

South Eastern Railway



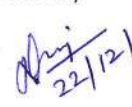
Technical Specification for LED based Luminaries for General Service applications

Specification No. CEE/S/185/ LED/12/21/Rev-0, Dec 2021

(This supersedes all earlier specifications issued by PCEE's Office on this subject)

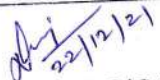
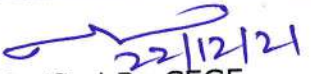
Approved By:-


PCEE/SER 22/12/21

Prepared By  SSE/Stores/TL&P	Checked By  Dy. CESE	Verified By  CESE
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 Prepared By SSE/S/TL&P	 Checked By Dy. CESE	 Verified By CESE
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1.0 SCOPE: This specification defines the requirement of Design, Manufacture, Supply Testing and Inspection of LED based luminaries/ fixtures for various applications such as Street Lights, Office Buildings Lights, Platform Lights, Signages and Pit Lights etc.

2.0 REFERENCE STANDARDS: The following documents given below are for reference to the Manufacturer for design, manufacture, performance, safety, environmental, biological and tests requirements. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall prevail.

S.N.	Referenced specification/Document	Description
1	IEC 60598-2-1/ 60598-1	Fixed general purpose luminaries/ Luminaries general requirement and tests.
2	IEC:62384/IS:16104:2012 (Reaffirmed: 2017)	LED Driver Performance requirements- DC or AC supplied electronic control gear for LED modules Performance requirements.
3	IEC 62031/IS: 16103 (part-1 &2)-2012 (Reaffirmed:2017)	LED modules for general lighting- safety requirements and performance requirements.
4	IEC:62471/EN 62471/ IS: 16108-2012(Reaffirmed 2017)	LED Photo biological safety requirements
5	IEC:60571/IS:9000	Luminaries environmental requirements
6	IEC 60068-2-38	Environmental testing/ Humidity Cycle Test
7	IEC 60332-1/IS:11000	Luminaries Fire retardant test
8	IEC. 60529	Luminaries Ingress Protection test
9	IEC 61000-3-2	EMC (Electromagnetic compatibility)- Limits for harmonic current emission
10	IEC 61373	Electric Shock testing
11	IEC:61347-2-13/EN:61347-2-13/IS:15885 (part-2/Sec-13)- 2012 (Reaffirmed 2017)	LED Driver safety requirements- Lamp control gear, particular requirements for DC or AC supplied electronic control gear for LED modules.
12	IEC 60081-1997 (Annexure B, C & D)/ ANSI_NEMA_ ANSLGC78.377-2008	Colour rendering index measurement test
13	IS-16101-2012 (Reaffirmed 2017)	General Lighting- LED/LED module- terms and definitions
14	IS:16102 (part-I & II)-2012 (Reaffirmed 2017)& IEC/PAS 62612	Self ballasted LED lamps for general lighting services (Safety Requirements and Performance Requirements)
15	IS:16104-2012 (Reaffirmed 2017)	Electronic control gear for LED modules performance requirements.
16	IS 10322 (PART-5/SEC-3) 2012 (Reaffirmed 2017)	Requirements of Luminaires for Road and Street Lighting
17	IS:14700 (part 4 section-2)	Standard testing of LED driver
18	IS:513	Specification of cold rolled low carbon steel strips
19	IS:4905	Method of random sampling
20	CISPR-15/IS:6573 IEC:61547	EMI/EMC tests for LED driver
21	LM-70 (IEC-60081-1997)/ IS:16107-part-2	LED life expectancy
22	LM-80/IS:16105-2012 (Reaffirmed 2017)	Approved method for measuring Lumen Maintenance of LED light source.
23	LM-79/IS:16106-2012 (Reaffirmed 2017)	Approved method for electrical and photometric measurements of solid state LED lighting products.

3.0 COMMON TECHNICAL PARAMETERS FOR ALL TYPES OF LED LUMINARIES:

3.1 GENERAL TECHNICAL REQUIREMENTS

- 3.1.1 The suitable connector fire retardant of UL94V0 or better type shall be provided for LED connection between driver output and LED for high power LED luminaries and for low power LED fittings connection with conformer coating.
- 3.1.2 The material of grommet shall be of silicon rubber and PG gland should be provided.
- 3.1.3 Nil
- 3.1.4 Nil
- 3.1.5 The illumination of luminaries will be uniform without dark bands or abrupt variations and smoothing to the eyes.
- 3.1.6 The luminaries works on single phase 3 wires system (Phase, Neutral and Earth). Length of 0.5 Mtr. ISI marked 3 core wire shall be provided with LED luminaries and LED tube light fittings.
- 3.1.7 LM 79 test report in respect of LED luminaries of manufacturer shall be provided along with supply of material.
- 3.1.8 LM80 test report of the LED chip of LED manufacturer shall be provided along with supply of material.
- 3.1.9 Power factor of luminary shall be ≥ 0.90 at full load.
- 3.1.10 The normal voltage of luminary shall be 230 Volt AC $\pm 5\%$, 50 Hz.
- 3.1.11 The input operating voltage of luminary shall be 140V-270 V AC.
- 3.1.12 The working temperature of luminary shall be as follows:-

Luminary type	Value
LED Tube Light, LED Bulb	-10 deg. C to 50 deg. C
LED Street Light/High Mast Light & Signage Board	-10 deg. C to 55 deg. C

- 3.1.13 The insulation resistance between earth and current carrying part shorted together shall not be less than 100 M ohm at 60% RH with 500 V megger and after HV test.
- 3.1.14 The complete unit cubicle together with its mounting arrangement shall be subjected to shock testing as per latest IEC 61373.
- 3.1.15 The firm shall provide the technical details as per Annexure- 'A' attached.
- 3.1.16 The tolerance limit of technical parameters wherever not given shall be applicable as per relevant IS/IEC.

3.2 LED/ LED LIGHT SOURCE

S.N.	Description	Specification
3.2.1	LED make	NICHIA/OSRAM/SAMSUNG/LUMILEDS/CREE/SEOUL/TOYODA GOSEI/ LG INNOTEK
3.2.2	LED type	(a) For Street Lights and High Mast Lights Low bay/ Medium Bay/ High Bay- High Power LED (Ceramic/EMC package) (≥ 1 watt) (b) For LED bulbs, LED tube light fittings and LED Signages- Low Power LED (< 1 watt)
3.2.3	Lumen Output	≥ 140 lumens/watt- For high power LED ≥ 110 lumens/watt- For low power LED
3.2.4	LED life expectancy	$\geq 50,000$ burning hours (to be supported by LM80 report and TM21 report of manufacturer of LED chip)
3.2.5	Beam Angle	120 deg
3.2.6	Colour Temperature	5500 - 6500 K
3.2.7	Colour Rendering Index	≥ 70 - For street light and high mast light fittings ≥ 80 - For LED bulbs and LED tube light fittings
3.2.8	LED wattage	LED should not be operated more than 90% of rated capacity in luminary.

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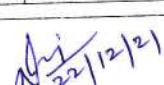
3.3 LED DRIVER

S.N.	Description	Specification
3.3.1	Driver type	Constant current driver with short circuit & open circuit protection. Note: The LED driver shall be required compulsory registration as per IS: 15885 (part 2/sec.-13)-2012 from 'BIS' in favour of tenderer or other authorized manufacturer.
3.3.2	THD	<10%
3.3.3	Driver Efficiency	Up to 100 W: >85% (Minimum) Above 100W: >90% (Minimum)
3.3.4	Driver Components	Industrial grade or above. Driver current should be less than rated current of component used to meet the rated life.
3.3.5	PCB	FR4 grade minimum 0.8-1.0 mm thick to be fixed with high thermal conductive paste or tape on the extruded aluminium heat sink for Street Light and High Mast Light. For LED Bulbs and LED tube light the same may be provided, if required.
3.3.6	Driver cut in and cut off voltage	The driver should be designed at cut in voltage 120 volt AC and cut off voltage at 300 volt AC.
3.3.7	Junction Temperature	Switching Device such as a Transistor and MOSFETs etc. shall not exceed 85 deg. C (allowing thermal margin of 25 deg. C)
3.3.8	Surge Protection	(1) <u>Internal voltage surge protection</u> : to protect the luminaire from switching surges the driver of all luminaires should have internal surge protection of MOV of ≥2.5 KV (on board) (2) <u>External Surge Protection Device (SPD) for Street Light Fittings And High Mast Light Fittings</u> External surge protection of minimum 10KV to be separately installed with the each fixture (As per ANSI C 136.2- 2014).

4.0 TECHNICAL PARAMETERS FOR LED STREET LIGHT/ HIGH MAST LIGHT:

General Technical Requirements of Luminaries under Para 3.0 to 3.3 will remain applicable.

S.N.	Description	Specification
4.1	System Lumen efficiency of the complete Luminary	≥110 lm/Watt (±5%)
4.2	Finishing	Anodised/Powder coated
4.3	Lamp Cover	Distortion free, clear, heat resistance toughened glass of thickness 4.0 mm
4.4	Secondary optics	Polycarbonate Lens Fire retardant FR grade.
4.5	Mounting	Suitable for existing pole/universal with dedicated mounting Kits/ Bracket mounting of adjustable type.
4.6	Ingress Protection	IP-66
4.7	Construction of Housing	Single Housing, Side entry High Pressure aluminium die cast/extruded aluminium, grey colour corrosion-resistant polyester powder coating with separate optical and control gear compartments. The housing shall be high conductivity (LM6/ADC12/LM24) with integral heat sink and heat proof silicon rubber.
4.8	Gasket between housing and cover	Silicon Gasket
4.9	Impact Resistance	IK-07

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4.10	Type of power supply	SMPS
4.11	Over Voltage Protection	Unit shall withstand 300 volt AC for 1 minute and cut off. It will automatically "ON" when voltage comes in operating voltage range.
4.12	Reverse Polarity	Shall be operated with Reverse Voltage for 3 minutes at maximum value of voltage range.
4.13	High voltage test	Shall be tested at 1500 volt AC for 1 minute between supply terminals and body of the unit.
4.14	Fixing Of Cover Frame	The cover to be fixed to the housing by means of stainless steel screws.

5.0 TECHNICAL PARAMETERS FOR LED TUBE LIGHT (LAMP) & TUBE LIGHT FITTING: General technical requirements of luminaries under Para 3.0 to 3.3 will remain applicable.

(a) LED TUBE LIGHT (Lamp)

S.N.	Description	Specification
5.1	Type of Tube Light	T8, Indoor Type
5.2	Length	1200mm/600mm ($\pm 2\%$)
5.3	System lumen efficiency of the complete luminary	100 lm/W ($\pm 5\%$)
5.4	LED tube light lamp construction	The LED tube light (lamp) shall be with inbuilt control driver and designed in such a way that driver should fitted in the LED tube light (lamp) or LED driver shall be fixed to the lamp in such a way that the driver end cap shall be detachable/ replaceable and they provide access to the driver which may be replaced if defective.
5.5	Ingress protection	IP 20
5.6	Lamp cover/diffuser	The diffuser of polycarbonate sheet shall be milky to ensure uniformity of light and Polycarbonate material shall be fire retardant UL94-VO grade (not less than 0.8-1.0 mm thick)
5.7	Wattage of LED used in package	≤ 1 W
5.8	High Surge Protection	As per Para 3.3.8 item no. (1)
5.9	LED Tube Light Heat Sink	Fabricated Aluminum for heat sink shall be with proper thermal management.
5.10	End Cap (Both ends)	Fixed to the tube rod on both ends in such a way that these shall be detachable/ replaceable.

(b) BATTEN/FITTING WITH LED TUBE LIGHT (LAMP)

S.N.	Description	Specification
5.11	Type of Fitting	Suitable for T8 light
5.12	Details of Fixture	Suitable for Single/Double Tube Light (lamp)
5.13	Type of Diffuser	Milky
5.15	Mounting Arrangement	The fixture shall be provided with suitable mounting arrangement for wall mounting as well as for platform mounting on steel structure complete with SS mounting clamps.
5.15	Tube Holder	The fixture shall be fitted with Bi-Pin G13 holder suitable for T8 tube light (lamp)
5.16	Batten (Box Type)	The batten should be high pressure Die-Cast/ extruded aluminium with ADC12 alloy or CRCA sheet (0.6mm thick) power coated to white colour.
5.17	Tube light (lamp)	Specification of Tube light (lamp) will remain applicable as per Para 5.0 (a).

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6.0 TECHNICAL PARAMETERS FOR LED BULBS: General technical requirements of luminaries under Para 3.0 to 3.3 will remain applicable.

S.N.	Description	Specification
6.1	Rating of LED bulbs	Up to 23 W
6.2	Type of base	B22
6.3	System Lumen Efficiency of The Bulb	100 lm/W ($\pm 5\%$)
6.4	High Surge Protection	As per Para 3.3.8(1)
6.5	Beam Angle of Luminary	270 deg
6.6	Construction Of Housing	Injection molded plastic housing with Aluminium insert minimum thickness 1.0 mm
6.7	Lamp Cover/ Diffuser	Polycarbonate milky diffuser shall be fire retardant confirming to UL94 VO grade (not less than 0.8- 1.0 mm thick)
6.8	LED life	≥ 25000 burning hours
6.9	Ingress protection	IP 20
6.10	Wattage of LED used in package	≤ 1 Watt

7.0 TECHNICAL PARAMETERS FOR LED SIGNAGE BOARDS: General Technical Requirements of Luminaries under Para 3.0 to 3.3 will remain applicable.

S.N.	Description	Specification
7.1	Type of Signage	(a) Backlit Signage (b) 3D character Backlit Signage
7.2	Backlit Signage for utility services (a)	SMD (Surface mounted device) LED Glow Sign Boards etc.
7.3	3D character Backlit Signage (b)	SMD LED Glow Sign Railway Station Name Boards etc.
7.4	Colour Scheme (a)	Size and colour scheme will be decided by the Consignee/Purchaser as per site requirement
7.5	Colour scheme (b)	Size and colour scheme will be decided by the Consignee/Purchaser as per site requirement
7.6	Luminous intensity	(a) Backlit Signage: minimum 990 mcd (mili candela). (b) 3D character Backlit Signage: Minimum 3000 mcd.
7.7	Signage Board	Backlit Signage: Sleek type energy efficient SMD LED based glow sign boards made of MS Steel square tube of size 25mm x 25mm X 14 gauge for frame and with 24mm aluminum extrusion male-female clip on fixture to catch and release the sheet. 3D character backlit signage: The background of board shall be made of 3mm thick ACP (Aluminum composite panel) of prescribed colour by consignee. The enclosure shall be fabricated from MS Steel square tube of size 25 x 25 mm of 14 gauge.
7.8	Language	All matter shall be written in Hindi, English or other regional language in 3D shape as per purchaser/ consignee requirement.

7.9 Technical details for Signages for A1 & A category Railway Station

Technical details for Type- A, B, C, D & other accessories are as per following details:-

Type 'A'

Entry gate and Exit gate, Line Marking Gantry, Parking Entry, Parking Exit Freight Entry, Freight Exit, Way Finding Sign External (6panelsx6 directories) Panels, Way Finding Sign External Building Titles, On staircase East gate sign, double sided sign shall be of size 30'x5', 60'x2.5', 50'x5', 72"x10", 16'x1.5' etc. Dimension may vary as per site requirement conforming to the following technical details:-

Made of laser cut Aluminium panel of 1mm thick aluminium sheet with painted face having 3 mm letter fascia to be laser cut out from opel perplex sheet of 4 mm thickness to use as per signage size: 20W, 40W, 60W, 100W, 150W constant current mode power supply, Universal AC input/ full range.

(a) Signage Support Gantry Structure: Made up of 50mm x 50mm x 2mm pipes sections for fixing sign board both front and back.

(b) Anchor Plates: To use plates from existing gantry structure RCC base (M40/50 concrete) of size 900X1800X1800 mm each pole.

Type 'B'

Way finding signage external shall be of size 36"x8" (4X2 panels, 1X1 Panels, 2X1 panels) way finding signage internal (4x1) panel shall be of size - 36"x8", dimension may vary as per site requirement conforming to following specifications:-

Signage Panel Sides front and back illuminated, 1mm aluminium sheet with laser cut graphics painted to required colour to use as per Sgnage size 20w, 40w, 60w, 100w, 150w constant current mode power supply universal AC input/ full range.

Type 'C'

Establishment Titles, Amenities Signs, Platform Number, Gate Entry/Exit shall be of size 3'x1', 2'x1.5', 5'x1.5' etc. dimension may vary as per site requirement conforming to following specifications:-

Signage panel, sides -front and back illuminated, 1 mm aluminium sheet with laser cut. graphics, painted to required colour to use as per signage size 20w, 40w, 60w, 100w, 150w constant current mode power supply universal AC input/ full range.

Type 'D'

Layouts sign shall be of size 8'x4' feet, dimension may vary as per site requirement conforming to following specification:-

Signage Panel, Sides- front and back illuminated, 1 mm aluminium sheet with laser cut graphics, painted to required colour to use as per sign size 20w, 40w, 60w, 100w, 150w constant current mode power supply universal AC input/ full range.

OTHER ACCESSORIES

(i) Fixing: To wall with anchor bolts of 50mm x 6mm size, fixed HILTI HS V M-12 expansion fastener.

(ii) Fixing Hanging Type: Telescopic pipes of size 25mm x 25mm x 10'/4' fixed to sign with size bolt of 25mm x 6mm size and SS 304 plate of size 75mm x 150mm x 3mm with a stiffening bar support and fixed to roof with fastener of size 75mm x 8mm through a 150 mm x 150 mm, SS 304 plate of 4 mm thickness.

(iii) Fixing projecting type: Two pipes of thickness 50mm X 50mm X 300mm with SS 304 plate of size 4" x 8" x 3mm for anchoring to wall with fastener of size 75mm X 8mm

(iv) support structure: Support structure of stainless steel grade 304, two square pipe of size- 75mm x 75mm x 1mm of length 10' fixed with use of SS:304 anchor plates of size- 200 mm x 2mm x 4mm fixed to RCC base with anchor fastener RCC base size 24" x 18" x 18".

(v) Pole Mounting Type-I: Single MS pole mounting with 200mm dia X 5mm X 6m with MS plate base of size 720 mm x 720 mm x 20mm with 3m x 25mm dia anchor rods (8 each plate) grouter in ground with 1mx1mx1.5m. RCC-M40/50 Conforming to IS 1239 2004 or latest HFW pipe of class A.

(vi) Pole Mounting Type-II: Single MS pole mounting with 300mm dia X 5mm X 6m with MS plate base of size 920 mm x 920 mm x 20mm with 3m x 25mm dia anchor rods (8 each plate) grouter in ground with 1.5mx1.5mx2m. RCC-M40/50 Conforming to IS 1239 2004 or latest HFW pipe of class A.

(vii) Fixtures: Signage structure made of 40 mm round pipes in scissor pattern conforming to IS: 1239 2004 or latest HFW pipe of class A.

Note:- RDSO document regarding functional requirement Specification for LED based luminaries for Pit lighting shall be followed.

8.0 TECHNICAL PARAMETERS FOR PIT LIGHT:

S.N.	Description	Specification for 18W	Specification for 22W (Bulkhead)
8.1	Rated Voltage	110V AC	
8.2	Front Cover	Toughened glass diffuser as per Para 4.3	
8.3	LED Test	LM79 & LM80 certified LED as per Para 3.1.7 & 3.1.8	
8.4	Control Gear/LED Driver	External constant current driver as per Para 3.3. (max. placement distance 1 mtr.)	External constant current driver as per Para 3.3
8.5	Internal Wiring	Teflon insulated Copper conductor	
8.6	Hardware	MS zinc plated & passivated	
8.7	Ingress Protection	IP66	
8.8	Impact Test	IK10	
8.9	Lumen Maintenance	50,000 hrs. & L70	
8.10	Operating Temperature	-10 to 50 deg. C	
8.11	Main Housing & Frame	Aluminum casting with powder coating as per Para 4.7	
8.12	Wattage	18W $\pm$ 10%	22W $\pm$ 10%
8.13	Power Factor	≥ 0.90	
8.14	Lumen Output	2340 lm	1760 lm (if bulkhead type)
8.15	CCT	5500-6500 K	
8.16	CRI	> 70	
8.17	Protection	System covers the open & short circuit protection, reverse polarity protection & surge protection as per Para 3.3.8	

9.0 Identification: The firm shall embossed/engraved firm name, month and year of manufacture, guarantee-period, serial number rated input voltage and wattage inside and outside the fitting and also screen print on LED panel and LED driver the firm name and year of manufacturing.

10.0 Inspection: The inspection shall be done by M/s. RITES or Railway authorized representative at manufacturers works, full facility for carrying out acceptance tests as per IS/IEC specification shall be made available by the manufacturer to inspecting authority at manufacturers cost.

11.0 TESTS: The LED, LED driver and luminaries shall be tested with the applicable IS/IEC reference standards given in Para 2.0 of this specification.

11.1 TYPES OF TESTS

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11.1.1 Type Tests: Inspecting Agency will verify the documents available with the firm for type tests mentioned in Para 11.1.4 carried out from Govt. Laboratory/National/International Accredited Laboratory to ensure the conformation with the requirement of specification for the luminaries. For signages, type Tests mentioned in Para 11.1.4 are not applicable. However, for signages following checks are applicable to Para 7.4, 7.5, 7.6 & 7.7.

11.1.2 Acceptance tests: These tests shall be carried out by an inspecting Agency at the manufacturer works on sample taken from a lot for the purpose of acceptance of material.

11.1.3 Routine Tests: These tests shall be performed by the manufacturer on each item and the records shall be shown to the inspecting Agency during the inspection of lot offered for acceptance tests.

11.1.4 TESTS SCHEME:

S.N.	Description of test	Reference Para of the specification	Type Test	Acceptance Test	Routine Test
1	Visual and dimension Check	As per requirements	—	Y	Y
2	Checking of documents i.e bills/ invoice for purchase of LED	3.2.1	—	Y	Y
3	Checking of documents of purchase of-				
	a) Connector	3.1.1	—	Y	Y
	b) Grommet & PG Gland	3.1.2	—	Y	Y
	d) LED Driver Components	3.3.4	—	Y	Y
	e) MOV	3.3.8	—	Y	Y
4	Checking of documents of:-				
	a) Lamp Cover	4.3	—	Y	Y
	b) Secondary Optics	4.4	—	Y	Y
	c) Diffuser	5.6 & 6.7	—	Y	Y
5	Operating Voltage	3.1.10	—	Y	Y
6	Input Voltage Range of Luminary	3.1.11	—	Y	—
7	Over voltage protection	4.11	Y	Y	—
8	HV Test	4.13	—	Y	—
9	Power factor	3.1.9 As per IS 16102 (Part. 2)-2012 Para 15 or latest	Y	Y	—
10	Harmonics (THD)	3.3.2 As per IS: 16102 (Part. 2)-2012 Para 15 or latest	Y	—	—
11	Types of power Supply (SMPS)	4.10	—	Y	Y
12	High Power LED ≥ 1 Watt	3.2.2(a)	Y*	—	Y
13	Low Power LED < 1 Watt	3.2.2(b), 5.7 & 6.10	Y*	—	Y
14	Beam Angle -LED	3.2.5(Covered under LM 80)	Y*	—	—
15	LED Life Test (L-70 & TM-21)	3.2.4 & 6.8	Y*	—	—
16	All Tests as per LM-79	3.1.7	Y	—	—
17	All Tests as per LM-80	3.1.8	Y*	—	—
18	LED Driver Cut in & Cut off voltage	3.3.6	Y	—	—
19	LED Driver Efficiency	3.3.3	Y	—	—

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S.N.	Description of test	Reference Para of the specification	Type Test	Acceptance Test	Routine Test
20	LED driver Certificate from BIS	3.3.1	Y*	—	—
21	High surge Protection (Street Lights)	3.3.8 (1 & 2)	Y	—	—
22	Surge Protection (LED Bulbs & LED Tube Lights)	3.3.8 (1), 5.8 and 6.4	Y	—	—
23	System Lumen Efficacy	4.1, 5.3 & 6.3	Y	Y	—
24	3 Core wire of one meter length	3.1.6 (IS:694)	—	Y	Y
25	Beam Angle of Luminaries	6.5	Y	—	—
26	Checking of tube Light Length & Batten	5.2 & 5.17	—	Y	—
27	Type of Base for LED Bulb	6.2 (As per IS: 16102(Part.1-2012) para6.1)	—	Y	—
28	Finishing of Luminaries	4.2	—	Y	Y
29	Mounting of Luminary	4.5 & 4.14	Y	Y	—
30	Construction of Housing of Luminary	4.7 & 6.6	Y	Y	—
31	Gasket of Luminary	4.8	—	Y	Y
32	Impact Resistance of Luminary	4.9	Y	—	—
33	Checking of PCB	3.3.5	Y	—	—
34	Lux measurement	IS: 16106 2012 Para 11.0	—	Y	Y
35	Fire retardant test	UL 94-VO	Y	—	—
36	Reverse Polarity	4.12	—	Y	Y
37	Protection Against Electric Shock	3.1.14, IEC: 61373	—	Y	Y
38	Junction Temperature	3.3.7	Y	—	—
39	Working Temperature	3.1.12 IS 16105-2012, Para 4	Y	—	—
40	Wattage Measurement Test	3.2.8 & 6.1	—	Y	—
41	Insulation Resistance Test	3.1.13	—	Y	—
42	Ra (Color Rendering index) measurement test	3.2.7 (Cover under LM 80)	Y*	—	—
43	CCT(Correlated Colour Temperature)	3.2.6 (Covered under LM 80)	Y*	—	—
44	Test for IP Protection	4.6, 5.5 & 6.9	Y	—	—
45	Identification	9.0	—	Y	Y
46	Luminous Intensity Test for Signages	7.6	—	Y	—
47	Signages Board	7.4, 7.5 & 7.7	—	Y	—

Y- Lab Test Report Documents

Y*- Documents to be submitted from OEM

12.0 Guarantee: The complete luminaire/LED bulb shall have replacement guarantee for satisfactory performance and manufacturing defects for a period of 60 months from the date of commissioning or 72 months from the date of supply whichever is earlier.

Annexure - 'A'

S.N.	Description Para as per specification	Technical Requirement as per specification no. CEE/S/185/LED/12/21/Rev-0, Dec 2021	Technical parameter offered by Firm
Common Technical Parameters for All Types of LED Luminaries			
1	LED Make	NICHIA/OSRAM/SAMSUNG/LUMILEDS/CREE/SEOUL/ TOYODA GOSEI/ LG INNOTEK	
2	Lumen Output	≥140 Lumens/Watt- For High Power LED ≥110 Lumens/Watt- For Low Power LED	
3	Range of Colour Temperature	5500-6500K	
4	Colour Rendering Index	≥70- For street light and high mast fittings ≥80- For LED bulbs and LED tube light fittings	
5	Driver Type	Constant current driver with short circuit & open circuit protection. The LED driver shall be required compulsory registration as per IS:15885 (part 2/sec.-13)-2012	
6	THD (Current)	<10%	
7	Working Temperature	-10 to 50/55 deg C as per Para 3.1.12	
(A) For Street Light/High Mast Light			
(i)	System Lumen efficiency of the complete Luminary	≥110 lm/Watt (±5%)	
(ii)	Ingress Protection	IP-65	
(iii)	Surge Protection	(1) <u>Internal voltage surge protection</u> : MOV of ≥2.5 KV (on board) (2) <u>External Surge Protection Device (SPD)</u> : External surge protection of minimum 10KV to be separately installed with the each fixture (As per ANSI C 136.2- 2014).	
(iv)	Over Voltage Protection	Unit shall withstand 300 volt AC for 1 minute and cut off. It will automatically "ON" when voltage comes in operating voltage range.	
(v)	Wattage of LED Used	≥1 Watt	
(B) For Tube Light Fitting/Lamp			
(i)	System Lumen efficiency of the complete Luminary	≥100 lm/Watt (±5%)	
(ii)	Ingress Protection	IP-20	
(iii)	Surge Protection	MOV of ≥2.5 KV(on board)	
(iv)	Wattage of LED Used	<1 Watt	
(v)	LED Tube Light lamp construction	The LED tube light (lamp) shall be with inbuilt control driver and designed in such a way that driver should fitted in the LED tube light (lamp) or LED driver shall be fixed to the lamp in such a way that the driver end cap shall be detachable/ replaceable and they provide access to the driver which may be replaced if defective.	
(C) For LED Bulb (Lamp)			
(i)	Wattage of Bulb	Wattage as per Description	
(ii)	Type of Base	B22	
(iii)	System Lumen Efficacy of the Bulb	100 lm/W (±5%)	
(iv)	High Surge Protection	MOV of ≥2.5 KV(on board)	
(v)	Beam Angle of Luminary	270 deg.	
(vi)	Ingress Protection	IP-20	
(vii)	Wattage of LED Used	<1 Watt	