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Kenya Power

STREET LIGHTING ACCESSORIES — SPECIFICATION

A Document of the Kenya Power & Lighting Co. Ltd
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TITLE:
**STREET LIGHTING
ACCESSORIES -
SPECIFICATION**

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REVISION OF KPLC STANDARDS

To keep abreast of progress in the industry, KPLC Standards shall be regularly reviewed. Suggestions for improvements to approved Standards, addressed to the Manager, Standards Department, are welcome.

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Amendment Record

Rev No.	Date	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 3 Rev. 0	2019-09-02	<ol style="list-style-type: none"> 1. Cancels and replaces all other previous editions 2. Clause 4.3.2: Review the LED Lanterns rating as per table 4 & dimming program as per table 2 & 3 3. Clause 4.3.1.4: Introduce corporate colour codes 4. 4.3.1.12. Introduce thermal paste. 5. Clause 4.3.8. Review the ratings of flood lights as per table 5 6. Clause 4.3.2.4: Include programmable drivers. 7. Include LED bulbs for replacing HPS lambs 8. Clause 4.13 :Include specifications for multifunction Testing Kit 9. Appendix C: Revise the QAP from ISO 9001: 2008 to 9001:2105 10. Deleted appendix G 	Eng. S. Nguli 	H. Njenga 

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FOREWORD

This specification has been prepared by the Standards Department in collaboration with Street Lighting Section, both of Kenya Power (abbreviated as KPLC), and it lays down requirements for street lighting accessories to be used in overhead street lighting. It is intended for use by KPLC in procuring the items.

This edition, Issue 3, Revision 0, is issued to address the various requests for improvement and to incorporate feedback received from countrywide quality of materials and equipment workshops held in 2018 and 2019.

The specification stipulates the minimum requirements for street lighting accessories acceptable for use in the company and it shall be the responsibility of the suppliers and manufacturer to ensure that the offered design is of the highest quality and guarantees excellent service to Kenya Power, and exhibits good workmanship and good engineering practice in the manufacture.

This specification shall be used in conjunction with the following specifications as required:

- (i) KP1/3CB/TSP/11/022: Low voltage cartridges
- (ii) KP1/3CB/TSP/05/016 and KP1/3CB/TSP/11/032: Auxiliary and wiring cables
- (iii) KP1/6C/4/1/TSP/011/002: Specifications for Miniature Circuit Breakers(MCB)

The following are members of the team that developed this specification:

Name	Department
Eng. S Nguli	SE Standards
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1. SCOPE

- 1.1. This specification is for lighting columns and brackets made from steel including lighting columns mounted on other structures, and luminaires and their accessories.
- 1.2. This specification covers the following items:
- a) Lighting columns and brackets
 - b) Luminaires (Lanterns) and accessories
 - c) Photo electric cell units (PECU)
 - d) Streetlight Control Timers
 - e) High intensity discharge ballasts for HPS luminaires
 - f) Capacitors for HPS luminaires
 - g) Ignitors for HPS luminaires
 - h) Earth leakage circuit breakers
 - i) Lighting contactors
 - j) Control pillars (Surface and pole mounted)
 - k) LED multifunction Test kits

2. REFERENCES

The following standards contain provisions which, through reference in this text constitute provisions of this specification. Unless otherwise stated, the latest editions (including amendments) shall apply:

ISO 9001:2015	Quality management systems – Requirements
ISO 1461:	Hot dip galvanized coatings on fabricated iron and steel articles -- Specifications and test methods
IEC 62031:	LED modules for general lighting (solid state lighting) -Safety specifications
IEC 60598-2-3:	Particular requirements – Luminaires for road and street lighting
IEC 60598-2-5:	Luminaires - Particular requirements — Flood lights
IEC/PAS 62717/PNW 34A-1445:	LED modules for general lighting- Performance requirements
IEC 60662:	High Pressure Sodium Vapor Lamps specifications
IEC 61439-3:	Low-voltage switchgear and control gear assemblies
IEC 60235:	Discharge Lamps safety specifications



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- IEC 60923: Ballasts for discharge lamps (excluding tubular fluorescent lamps) Performance requirements
- IEC 60926: Auxiliaries for lamps—Starting devices: General and safety requirements
- IEC 60927: Starting devices (other than glow starters) - Performance requirements
- IEC 61048: Capacitors for use in tubular fluorescent and other discharge lamp circuits: General and safety requirements
- IEC 61049: Capacitors for use in tubular fluorescent and other discharge lamp Circuits: Performance requirements
- IEC 60947-4-1: Low voltage switchgear and control gear—Contactors and motor Starters
- IEC 61095: Electromechanical contactors for household and similar purposes
- IEC 61439: Low Voltage switchgear and Control gear assemblies
- IEC 61547: Equipment for general lighting purposes - EMC immunity
- IEC 62471: Photo biological safety of lamps and lamp systems
- IEC 62262: Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
- IEC 60898-1: Electrical accessories -Circuit-breakers for overcurrent protection for household and similar installations, Part 1: Circuit-breakers for AC operation
- EN 55014-1: Electromagnetic Compatibility –Requirements for Household Appliances, Electric Tools and Similar Apparatus –Part 1: Emission
- IES LM-80-08: Method for Measuring Lumen Maintenance of LED Light sources
- IESNA LM-58-94: Color Rendering Index and Correlated Color Temperature
- IESNA TM-16-05: IESNA technical memorandum on light emitting diode (led) sources and systems
- IESNA LM-79-08: Approved Method: Electrical & Photometric Measurement of Solid-state Lighting Products
- BS 5649: Lighting columns (All parts)
- BS 7430: Code of practice for protective earthing of electrical installations
- BS EN 1011-1 & 2: Welding. Recommendations for welding of metallic materials. —Part 1: General guidance for arc welding – Part 2: Arc welding of ferritic steels

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- BS EN 288-1 & 2: Specification and approval of welding procedures for metallic materials – Part 1: Fusion welding -- Part 2. Welding procedure specification for arc welding
- BS EN 287-1: Qualification test of welders —Fusion welding —Part 1: Steels
- ASTM B 117: Salt Spray (Fog) Testing
- KS 04 – 744: Specification for earth rods and their connectors. Part 1: Copper clad earth rods
- UL 8750-2009: Light Emitting Diode (LED) Equipment for use in Lighting Products
- IEC 61347-2-13: Lamp control gear - Part 2-13: Particular requirements for DC or AC supplied electronic control gear for LED module
- IEC 61000-3-3: Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current not more than or equivalent to 16A per phase and not subject to conditional connection

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3. TERMS AND DEFINITIONS

For the purpose of this specification, the definitions given in the reference standards shall apply.

4. REQUIREMENTS

4.1. Service Conditions

The street lighting accessories shall be suitable for continuous use outdoors in tropical areas exhibiting the following conditions:

- (i) Altitude up-to 2200m above sea level,
- (ii) Humidity of up to 95%,
- (iii) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C and
- (iv) Pollution: Design pollution level to be taken as “Heavy” (Pollution level III) for inland and “Very Heavy” (Pollution level IV) for coastal applications.
- (v) Isokeraunic levels of up to 180 thunderstorm days per year.

4.2. Lighting Columns and Brackets

The street lighting fixtures shall be mounted on any of the following structures: tubular columns, concrete poles, wooden poles or composite poles.

4.2.1. Design and Construction - Columns and Brackets

- 4.2.1.1. The design, manufacture and installation of lighting columns and brackets shall comply with BS EN 40-1 & 2; BS EN 40-3-1 and BS EN 40-3-3 (BS 5649 – relevant parts) for the design; BS EN 1991-1-4 for wind actions; BS EN 1993-1-1 for structural strength as per Table 1.
- 4.2.1.2. The design life shall not be less than 25 years, unless otherwise required by the Technical Approval Authority in accordance with BD 94/07.
- 4.2.1.3. Columns and brackets shall be designed to satisfy the relevant ultimate limit states and the serviceability limit state, including, for steel structures, meeting fatigue criteria in accordance with EN 1993-1-1 especially for:
 - (i) The flanges – at the weld throat between the column and flange; in the parent metal adjacent to the weld; any stiffening between the column and the flange
 - (ii) Door openings - at welded attachments and at poorly finished cut edges;
 - (iii) Shoulder joints - at the weld throat and in the parent metal adjacent to the weld.

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- 4.2.1.4. The dimensional requirements for lighting columns shall be in accordance with EN 40-2, Annex B. The overall dimensional limitations for the lighting brackets and columns covered by this specification shall be:
- (i) Post top columns (for floodlights) – 12m & 15m nominal height
 - (ii) Columns with brackets (for HPS and LED luminaire) 8m, 10m, 12m & 15m nominal height
 - (iii) Bracket projections - not exceeding the lesser of 0.25 x nominal height or 3m
- 4.2.1.5. The minimum thickness of structural steel sections used in column and bracket design shall be as follows:
- (i) Plates and sections other than hollow sections shall be at least 6 mm
 - (ii) Hollow sections effectively sealed by welding, other than a small drain hole with a diameter of between 10mm and 15mm shall be at least 5 mm for columns and at least 4 mm for brackets.
- 4.2.1.6. The end plates measuring 375 x 375mm shall be joined by continuous structural quality welding to BS EN 1011: Parts 1 and 2. Should there be a possibility of water entering and subsequently freezing, then drain holes shall be provided. The size of the hole shall be appropriate to the void being drained, but shall not be less than 10 mm or greater than 15 mm diameter. Hollow sections in non-corrosive or galvanized steel shall be provided with such drain holes at all low points.
- 4.2.1.7. The method of joining the base section and the shaft shall be by a swage joint with an internal centralizing washer. All welding procedures shall be in accordance with the requirements of BS EN 288 and all welders approved to the requirements of BS EN 287 with welding carried out in accordance with BS EN 1011: Parts 1 and 2.
- 4.2.1.8. Where a separate bracket is fixed to a column, the assembly of the column shaft and bracket shall incorporate a mechanical locking system using stainless steel bolts, in addition to high tensile socket headed securing screws and it shall be possible to fix the bracket in any of 4 x 90° positions relative to the door opening.
- 4.2.1.9. When correctly fixed, the design of the bracket shall not allow any movement of the bracket either vertically or horizontally with respect to the column. At the point of interconnection, the cross-section of the bracket shall, preferably, equal that of the column shaft. Brackets shall blend with their columns, in material, finish and colour and shall be as short as practicable.

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- 4.2.1.10. Base compartments shall afford easy access to cable terminations and wiring. All electrical equipment mounted in the base compartment shall be securely fixed to a 15mm minimum thickness backboard which shall be of a non-hygroscopic material of sufficient size to accommodate any control gear and cable termination units.
- 4.2.1.11. Doors, shall be sealed to minimum IP33, shall be provided with a substantial and positive, triangular-headed, tamper proof lock. The locking mechanism shall be lubricated with grease immediately following installation and if necessary prior to adoption. Two keys per 10 columns, with a minimum requirement of two keys shall be provided to the Street Lighting Engineer at time of delivery to KPLC stores.
- 4.2.1.12. The earthing terminal shall be provided for steel columns and their doors shall comprise a brass or stainless-steel bolt, size M8, complete with nuts and washers. The column shall have a cable entry slot 75mm in width.

4.2.2. Materials of Manufacture

Columns and brackets shall be manufactured from welded carbon steel tube to BS EN 10210, steel grade S355J2, with minimum tensile strength of 470-630 MPa, minimum yield strength of 355 MPa and minimum percentage elongation of 22% or equivalent as detailed below and as stated in Annex B:

- (i) Circular tubular steel manufactured from cold-formed hollow sections without heat treatment with constant shaft diameter above the base compartment
- (ii) Continuously tapered steel with either circular or polygonal cross-section

4.2.3. Protection against Corrosion

4.2.3.1. Steel columns and brackets shall be protected against corrosion at the fabricator's works by the following system:

- a) Surface preparation: the complete column and/or bracket shall be hot-dip galvanized to comply with the requirements of ISO 1461. The average coating mass shall not be less than 720 g/m², (equivalent to a nominal coating thickness of 100µm (microns) for flat articles (tubes included) and not be less than 390 g/m², (equivalent to a nominal coating thickness of 55 µm for centrifuged articles.
- b) When specified on the tender, further treatment of the galvanized surface shall then be degreased and left with a smooth finish to prepare for painting. The paint system shall comprise:
 - (i) 1st Coat - On the internal root section, to 250mm above ground level and on the overall external surfaces, one coat of Mordant Solution, T wash.

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- (ii) 2nd Coat - On the internal root section, to 250mm above ground level, one coat of modified vinyl micaceous iron oxide with high solids to give a high build coating colour grey to provide a minimum dry film thickness of 60 μm .
- (iii) 3rd Coat - On the external surface overall, one coat of two pack high build epoxy zinc phosphate primer, light grey to provide a minimum dry film thickness of 75 μm
- (iv) 4th Coat - On the external root section to 250mm above ground level, one coat of modified vinyl micaceous iron oxide with high solids to give a high build coating, coloured grey to provide a minimum dry film thickness of 75 microns.
- (v) 5th Coat - On the external surface overall, one coat of modified vinyl with high solids to give a sheen finish to the dried film colour grey from BS 4800 shade 18B25 to provide a minimum dry film thickness of 60 microns. A line on the circumference of the base section shall denote ground level. The minimum dry film thickness shall be:
 - Root - 60 μm (internal) 210 μm (external to 250mm)
 - External - 135 μm (from 250mm)

4.2.3.2. In general, galvanized steel columns shall be left unpainted; however, where columns require painting the developer shall submit details of the proposed paint system to be used to the Chief Engineer, Street Lighting for approval before undertaking any work

Table 1: Technical particulars of the columns and brackets as per EN 40

Particulars		Requirements
Performance under vehicle impact (Impact tested at km/h)	Untested	Class 0
	Tested	100:NE:3
Partial load factor class		B
Deflection class		3
Maximum wind velocity withstands, m/s		26
Maximum luminaire weight, Kg.	>10m	20
	<10m	10
Maximum luminaire windage, m ²		0.25
Minimum terrain category		II

4.2.4. Marking and Labeling of Columns and Brackets

4.2.4.1. All columns and brackets shall carry a unique identification mark which indicates:

- (i) The name or symbol of the manufacturer,
- (ii) Year of production and manufacturer's batch number.

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(iii) Standard of manufacture

(iv) The identification mark shall be permanent, legible and clearly visible and shall be located within the base compartment of the column.

4.2.4.2. There shall be a CE marking with the following mandatory requirements

(i) Resistance to horizontal loads (type of verification i.e. testing (T) – EN 40-3-2 or calculation (C)- EN 40-3-3; (ii)Reference wind velocity;

(ii) Windage area;

(iii) Weight at top

(iv) Deflection class;

(v) Terrain category if different to II.

4.2.5. Sizes of Columns and Brackets

4.2.5.1 Street Lighting Columns Complete with Bracket

4.2.5.1.1. The columns shall be tubular column flange plated complete with various bracket arrangements.

4.2.5.1.2. The sizes shall be 8m, 10m, 12m and 15m with their brackets having projection lengths of 0.45m, 1.0m, 1.5m, 2.0m, 2.5m and 3.0m and shall be specified in the tender.

4.2.5.1.3. All columns shall have a root for planting to a depth shown by the middle range as stated in Clause 5 of Part 2 of BS 5649 and Annex B as follows:

(i) The columns shall have a root for planting to a depth 1200mm, 1500mm, 1700mm and 2,000mm for 8m, 10m, 12m and 15m columns respectively.

(ii) The columns shall have a cable entry slot of 65mm x 150mm with the top of the slot 500mm below ground level or provisions for fixing insulators as applicable.

4.2.5.1.4. Flange Plated columns shall have a flange plate.

4.2.5.2 Street Lighting Bracket without Columns

4.2.5.2.1. The brackets (lighting heads) without columns shall be classified in the following categories and the KPLC requirement shall be specified in the tender:

(i) Outreach brackets for lighting columns for mounting on columns:

a) Single straight or curved brackets

b) Double straight or curved brackets

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(ii) Curved outreach brackets for wood, concrete or composite pole mounting;

(iii) Circular floodlight brackets for mounting on columns and masts:

- a) 4-way circular brackets
- b) 6-way circular brackets

4.2.5.2.2. The outreach brackets shall be designed; manufactured and tested in accordance with clauses 4.2.1, 4.2.2, 4.2.3 and 4.2.4 of this specification and shall have the following projection lengths: 1.0m, 1.5m, 2.0m, 2.5m, 3.0m

4.2.5.2.3. The circular floodlight brackets shall be suitable for top post mounting on the 12m steel columns and shall have dimensions matching with the columns. The spigot lengths shall have fixing diameters matching with that of the 12m columns. The spigot shall be fixed using four (4) stainless steel bolts properly spaced for stability after fixing. The diameters of circular floodlight brackets shall not be fixed but vary from 0.9-1.15m for 4-way and 1.15-2.0m for 6-way brackets.

4.3. Luminaires (Lanterns)

4.3.1. General Design and Construction

- 4.3.1.1. Luminaires (lanterns) in this specification shall include High Pressure Sodium (HPS), Light Emitting Diode (LED) and Floodlight lanterns (LED & HPS) complete with their control gear. The luminaire shall include the reflector, the refractor, and the housing.
- 4.3.1.2. The luminaires shall be manufactured to IEC 60598-1 and IEC 60598-2-3 standards and shall incorporate an efficient optical system to direct the light onto the highway to ensure minimum environmental pollution of the night sky of the upward light emitted. Luminaires will be specified with due consideration of the Institution of Lighting Professionals Guidance Notes for the Reduction of Obtrusive Light and shall be of the side entry type.
- 4.3.1.3. All luminaires shall be constructed from LM5 marine grade aluminum with a polyester powder coating, grey, silver or black, over a Restriction of Hazardous Substances (ROHS) directive, compliant chrome passivation substrate; the polyester powder coat finish that shall withstand the standard cut tests as defined in ISO 2409.
- 4.3.1.4. The final colour of the luminaire shall be alternate strips of blue(pantone 288c), yellow (pantone 7406)and white to represent KPLC corporate colours
- 4.3.1.5. The colours shall be resistant to environmental conditions specified in clause 4.1and shall not faint.

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- 4.3.1.6. Luminaires shall have an integral flexible mounting system and be capable of being mounted 42mm to 60mm diameter side entry. The bolts provide shall be a minimum of 40mm in length to provide proper grip of the lantern to the bracket.
- 4.3.1.7. Luminaires shall be environmentally friendly and all component parts shall be 98% recyclable at the end of life.
- 4.3.1.8. Bowls/protectors shall be vandal resistant and stabilized to minimize loss of transparency due to weathering and exposure to ultra violet light. The efficiency of the light transmission system shall be declared.
- 4.3.1.9. Fully assembled luminaires shall weigh 10kg maximum, with a maximum windage of 0.14m² and impact rating shall be IK08 minimum in accordance with IEC 62262.
- 4.3.1.10. The luminaires shall have double insulation with a protection class of at least class II in accordance with IEC 60598-1 and the luminaire optical system and the control gear compartment shall have a minimum protection rating of IP66 in accordance with IEC 60529.
- 4.3.1.11. Luminaires shall be reasonably weather and dust-proof and shall be fitted with a suitable gasket (heat resistant silicone rubber) between the body of the lantern and the bowl. The IP Rating of the lantern shall not be less than IP 66 in accordance with IEC 60529.
- 4.3.1.12. A thermal paste shall be put between the PCB board and the heat sink to enhance heat dissipation and increase life of chips. This shall be demonstrated in the drawings submitted for evaluation and during FAT.
- 4.3.1.13. Luminaires shall be self-cleaning and be designed to prevent jamming injuries during installation and be free of sharp edges. Luminaires shall be designed to prevent the supply cable being damaged during installation.
- 4.3.1.14. Luminaires shall have integral control gear and an option to retrofit proprietary front and/or rear shields, which shall reduce unwanted spill. The colour of the shields shall match the luminaire.
- 4.3.1.15. Photometric data shall be based on test results from a verified laboratory using absolute photometry in accordance with methods and conditions detailed in IESNA LM-79-08 or equivalent.
- 4.3.1.16. The bowl or other component giving access to the interior of the lantern shall, when in a closed position, be firmly attached to the body of the lantern; in the open position it shall be attached in such a way that there is no likelihood of it becoming accidentally detached.

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- 4.3.1.17. All hinges, toggle catches, captive screws and nuts shall be made of non-corrosive material. A proof (salt and fog spray Type Tests) of the same shall be submitted for purposes of tender evaluation.
- 4.3.1.18. The optical equipment controlling distribution shall include prismatic refractors and these shall have a smooth exterior surface or be protected by hermetically sealed cover plates to prevent any accumulation of dirt and to facilitate cleaning. Refractors wholly within a totally enclosed lantern need not be sealed.
- 4.3.1.19. All luminaires shall be fitted with integral control gear and have a heat barrier between the lamp enclosure and gear compartment. The control gear shall be fitted to a tool-less, quick release gear tray, equipped with a plug and socket connector for ease of maintenance or replacement purposes.
- 4.3.1.20. Electrical equipment shall be installed so that levels of radio interference given in IEC 55014-1 are not exceeded.
- 4.3.1.21. Luminaires shall be securely fitted to bracket arms or columns and the lamp and all parts affecting the photometric performance shall be in a clean condition and correctly orientated.
- 4.3.2. LED Luminaires Complete with Control Gear**
- 4.3.2.1. The LEDs luminaires shall fully comply with the provisions of clause 4.3.1 and it shall be designed, manufactured and tested in accordance with IEC 60598-2-3, LED safety shall conform to IEC 62031 and IEC 62035 with performance requirements complying fully with provisions of IEC/PAS 62717 and PNW 34A-1445.
- 4.3.2.2. The LEDs & LED Modules-Drivers shall comply with IEC 61000-3-2, IEC 61347-2-13, IEC 61000-3-3, IEC 61347-1, IEC 61347-2-1, IEC 61347-2-8, IEC 61347-2-9, IEC 60921 and IEC 60923 and subsequent amendments as appropriate and be tap selected to specified operating voltage.
- 4.3.2.3. All LED drivers shall be contained within the lanterns housing and shall have a voltage range of $230 \pm 10\%$, 50Hz with other ratings as per Table 2.
- 4.3.2.4. The LED drivers shall be standalone programmable or constant current. The type to be procured with the LED luminaire or for retrofitting shall be specified in the tender.
- 4.3.2.5. The LED drivers shall be housed in a separate gear compartment from LED modules. The driver shall have a minimum operating efficiency of 95%.
- 4.3.2.6. The driver shall be independently tested and certified in accordance with IEC 60598-1 and IEC 60598-2-3 by an independent approved body recognized standardization body and current validation certification must be provided during tender for evaluation.

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4.3.2.7. The energy saving of the LED drivers shall be demonstrated by calculation and the same be submitted with the bid for evaluation.

Table 2: Technical parameters of the LED drivers

Technical parameter	Units	Value
Nominal Input Voltage	Vac	200-253
Input voltage(operational Safety)	Vac	90-300
Input frequency	Hz	50
Power Factor	%	≥98
Efficiency	%	≥90
Harmonic Distortion	%	≤20
Output Voltage	Vdc	72-214
Output power	W	75-150
Output Current	A	0.3-1.05
Diming Range	%	20-100

4.3.2.8. The program specified in clause 4.3.2.4 shall be factory set as per table 3

Table 3: LED Drivers Default Program

Location: Nairobi, GMT+3

S/N	Time	% power output
1	18.30	ON(100)
2	22.30	80
3	23.30	60
4	00.00	50
5	05.00	80
6	06.30	Off

Note. The above program shall be documented for evaluation and demonstrated during FAT.

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- 4.3.2.9. The driver shall be tested in accordance with NEN-EN-IEC62471 (2006-07) for Photo-Biological Safety and shall comply with Group 1 classification; current validation must be provided.
- 4.3.2.10. All terminals shall be shrouded to IP2X so that live parts cannot be accidentally touched. They shall be fitted with group 1 classification; current valid certification must be provided.
- 4.3.2.11. Drivers shall be compatible with all other components including LED and Photo-Electric Control Units (PECU) with a stable power consumption over full operating voltage range.
- 4.3.2.12. Drivers shall indicate all wiring connections and operating voltages via indelible markings in accordance with IEC/PAS 62717 and PNW 34A-1445. This shall be confirmed at the time of acceptance.
- 4.3.2.13. The LED driver shall be protected against overheating by an over-temperature sensing system and with a Total Harmonic Distortion (THD): $\leq 20\%$ and shall comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards. The drivers shall have a ROHS compliance marking.
- 4.3.2.14. LED flux and luminaire data shall be presented for an ambient temperature of 150° C and the light source data shall be measured at a junction temperature of 250° C. This shall be submitted for purposes of tender evaluation.
- 4.3.2.15. The LED module efficacy shall not be less than 90% of the rated LED module efficacy as declared by the manufacturer in accordance with clause 8.3 of IEC/PAS 62717.
- 4.3.2.16. Colour correlated temperature (CCT) of the LED's shall be equal to or greater than 4000K (Kelvin) and tolerances beyond a 5 step MacAdam ellipse shall not be acceptable as per Table 5 of IEC/PAS 62717 Part PNW 34A-1445.
- 4.3.2.17. Each LED shall be mounted beneath an individual lens providing photometric footprint base on an overlay methodology and mounted within a self-contained module (LED module) that can be removed, replaced using simple tools and lenses and manufactured from optical grade polycarbonate or PMMA (polymethyl methacrylate) acrylic thermoplastic.
- 4.3.2.18. In order to maximize opportunities for KPLC to benefit from advances in LED technology and product developments, the proposed equipment shall be flexible and allow for easy installation of upgrades and replacements.
- 4.3.2.19. The system power factor shall be greater than 0.95 at full power.
- 4.3.2.20. All LED luminaires shall be supplied fully assembled in all respects with LED and photo electric control unit at 70/35 lux.

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- 4.3.2.21. The LEDs shall be of Hi-flux/Hi-power pure white LEDs producing a minimum of 90% of initial intensity at 50,000 hours of life / 5year minimum. This shall be demonstrated by calculation assuming 12hours running per day and the same submitted with tender for evaluation.
- 4.3.2.22. The LEDs shall be 100% mercury and lead free.
- 4.3.2.23. The LEDs micro-lens systems shall be of full cut-off type, producing IESNA Type 2 or Type 3 light distributions. The Luminaire shall produce 0% total lumens above 90 (BUG Rating, U=0). The BUG rating shall be B2 U0 G2.
- 4.3.2.24. The LED luminaires with LED arrays shall have a 5-year limited warranty covering the LED arrays and LED drivers.
- 4.3.2.25. The LED and LED Modules-Drivers shall comply with the following minimum system performance criteria and a proof of the same shall be submitted together with the tender for evaluation:
- i. The T_c life shall be + 65°C,
 - ii. The LEDs shall have a system lifetime @ T_c life (min 90%) of at least 50,000 hrs
 - iii. The T_c min shall be at least - 20 °C (start up at - 40°C)
 - iv. The T_c max shall be + 75 °C
 - v. The T_c thermal cutoff module shall be + 75°C (starts dimming)
 - vi. The T_c thermal cutoff driver shall be + 85°C (maximum dimming)
 - vii. The input voltage shall be 230V±10%
 - viii. Shall be suitable for at least insulation protection class I.

Table 4: LED Performance Ratings (LM- 80)

Input Power (W)	Minimum efficacy Lm/W	Power Factor	Minimum Lumens (Lm), min at 25 °C (±5%)	Minimum lumens after all losses (Measured after steady state) (±5%)
80	≥165	≥0.95	13200	9900
90	≥165	≥0.95	14850	11200
100	≥165	≥0.95	16500	13400
110	≥165	≥0.95	18150	13600
120	≥165	≥0.95	19800	14850

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Notes: (i) The wattage of the LED lantern to be procured shall be specified in the tender.

(ii) Over driving the chips shall not be accepted.

(iii) The above parameters shall be demonstrated by calculation submitted with bid for evaluation and during FAT.

(iv) Type Test report as per LM 80 shall be submitted to support the offer.

4.3.2.26. All LED luminaires shall be shall be indelibly and permanently marked as per the respective manufacturing standard requirements on marking (including serial number) and also with the following words: **“PROPERTY OF G.O.K/INSTALLED BY KPLC”**. This marking and serial number shall be available in bar code readable mode permanently engraved on the LED lantern. The height of the letter shall be a minimum of 10mm and width of 2mm so as to be reader from the ground.

4.3.2.27. This shall also be in a bar code readable by the standard bar code reader.

4.3.3. Protection of the LED Drivers

4.3.3.1. Short Circuit Protection

The average value of input power shall be less than 10W when the output rail shorts, the power supply shall be self-recovery when the fault condition is removed.

4.3.3.2. Output Over Voltage Protection

Output voltage is $230 \pm 10\%V$, the power supply shall be output over voltage protect model, should restart power supply when fault condition is removed. This shall by means low voltage of surge arrestor of minimum impulse rating of 6/10 kV.

4.3.3.3. Over Temperature Protection

When the temperature of power supply enclosure is over $85^{\circ}C$, the output of power supply shall decrease. Output current is limited in 30% (typ.). Meet the demand of double 85, at the maximum operation temperature $125^{\circ}C$, operate two hours and do not damage.

4.3.4. Electromagnetic Compatibility Standards (EMC)

The driver shall comply with IEC 61000-3-2, IEC 61547 and IEC 61000-3-3 EMC standards and the requirements of this specification.

4.3.5. Safety requirements (at $25^{\circ}C$)

4.3.5.1. The Grounding Resistance when a current of 25A is applied for 60s, the measured grounding resistance is shall be less than 0.1Ω .

4.3.5.2. Leakage Current when a voltage of 230Vac/50Hz is applied shall be less than 0.75mA.

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4.3.5.3. When a voltage of 500V DC is applied at to each port of Input to output, input to GND, output to GND for at least 60s, the insulation resistance shall be at least 50MΩ.

4.3.5.4. The Surge Immunity shall be as follows:

- (i) L line to N line is 4000V,
- (ii) L line to earth is 6000V,
- (iii) N line to earth is 6000V.

4.3.6. **Reliability**

4.3.6.1. Mean Time Between Failure (MTBF) shall be at least 200,000 hours under 25°C ambient temperature, 230VAC input, and 80% load.

4.3.6.2. The Life Time Qualification (Tc) shall be at least 50, 000 hours, under 45°C case temperature, 230VAC input, and 80% load.

4.3.6.3. The Tc reliability shall be demonstrated by calculation and submitted with tender for evaluation.

4.3.6.4. Maximum Case Temperature Tc: Under 60°C ambient temperature, 115VAC input and maximum load, the maximum case temperature is 85°C .

4.3.6.5. Vibration: 10 to 500HZ Sweep at constant acceleration of 1.0G (depth: 3.5mm) for 1 Hour for each of the perpendicular axes X, Y, Z.

4.3.6.6. Drop Test: Ten times 60cm drop test with one angle three edges and six face of complete package, package shall not damage, product function and dielectric strength should meet the requirement.

4.3.7. **Markings**

4.3.7.1. The driver shall have all the technical parameters and certification it complies to legibly permanently marked on it

4.3.7.2. The following additional markings shall be indelibly and permanently marked on the driver as per the respective manufacturing standard requirements on marking (including serial number) and also with the following words: "**PROPERTY OF G.O.K /INSTALLED BY KPLC**". This shall be available in a bar code readable mode permanently engraved on the LED lantern.

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4.3.8. LED Floodlighting Luminaires

4.3.8.1. General

- 4.3.8.1.1. The LEDs luminaires shall fully comply with the provisions of clause 4.3.1 and 4.3.2.1-4. The luminaire shall be designed for aggressive ambient conditions including salt mist and high humid environments. The manufacturer shall have test records showing the successful completion of a 2500-hour salt spray test of the luminaire.
- 4.3.8.1.2. All external screws, bolts, washers etc. shall be of V4A (1.4401) or equivalent stainless-steel. The bracket shall enable a stepless tilting of the floodlight.
- 4.3.8.1.3. The floodlight luminaire shall have a low profile to minimize the structural load. The luminaire shall have a wind load lower than 0.1 m² at 0° tilting angle.
- 4.3.8.1.4. Optional powder coating of aluminum shall be available for extreme conditions, with 500 hour salt spray test as defined in ASTM Standard B 117

4.3.8.2 Tilt Angle

- 4.3.8.2.1. The tilt angle of the luminaire in normal operation shall not exceed 15° to avoid light pollution and glare towards the road users as per IESNA LM-79-08 standards.
- 4.3.8.2.2. The ULR (Upward Light Ratio) value shall be 0.0% eliminating light pollution and wasted energy costs.

4.3.8.3 Protection

- 4.3.8.3.1. The floodlight shall have a minimum ingress protection rate of IP65 in accordance with IEC 60529. The luminaire shall not require cooling fins (finned heat sinks) to avoid dirt collection resulting in a reduction of the cooling capacity and reduced life of the LEDs.
- 4.3.8.3.2. All optical and electronic components shall be protected by a single layer hardened glass cover with a minimum transmission factor of 95%.
- 4.3.8.3.3. All cables inside the floodlight shall have two (2) protective layers (double-insulated).

4.3.8.4 LED Flood Lighting Units

- 4.3.8.4.1. The floodlight shall be composed of individual replaceable LED lighting units. The optical part shall be made of high-transparent, non-yellowing PMMA.
- 4.3.8.4.2. In case of partial default the system can be replaced in parts. The replacement of an LED lighting unit shall be via a plug connection requiring no special tools or on-site wiring.

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4.3.8.4.3. To enable efficient spare parts management, the LED lighting units shall be interchangeable with the manufacturer's other LED lighting products for applications including service roads, parking areas etc.

4.3.8.5 Built in Redundancy

4.3.8.5.1. The floodlight shall be equipped with a multi-layer optical system that ensures equal uniformity at the reference surface in the event of partial failure of the lighting system. A single LED lighting unit failure shall never result in a decrease below the uniformity value of 4:1 ratio required by CIBSE standards.

4.3.8.5.2. The manufacturer shall be able to demonstrate via lighting calculations and false colour rendering drawings that even by turning OFF 50% of the floodlight luminaires, the lighting system still meets the 4:1 uniformity ratio required by CIBSE standards.

4.3.8.6 Hot Restrike (Instant On)

In the event of power failure, each floodlight shall be at full light output when the power returns. Full light output power must be reached within one (1) second. No additional equipment shall be required to be installed such as hot restrike equipment.

4.3.8.7 Control

The floodlight shall include an LED driver capable of controlling the luminaire via either an industry standard DALI (Digital Addressable Lighting Interface) or a 1-10V control interface.

4.3.8.8 Surge Protection



The floodlight shall include an integrated two (2) stage surge protection system to protect the electronic driver (1st stage) with a minimum surge protection rating of 10KV and the LED lighting units (2nd stage) with a test Class II surge protection in accordance with IEEE/ANSI C62.41.2.

4.3.8.9 Colour Rendering Index

The floodlight shall have a minimum colour rendering index (Ra) of 80 and a colour temperature minimum of 4,000 K for maximum efficiency in accordance with IESNA LM-58-94.

4.3.8.10 Operational Life Expectancy

The floodlight shall have a lifetime (MTBF - Mean Time Between Failures) of 50,000 hours (L70). The lumen output shall not drop below 70% of the initial output during this period. This shall be demonstrated by calculation and the same submitted for tender evaluation.

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4.3.8.11 Compliance and Rating

- 4.3.8.11.1. The floodlight shall enable for CIBSE compliant illuminations. The manufacturer shall be ISO 9001 and ISO 14001 certified.
- 4.3.8.11.2. The luminaire shall allow an optimal maintenance with reduced recycling and related costs. The floodlight shall have the performance ratings as per Table 5:

Table 5: LED floodlight performance ratings in accordance with LM 80

LED Input Power	Minimum Lumen Efficacy, Lm/W	Power Factor	Rated Lumen (Lm) at 25°C (±5%)	Measured Lumens Output after loses(measured at steady state) ±5%
120	≥165	≥0.95	16500	11500
150	≥165	≥0.95	27000	17250

- Notes: (i) The wattage of the LED flood light to be procured shall be specified in the tender*
- (ii) Over driving the chip shall not be acceptable.*
- (iii) The above parameters shall be demonstrated by calculation and submitted with bid for evaluation and during FAT.*
- (v) Type Test report as per LM 80 shall be submitted to support the offer.*

4.3.8.12 Certifications

- 4.3.8.12.1. The LED floodlight shall be CE certified and all components shall be ENEC and UL certified. The floodlight shall allow the roadways to reduce energy consumption and CO₂-emission significantly.
- 4.3.8.12.2. The LED floodlight shall have a photo biological certificate in compliance with IEC 62471 validating the safety of the LEDs and shall not be classified higher than “Exempt Risks”.
- 4.3.8.12.3. The LED floodlight shall be RoHS compliant.
- 4.3.8.12.4. All LED Floodlighting luminaires shall be indelibly and permanently marked as per the respective manufacturing standard requirements on marking (including serial number) and also with the following words: **“PROPERTY OF G.O.K /INSTALLED BY KPLC”**. This marking and serial number shall be available in bar code readable mode permanently engraved on the LED floodlight lanterns

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4.3.9. High Pressure Sodium Luminaires Complete with Control Gear

4.3.9.1 General Requirements

4.3.9.1.1. High Pressure Sodium (HPS) luminaires shall comply with IEC 60598-2-3, IEC 60235 and IEC 60662 for the lamps with all the luminaire qualities described in clause 4.3.1.

4.3.9.1.2. It shall have EC Declaration mark to ascertain conformity and a certificate shall be provided by the bidder during tender for confirmation.

4.3.9.2 Specific requirements

4.3.9.3.1. High pressure sodium (HPS) luminaires shall be of the "Plus" type with higher xenon pressure for increased lm/W.

4.3.9.3.2. The HPS luminaire shall have a means of supporting the lamp so designed that the position of the lamp in the lantern relative to any optical equipment remains substantially the same under all conditions of service and throughout the life of the lantern.

4.3.9.3.3. HPS luminaires shall be fitted with a porcelain terminal block, earth terminal, cable clamp and lamp holder ready wired to connector block with heat resisting type cable.

4.3.9.3.4. The construction shall be sturdy and robust with as few welds as possible in order to reduce the risk of early failures due to external shock and vibration during transportation and installation.

4.3.9.3.5. The ballasts specification shall be as per clause 4.7 and shall be approved for use under the Balancing and Settlement Code (BSC) Unmetered Supplies Arrangements and shall have all necessary UMSUG codes.

4.3.9.3.6. The ballasts used in the luminaire shall comply with IEC 61000-3-2, IEC 61347-2-12, IEC 61000-3-3:2001, IEC 61347-1, IEC 61347-2-1, IEC 61347-2-8, IEC 61347-2-9 and IEC 60921 or IEC 60923 as appropriate and be tap selected to the specified operating voltage of the network.

4.3.9.3.7. The minimum performance criteria of HPS Luminaire shall be as per Table 6.

4.3.10. High Pressure Sodium (HPS) Floodlight Luminaires Complete with Control Gear

4.3.10.1. The High-Pressure Sodium (HPS) flood lights units shall be designed manufactured and tested in accordance with IEC 60598-2-5 and shall have all the luminaire qualities described in clause 4.3.1. It shall be of rated voltage/frequency of 220-250V, 50HZ.

4.3.10.2. Floodlight luminaires shall be fitted with a porcelain terminal block, earth terminal, and cable clamp and lamp holder ready wired to connector block with heat resisting type cable.

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Table 6: Minimum Performance Criteria of HPS Luminaire

High Pressure Sodium Lamps	Rated Luminous Efficacy lm/W (100hrs), min	Lumens Lm/min	LSF @ 16,000 hrs	LLMF @ 16,000hrs	Correlated Colour Temp. Tc (K)	Colour Rendering (Ra)
150W	140	21000	0.96	0.94	2170	≥ 70
250W		35000				≥ 70

- 4.3.10.3. The HPS floodlight luminaires shall be compact in size, attractively styled contemporary design, rugged and dependable, easy to install and service.
- 4.3.10.4. The HPS floodlight luminaires shall have a built-in control gear complete with 400W HPS lamps described in clause 4.4, with a separate one (1)-piece housing for control gear and one (1)-piece lens cover.
- 4.3.10.5. The HPS floodlight luminaires shall be secured by four 6.35mm (1/4") diameter captive stainless steel slotted hex-head bolts.
- 4.3.10.6. The HPS floodlight luminaires shall have thermal shock and impact resistant glass lens sealed with heavy duty, high temperature silicone rubber gasket, firmly seated.
- 4.3.10.7. The HPS floodlight luminaires shall have a heavy-duty mogul-base porcelain socket with heavy gauge brass, nickel-plated, double lamp-grip screw shell and spring-loaded center contact.
- 4.3.10.8. The HPS floodlight luminaires shall have a compound parabolic, double segment, finished aluminum reflector for optimum efficiency.
- 4.3.10.9. The HPS floodlight luminaires shall be for pole mounting, built-in slip-fitter, for internal wiring, adjustable laterally and vertically, with bronze polyester finish.
- 4.3.10.10. The HPS floodlight luminaires shall have a high-pressure aluminum die-cast housing with a high purity anodized hammered finish aluminum reflector.
- 4.3.10.11. The HPS floodlight luminaires shall have a frameless thermal resistant tempered glass and a steel mounting bracket coated with epoxy powder

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4.3.10.12. The ballasts specification shall be as per clause 4.7 and shall be approved for use under the Balancing and Settlement Code (BSC) Unmetered Supplies Arrangements and shall have all necessary UMSUG codes.

4.3.10.13. The ballasts shall comply with IEC 61000-3-2, IEC 61347-2-12, IEC 61000-3-3:2001, IEC 61347-1, IEC 61347-2-1, IEC 61347-2-8, IEC 61347-2-9 and IEC 60921 or IEC 60923 as appropriate and be tap selected to the specified operating voltage of the network.

4.4. High Pressure Sodium (HPS) Lamps

4.4.1. The HPS lamps shall be designed manufactured and tested in accordance with IEC 60662 and shall comply with the safety requirements of IEC 62035 with the HPS Lamp technical characteristics as per Table 7.

4.4.2. High pressure sodium (HPS) lamp shall be of the single arc-tube type to ensure the light source is always at the center of the luminaire optic for consistent photometric performance. Elements within the lamp construction shall not give rise to shadows cast.

4.4.3. The HPS lamp shall be so designed that its performance is reliable in normal and accepted use.

4.4.4. High pressure sodium lamp shall incorporate a solid-state getter with clear lamp bases (getter - blackened lamp bases shall not be accepted).

4.4.5. High pressure sodium (HPS) lamp shall be of the single arc-tube type to ensure the light source is always at the center of the luminaire optic for consistent photometric performance. Elements within the lamp construction shall not give rise to shadows cast.

4.4.6. Lamp starting shall be with external igniter. The circuit connections for lamp starting shall be such that the pulse is applied to the lamp through the eyelet terminal of the cap and with the shell substantially at earth potential.

4.4.7. The lamps shall be clear and tubular with the cap on finish of type E39 for 150W lamp and E40 for 250W & 400W and shall comply with IEC 60061-1.

4.4.8. The dimensional values for outlines of E40 capped lamps shall as per Table L.2 of IEC 60662 and the dimensional values for outlines of E39 capped lamps shall as per Table L.2 of IEC 60662.

4.4.9. Mechanical acceptance of the lamp cap and adjoining part of the lamp neck in the holder shall be ensured by compliance of the lamp with the gauges for testing contact-making as given in IEC 60061-3.

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Table 7: HPS Lamp Technical Characteristics

Sr. No	Particulars	150W	250W	400W
1	Nominal wattage, W	150	250	400
2	Circuit	With external ignitor		
A	Starting and warm-up characteristics - Starting			
1	Test voltage (r.m.s.), V _{max}	198	198	198
2	Starting time, s	5	5	5
3	Pulse characteristics			
4	Height (peak) A, V	2,500	3,300	3,300
5	Width T ₂ at 50 % of A, μs	1.0	2.0	2.0
6	Repetition rate	1/half cycle	1/full cycle	1/full cycle
7	Phase angle, °	90	90	90
B	Starting and warm-up characteristics - Warm-up			
1	Test voltage, V	198	198	198
2	Time required to reach 45 V minimum at lamp terminals, min	5	7	7
C	Electrical characteristics			
1	Wattage, W	148	245	380
2	Voltage (r.m.s.) at lamp terminals, V	90	85-115	85-115
3	Current (r.m.s.), A	2.0	2.95	4.5
4	Extinguishing voltage r.m.s., V	111	120	125
D	Photometric characteristics			
1	Correlated colour temperature (nominal), K	2170	2,170	2,170
2	Chromaticity co-ordinates	-	0.510/0.420	0.510/0.420
3	Colour rendering index Ra (nominal)	-	≥70	≥70

4.4.10. All high-pressure sodium (HPS) lamps shall be indelibly and permanently marked as per the respective manufacturing standard requirements on marking (including serial number) and also with the following words: “**PROPERTY OF G.O.K /INSTALLED BY KPLC**”. The height of the letter shall be a minimum of 10mm and width of 2mm so as to be reader from the ground.

4.4.11. This shall also be in a bar code readable by the standard bar code reader.

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4.5. **LED bulbs**

4.5.1. The LED bulbs shall be used for retrofitted into HPS lamps enclosures when the latter is used up.

4.5.2. The LED bulbs shall be designed manufactured and tested in accordance with EN 13201 and shall comply with the safety requirements of ROHS

4.5.3. The LED bulbs shall be soft start (self-ballasted). The light source is always at the center of the luminaire optic for consistent photometric performance. Elements within the lamp construction shall not give rise to shadows cast.

4.5.4. Technical parameters

Table 8: LED Bulbs Technical Characteristics

Sr. No	Particulars		
1	Nominal wattage, W	100	150
2	Input voltage (r.m.s.), Vac ,50Hz	120-277	120-277
3	Total lumens measured(Lm) @ 25°C, ±5%	≥14000	≥21000
4	Total lumens measured at steady state(Lm) ±5%	≥11000	≥16500
6	Efficacy (L/W)	140	140
7	Light degree	360	360
8	Dimensions mm	334x 120	
9	Operating temperature	≥70°C	
10	PFC	≥90	
11	Housing	PC+Al	
12	Housing colour	White +gun- colour	
13	cover	High transparent Protective cover	
Photometric characteristics			
1	Correlated colour temperature (nominal), K	≥5000	≥5000
2	Colour rendering index Ra (nominal)	≥80	≥80

Note: Samples of the LED bulbs shall be submitted with tender for tender evaluation

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- 4.5.5. They shall have in built surge suppression and protection (same requirement as clause 4.3.3.2 above) suitable for closed fixtures.
- 4.5.6. The LED bulb shall be so designed that its performance is reliable in normal and accepted use.
- 4.5.7. The LED bulb power factor shall be greater than 0.97 at full power.
- 4.5.8. The LED bulbs shall be tubular with the cap on finish of type E39 (screw type)
- 4.5.9. The LED bulbs shall be of Hi-flux/Hi-power pure white LEDs producing a minimum of 90% of initial intensity at 50,000 hours of life / 5year minimum.
- 4.5.10. The LED bulbs shall be 100% mercury and lead free.
- 4.5.11. All LED bulbs shall be indelibly and permanently marked as per the respective manufacturing standard requirements on marking (including serial number) and also with the following words: **“PROPERTY OF G.O.K /INSTALLED BY KPLC”**. The height of the letter shall be a minimum of 10mm and width of 2mm so as to be reader from the ground.
- 4.5.12. This shall also be in a bar code readable by the standard bar code reader.

4.6. Photo Electric Cell Unit (PECU)

4.6.1. General

- 4.6.1.1. All Photo Electric Cell Units (PECUs) shall conform to BS 5972 and be manufactured under the QA System and Procedures of BS 5750, ISO 9002 or EN 29002 with the technical characteristics as per Table 9.
- 4.6.1.2. All PECU shall be suitable for mounting at 5m and/or 6m and be of the miniature type fitted to the lantern with conduit thread fixing.
- 4.6.1.3. All PECU shall be guaranteed for a minimum life of 6 years from the date of manufacture and this date shall be clearly marked on the unit.
- 4.6.1.4. All PECU shall provide Class 2 protection against electric shock, with a minimum enclosure protection rating of IP65 to IEC60529.
- 4.6.1.5. The PECU shall be classified in the following classes:

4.6.2. Type I – Ordinary PECU

- 4.6.2.1. Type I PECU shall operate on 230V±10%, 50Hz AC and shall be capable of switching discharge lighting load of upto1000W high pressure sodium lamps or up to 400W LED

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luminaires with a pre-set switch on/off level of 35/18 lux and a negative switching differential of 1: 0.5

- 4.6.2.2. Type I PECU shall incorporate a time delay circuit to ensure lamps are not switched on by transient changes of luminance; the delay shall be between 15 and 30 seconds.
- 4.6.2.3. Type I PECU shall be designed to fail in the ON position, such that in the event of a fault in the cell, the controlled lights will switch on.
- 4.6.2.4. Type I PECU shall be switched by a relay assisted by a triac or a synchronous switch method and be fully solid state with switching activated by a filtered silicon photo diode to match the CIE photopic response.
- 4.6.2.5. A method of ensuring that the load remains switched to the on state must be provided in the event of an overload destroying the device.
- 4.6.2.6. Type I PECU shall have zero drift over its guaranteed life, have a power consumption not exceeding 0.5W under load conditions and be capable of operating within a temperature range of -20°C to +80°C, comply with European EMC Emission Directives and conform to BS 2011 in respect to vibration.
- 4.6.2.7. Photoelectric control shall fit an EEI/NEMA standard 3-terminal polarized twist lock type receptacle and shall be furnished complete with a neoprene receptacle gasket.
- 4.6.2.8. Photo-electric controllers must be manufactured using non-hazardous materials
- 4.6.2.9. All units must be indelibly marked with the switch setting, the manufacturer's identification mark, model number and the date of installation.

Table 9: Photo Electric Cell Units (PECUs) technical characteristics

Sr. No	Parameter	Specification
1	Operating Voltage	230V±10% , 50Hz
2	Current rating	30 A
3	Contacts	Single-pole/single-throw; normally closed at night
4	Contact load rating	1500 Watts incandescent; 2000 VA H.I.D
5	Surge Protection	Expulsion or Metal-Oxide-Varistor type arrestor
6	Turn-on level	1.0-1.5 lumens
7	Turn-on to Turn-off ratio	1:2- 1:5
8	Temperature range	-20°C to +80°C.

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4.6.3. Type II – PECU complete with a Timer Switch

4.6.3.1 General

4.6.3.1.1 Type II PECU shall be complete with a timer switch suitable for direct installation in single-phase AC supply operated a voltage range of 180 to 290V AC and shall be able to withstand a fault voltage of up to 400 VAC. Its application shall include - Compound / Yard Lighting, Street Lighting, Elevation Lighting, Landscape Lighting, Gardens, Aviation Lighting etc.

4.6.3.1.2 The terminals provision for connection to LIVE IN, NEUTRAL and LIVE OUT shall be properly enclosed in such a way that no live part is open.

4.6.3.1.3 The switch must have an endurance of at least 5,000 cycles at full rated load, an ambient temperature range of -1°C to $+40^{\circ}\text{C}$ and shall perform in open air with RH up to 95% at 25°C .

4.6.3.1.4 The internal clock shall be quartz based for long-term stability. Input mains power failure will not stop the clock since it shall be equipped with a rechargeable battery. The switching OFF will take place as per user selection instead of at DAWN.

4.6.3.2 Features

Type II PECU shall have the following features:

a) Optical Sensor

- (i) The sensor used should be reliable for calibration stability
- (ii) The sensing circuit should be sealed in a container meeting IP 54
- (iii) The sensor should be located behind a vertical wall to avoid accumulation of dust etc.

b) Auto Over Load Trip and Latch Mechanism

Type II PECU shall be equipped a switch with Electronic Overcurrent Trip and Latch Mechanism, LED Flashes as an indication of this state and Electrical reset which restart the switch according to the following steps are:

- (i) Switch OFF the mains, and
- (ii) Remove overload, and
- (iii) Switch ON the mains

c) Auto Over/Low Voltage Trip and Reset

These shall consist of the following functionalities:

- (i) Auto over voltage trip - $>270\text{ VAC}$
- (ii) Auto Over Voltage Reset - $< 250\text{ VAC}$
- (iii) Auto Low Voltage Trip - $<150\text{ VAC}$
- (iv) Auto Low Voltage Reset - $>165\text{ VAC}$

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4.6.3.3 Additional Features

- (i) Automatic switch ON at DUSK.
- (ii) Automatic switch OFF at DAWN.
- (iii) Immunity to dust, bird sittings and cloud cover.
- (iv) Immunity to moon and other street light.
- (v) Switch OFF selection from 4-8 hrs or at DAWN.
- (vi) Override facility for ON and Continuous OFF

4.6.3.4 Operational specifications shall include:

- a) Operating Voltage – 230V±10%, +10% ,50 Hz
- b) Recommended Lighting Load - upto 5000 watts
- c) Maximum Continuous Current - 30A
- d) Illuminance for Switching ON - <60 lux for >30 seconds
- e) Illuminance for Switching OFF;
 - (i) In Field - >10 lux for >30 seconds
 - (ii) In Lab - >60 lux for >30 seconds
- f) Resolution for ON Duration - 4 to 8 hours with ½ hour steps

4.6.4. Type III – GSM enabled PECU complete with Timer Switch for Outdoor Lighting



4.6.4.1. Design and Construction

4.6.4.1.1. Type III PECU shall be complete with a timer switch and GSM enabled suitable for direct installation in single-phase AC supply operated a voltage range of 180 to 290V AC and shall be able to withstand a fault voltage of upto 400 VAC. Its application shall include - Compound / Yard Lighting, Street Lighting, Elevation Lighting, Landscape Lighting, Gardens, Aviation Lighting etc.

4.6.4.1.2. It shall be suitable for switching of indoor and outdoor lighting systems remotely using an SMS from your mobile handset to turn ON/OFF, set timings or else the device can operate independently. Type II PECU shall be equipped with sun based, time based, and combination of sun and time settings.

4.6.4.1.3. The terminals provision for connection to LIVE IN, NEUTRAL and LIVE OUT shall be properly enclosed in such a way that no live part is open.

4.6.4.1.4. The switch must have an endurance of at least 5,000 cycles at full rated load, an ambient temperature range of –10°C to +60°C and shall perform in open air with RH upto 95% at 25°C.

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4.6.4.2. **Design Features and Operational Characteristics**

4.6.4.2.1. It shall consist of the following modular components:

(a) Optical sensor:

- (i) The sensor used should be reliable for calibration stability
- (ii) The sensing circuit should be sealed in a container meeting IP 65
- (iii) The sensor should be located behind a vertical wall to avoid accumulation of dust etc.

(b) Communication Unit (GSM MODULE)

- (i) Module – SIM 900
- (ii) Quad-Band 850/ 900/ 1800/ 1900 MHz
- (iii) Operation temperature: -30 °C to +80 °C

4.6.4.2.2. Operational specifications shall be as follows:

- (iv) Operating Voltage - 230VAC \pm 10% 50 Hz
- (v) Recommended Lighting Load - Up to 5000 watts
- (vi) Maximum Continuous Current - 30A
- (vii) Illuminance for Switching ON - <60 lux for >30 seconds
- (viii) Illuminance for Switching OFF:
 - (i) In Field - >10 lux for >30 seconds
 - (ii) In Lab - >60 lux for >30 seconds

4.6.4.2.3. Type II PECU shall have an optional provision for:

- (i) Manual ON/OFF switching
- (ii) Automatic switching.

4.6.4.2.4. The automatic switching operations shall be based on:

- (i) Sun based operation (On at Sunset, Off at Sunrise)
- (ii) Time based operation
 - Single On/Off Cycle
 - Double On/Off Cycle
 - Triple On/Off Cycle
- (iii) Combination of Sun and Time-based operation
 - On at Sunset-Off at Time
 - On at Time-Off at Sunrise
 - On at Sunset-Off at Time- On at Time off at Sunrise

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4.6.4.2.5. Type II PECU shall also have an Auto Over/Low Voltage Trip and Reset with the following functionalities;

- (i) Auto Over Voltage Trip - >280 VAC
- (ii) Auto Over Voltage Reset - < 265 VAC
- (iii) Auto Low Voltage Trip - <150 VAC
- (iv) Auto Low Voltage Reset - >165 VAC

4.6.4.3. **MARKINGS:** The PECU unit shall be marked in a permanent manner with the following information (in English Language):

- a) Standard to which the unit complies
- b) Name of manufacturer
- c) Type of PECU (description of type, number and overall size of sections)
- d) Year and month of manufacture and serial number
- e) Maximum permissible measurement limits
- f) The words “**Property of GOK/Installed K P L Co. Ltd**” shall be engraved permanently on each PECU unit while the other parameters shall be marked on a permanent label.
- g) The overvoltage protection category and duty rating.
- h) The PECU unit shall be provided with a separate permanent label displaying advice to the user.

4.6.4.4. **Warranty:** The PECU unit shall be backed by a minimum 60-months factory warranty.

4.6.5. Timers for Street Lighting

4.6.5.1. Design

4.6.5.1.1. The timer for street lighting shall be a digital-type timer rated 230±10% AC, 50Hz in single frame of size capable of carrying a load of 6 kW to 12 kW manufactured to IEC60439-3.

4.6.5.1.2. The timers shall be of type 50Hz net-synchronization or type quartz control with a self-power reserve to secure the time setting and program storage in case a power interruption does occur.

4.6.5.1.3. The timers shall allow one to set the ON and OFF time. The switching of street lights shall be repeated every day as per the set time through Programmable 24 hours' Time Switch / Programmable Astronomical Time Switch. The program shall consist of a closing time and an opening time for a circuit.

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4.6.5.1.4. The timers shall have a Programmable Time Switch (PTS) that shall automatically adjust the set time along with seasonal variation to control ON /OFF for lighting on purpose of realizing that light is turned ON when sun sets & turned OFF when sun rises. This time switch is programmed on latitude base for whole year for sun rise and sun set timing.

4.6.5.1.5. The timer selection mode shall be by Auto or Manual Selector switch

4.6.5.1.6. The timers shall be for wall mounting on cubicles and shall be pre-wired ready for use

4.6.5.1.7. The technical characteristics (depending on type) of the timers shall be:

- a) Modular design.
- b) Time adjustment by 50 Hz net, quartz.
- c) Maximum two (2) channel output.
- d) Manual override switching function.
- e) Power reserve for all quartz and DCF controlled timers.

4.6.5.2. **Features**

The following features shall be present:

- a) Easily programmable on front of device.
- b) Computer aided programming software available.
- c) Compact 18 mm design for restricted space opportunities.
- d) Separate IP40 covers are available for direct wall mounting.
- e) High level of accuracy.
- f) Maximum lamp load test data for reference.
- g) Automatic summer and winter time adjustment.
- h) Holiday & Random program settings.
- i) High power reserve up to 10 years.

Table 10: Timers for Street Lighting technical characteristics

Particular	Ratings.
Operating Voltage	230±10% Vac
Program Functions	ON / OFF
Number of Memory Locations	48
Power Reserve	150 Hrs
Max. Switching Capacity at 250 VAC cosΦ = 1	16 A
Max. Switching Capacity at 250 VAC cosΦ = 0.6	10 A
Shortest Switching Time	15 Min

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4.7. High Intensity Discharge Ballasts

- 4.7.1. Ballasts shall comply with IEC 61000-3-2, IEC 61347-2-12, IEC 61000-3-3, IEC 61347-1, IEC 61347-2-1, IEC 61347-2-8, IEC 61347-2-9 and IEC 60921 or IEC 60923 as appropriate and be tap selected to the specified operating voltage of the network.
- 4.7.2. Ballasts shall bear the CE Mark and wiring connection type on the casing and shall also be approved for use under the Balancing and Settlement Code (BSC) Unmetered Supplies Arrangements and shall have all necessary UMSUG codes.
- 4.7.3. Ballasts shall be vacuum-pressure impregnated with a silica-filled polyester varnish to re-enforce the electrical insulation, preclude moisture, inhibit noise, and dissipate heat. The process of vacuum impregnation shall be such that the interstices of the windings are completely filled with the impregnating material.
- 4.7.4. Connections shall be brought out to a suitable brass screw terminal block mounted on the ballast housing. Terminal blocks with steel screws will not be acceptable.
- 4.7.5. The HID ballasts shall be constructed in such a manner that the lamination is engaged within a galvanized steel standard and the insulation system shall be rated class H (180°C maximum coil hot spot temp.)
- 4.7.6. The bidders shall provide the HID ballasts characteristic curves to support their offers during tender in accordance with IEC 60662.
- 4.7.7. The HID ballasts shall date stamped on either the top surface or the side surface of the ballast core.
- 4.7.8. The HID ballasts shall be component recognized by the UL (Underwriters Laboratory) and shall meet the 88% efficiency requirements of EISA (ACT, 2007).
- 4.7.9. The ballast shall be matched to the actual supply voltage within 2.5 % of this voltage to obtain optimum performance regarding colour characteristics and life as per Table 8.
- 4.7.10. The ballasts connection shall be a constant wattage autotransformer with the following electrical characteristics as per Table 11 and shall be capable of operating lamps of the following wattage range - 150W, 250W and 400W as described in clause 4.4.

Table 11: Characteristics of ballasts

Sr. No	Characteristics	Ratings		
1	Nominal lamp wattage	150	250	400
2	Frequency, Hz	50	50	50
3	Rated voltage, V	230	230	230
4	Calibration current, A	2.0	3.0	4.6

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Sr. No	Characteristics	Ratings		
		5	Voltage/current ratio	81.0 ± 0.5%
6	Power factor	0.060±0.010	0.06±0.005	0.06±0.005
7	Pulse width	2.0-3.6	3.0-5.2	4.6-7.5
8	Lamp warm-up current (r.m.s.), A	2,700-4,500	<5,000	<5,000
9	Pulse height (peak), luminaire requirement, V	10	10	12
10	Temperature rise °C	180	180	180

4.8. Capacitors for Luminaires

- 4.8.1. Capacitors shall comply with IEC 61048 and IEC 61049 and shall bear the CE mark and fully capable for use in HPS lamps rated 150W, 250W and 400W as per clause 4.4.
- 4.8.2. Capacitors shall only be connected to the primary (line) side of transformer ballasts. After connection of the power factor correction capacitor, the power factor shall not be less than 0.88 (lagging).
- 4.8.3. All capacitors shall be fully encapsulated and filled with self-extinguishing resin.
- 4.8.4. The capacitors shall be of the ratings shown in the table below for the corresponding High-Pressure Sodium lamps
- 4.8.5. The characteristics of capacitors shall be as per Table 12.

Table 12: Technical characteristics of capacitors for Luminaires

Lamp		Capacitor
Wattage	Current	µF± 5%
150	1.8	21
250	3.0	33
400	4.4	45

4.9. Ignitors for Luminaires

- 4.9.1. Ignitors shall comply with IEC 60926 and IEC 60927 and shall bear the CE mark. Ignitors shall be of the superimposed-pulse solid-state electronic trigger type.
- 4.9.2. The ignitors shall be capable of operating lamps of the following wattage range - 150W, 250W and 400W in clause 4.4.
- 4.9.3. Ignitors shall be of the standard type to allow striking of the lamp without switching the power off after replacement of a faulty ignitor.

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4.9.4. Ignitors shall be suitable for operating any make of lamp in conjunction with any make of ballast at temperatures up to 90^o C. All ignitors shall be suitable for connection in the circuit so that the ignition pulse is confined between the ignitor and lamp holder.

4.9.5. The ignitors shall conform to the following electrical characteristics as per Table 13.

Table 13: Ignitor characteristics

S/ No.	Characteristics	Ratings		
1	Lamp wattage, W	150	250	400
2	Switch on voltage, V	≤ 230±10%		
3	Switching off voltage, V	> 168		
4	Voltage peak, kV	3.4		
5	Load capacitance, pF	155		
6	Losses at peak current of 4.5A, W	2.7		
7	Pulse width	2.0-3.6	3.0-5.2	4.6-7.5
8	Lamp warm-up current (r.m.s.), A	2,700-4,500	<5,000	<5,000
9	Pulse height (peak), luminaire requirement, V	10	10	12

4.10. Earth Leakage Circuit Breaker

4.10.1. Design

4.10.2. The Earth Leakage Circuit Breaker (ELCB) shall be current operated with a sensitivity of 30mA and shall conform to IEC 61008 and BS 4293.



4.10.3. The ELCB shall incorporate a residual current operated electromagnetic release which operates without any auxiliary source of supply to open a circuit automatically in the case of an earth leakage fault between phase and earth greater than or equal to IΔn.

4.10.4. The ELCB shall operate and switch off the circuit within 30 milliseconds in case of a fault.

4.10.5. The ELCB shall be suitable for the circuit of 50Hz, rated voltage 230/400V, and rated current at least 40Amps.

4.10.6. Features

The ELCB shall have the following features;

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- (i) Overload, short circuit and over voltage protect functions.
- (ii) Electrical distribution system to prevent electric shock.
- (iii) A trip free mechanism that operate even on neutral failure.
- (iv) A test button to simulate leakage and to test the ELCB.

4.10.7. The characteristic performance of ELCB shall be as per Table 14.

Table 14: Technical Characteristics of ELCB

S/No	Particulars	Requirements
1	Number of Poles	1P+N
2	Rated Current(A)	40
3	Rated Residual Operating Current (I_n)(mA)	30
4	Rated Residual Non-operation Current (I_{no})(mA)	$0.5I_n$
5	Rated Voltage(V)	230/400
6	Residual Current Off-time	0.1S
7	Short Circuit Capacity(Icu)	3000A
8	Mechanical Endurance	4000
9	Tripping Curve	C, D
10	Degree of protection	IP20

4.11. Lighting Contactors

4.11.1. General construction and performance requirements

4.11.2. The contactor shall be two-pole contactors on single-phase AC designed and manufactured in accordance with IEC 61095 and IEC 60947-4-1 standards. The contactor shall be suitable for switching of lamp loads in both utility as well as industrial areas.

4.11.3. The contactor shall be very specific due to the applied operating coil and the construction of the main contacts. They shall be designed with AC coils to ensure silent operation and enhanced low power consumption.

4.11.4. The contactor with its enclosure shall be designed and constructed to withstand the stresses occurring during installation and normal use and, in addition, shall provide a specified degree of resistance to abnormal heat and fire as per clause 8.1 of IEC 61095.

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- 4.11.5. The moving contacts of the contactors intended to make and break together shall be so mechanically coupled that all poles make and break substantially together whether operated manually or automatically.
- 4.11.6. The contactors shall close satisfactorily at any value between 85 % and 110 % of their rated control supply voltage Vs. Where a range is declared, 85 % shall apply to the lower value and 110 % to the higher as per clause 8.2 of IEC 61095
- 4.11.7. The contactors shall offer optimal contacts and low heat dissipation to guarantee a long lifetime and a wide range of characteristics.
- 4.11.8. The bidder shall provide the relevant electrical durability curves to support the offer.
- 4.11.9. Features

The following features shall be part of the design of the lighting contactors:

- It shall be an AC current operated type rated 25, 40A and 63A with double-pole and triple pole contacts and optional add-on auxiliary contact.
- The coil voltages shall be at least 220 - 250V AC
- Shall have a DIN modular profile.
- Spacers available to extend lifetime (it is recommended to use 1 spacer between every 2 contactors installed).
- Day/night operation with manual override function.
- Low inrush power for all AC types.
- Integral contact indication.

4.11.10. Ratings

The contactor shall be suitably rated for operating lighting circuits of luminaires rated 150W, 200W and 400W respectively and shall be rated as per Table 15.

Table 15: Technical Parameters for Lighting Contactors

No	Description	Requirements		
		25A	40A	63A
1	Current rating,	25A	40A	63A
2	Type (<i>To be declared during tender</i>)	AC operated double or triple pole		
3	Utilization category	AC-1/AC-7a		
4	Rated operational voltage Umax	600V		
5	Rated frequency, Hz	50		
6	Rated insulation voltage, kVrms	2,500V for 1s as per Table 19 of IEC 61095		
7	Rated operational current –AC1/AC7a	25A	40A	63 A
8	Impulse withstand voltage, kVpk	4 kV/s as per Table F.1 of IEC 61095		
9	Rated making/breaking capacity, I _c / I _e = 1.5, A	35.7	60	94.5

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No	Description	Requirements		
10	Maximum breaking capacity, A	250A		
11	Short circuit current, kA	3 kA as per Table 21 of IEC 61095		
12	Associated protection MCB	25A-6kA	40A-10kA	63A-10kA
13	Maximum electrical switching frequency for AC-1/AC-7a,	300 cycles/h as per clause 5.3.4.2 of IEC 61095		
14	Coil operating limits as per IEC 60947-4-1	0.85...1.1xUc (at $\theta \leq 55^{\circ}\text{C}$)		
15	Heat dissipation per pole, W	1.5	3.2	6
16	Electrical durability, cycles	1,500,000		
17	Mechanical durability, operating cycles	1,000,000		
18	Degree of enclosure	IP 20		
19	Air temperature close to contactor, $^{\circ}\text{C}$	-25 to +55		
20	Climatic withstand	According to IEC 60082-2-30		

4.11.11. Markings on the Contactor

- (i) The following indelible and easily legible mandatory markings shall be made on the contactor, preferably on the nameplate if any, to enable complete data to be obtained from the manufacturer.
- Marking of the manufacturer's name or trade mark and
 - Type designation or serial number shall be mandatory.
- (ii) The following information shall also be marked and visible after mounting:
- Direction of movement of the actuator
 - Indication of the position of the actuator;
 - Approval or certification mark, if applicable;
 - Terminal identification and marking;
 - IP code and class of protection against electric shock.

4.12. Control Pillars

4.12.1. General

- 4.12.1.1. The control pillars shall be designed and manufactured in accordance with IEC 61439-1 and IEC 61439-3.
- 4.12.1.2. The pillar shall be made of Fibre/Plastic material to prevent corrosion
- 4.12.1.3. The control pillar shall be equipped with a 12-way mounting rails and shall be rated 200A for surface mounted and 125A for pole mounted designs. The normal rating shall be at a maximum temperature of 40°C .
- 4.12.1.4. The pillar shall be sealed to minimum IP65 on the doors and purpose-designed equipment mounting system may be used.

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- 4.12.1.5. The pillar design shall include a double door (surface mounted) and single door (pole mounted) and shall be fitted with tamper-proof "O locks", all locks being identical in pattern. The locking mechanism shall be lubricated with grease immediately following installation. Two sets of keys shall be provided to the Chief Engineer - Street Lighting prior to the adoption of the installation. All doors are to be provided with an earthing strap. The pillar shall also be lockable with a Standard Padlock.
- 4.12.1.6. The control pillar shall have a glass or transparent front to enable the intergraded timer/photocell to access sunlight and Energy Meter to be read without opening the box.
- 4.12.2. **Ground mounted (GM) control pillars**
- 4.12.2.1. The GM control pillars shall be suitable for mounting on a 250mm thick foundation of concrete ST2 mix complying with BS 5328 – 1:1997. They shall be rooted or provided with fixing bolts to enable the unit to be securely located. The entry for cables shall be via the root.
- 4.12.2.2. The control pillars shall be a minimum of 1350mm x 1200mm x 450mm (H x W x D) raised to a height of 400mm and overall height of 1750mm. It shall have a backboard dimension of approximately 1170mm x 980mm (H x W) with a working area of at least 420mm. It shall also have a glass window complete with UV treated neoprene (PVC) seal to ease meter reading. The enclosure shall have 4No x Φ 20mm knock outs for cable entry.
- 4.12.2.3. The pillar shall also have a DIN rail for mounting the MCBs and a terminal block to ease wiring. A pocket for the photo sensor shall also be provided.
- 4.12.2.4. This shall be sufficient to accommodate:
- The incoming supply cable including cut-out.
 - A sealable double pole isolator [if not included in the cut-out].
 - Any contactor and/or photocell relay.
 - A distribution board for all highways electrical feeds including sufficient spare capacity to accommodate at least one extra circuit.
 - All necessary fuses.
 - At least 25% spare space on the backboard upon completion.
 - Heater
 - RCD (Residual Current Device)
 - Interior light
 - 13A Socket
- 4.12.2.5. Distribution fuse boards shall be of the HRC type provided with an external earth, phase barrier and colour coded (red-phase; black-earth). They shall be fitted with the same number

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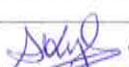



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of live and neutral bus bar terminals as there are outgoing circuits plus at least one spare way.

- 4.12.2.6. A circuit diagram and labeling showing details of interconnection of equipment and the connection of cables to and from the pillar, all indelibly drawn or engraved on a material not subject to damage by the environment or normal use, shall be securely fixed internally to each feeder pillar after completion of the installation.
- 4.12.2.7. An earthing system shall be provided in each control pillar. It shall accept the incoming earth facility from the supply authority onto an earthing bar or terminal strip and interconnect all outgoing cable earth connections and the bonding of the feeder pillar. The earthing facility shall accommodate up to 25mm² earth conductors.
- 4.12.2.8. All control pillars shall be fitted with a durable warning sign, fitted externally and in a prominent position, indicating “**DANGER 400 VOLTS**” or “**DANGER 230 VOLTS**” as appropriate and a ‘lightning flash’ in black on yellow.
- 4.12.3. **Pole mounted control pillars**
- 4.12.3.1. This shall be a multi row Type A-Distribution board (distance between rows 150mm) which is fully type tested with a conditional short circuit rating of 15kA to IEC 61439.
- 4.12.3.2. The PM control pillars shall be a minimum of 540mm x 300mm x 160mm (H x W x D) suitable for mounting on wooden, concrete or composite poles and shall have a mounting bracket suitable for pole diameters of 190mm to 230mm.
- 4.12.3.3. It shall be fitted with at least three (3) DIN rails and a main bus-bar which shall be removable for flexible installation and a fully shrouded neutral bus-bar for increased safety.
- 4.12.3.4. It shall be complete with a ‘full form’ blanking modules for unused MCB ways to provide a secure shrouding of unused bus-bar stabs for increased electrical safety. Blanking modules shall have interlinking form for improved positional security.
- 4.12.3.5. It shall be suitable for metering and to suit application needs and aid compliance with latest Building Regulation – part L2.
- 4.12.3.6. The doors shall open 180° to provide easy access and device operation.
- 4.12.3.7. It shall be supplied complete with an incomer switch disconnecter rated 125A to provide a higher rated solution for street lighting.
- 4.12.3.8. There shall be a provision to electrically connect two distribution boards together vertically from a single supply cable to expand number of MCB ways.
- 4.12.3.9. The technical parameters shall be as per Table 16 below.

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Table 16: Technical Parameters for Control pillars

Particulars	Requirement	
	Surface mounting	Pole mounting
Type of pillar	Type A as per IEC 61439-1	
Standard of manufacture	IEC 61439-1 & 3	
Rated current (In)	200A	125 A
Rated short circuit withstand current	15 kA for 1s	
Rated frequency	50 Hz	
Rated diversity factor	0.8	
Power frequency withstand voltage, Vrms	AC	1.8 kVrms
	DC	2.67 kV
Impulse withstand voltage	2.5 kVpk	
Type of coordination overload characteristics	Specify	
Pollution degree	III	
Types of system earthing	Solidly earthed system	
Indoor and/or outdoor installation	Outdoor	
Stationary or movable	Removable	
Degree of protection	IP 54	
Intended for use by skilled or ordinary persons	Ordinary persons	
Electromagnetic compatibility (EMC) classification	Performance criterion B as per IEC 61439-1	
External design	Specify	
Mechanical impact protection	At least IK 08 as per IEC 62262	
The type of construction	Specify	Specify
The nature of short-circuit protective device(s)	Specify	Specify
Measures for protection against electric shock	Specify	Specify
The weight	Specify	Specify

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4.13. Multifunction Test Kit

4.13.1. Service conditions

The equipment shall be suitable for continuous operation outdoors in tropical areas and harsh climatic conditions including areas described in clause 4.1

4.13.2. Design and Construction

- 4.13.2.1. The Multifunction Test Kit shall conform to IEC 610610-1, IEC 60950 and IEC 60664-1 & 3 standards and the requirements of this specification.
- 4.13.2.2. The multifunction Test Kit test unit shall perform complete testing of LED lanterns together with the calibration of instruments such as ammeters, voltmeters, energy meters, Power factor meter and Lumens meter
- 4.13.2.3. The test kit shall be a light weight portable unit (not more than 20 Kgs) designed for both laboratory and field use.
- 4.13.2.4. The test kit shall be PC/laptop controlled manufactured to meet IEC 60950 requirements. Its Operating System shall run on windows 7 professional or equivalent higher version and be capable of being integrated with other analytical and data management software in MS office suite.
- 4.13.2.5. It shall be fully automated, intelligent and of high accuracy with no additional external calibration kit/tool and shall be equipped with most recent software for ease of operation, data analysis and test plan scheduling.
- 4.13.2.6. The Test Kit shall provide basic functional testing of electro-mechanical, solid state and microprocessor-based measurands
- 4.13.2.7. It shall be capable of being upgraded in hardware instrumentation-features/options and software, which provides for customization to meet various field and laboratory applications.
- 4.13.2.8. The system shall be formed to provide full testing capability; voltage and current sources, Lumens, Power factor, Total power consumption, apparent and active power and frequency
- 4.13.2.9. In order to achieve maximum power to test LED lanterns, the test system shall be provided with multiple current and voltage ranges. Control of the parametric values shall come from individual controls.
- 4.13.2.10. The input voltage range shall be AC 85-265V

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4.13.3. Test results


- 4.13.3.1. Test preparations and analysis of results and parameters shall be prepared off-line and tests executed automatically.
- 4.13.3.2. The equipment shall generate the test reports automatically, and a facility for exporting them to MS Word or Excel for detailed analysis shall be available.
- 4.13.3.3. The equipment shall be equipped with a standard data communication interface for connection to remote data processing such as computer, or control equipment.
- 4.13.3.4. The equipment shall be capable of data uploading and downloading to laptop through 2.0 or higher USB port and/or Ethernet

4.13.4. PC software

- 4.13.4.1. Test set shall be provided with window-based software that enables the user to record the currents and voltages as well as the trip time while the test set is connected to the PC.
- 4.13.4.2. The Windows software shall provide easy access to connection instructions, test instructions and advance preparation using standard word processing packages.
- 4.13.4.3. The settings made by a user during a test shall be saved in a file, and shall be retrievable for future use.
- 4.13.4.4. It shall also provide test results that are reportable directly with table and graph as well as being exported to an external program, such as Microsoft® EXCEL.
- 4.13.4.5. The PC software shall run on Windows® 7 / 8 / 10 or higher platforms.

4.13.5. Marking

- 4.13.5.1. The Multifunction Test Kit shall be marked in a permanent manner with the following information (in English Language):
 - i) Standard to which the Test Kit complies
 - j) Name of manufacturer
 - k) Type of Test Kit (description of type, number and overall size of sections)
 - l) Year and month of manufacture and serial number
 - m) Maximum permissible measurement limits
 - n) The words “**Property of GOK/ KPL Co. Ltd**” shall be engraved permanently on each test unit while the other parameters shall be marked on a permanent label.

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- o) The overvoltage protection category and duty rating.
- p) The Test Kit shall be provided with a separate permanent label displaying advice to the user.

4.13.6. Transportation casing

- 4.13.6.1. The portable multifunction Test Kit shall be packed in a Standard-size case for ease of stress free transportation with at least IP20 according to EN 60529 Class protections. The case shall be suitable for storage and long-term use.
- 4.13.6.2. The equipment shall be portable, rugged and light weight. Its carrying case shall be shockproof, and impact resistant.

4.13.7. Warranty and Training

- 4.13.7.1. The Multifunction Test Kit shall be backed by a minimum 36-months factory warranty.
- 4.13.7.2. Technical support and software upgrades, where applicable, shall be provided free of charge to Kenya Power for a period of not less than 36 months.
- 4.13.7.3. The manufacturer shall conduct complete training on the Multifunction Test Kit to Kenya Power engineers/Technicians, in Nairobi Kenya. The supplier shall meet all the costs of the trainer/s and their logistics and any materials required for the training. The venue and facilitation cost for the KPLC participants will not be the responsibility of the bidder. The training shall be for not less than 20 engineers/Technicians.
- 4.13.7.4. The supplier to submit a detailed training program for at least a day with the bid.
- 4.13.7.5. The Training shall include theory on how the multifunction Test Kit works, followed by practical demonstrations on operation, protection and control configuration and parameter settings. All the operational and control features of the multifunction Test Kit shall be exhaustively explained and demonstrated, including the operation of the software.
- 4.13.7.6. The Training shall be considered to have been successful once the Engineers/Technicians are able to: -
 - a) Competently carry out all the operations on the multifunction Test Kit
 - b) Establish communication from a computer to the multifunction Test Kit and carry out complete configuration, parameter settings and download and analyse data from the Multifunction Test Kit;
 - c) Trouble shoot, analyse and rectify any minor breakdowns that may occur.

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APPENDICES

APPENDIX A: Testing

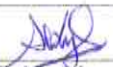

- A.1. It shall be the responsibility of the manufacturer to perform or to have performed all the tests of the street lighting luminaries, accessories, control devices and accessories and measuring instruments at the factory.
- A.2. Copies of previous Test Certificates and Test Reports issued by a third-party testing laboratory that is accredited to ISO/IEC 17025 shall be submitted with the tender for the purpose of technical evaluation. The Test Reports to be submitted with the tender shall not be more than five years old. A valid copy of accreditation certificate for the third-party testing laboratory shall also be submitted with the tender (all in English Language).
- A.3. After manufacture, tests shall be done at the manufacturer's works in the presence of KPLC Engineers. Complete test reports for the accessories shall be submitted to KPLC for approval before delivery.
- A.4. Upon delivery, KPLC will inspect the accessories and may perform or have performed any of the relevant tests in order to verify compliance with the specification. The supplier shall replace/rectify without extra or additional charge to KPLC, accessories which upon examination, test or use fail to meet any of the requirements in the specification and reference standards.

APPENDIX B: Warranty

- B.1. The supplier/manufacturer warrants the purchaser that all goods supplied under this tender shall have no defect arising from design, materials or workmanship.
- B.2. A warranty of 24 months from the date of delivery of the items (where warranty is not specified) to Kenya Power store shall be offered by the manufacturer for the items specified in this specification

APPENDIX C: Quality Management System (Normative)

- C.1. The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the QAP properties, tests and documentation, will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2015
- C.2. The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications, including copy of valid and relevant ISO 9001: 2015 certificate, shall be submitted with the tender for evaluation.

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C.3. The manufacturer shall indicate the delivery time of the equipment; manufacturer's monthly and annual production capacity and experience in the production of the type and size of items being offered. A detailed list and contact addresses (including e-mail) of the manufacturer's previous customers for similar type of items sold in the last five years as well as reference letters from at least four of the customers shall be submitted with the tender for evaluation.

APPENDIX D: Technical Documentation (Normative)

D.1. The bidder shall submit its tender complete with technical documents required for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

- a) Fully-filled clause by clause Guaranteed Technical Particulars (GTPs) - Appendix F - stamped and signed by the manufacturer.
- b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data for the equipment;
- c) Details of the manufacturer's experience; Sales records for the last five years and at least four customer reference letters.
- d) Copies of previous test certificates and test reports (As given in Clause A.2) by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation. A copy of accreditation certificate for the laboratory shall also be submitted (all in English Language);
- e) Marking & Packaging details (including packaging materials).

D.2. The successful bidder (supplier) shall submit the following documents/details to Kenya Power for approval before manufacture:

- a) Fully filled clause by clause Guaranteed Technical Particulars (GTPs) stamped and signed by the manufacturer (*these are not the ones submitted with the tender*);
- b) Technical details and drawings with details of portable single phase secondary injection set to be manufactured for KPLC.
- c) Quality assurance plan (QAP) that will be used to ensure that the design, material; workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations.

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- D.3. Routine and sample test reports for the equipment to be supplied shall be submitted to Kenya Power for approval before shipment/delivery of the goods.
- D.4. Each package shall be supplied with detailed manuals printed in the English language to Kenya Power stores. All documentation necessary for installation and management of the accessories shall be provided with the equipment.
- D.5. Statement of compliance to specification (indicate deviations if any and supporting documents).

APPENDIX E: Factory Acceptance Tests and Inspection

- E.1. The street lighting accessories shall be subjected to factory acceptance testing and inspection by two KPLC engineers at place of manufacture where all routine tests as per this specification shall be carried out on two relays of each type for each specific (unique) configuration.
- E.2. All the street lighting accessories and Control devices shall be inspected to ensure they fully comply with the specifications.
- E.3. In addition, training shall be conducted in the factory for the two KPLC engineers attending FATs. Approval for shipment of goods by KPLC shall dependent on a satisfactory FAT report by the Engineers.
- E.4. The full cost of the visit, including air tickets and accommodation shall be borne by KPLC. The manufacturer/bidder shall however take care of the local transport.
- E.5. The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the street lighting accessories to KPLC stores

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APPENDIX F: Guaranteed Technical Particulars

(To be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for past five years, four customer reference letters, details of manufacturing capacity, the manufacturer's experience, copies of complete type test reports and accreditation certificate to ISO/IEC 17025 for the third-party testing laboratory for tender evaluation, all in English Language)

Tender No.

Clause	Description	KPLC REQUIREMENTS	Bidder's offer (indicate full details of the values offered)
	Bidder's Name and address		State
1	Scope		State
2	Applicable standards		State
3	Item on offer		State
4	Requirements		State
4.1	Service conditions - compliance		State
4.2	Lighting columns and Brackets		State
	Name of Manufacturer		State
	Country of manufacture		State
	Type/Model Reference Number		State
	Manufacturing standards complied with		State
	Compliance to all clauses		State
4.2.1.	Design and construction		
	Applicable standards		State
	Design life		25 years State
	Designed to meet the relevant ultimate limit states and the serviceability limit state		Compliance State
	Dimensional limits	Post top columns (for floodlights)	12m nominal height
		Columns with brackets (HPS and LED luminaire)	8m & 10m nominal height State
		Bracket projections	<Lesser of 3m or 0.25 x nominal height

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Clause	Description	KPLC REQUIREMENTS		Bidder's offer (indicate full details of the values offered)
	Minimum thickness of structural steel sections	Plates and sections other than hollow sections	6mm	State
		Hollow section	4 mm	State
	End plates dimensions		375 x 375mm	State
	Drain hole size		10mm < size < 15mm	State
	Method of joining the base section and the shaft, welding procedures requirements		Compliance	State
	Fixing of separate bracket to a column		Compliance	State
	No movement of the bracket either vertically or horizontally with respect to the column.		Compliance	State
	Minimum thickness backboard		15mm	State
	IP rating of doors		IP 33	State
	Lock		Compliance	State
	Keys per 10 columns		2	State
	Size of brass or stainless-steel bolt		M8	State
	Width of cable entry slot		75mm	State
4.2.2	Materials of manufacture			
	Material of brackets and columns	Carbon steel grade S355J2 in accordance with EN 10210		State
	Tensile strength	470 – 630 MPa		Attach test certificate
	Yield strength	355 MPa		
	Shape of steel tube	Constant diameter above the base compartment		Attach drawing
		Continuously tapered with either circular or polygonal shape		
4.2.3.	Protection against corrosion			
	Level of galvanization	>720 g/m ² , for flat articles		State
		>390 g/m ² , for centrifuged articles		
	Painting method	Compliance		State

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Clause	Description	KPLC REQUIREMENTS				Bidder's offer (indicate full details of the values offered)
	Paint colour	Grey of shade 18B25				State
Technical particulars of the brackets as per EN 40 (relevant parts)						
	Performance under vehicle impact (impact tested at km/h)	Untested	Class 0			State
		Tested	100:NE:3			
	Partial load factor class	B			State	
	Deflection class	3			State	
	Maximum wind velocity withstand, m/s	26			State	
	Maximum luminaire weight, kg	>10m	20		State	
		< 10m	10			
	Maximum luminaire windage, m ²	0.25			State	
	Minimum terrain category	II			State	
4.2.4	Marking and Labeling of Columns and Brackets					State
	Unique identification mark					State
	CE marking					State
4.2.5	Sizes					
	Sizes of columns, m	8	10	12	12	State
	Depth of root for planting, mm	1200	1500	1800	1800	State
	Cable entry slot	65mm X 150mm				State
	Depth of top of slot below ground level	500mm				State
	Sizes of brackets	1.0m, 1.5m, 2.0m, 2.5m and 3.0m				State
	Diameter of circular brackets	4-Way	0.9-1.15m			State
		6-Way	1.15-2.0m			State
	Drawings and dimensions of columns complete with bracket					Provide drawing
4.3	Luminaires (Lanterns)					
4.3.1	General Design and Construction					
	Standards of manufacture					State
	Type on offer					state
	Materials of manufacture					State
	Final colour					state

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Clause	Description	KPLC REQUIREMENTS	Bidder's offer (indicate full details of the values offered)
	Mounting system		State
	Environment compatibility		State
	Resistance to vandalism & stabilization		State
	Assembled luminaires characteristics	Weight	State
		Windage	State
		Impact rating	State
	Insulation		State
	IP rating		State
	Thermal paste		State
	Self-cleaning		State
	Control gear and option to retrofit proprietary		State
	Photometric data		State
	Access to interior		State
	Corrosion protection - hinges, toggle catches, captive screws and nuts		State
	Optical equipment material of manufacture		State
	Luminaires integral control gear		State
	Radio interference protection		State
	Luminaires design		State
	Luminaires fitting		State
4.3.2	LED Luminaires complete with control gear		State
	Name of Manufacturer		State
	Country of manufacture		State
	Type/Model Reference Number		State
	Standard of manufacture	IEC 60598-1	State
	Compliance to all clauses	Attach Type Test report	State
	Components of luminaire	Reflector, refractor and housing	State
	Body material	LMN 5 marine grade aluminum, or polyester powder coating	State
	Colour	Grey, silver or black over ROHS compliant chrome passivation	State
	Finish	Polyester powder coating	State

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Clause	Description	KPLC REQUIREMENTS	Bidder's offer (indicate full details of the values offered)
	Components	Control gear fitted with tool-less guide release gear tray, equipped with a plug, socket and heat barrier	State
	Mounting diameter	Side entry	State
		Post top entry	State
	Integral flexible mounting system	As per clause 4.3.1.4	State
	Bowl protection	UV and vandal resistant	State
	Maximum weight	8kg	State
	Maximum windage	0.14m ²	State
	Minimum impact rating	IK08	State
	Insulation type	Double insulation	State
	Class of protection	At least class I	State
	Self-cleaning capability	Yes/No	State
	Photometric data	As per LM-78-08 (attach Type Test report)	State
	IESNA distribution type	Type 2 or 3	State
	Light output percentage	>90%	State
	Upward light output ratio	<0.5%	State
	IP rating of lantern	IP 66	State
	Specific requirements		
	Rated input power (in W)		State
	Rated luminous flux (in lm)		State
	LED luminaire efficacy (in lm/W)		State
	Minimum operating efficiency	95%	State
	Terminals IP rating	IP2X	State
	Surge protection voltage	6kV/10 (1.2x50μs)as	State
	Short circuit current	10/15kA/8 x 20 μs	
	System power factor	>0.95 at full power & dimmed.	State
	Minimum initial intensity at 50,000 hours of life / 5year minimum	≥95%	State
	Total lumens above 90 ⁰	Specify	State

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Clause	Description	KPLC REQUIREMENTS	Bidder's offer (indicate full details of the values offered)
	Photometric code	840/358	State
a	Correlated Colour Temperature (CCT in K)(pure white)	=>5000K	State
b	Rated Colour Rendering Index (CRI)	Code 7 (CRI) range 67-76) or greater	State
c	Rated chromaticity co-ordinate values (initial and maintained)	Initial spread of chromaticity co-ordinates within a 3-step MacAdam ellipse – code 3 Maintained spread of chromaticity co-ordinates within a 5-step MacAdam ellipse – code 5	State
d	Maintained luminous flux	>80% , code 8	State
	Rated life (in h) of the LED module and the associated rated lumen maintenance (Lx) , min	70	State
	Failure fraction (Fy) corresponding to the rated life of the LED module in the luminaire, max.	10	State
	Ambient temperature (ta) for a luminaire, °C	35	State
	Power Factor	>0.95	State
	Intensity Distribution	Relative Photometry as per EN13032-1	State
	Drive Current, mA, maximum	700	State
	Optical Risk, min	Risk group 2 as per IEC 62472	State
	Ageing time (h), if different to 0 h		State
	Temperature cycling, energized		State
	Minimum system performance criteria (attach calculations and decay curve)		State
	Accelerated operation life test		State
	The T _c life	65°C	State
	System life @ T _c life (min 90%)	50.000hrs	State
	The T _c min	-20°C (start up at -40°C)	State

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	The T _c Max	+75°c	State
	The T _c thermal cutoff module	+75°c (starts dimming)	State
	The T _c thermal cutoff driver	+85°c (maximum dimming)	State
	Input voltage	230V±10%	State
	Insulation class of protection	I	State
	LED Performance Ratings (LM-80)	Input Power (W)	
		80	state
		90	state
		100	state
		110	state
		120	state
	LED Markings (Mandatory)	Shall be per IEC/PAS 62717 and additional markings in tender specification	State
	Dimensions, including dimensional tolerances		State
	Availability of heat sink(specify heat sink efficiency)		State
	Marking, Type, Method of marking on LED luminaries		specify
4.3.3	Protection of the LED Drivers		
4.3.3.1	Short Circuit Protection		State
4.3.3.2	Output Over Voltage Protection		State
4.3.3.3	Over Temperature Protection		State
4.3.4	Electromagnetic Compatibility Standards (EMC)		State
4.3.5	Safety requirements (at 25° C)		State
	Grounding Resistance	<0.1Ω	State
	Leakage Current	<0.75mA	State
	Insulation resistance	≥50MΩ	State
	Surge immunity	L line to N line	4000V
		L line to earth	6000V
		N line to earth	6000V
4.3.6	Reliability	Mean Time Between Failure	≥200,000 hours
			State

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		Life Time Qualification (Tc)	>50,000	State
		Tc calculation	Provide	provide
		Maximum Case Temperature Tc	85°C	State
		Vibration		State
		Drop Test		State
4.3.7	Markings	As per requirement		state
4.3.8	LED Floodlighting Luminaire			State
	Name of Manufacturer			State
	Country of manufacture			State
	Type/Model Reference Number			State
	Standard of manufacture	IEC 60598-1		
	Compliance to all clauses	(Attach Type Test report)		State
	Components of luminaire	Reflector, refractor and housing		State
	Body material	LMN marine grade aluminum, or equivalent with polyester powder coating		State
	Colour	Grey, silver or black over ROHS compliant chrome passivation		State
	Finish	Polyester powder coating		State
	Components	Control gear fitted with tool-less guide release gear tray, equipped with a plug, socket and heat barrier		State
	Mounting diameter	Side entry	State	State
		Post top entry	State	State
	Integral flexible mounting system	As per clause 4.3.1.4		State
	Bowl protection	UV and vandal resistant		State
	Maximum weight	14kg		State
	Maximum windage	0.4m ²		State
	Minimum impact rating	IK08		State

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Clause	Description	KPLC REQUIREMENTS		Bidder's offer (indicate full details of the values offered)
	Insulation type	Double insulation		State
	Class of protection	At least class I		State
	Self-cleaning capability	Yes/No		State
	Photometric data	As per LM-78-08 (attach Type Test report)		State
	IESNA distribution type	Type 2 or 3		State
	Light output percentage	>90%		State
	Upward light output ratio	<0.5%		State
	I _{MAX} above 95	0		State
	IP rating of lantern	IP 66		State
	Specific requirements			
	Rated input power (in W)	Specify		State
	Rated luminous flux (in lm)	Watts	Total Lumens(Lm)	State
		100	18000	State
		150	27000	State
		200	36000	state
	Drive Current, mA, maximum			State
	LED floodlight luminaire efficacy (in lm/W) , min	180lm/W, min		State
	Salt spray test(hrs)	2500 hour		State
	All external screws, bolts, washers	V4A (1.4401) or equivalent stainless-steel(Attach Type Test report)		State
	Mounting bracket	Stepless tilting		State
	Tilt Angle	< 15°		State
	ULR (Upward Light Ratio) value	0.0%		State
	Minimum ingress protection rate	IP66		State
	LED Lighting Units	Individual replaceable LED lighting units.		State
	Optical lens	Made of high-transparent non-yellowing PMMA.		State
	Built in Redundancy ratio:	4:1		State
	Hot Restrike (Instant On)	Yes		State

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	Control	DALI (Digital Addressable Lighting Interface) or a 1-10V control interface.	State
	Surge Protection	10kV	State
	Colour Rendering Index (Ra)	70	State
	Correlated colour temperature (CCT)(pure white)	≥5,000	State
	Operational Life Expectancy	50,000 hours (L70).	State
	The lumen output drop	> 70% of the initial output	State
	Compliance	CIBSE, ISO 9001 and ISO 14001 certified.	State
	LED Markings (Mandatory)	Shall be per IEC/PAS 62717	State
	Certifications	CE certified and all components shall be ENEC and UL certified	State
		Photobiological certificate in compliance with IEC 62471 validating the safety of the LEDs and shall not be classified higher than "Exempt Risks"	State
		RoHS compliant.	State
	Markings	Marking, Type, Method of marking on LED luminaries	specify
4.3.9	High Pressure Sodium (HPS) Luminaire complete with control gear		
	Name of Manufacturer		State
	Country of manufacture		State
	Type/Model Reference Number		State
	Standard of manufacture	IEC 60598-1	State
	Compliance to all clauses	Attach test report	State
	Components of luminaire	Reflector, refractor and housing	State
	Body material	LMN marine grade aluminum, or equivalent with polyester powder coating	State
	Colour	Grey, silver or black over ROHS compliant chrome passivation	State
	Finish	Polyester powder coating	State

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Clause	Description	KPLC REQUIREMENTS	Bidder's offer (indicate full details of the values offered)
	Components	Control gear fitted with tool-less guide release gear tray, equipped with a plug ,socket and heat barrier	State
	Mounting diameter	Side entry 42mm to 60mm	State
		Post top entry State	
	Integral flexible mounting system	As per clause 4.3.1.4	State
	Bowl protection	UV and vandal resistant	State
	Maximum weight	10kg	State
	Maximum windage	0.15m ²	State
	Minimum impact rating	IK 08 as per IEC 62262	State
	Insulation type	Double insulation	State
	Class of protection	Class I	State
	Self-cleaning capability	Yes/No	State
	Photometric data	As per LM-78-08 (attach test report)	State
	IESNA distribution type	Type 2 or 3	State
	Light output percentage	>90%	State
	Upward light output ratio	<0.5%	State
	I _{MAX} above 95%	0	State
	IP rating of lantern	IP 65	State
	Minimum Performance Criteria		State
	Ratings in W		
	Rated Luminous Efficacy lm/W min		
	Luminance, Lm, min		
	LSF @ 16,000hrs		
	LLMF @ 16,000hrs		
	Correlated Colour Temp. Tc (K)		
	Max. Colour Rendering (Ra)		

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Clause	Description	KPLC REQUIREMENTS	Bidder's offer (indicate full details of the values offered)
4.3.1 0	High Pressure Sodium (HPS) Flood lights Luminaire with integral ballast.		
	Name of Manufacturer		State
	Country of manufacture		State
	Type/Model Reference Number		State
	Standard of manufacture	IEC 60598-1	State
	Compliance to all clauses	Attach test report	State
	Components of luminaire	Reflector, refractor and housing	State
	Body material	LMN marine grade aluminum, or equivalent with polyester powder coating	State
	colour	Grey, silver or black over ROHS compliant chrome passivation	State
	Finish	Polyester powder coating	State
	Components	Control gear fitted with tool-less guide release gear tray, equipped with a plug, socket and heat barrier	State
	Mounting diameter	Side entry 42mm to 60mm	State
		Post top entry 60mm to 76mm	State
	Integral flexible mounting system	As per clause 4.3.1.4	State
	Bowl protection	UV and vandal resistant	State
	Maximum weight	10kg	State
	Maximum windage	0.14m ²	State
	Minimum impact rating	IK08 as per IEC 62262	State
	Insulation type	Double insulation	State
	Class of protection	Class I	State
	Self-cleaning capability	Yes/No	State
	Photometric data	As per LM-78-08 (attach test report)	State
	IESNA distribution type	Type 2 or 3	State
	Light output percentage	>90%	State
	Upward light output ratio	<0.5%	State

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	I _{MAX} above 95	0			State
	IP rating of lantern	IP 65 as per IEC 60529			State
	Specific requirements				
	Design	Compact rugged design			State
	Power ratings				State
	Fixing design	6.35mm captive stainless steel slotted hex-head bolts			State
	Socket and lamp contact material	h/duty mogul-base porcelain, heavy gauge brass, nickel plated double lamp-grip screw and spring loaded centre contact			State
	Reflector design	Compound parabolic, double segmented finished aluminum			State
	Mounting design	Built-in slip fitter, adjustable laterally with steel mounting			State
	Inner housing	HP aluminum die-cast with high purity anodized hammered finish			State
	Glass design	Frameless thermal resistant tempered glass			State
	Ballasts specification	As per clause 4.7, approved under the BSC Unmetered Supplies Arrangements			State
	Ballasts	Applicable standards			State
4.4	High Pressure Sodium (HPS) Lamps				
	Name of Manufacturer				State
	Country of manufacture				State
	Type/Model Reference Number				State
	Standard of manufacture	IEC 60598-1			State
	Compliance to all clauses	Attach test report			State
	Nominal wattage, W				State
	Circuit				State
	Starting and warm-up characteristics - Starting				
	Test voltage (r.m.s.), V _{max}	198	198	198	State
	Starting time, s	5	5	5	State
	Pulse characteristics				



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Clause	Description	KPLC REQUIREMENTS			Bidder's offer (indicate full details of the values offered)
	Height (peak) A, V	2,500	3,300	3,300	State
	Width T ₂ at 50 % of A, μs	1.0	2.0	2.0	State
	Repetition rate	1/half cycle	1/full cycle	1/full cycle	State
	Phase angle, °	60-90	90	90	State
Starting and warm-up characteristics - Warm-up					
	Test voltage, V	198	198	198	State
	Time required to reach 45 V minimum at lamp terminals, min	5	7	7	State
Electrical characteristics					
	Wattage, W	148	245	380	State
	Voltage (r.m.s.) at lamp terminals, V	90	85-115	85-115	State
	Current (r.m.s.) , A	2.0	2.95	4.5	State
	Extinguishing voltage r.m.s., V	111	120	125	State
Photometric characteristics					
	Correlated colour temperature (nominal), K	-	2,170	2,170	State
	Chromaticity co-ordinates x/y (nominal)	-	0.510/0.420	0.510/0.42 0	State
	Colour rendering index Ra (nominal)	-	≥60	≥60	State
	Marking	Marking, Type, Method of marking on LED luminaries			specify
4.5	LED Bulbs				
	Name of Manufacturer	State			State
	Country of manufacture	State			State
	Type/Model Reference Number	state			State
	Standard of manufacture	State			State
	Light degree	State			State
	Nominal wattage, W	specify			State
	Input voltage (r.m.s.), Vac ,50Hz	State			State

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Clause	Description	KPLC REQUIREMENTS	Bidder's offer (indicate full details of the values offered)
	Total lumens measured(Lm) @ 25°C, ±5%	State	State
	Total lumens measured at steady state(Lm) ±5%	State	State
	Efficacy and Total Lumens	State	State
	Operating temperature	State	State
	Dimensions	specify	State
	Power Factor	specify	State
	Housing material and colour	specify	State
	State the markings and method of marking on the LED lamps	detail	State
	Correlated Colour Temp. Tc and Max. Colour Rendering (Ra)	state	State
4.6.	Photo Electric Cell Units (PECUs)		
	Type I – Ordinary PECU		
	Name of Manufacturer		State
	Country of manufacture		State
	Type/Model Reference Number		State
	Manufacturing standards complied with		State
	Compliance to all clauses		State
	Guaranteed for a minimum life	5 years	State
	Protection against electric shock	Class 2	State
	IP rating	IP65 as per IEC 60529	State
	Operating voltage, frequency	230V±10%, 50Hz	State
	Current rating	30A	State
	Contacts	Single-pole/single-throw; normally closed at night	State

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	Contact load rating	1000 Watts incandescent ; 1800 VA H.I. D	State
	Surge Protection	Expulsion or Metal-Oxide-Varistor type arrestor	State
	Time delay, s	15 – 30	State
	Turn-on level	1.0-1.5 lumens	State
	Turn-on to Turn-off ratio	1:2- 1:5	State
	Temperature range	-20°C to +80°C.	State
	Pre-set switch on/off level	35/18 lux	State
	Negative switching differential	1:0.5.	State
	Power consumption	<0.5W	State
	Contacts	EEI/NEMA standard 3-terminal polarized twist lock type	State
Type II –PECU complete with surge Switch			
	Name of Manufacturer		State
	Country of manufacture		State
	Type/Model Reference Number		State
	Manufacturing standards complied with		State
	Compliance to all clauses by attaching catalogue		Attach catalogue
	Guaranteed for a minimum life	6 years	State
	Protection against electric shock	Class 2	State
	IP rating	IP65 as per IEC 60529	State
	Operating voltage, frequency	230 V±10%, 50Hz	State

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	Current rating	30 A	State
	Contacts	Single-pole/single-throw; normally closed at night	State
	Contact load rating	5000 Watts incandescent ; 3000 VA H.I.D	State
	Surge Protection	Expulsion or Metal-Oxide-Varistor type arrester	State
	Type III – GSM enabled PECU complete with Timer Switch for Outdoor Lighting		
	Name of Manufacturer		State
	Country of manufacture		State
	Type/Model Reference Number		State
	Manufacturing standards complied with		State
	Compliance to all clauses		State
	Features – prove compliance for all the features by attaching a catalogue		Attach catalogue
	Guaranteed for a minimum life	6 years	State
	Protection against electric shock	Class 2	State
	IP rating	IP65 as per IEC 60529	State
	Operating voltage, frequency	230V±10%, 50Hz	State
	Current rating	30 A	State
	Contacts	Single-pole/single-throw; normally closed at night	State
	Contact load rating	5000 Watts incandescent ; 3000 VA H.I.D	State
	Surge Protection	Expulsion or Metal-Oxide-Varistor type arrester	State
4.6.5	Timers for Street Lighting		
	Name of Manufacturer		State
	Country of manufacture		State
	Type/Model Reference Number		State
	Manufacturing standards complied with		State
	Compliance to clauses design clauses		State

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Clause	Description	KPLC REQUIREMENTS				Bidder's offer (indicate full details of the values offered)			
	Rated voltage and frequency	230V AC, 50 Hz				State			
	Load carrying capacity	6-12 kW				State			
	IP rating	IP 40 as per IEC 60529				State			
	Operating Voltage	230V±10% Vac				State			
	Program Functions	ON / OFF				State			
	Number of Memory Locations	48				State			
	Power Reserve	150 Hrs				State			
	Max. Switching Capacity at 250 VAC cosΦ = 1	10 A				State			
	Max. Switching Capacity at 250 VAC cosΦ = 0.6	16 A				State			
	HPS Lamps	2300 watt				State			
	Shortest Switching Time	15 Min				State			
4.7	High intensity discharge ballasts								
	Name of Manufacturer					State			
	Country of manufacture					State			
	Model/Reference Number					State			
	Manufacturing standards complied with					State			
	Ballast type	Vacuum pressure impregnated			State				
	Insulation rating	Class H			State				
	Efficiency	88%			State				
	Characteristic curve	As per IEC 60662			State				
	Voltage tolerance	+2.5%			State				
	Characteristics of ballasts								
	Wattage (W)	150	250	400	150	250	400		
	Connection type	CWA	CWA	CWA					
	Nominal lamp wattage	150	250	400					
	Frequency, Hz	50	50	50					
	Rated voltage, V	230	230	230					
	Calibration current, A	2.0	3.0	4.6					
	Voltage/current ratio	81.0 ± 0.5%	60.0	39					
	Power factor(λ)	0.80±0.010	0.8±0.05	0.8±0.05					

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	Pulse width	2.0-3.6	3.0-5.2	4.6-7.5				
	Lamp warm-up current (r.m.s.), A	2,700-4,500	<5,000	<5,000				
	Pulse height (peak), luminaire requirement, V	10	10	12				
	Temperature rise	180	180	180				
4.8	Capacitors for Luminaires							
	Name of Manufacturer						State	
	Country of manufacture						State	
	Type/Model/Reference Number						State	
	Manufacturing standards complied with						State	
	Connection type		Primary side of transformer ballast			State		
	Type		Resin encapsulated			State		
	Power factor(λ)		0.88 lagging			State		
	Characteristics of capacitors for Luminaires							
	Lamp	Wattage	150	250	400	150	250	400
		Current	1.8	3.0	4.4			
	Capacitor	$\mu\text{F} \pm 5\%$	21	33	46			
4.9	Ignitors for luminaires							
	Name of Manufacturer						State	
	Country of manufacture						State	
	Type/Model Reference Number						State	
	Manufacturing standards complied with						State	
	Compliance to all clauses						State	
	Operating temperature		90°C			State		
	Ignitors electrical characteristics							
	Lamp wattage, W		150,	250	400	150	250	400
	Switch on voltage, V		≤ 210			State		
	Switching off voltage, V		> 168			State		
	Voltage peak, kV		3.4			State		
	Load capacitance, pF		155			State		
	Losses at peak current of 4.5A, W		2.7			State		

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	Pulse width	2.0-3.6	3.0-5.2	4.6-7.5			
	Lamp warm-up current (r.m.s.), A	2,700-4,500	<5,000	<5,000			
	Pulse height (peak), luminaire requirement, V	10	10	12			
4.10	Earth leakage circuit breaker						
	Name of Manufacturer						State
	Country of manufacture						State
	Type/Model Reference Number						State
	Manufacturing standards complied with						State
	Compliance to all clauses						State
	Technical characteristics of ELCB						
	Number of Poles	1P+N			State		
	Rated Current(A)	40			State		
	Rated Residual Operating Current(I n)(mA)	30			State		
	Rated Residual Non-operation Current (I no)(mA)	0.5IΔ n			State		
	Rated Voltage(V), frequency	230/400, 50Hz			State		
	Residual Current Off-time	0.1S			State		
	Short Circuit Capacity(Icu)	3000A			State		
	Endurance	4000			State		
	Tripping Curve	C,D			State		
	Degree of protection	IP20			State		
	Operating time	30ms			State		
4.11	Lighting contactors						
	Name of Manufacturer						State
	Country of manufacture						State
	Type/Model Reference Number						State
	Manufacturing standards complied with						State
	Compliance to all clauses						State
	Technical parameters for lighting contactors						
	Type	AC operated double pole			State		

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	Rated operational voltage U _{max}	690V		State
	Rated insulation voltage	1000V		State
	Rated operational current	40A		State
	Impulse withstand voltage	8KV		State
	Maximum breaking capacity	250A		State
	Maximum electrical switching frequency for AC-1	600 cycles/h		State
	Heat dissipation per pole	1.8W		State
	Mechanical durability	3 million operating cycles		State
	Degree of enclosure	IP 20		State
4.12	Control Pillars			
4.12.1	General			
	Manufacturing standards			specify
	Material of manufacture			specify
	Mounting rails	12-way		specify
	Rating	Surface mounted	200A	specify
		Pole mounted	125A	specify
	Degree of protection, min	IP65		Specify
	Design	Surface mounted	Double door	Specify
		Pole mounted	Single door	specify
	Front design	Glass or transparent front		specify
4.12.2	Ground mounted control pillars			
	Name of Manufacturer			State
	Country of manufacture			State
	Type/Model Reference Number			State
	Manufacturing standards			State
	Minimum thickness of galvanized mild steel	3mm		State
	Minimum galvanization thickness	85µm		State
	Number of ways	12-way		State

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	Maximum temperature	40°C	State
	Degree of protection	IP 65 , min on the doors	State
		IP 45, min on the vent louvers	State
		IK 08, min	State
	Thickness of marine plywood or equivalent backboard	15mm	State
	Door design	Double door with tamper proof "O" locks	State
	Protection	Vermin proof screens	State
	Minimum size (H x W x D)	1,350mm x 1,200mm x 450mm	State
	Raise and backboard dimensions	400mm, 1170 x 980mm respectively	
	Application	Shall accommodate all items specified in clause 4.15.2.2 (a to j)	State
	Provision for earthing	Y/N	State
	Labeling including circuit diagram in accordance to clause 4.15.2.4	Y/N	State
	A durable warning signs	Y/N	State
	Type of pillar	Type A as per IEC 61439-1	State
	Standard of manufacture	IEC 61439-1 & 3	State
	Rated current (In)	200A	State
	Rated short circuit withstand current	10 kA for 1s	State
	Rated frequency	50 Hz	State
	Rated diversity factor	0.8	State
	Power frequency withstand voltage	AC 1.8 kVrms	State
		D.C 2.67 kV	State
	Impulse withstand voltage	2.5 kV pk	State
	Type of coordination overload characteristics		State
	Pollution degree	III	State
	Types of system earthing	Solidly earthed system	State

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	Indoor and/or outdoor installation	Outdoor	State
	Stationary or movable	Removable	State
	Degree of protection	IP 54	State
	Intended for use by skilled or ordinary persons	Ordinary persons	State
	Electromagnetic compatibility (EMC) classification	Performance criterion B as per IEC 61439-1	State
	External design	Specify	State
	Mechanical impact protection	At least IK 08 as per IEC 62262	State
	The type of construction	Specify	State
	The nature of short-circuit protective device(s)	Specify	State
	Measures for protection against electric shock	Specify	State
	Overall dimensions (including projections e.g. handles, covers, doors)	Specify	State
	The weight	specify	State
4.12.3	Pole mounted control pillars		
	Name of Manufacturer		State
	Country of manufacture		State
	Type/Model Reference Number		State
	Type of distribution board	multi row Type A	State
	Manufacturing standards	IEC 61439-1 & 3	State
	Minimum thickness of plastic or fibre	3mm	State
	Control pillar rating	200A	State
	Maximum temperature	40°C	State
	Degree of protection	IP 65 , min on the doors	State
		IP 45, min on the vent louvers	State
		IK 08, min as per IEC 62262	State

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	Door design	Double door with tamper proof "O" locks and non-standard lock provision	State
	Minimum size (H x W x D)	540mm x 300mm x 160mm	State
	DIN rails	At least three in number	State
	Complete with blanking plates	Y/N	State
	Removable main bus-bar	Y/N	State
	Suitable for protection and metering	Y/N	State
	Doors open at 180 ⁰	Y/N	State
	Supplied complete with a disconnect or rated 125A	Y/N	State
	Provision to electrically connect two DBs together	Y/N	State
	Standard of manufacture	IEC 61439-1 & 3	State
	Rated current (In)	125A	State
	Rated short circuit withstand current	10 kA for 1s	State
	Rated frequency	50 Hz	State
	Rated diversity factor	0.85	State
	Power frequency withstand voltage, kV rms	AC 1.8 kV rms	State
		DC 2.67 kV D.C	State
	Impulse withstand voltage	2.5 kV pk	State
	Type of coordination overload characteristics	Specify	State
	Pollution degree	III	State
	Types of system earthing	Solidly earthed system	State
	Indoor and/or outdoor installation	Outdoor	State
	Stationary or movable	Removable	State
	Intended for use by skilled or ordinary persons	Ordinary persons	State
	Electromagnetic compatibility (EMC) classification	Performance criterion B as per IEC 61439-1	State
	External design	Specify	State

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	The type of construction	Specify	State
	The nature of short-circuit protective device(s)	Specify	State
	Measures for protection against electric shock	Specify	State
	Overall dimensions (including projections e.g. handles, covers, doors)	Specify	State
	The weight	Specify	State
4.13	Multifunction Test Kit		
	Name of manufacture and country of origin		state
	Make and Type Designation of Multifunction Test Kit		state
	Standard(s) of manufacture		state
	Service conditions		Specify
	Input Voltage range(V)		State
	Instruments that compose the Test kit		List
	Weight of the complete Test Kit		State
	Operating system of the Test Kit and compatibility with PC/Laptop		State
	Capacity to upload data in excel/word for analysis and processing speed(kb/s)		State
	Controls provided to ease operations		List
	Data communication Protocol of the Test Kit		State
	Software(s) provided		State
	Test results reportable(s)		List
	Markings and Method of Marking		Specify
	Carriage bag properties		Specify
	Warranty		specify
	Training :provide a training program		specify
			specify
APPENDICES			
A.1	Test standards and responsibility of carrying out tests		Provide
A.2	Copies of Type Test Reports submitted with tender		Provide

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A.3	Acceptance tests to be witnessed by KPLC at factory before shipment. Test reports to be submitted by supplier to KPLC for approval before shipment		Provide
A.4	Replacement of rejected street lighting accessories		State compliance
B.1, 2	Manufacturer's warranty and period of warranty		State period
C1	Quality Assurance Plan		Submit copy
C2	Declaration of Conformity to applicable standards & Copy of ISO 9001:2015 Certificate		Submit
C3	Delivery time, manufacturer's monthly & annual production capacity, experience. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar type of accessories sold in the last five years as well as reference letters from at least four of the customers shall be submitted with the tender for evaluation		Submit
D.1	Documents submitted with tender		State
D.2	Documents to be submitted by supplier to KPLC for approval before manufacture		State
D.3	Routine and sample test reports to be submitted to Kenya Power for approval before shipment/delivery of the goods		State compliance
D.4	Recommendations for installation, use, care, storage and routine inspection/testing procedures		Provide
D.5	Statement of compliance to specification (indicate deviations if any & supporting documents)		Provide

NOTE:

- 1) The clauses in the specification take **precedence** over the Guaranteed Technical Particulars.
- 2) Bidders shall give full details of the items on offer as per the specification and applicable standards. The details provided shall conform to the test reports and their certificates, as well as labeled drawings complete with dimensions, catalogues and/or brochures for the purpose of tender evaluation.
- 2) Bidders should note that the above Guaranteed Technical Particulars Schedules must be fully completed and submitted with the bid. Wherever there is conflict between the GTPs and the clauses in the specification, the clauses in the specification shall take precedence. Failure to complete the schedules shall lead to rejection of the bid.

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3) *Guaranteed values shall be specified.*

* *Words like 'agreed' 'Yes', 'confirmed', 'As per KPLC specifications', etc. shall not be accepted and shall be considered non-responsive.*

.....
Manufacturer's Name, Signature, Stamp and Date

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