperature (CCT)	9.2	9.2	-do-
8	Color rendering index (CRI)	9.3	9.3	-do-
9	Lumen maintenance	10.3	6.2 & 10.2	-do-
10	Endurance Test	10.4	10.3	-do-
11	Operating temperature (range °C)	11	11	IS 16107 (Part 2/Sec2)
12	Power Factor Test	12	-	14700 (Part 3/section 2)

S. No.	Test Requirement	Clause reference as per IS 16107 (Part 2/Sec 2)	Test Method	
			Clause	Referred Standard
13	Harmonics	13	13 - Table 5	16107 (Part 2/Sec 2) 14700 (Part 3/section 2) 16103 (Part 2)
14	Surge protection	14	14	16107 (Part 2/Sec 2)
15	Reverse polarity (for DC supply only)	15	15.1	IS 16107 (Part 2/Sec 2)
16	Ingress Protection	16	-	10322 (Part 1) & IS/IEC 60529

7.1.2 Document Verification

The following documents shall be submitted by the manufacturers/bidders for verification and scrutiny by EESL. A detail scrutiny of the documents listed below is essential to verify the authenticity and validity of each documents submitted.

- a. Copy of valid BIS certification marks Licence, if the product carries BIS certification mark
- b. Document relating to BEE approval for star rating label
- c. Type test report in original from a NABL accredited testing laboratory as per IS 16107 (Part 2/Sec 2).
- d. Copy of test certificates of important raw materials and components, wherever applicable
- e. Copy of valid NABL certificate of accreditation of manufacturers lab and independent lab
- f. Warranty certificate for guarantee of performance of minimum as prescribed by EESL

7.2 Production/ Pre-Delivery Inspection

The production/pre-delivery inspection shall be carried out by EESL or their authorized representatives. The sample shall be supplied free of cost by the manufacturer. The testing charges for all the type tests shall be borne by EESL. The schedule of test for pre-delivery inspection prior to shipment from the manufacturer's premises or their warehouse shall comprise of the following:

- a) Type test
- b) Acceptance test
- c) Routine Test

The production/pre-delivery inspection shall be carried out at the manufacturer's premises on samples selected at random from their finished stock or their warehouse.

To ensure the production of quality products in a continuous manner, verify the proper levels of control in the manufacturing process by the manufacturer. These include presence of an in house accredited test facility, trained and competent testing personnel, maintenance of test records, inspection and calibration, proper Quality Management System measures in accordance with IS/ISO 9001.

7.2.1 Type Test

For the purpose of type tests, two samples shall be selected from the lot offered. Sample drawn for type tests shall be tested at a NABL approved manufactures or third party test lab.

The tests given in the Table 3 and Table 4 for direct connected and transformer operated respectively as given below shall constitute the type tests and shall be carried out on the selected samples for type tests. The sample shall be representative of a manufacturer's production selected from the finished stock at the manufacturers end or in their warehouse.

Before commencement of the type tests, the LED street light luminaire shall be visually examined including the components, parts and their assembly, constructions, mechanical hazards, marking provision of suitable terminals for supply connections including the provisions for earthing. The external surface finish shall be even and free from surface defects.

The samples shall successfully pass all the type tests for proving conformity with the requirements of the standard. If the sample fails in any of the type tests, EESL at its discretion, may call for fresh samples not exceeding twice the original number and subject them again to all tests or to the test (s) in which failure (s) had occurred. No failure is permitted in the repeat test.

Type test may be waived off in case tender document originally lays out the requirement of BIS certification mark and/or BEE label if any.

The LED street lighting luminaire shall be subjected to the following type test as given in Table 3 for safety test and Table 4 for performance tests as given below:

The type test report shall also contain the nameplate or rating plate particulars of the LED street light luminaire for purposes of identification.

NOTE: EESL may waive the type test on the lot offered by the supplier/manufacturers in case the street light luminaire carry BIS certification mark and/or BEE energy efficiency level.

7.2.2 Acceptance Test

To ensure the quality of products supplied by the manufacturer, acceptance test shall be carried out by EESL on each lot offered for inspection.

Samples shall be selected at random to ensure proper representation of a lot from the factory or their warehouse/stockyard for necessary testing in the manufacturers own lab duly accredited by NABL in the presence of EESL representatives. The method employed for random selection should be in accordance with IS 4905 to ensure proper representation of a lot. The sample size and acceptance quality level (AQL) shall be as laid down in IS 2500 (Part 1).

The samples selected from the lot shall be checked for any visual defects including the components, parts and their assembly, constructions, mechanical hazards, marking provision of suitable terminals for supply connections including the provisions for earthing as well as the external surface finish for any surface defects.

In case of failure of sample in any of the tests specified in the standard/inspection manual, reject the lot and send a written communication to the manufacturer. The manufacturer may after rectifying the necessary corrective measures can reoffer the lot for inspection.

Three inspection levels, I, II and III, are given in Table 1 of IS 2500 (Part 1) for general use. Unless otherwise specified, level II shall be used. Level I may be used when less discrimination is needed level III when greater discrimination is required.

Table 1 of IS 2500 (Part 1) provides the information about the lot size and corresponding inspection level. For the purpose of lot inspection by EESL, single sampling plan with normal or tightened or reduced inspection as given in Table 2A, 2 B and 2 C of IS 2500 (Part 1) may be followed. The different level of AQL specifying the acceptance and rejection number of the lot as given in Tables 2 A to 2 C shall be at the discretion of EESL.

Special levels, S-1, S-2, S-3 and S-4 given in Table 1 of IS 2500 (Part 1) may also be used where relatively small sample sizes are necessary and larger sampling risks can be tolerated.

NOTE: A third party inspecting agency can be employed for inspection of the lot offered by the manufacturers and submit test reports in the prescribed format as given in Annex C and duly approved by EESL for scrutiny and approval.

The nature of tests and the relevant test standard for the acceptance tests are given in the Table 5 for safety and performance tests.

Table 5
Acceptance Tests for Pre-Delivery Inspection

Sr. No.	Test Requirements	Clause reference as per IS 16107 (Part 2/Sec 2)	Test methods	
			Clause	Reference Standard
1	Creepage distances and clearances	5	8	IS 10322 (Part 5/Sec 3)
2	Provisions for earthing	5	9	-do-
3	Protection against electric shock	-do-	12	-do-
4	Thermal test (normal operation)	-do-	13	-do-
5	Insulation resistance and electric strength	-do-	15	-do-
6	Resistance to heat, fire and tracking	-do-	16	-do-
7	Mechanical strength test	-do-	Clause 4.13	-do-
8	Resistance to corrosion	-do-	Clause 4.18	-do-
9	Photobiological safety	-do-	-	IS/IEC 62778 and IS 16108
10	Marking	16107 (Part 2/Sec 2)	4.1	IS 16107 (Part 2/Sec2)
11	Total Input Power	-do-	7	-do-
12	Luminaire Efficacy	-do-	8.3	-do-
13	Colour Rendering Index (CRI)	-do-	9.3	-do-
14	Correlated Colour Temperature (CCT)	-do-	9.2	-do-
15	Power Factor	-do-	12	-do-

7.2.3 Routine Test

In case production routine tests are to be repeated at the time of procurement, then where agreed to between EESL and the manufacturer, the tests may be carried out at the manufacturer's works; alternatively, the tests may be repeated at the place specified by EESL provided that all the arrangements for tests are made by EESL at the specified place.

Routine tests are the tests that would be conducted on each unit after completion at the manufacturer's work. The following shall constitute the routine tests.

Nature of Test	Referred Indian Standard	Clause Number
Provisions for earthing	10322 (Part 5/sec 3)	9
Protection against electric shock	-do-	12
Insulation resistance and electric strength	-do-	15
Marking	IS 16107 (Part 2/sec 2)	4.1
Total Input Power	-do-	7

7.3 Post Delivery Inspection/Verification Testing

For verification testing, the sample shall be drawn from open market or manufacturer's warehouse/stockyard. EESL shall bear the cost of the sample as well as the cost of testing. Verification tests shall cover all the type tests for LED street light luminaire as mentioned in 7.2.1 of this manual. The type testing shall be carried out in an independent test laboratory.

8 COMPLAINT REDRESSAL

Whenever a complaint is received after the LED street lighting luminaire have been delivered/used and the complaint is proved to be genuine and the warranty period (where applicable) has not expired, the defective goods or their components shall be replaced or repaired free of cost by the manufacturer. The final authority to judge the conformity of the product to the relevant standard specified in the contract shall be with EESL. In the event of any damages caused by the luminaire or claim filed by the user against the supply made by the manufacturer as per the contract and also non-compliance of the product to the relevant standard specified in the contract, entire liability arising out of such non-compliant product shall be with the manufacturer and EESL shall not in any way be responsible in such eventualities.

The manufacturer shall give a guarantee for the soundness of construction and performance of the led street light luminaire, and shall be responsible for putting right any manufacturing defects free of charge for a period of 12 months right from the date of sale or date of installation whichever is later. Such repairs or replacements of defective parts shall be carried out at manufacturer's works, or his authorized agent at site or at service shop.

9 PRODUCTION PLAN

The manufacturer shall provide advance information about their production plan and readiness of the lot to be offered for inspection to EESL.

10 TEST METHOD AND ITS REQUIREMENTS

The method of tests and its requirements shall be in accordance with IS 16107 (Part 2/Sec 2).

11 TEST REPORT PROFORMA FOR LED STREET LIGHT LUMINAIRE

The test report format give in Annex B shall be used by the testing laboratory or EESL while preparing the test reports.

Annexures

ANNEX A

STEPWISE GUIDELINES FOR THE INSPECTION OF THE LED STREET LIGHTING LUMINAIRE

1. Introduction

This inspection manual elaborates the quality assurance process for LED street lighting luminaire procured by EESL. This will ensure compliance of the procured products with the requirements laid out in the tender document, thereby building credibility of the program and ensuring the quality of the product.

To ensure procurement of quality products, proper inspection should be carried out by EESL. The inspection activities are divided in three different stages:

Step 1 – Bid Evaluation before finalization of the bid

Step 2 – Production/Pre-Delivery

Step 3 – Post-Delivery/Verification Testing

2. Bid Evaluation

For bid evaluation, manufacturer shall submit the test report from an NABL accredited lab against the relevant standard along with other necessary supporting documents (show the list in red below) while submitting their bid. The test report should include type tests on safety and performance.

All the necessary information submitted by the bidder should comply with the prescribed guidelines of EESL and relevant test standard. In case of non-compliance in any of the parameter, the bid shall be rejected.

- a. Copy of valid BIS certification marks License, if the product carries BIS certification mark ;
- b. Type test report in original from a NABL accredited testing laboratory as per the relevant standard;
- c. Copy of test certificates of important raw materials and components;
- d. Copy of valid NABL certificate of accreditation of the test lab issuing the test certificate/report; and
- e. Warranty certificate for guarantee of performance of minimum number of years prescribed by EESL.

3. Prerequisite for Inspection at the manufacturers premises

Before undertaking the inspection, the EESL inspecting officers should ensure the following;

- a) Opening meeting with the concerned officials and the testing and quality control personal to discuss and planning to undertake the required task;
- b) Visit to the test laboratory to check the following;
 - Availability of requisite test facilities as per the prescribed standard and its workability
 - Calibration detail and the validity of each instruments and test equipment

- Verification of test records and other relevant records related to in process quality control including the manual and procedure for ISO 9001 certification
- Verification of testing facilities at the production line if applicable

After ensuring the compliance of all the requirements mentioned above, the inspecting officers shall draw samples for acceptance and type tests from the lot offered for inspection by the manufacturers. For acceptance tests the sampling plan and AQL shall be as per IS 2500 (Part 1). Routine tests shall be carried out on the entire lot.

After the completion of all the tests as per the specified standard, the test report shall be prepared on the prescribed format as given in Annex B of this manual. The test reports shall be signed by the inspecting officer from EESL and the authorized person from the manufacture.

4. Production/ Pre-Delivery Inspection

The field-inspecting officer shall draw samples at random from the finished stock of the lot offers. The number of samples for acceptance tests shall be as laid down in IS 2500 (Part 1) using a suitable AQL.

The production/pre-delivery inspection shall be carried out by field inspecting personnel from EESL or their authorized representatives at the manufacturer's premises on samples selected at random from their finished stock or their warehouse for testing. The sample shall be supplied free of cost by the manufacturer. The manufacturer shall provide advance information about their production plan and readiness of the lot to be offered for inspection to EESL. Pre dispatch inspection tests include type, acceptance and routine tests.

Before commencement of the type tests, the LED street light luminaire shall be visually examined including the components, parts and their assembly, constructions, mechanical hazards, marking provision of suitable terminals for supply connections including the provisions for earthing. The external surface finish shall be even and free from surface defects.

4.1 Type Tests

The sample selection for type testing shall be based on random sampling. The number of samples for type testing shall be two drawn from the finished stock of the lot offered by the manufacturer/supplier. Sample drawn for type tests shall be sent to an NABL approved test labs. The testing charges for all the type tests shall be borne by EESL.

The samples shall successfully pass all the type tests for proving conformity with the requirements of the standard. If the sample fails in any of the type tests, EESL at its discretion may call for fresh samples not exceeding twice the original number and subject them again to all tests or to the test in which failure had occurred. No failures are permitted in the repeat test.

EESL may waive off the type test on the lot offered by the supplier/manufacturers in case the street light luminaire carries BIS certification mark and/or BEE energy efficiency level.

The list of type tests shall be as given in Table 3 and Table 4 of this manual.

4.2 Acceptance Tests

To ensure the quality of products supplied by the manufacturer, acceptance test shall be carried out by EESL on each lot offered for inspection. The manufacturer shall supply, free of charge, the samples from the factory or their warehouse/stockyard for necessary testing in the manufacturers' accredited lab in presence of EESL representatives.

Samples shall be selected at random from the lot offered by the manufacturers/supplier from the finished stock using IS 4905 to ensure proper representation of a lot. The sample size and acceptance quality level (AQL) shall be as per IS 2500 (Part 1).

In the absence of test facilities for any particular test, the testing personnel deputed by EESL shall draw the samples from the manufacturing premises or from manufacturers warehouse/stockyard and send the same to an NABL approved test labs for the required tests.

In case of failure of sample in any of the tests specified in the standard/inspection manual, the lot shall be rejected and a written communication to this effect shall be made to the manufacturer. The manufacturer may after rectifying the necessary corrective measures can reoffer the lot for inspection. A third party inspecting agency can be employed by EESL for inspection of the lot offered by the manufacturers and submit test reports in the prescribed format given in the inspection manual. The list of acceptance tests shall be as given in Table 7 of this manual.

4.3 Routine Test

In case production routine tests are to be repeated at the time of procurement, then where agreed to between EESL and the manufacturer, the tests may be carried out at the manufacturer's works; alternatively, the tests may be repeated at the place specified by EESL provided that all the arrangements for tests are made by EESL. The routine tests shall be carried out on each luminaries from the lot offered for inspection. In case of failure in any of the tests, the sample under tests shall be either rejected or reworked/rectified and retested. The list of routine tests is given in section 7.2.3 of this manual.

5. Post Delivery Inspection/Verification Testing

Verification testing is a vital crosscheck mechanism to ensure quality products reach the end users/consumers post-delivery. For verification testing, the sample shall be drawn from open market or manufacturer's warehouse/stockyard. EESL shall bear the cost of the sample as well as the cost of testing in an independent NABL accredited lab. The verification testing shall include all the type tests specified in IS 16107 (Part 2/Sec2) and the inspection manual and shall be sent to independent test lab approved by NABL. The samples shall successfully pass all the type tests for proving conformity with the requirements of the standard. If the sample fails in any of the type tests, EESL at its discretion, shall draw the sample may call for fresh samples not exceeding twice the original number and subject them again to all tests or to the test in which failure had occurred. No failures are permitted in the repeat test. In case of failure of samples in repeat testing, EESL shall take appropriate action against the manufacturers.

ANNEX B

TEST REPORT FORMAT FOR MANUFACTURERS LAB AND INDEPENDENT LAB FOR LED STREET LIGHTING LUMINAIRE

1. General Information

Manufacturer/ Laboratory Name			
Address			
Date of Receipt (for Independent Labs)			
Test Report No.		Date of testing	
Tested by		Reviewed/Approved by	

2. Details of the Sample Tested

S. No.	Testing	Results/Remarks
1	Rated Input Power (W)	
2	Photometric Code	
3	Rated Luminous Flux (Lm)	
4	Rated Median Useful Life (h) and the associated rated lumen maintenance factor (x)	
5	Rated abrupt failure fraction (%)	
6	Lumen Maintenance Code	
7	Rated Chromaticity Coordinates both initial and maintained	
8	Correlated Color Temperature in K (CCT)	
9	Rated Color Rendering Index (CRI)	
10	Rated Color Rendering Index (CRI)	

S. No.	Testing	Results/Remarks
11	Operating Temperature Range of Luminaire	
12	Luminaire Efficacy (lm/W)	
13	Rated ambient temperature related to performance for a luminaire	
14	Date of manufacture, batch number/Serial No	
15	Luminous intensity distribution	
16	Photobiological safety risk group	
17	BIS standard mark and BIS License number, if any and BEE star label, if any	

3. Measuring Equipment/Instruments Details

Sr. No.	Instrument/Equipment Name	Make	Accuracy Class	Range and least count	Cal. Valid Date

4 Test Result

4.1 Safety Requirements

Sr. No.	Test Requirements	Test methods		Specified Value	Observed Value	Pass/Fail
		Clause	Reference Standard			
1	Construction	7	10322 (Part 5/sec 3)			
2	Creepage distances and clearances	8	-do-			
3	Provisions for earthing	9	-do-			
4	Terminals	10	-do-			

Sr. No.	Test Requirements	Test methods		Specified Value	Observed Value	Pass/Fail
		Clause	Reference Standard			
5	External and Internal wiring	11	-do-			
6	Protection against electric shock	12	-do-			
7	Thermal test (normal operation)	13	-do-			
8	Endurance tests and thermal tests (abnormal operation)	13	-do-			
9	Resistance to dust and moisture	14	-do-			
10	Insulation resistance and electric strength	15	-do-			
11	Resistance to heat, fire and tracking	16	-do-			
12	Mechanical strength test	Clause 4.13	-do-			
13	Resistance to corrosion	Clause 4.18	-do-			
14	Photobiological safety	-	IS/IEC 62778 and IS 16108			

4.2 Performance Requirements

Sr. No.	Test Requirement	Test Method		Specified Value	Observed Value	Pass/Fail
		Clause	Referred Standard			
1	Total power Input	7	IS 16103 (Part 2)			
2	Luminous flux	8.1	-do-			
3	Luminaire Efficacy	8.3	-do-			
4	Luminous intensity distribution	8.2 & 8.2.2	-do- IEC 62717			

Sr. No.	Test Requirement	Test Method		Specified Value	Observed Value	Pass/Fail
		Clause	Referred Standard			
5	Photometric test	- 17.1 to 17.4 -	16106 10322 (Part 5/Sec 3) 13383 (Part 2)			
6	Chromaticity co-ordinates	9.1	IS 16103 (Part 2)			
7	Correlated color temperature (CCT)	9.2	-do-			
8	Color rendering index (CRI)	9.3	-do-			
9	Lumen maintenance	6.2 & 10.2	-do-			
10	Endurance Test	10.3	-do-			
11	Operating temperature (range °C)	11	IS 16107 (Part 2/Sec2)			
12	Power Factor Test	-	14700 (Part 3/section 2)			
13	Harmonics	13 - Table 5	16107 (Part 2/Sec 2) 14700 (Part 3/section 2) 16103 (Part 2)			
14	Surge protection	14	16107 (Part 2/Sec 2)			
15	Reverse polarity (for DC supply only)	15.1	IS 16107 (Part 2/Sec 2)			

Sr. No.	Test Requirement	Test Method		Specified Value	Observed Value	Pass/Fail
		Clause	Referred Standard			
16	Ingress Protection	-	10322 (Part 1) & IS/IEC 60529			



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