



*Central Office – P.O. Box 30099 – 00100,
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Fax No. 254-02-3514485
Stima Plaza, Kolobot Road,
Nairobi, Kenya*

Our Ref: KP1/9AA-3/PT/27/14-15/en

5th November 2014

Your Ref:

TO:

ALL PROSPECTIVE BIDDERS

Dear Sirs/ Madams

**RE: ADDENDUM NO. 1 TO THE TENDER NO. KP1/9AA-3/PT/27/14-15 FOR
SUPPLY OF MATERIALS FOR STREET LIGHTING PROJECT.**

The following amendments are made to the specified provisions for the tender document for the supply of materials for street lighting project dated October, 2014.

1. RELATIONSHIP WITH THE PRINCIPAL TENDER DOCUMENT

Save where expressly amended by the terms of this Addendum, the PTD shall continue to be in full force and effect. The provisions of this Addendum shall be deemed to have been incorporated in and shall be read and construed as part of the PTD

2. SECTION IV- SCHEDULE OF REQUIREMENTS.

Item no. 32- We require single brackets (1100pcs)

2. PART B-DETAILED TECHNICAL SPECIFICATIONS

- i) Page 3 of technical specifications section 1.2, the high pressure sodium lanterns ,the high pressure sodium lamps and the high pressure sodium flood or LED should be equipped with electronic ballast.
- ii) Section 4.4.1- The centrally managed System is omitted- shall be stand alone control by photo cells.
- iii) Section 4.4.5 ,section 4.4.6, and section 4.4.8- The parts describe different

- iv) Section 4.4.19- The clause is deleted and controls shall be stand alone by photo cells at the control pillar.
- v) Page 15 of the specifications – For the lamps to be used in eroded industrial and coastal areas.
- vi) Section 4.2.10, Section 4.3.8 and , Section 4.9.5 – Revised specification is attached.
- vii) The revised Specifications are attached as follows:-
- viii) i) Specifications for Street Lighting No: KP1/3CB/TSP/15/002
ii) Specifications for Alluminium and Copper 2- Core PVC Insulated, Steelwire Armoured Cables.- No. KP1/3CB/TSP/05/032.

3. DEADLINE FOR SUBMISSION OF TENDER.

The tender closing date remains the same, **Tuesday 12th November, 2014 at 10.00am.**

Tenders must be received by the procuring entity not later than **10.00a.m** at **Stima Plaza – Tender Box**.The procuring entity will open the bids immediately thereafter on the same ~~day~~ in the **Auditorium Stima Plaza**.

All other terms and conditions remain as per the Principal Tender Document.

Yours faithfully,

FOR: THE KENYA POWER & LIGHTING COMPANY LIMITED



ENG. JOHN OMBUI

GENERAL MANAGER, SUPPLY CHAIN



Kenya Power

TITLE:

**SPECIFICATION FOR STREET
LIGHTING ACCESSORIES**

Doc. No.

KP1/3CB/TSP/15/002

Issue No.

1

Revision No.

1

Date of Issue

2014-10-30

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ANNEX A: *Guaranteed Technical Particulars (to be filled and signed by the supplier and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of complete type test reports for tender evaluation, all in English Language)*

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0.1 Circulation List

COPY NO.	COPY HOLDER
1	Research & Development Manager
2	Supply Chain Manager (Procurement)
Electronic copy (pdf) on Kenya Power server (http://172.16.1.40/dms/browse.php?fFolderId=23)	

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
1	2014/10/30	Section 4.19: Added Mercury Lamps	<i>J. Ngugi</i>	<i>Cr. K. LATHIGE</i>
	2014/10/30	clause 4.4.1: removed Central Management System (CMS)	<i>J. Ngugi</i>	<i>Cr. Lathige</i>
	2014/10/30	Clause 4.4.7: Included all available options	<i>J. Ngugi</i>	<i>Cr. K. LATHIGE</i>
	2014/10/30	Clause 4.9.5: included minimum life Tc as 50,000hrs	<i>J. Ngugi</i>	
	2014/10/30	Clause 4.3.8 : dimensions of bracket amended	<i>J. Ngugi</i>	

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FOREWORD

This specification has been prepared by the Standards Department of The Kenya Power and Lighting Company Limited (abbreviated as KPLC) and it lays down requirements for accessories to be used in overhead street lighting. It is intended for use by KPLC in purchasing the items.

1. SCOPE

1.1. This specification is for street lighting accessories to be used in street lighting on streetlighting columns and along the pole on power lines.

1.2. This specification covers the following items:

- (i) street lighting columns
- (ii) street lighting bracket
- (iii) lanterns as follows:-
 - (a) 100W, 150W, 250W, 400W High Pressure Sodium lanterns or LED lights complete with control gear (i.e chokes, igniters, capacitors etc. as applicable)
 - (b) 100W, 150W, 250W High Pressure Sodium Lamps or LED lights
 - (c) 125W, 250W and 400W High Pressure Mercury Lamps
 - (d) 400W High Pressure Sodium Flood or LED lights
- (iv) Pole mounted street lighting control pillar (separate specs attached)
- (v) Photo – cell
- (vi) Control Timers
- (vii) High Intensity discharge ballasts
- (viii) Igniters
- (ix) Contactors
- (x) Capacitors

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- (xi) Consumer Units
- (xii) Earth leakage Circuit Breakers

1.3. The specification stipulates the minimum requirements for street lighting accessories, for use in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the items for the Kenya Power & Lighting Company.

1.4. The specification does not purport to include all the necessary provisions of a contract.

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:

BS EN 40-3-1:2013: Lighting columns, design and verification for characteristic loads

IEC 62031:LED modules for general lighting (solid state lighting) -Safety specifications

IEC 61547-2009: Equipment for general lighting purposes - EMC immunity

IES LM-80-08 : Method for Measuring Lumen Maintenance of LED Light sources

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)

IEC60598-2-3:Particular requirements – Luminaires for road and street lighting

IEC60662:High Pressure Sodium Vapor Lamps specifications

IEC60192:Low Pressure Sodium Lamps Performance Specifications

IEC 61439-3:low-voltage switchgear and control gear assemblies

EN 60235:Discharge Lamps safety specifications

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ISO 9001:Quality management systems – Requirements

ISO 1460: Metallic coatings-Hot dip galvanized coatings on ferrous materials

IEC 60923:2001 Ballasts for discharge lamps (excluding tubular fluorescent lamps)
Performance requirements

IEC 926:1995Auxiliaries for lamps–Starting devices: General and safety requirements

IEC 60927:2005 Starting devices (other than glow starters) - Performance
requirements

IEC 61048:2006 Capacitors for use in tubular fluorescent and other discharge lamp
circuits:General and safety requirements

IEC 61049:1991 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 60439 Low Voltage switchgear and Control gear assemblies

IEC 61008 Residual current operated circuit breaker without integral overcurrent
protection for household and similar uses

IEC 60188 High pressure mercury vapour lamps- performance specifications

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 of altitude upto 2200m above sea level, humidity of up to 90%, average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C and heavy saline conditions along the coast.

4.2 Street lighting columns

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- 4.2.1 The size of the columns shall be 8m or 10m and shall be specified in the tender
- 4.2.2 The columns shall be manufactured in accordance with the requirements of BSEN40 and latest revisions
- 4.2.3 The columns shall be manufactured from galvanized tubular/ sheet steel
- 4.2.4 The columns shall be designed to be capable of accepting lanterns with the following weights and windage of lanterns:-

Table 1.0 Lantern parameters

mounting height (m)	lantern (kg)	Windage Area (m ²)
8m post top/ side entry	10	0.19
10m post top/side entry	15	0.19

- 4.2.5 The columns shall have a root for planting to a depth 1200mm and 1500mm for 8 and 10 metre columns respectively
- 4.2.6 The columns shall have a cable entry slot of 65mm x 150mm with the top of the slot 350mm below ground level
- 4.2.7 The base section of the columns shall have a minimum wall thickness of 3.2mm and have base compartment openings of a minimum 600 x 115mm
- 4.2.8 The shaft sections shall have minimum diameters of 114mm for all the columns
- 4.2.9 The height above ground of the base sections shall be 1250mm marked A
- 4.2.10 The fixing of the bracket to the column shall be over a reduced diameter spigot to maintain the smooth parallel line between the column and bracket arm. The bracket arm shall be held in position by stainless steel screws allowing fixing in any one of four 90degrees positions.

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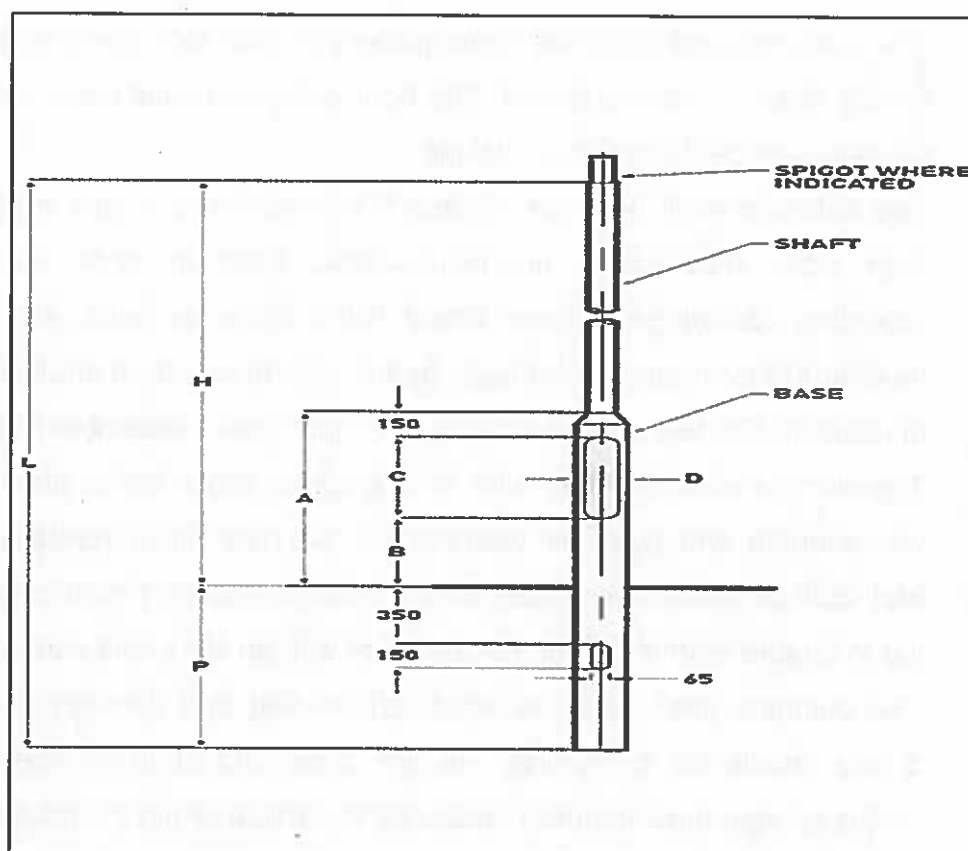


Fig1: Column details

The parameters in figure 1 are tabulated below

Table 2: Column characteristics

H	P	L	A	B	C	D	Base diam.	Shaft diam.
6	1200	7200	1250	500	600	115	168	114
8	1500	9500	1250	500	600	115	168	114

- 4.2.11 The columns shall have a means of preventing undesired rotational movement of the bracket, once fixed in position, to the column shaft shall be incorporated in the column design.
- 4.2.12 The method of joining the base section and the shaft of the columns shall be by a swage joint with an internal centralizing washer.

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- 4.2.13 The columns shall have the same pattern of door lock. Keys shall be supplied for 5% of all columns supplied. The door fixing bolt shall have a tapered end to facilitate self-centering when closing.
- 4.2.14 The columns shall have an internal full length base board, equivalent to the door size, substantially non-hygroscopic, fitted in each compartment for mounting control gear. Base board fixing studs or bolts shall not protrude beyond the front face of the base board. The base board shall be firmly bolted in position. On delivery, the column door shall come assembled on the column
- 4.2.15 The columns shall be fitted with M12 x 30mm brass earth studs threaded the whole length, with two plain washers and two nuts within the base compartment and shall be easily accessible. Column doors shall be provided with an internal lug to enable earthing of the column door with an M8 brass earth stud.
- 4.2.16 The columns shall have no sharp edges that can damage electrical cables during installation or service. An anti-chafe ring shall be fitted where cable routes change direction from horizontal to vertical within the bracket
- 4.2.17 The columns and bracket arms shall be hot dip galvanized to a minimum of 100 μ m in accordance with ISO 1461 unpainted. The galvanized surface shall then be degreased and left with a smooth finish to prepare for painting.
- 4.2.18 The minimum dry film thickness of paint shall be 100 μ m throughout the column
- 4.2.19 The columns shall have line on the circumference of the base section to denote ground level.

4.3 Street lighting bracket for use with steel columns, wooden and concrete poles

- 4.3.1 The brackets shall be manufactured from galvanized tubular steel, or aluminum. The aluminum/zinc coating shall be tested to ISO 1460 standards.
- 4.3.2 The brackets shall be manufactured, supplied and installed in accordance with the requirements of BS EN 40-3 or revision of such. Sharp edges shall not be permitted.
- 4.3.3 The brackets shall be designed to be capable of accepting lanterns with the following weights and windage of lanterns as per table 1 below

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Table 3: Lantern mounting details

MOUNTING HEIGHT	LANTERN WEIGHT (kg)	Windage Area (m ²)
10m / side entry	Max. 15	0.19
12m / side/entry	Max.15	0.27

- 4.3.4 The method of securing the bracket arm must be positive such that the arm cannot rotate. The arm and lantern shall be at right angles to the highway to be illuminated.
- 4.3.5 The outreach of the bracket shall be 1.0m, 1.5m and 2.0m. This shall be stated in the tender
- 4.3.6 The bracket arms shall, provide an incline of lantern of 5°, or 0° in Environmental Zone E1 when fitted to spigots of 42mm OD x 127mm.
- 4.3.7 The brackets shall be of single or double projection. The details shall be as per attached drawings below

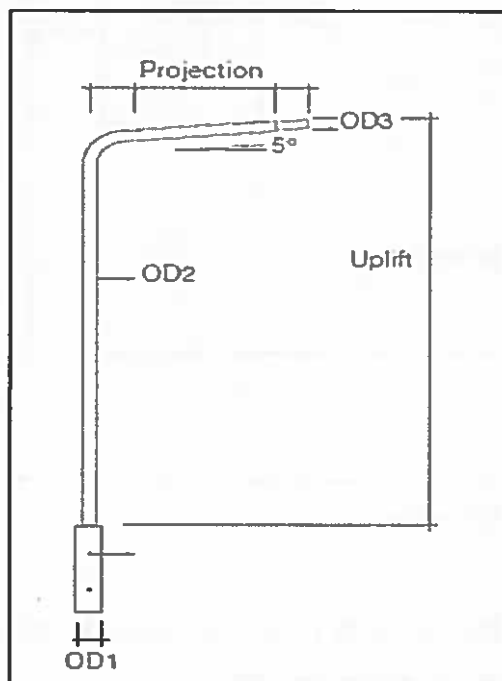


Fig 2(a): single bracket

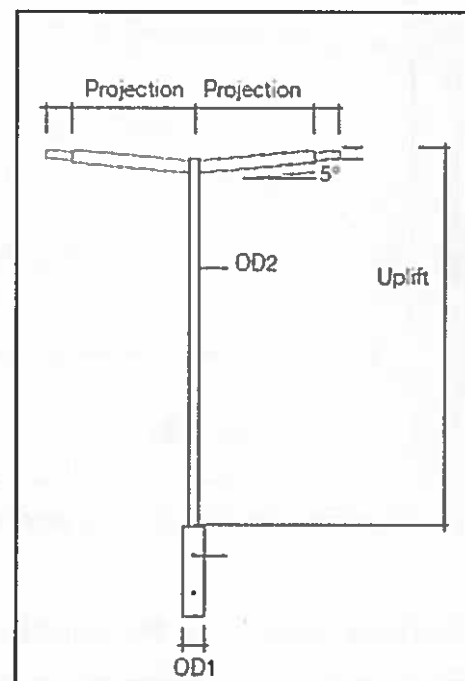


Fig2 (b): Double bracket

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4.3.8 Technical details of brackets for columns

Table 4.0 Details of brackets

Projection (mm)	Spigot (mm)	ϕ	OD ₁ (mm)	OD ₂ (mm)	OD ₃ (mm)	Uplift(mm)
1000	76		89	48	42	2000
1500	76		89	48	42	2000
2000	76		89	48	42	2000

4.3.9 Wood and concrete street lighting bracket

4.3.9.1 In additions to the requirements of above clauses 4.3.1 to 4.3.6, the brackets to be used in wooden and concrete pole shall be designed as per fig3 below

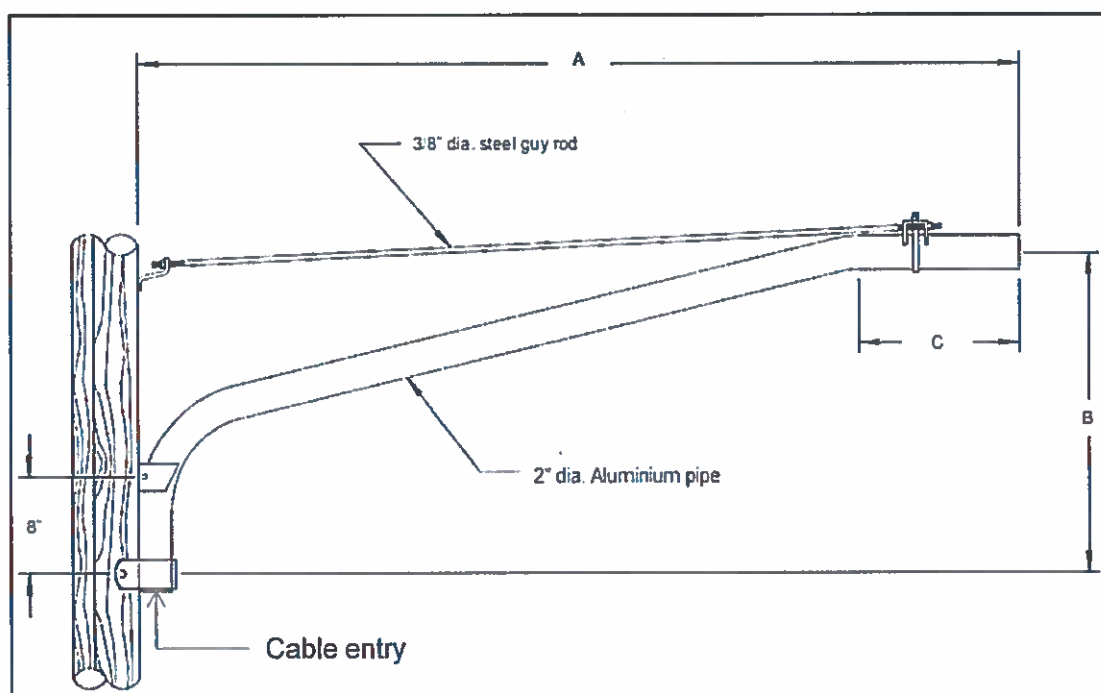


Fig 3: bracket for use in concrete and wooden poles

4.3.9.2 The bracket shall be fabricated complete with plate for fixing on either concrete or wooden pole as shown above by means of steel straps or bolts

4.3.9.3 The bidder shall submit detailed drawings for evaluation together with the bid.

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- 4.3.9.4 The brackets shall conform to the general shape shown in figure 3 and comply with dimensional details in table 5

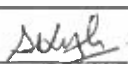
Table 5.0 Dimension of the wood/concrete bracket

Projection A (mm)	B(mm)	C(mm)
1000	300	300
1500	450	300
2000	600	300

4.4 Lanterns


- 4.4.1 The Lanterns used for road lighting shall be integral and fitted with electronic control equipment complete with bulbs.
- 4.4.2 The lanterns should be manufactured to IEC 60598-1 and incorporate an efficient optical system to direct the light onto the highway. To ensure minimum environmental pollution of the night sky the upward light emitted shall be kept to a minimum.
- 4.4.3 The Lanterns shall allow for side entry and post mounting and shall, when post mounted, be capable of adjustable inclination between zero (0°) and five (5°) degrees without the need for special and additional adaptors
- 4.4.4 Lanterns shall be environmentally friendly and all component parts shall be easily recyclable.
- 4.4.5 The lanterns body shall be UV stabilized polycarbonate, with installation hardware and instructions. All component parts shall be corrosion resistant.
- 4.4.6 The frame and canopy of lanterns shall be made of high-quality die-cast aluminum, painted grey, silver or black. An alternative to an aluminum canopy shall be allowed if manufactured from high quality, recyclable materials
- 4.4.7 Lanterns shall be available with polycarbonate bowls, low profile bowls, and flat glass or curved tempered glass protectors.

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- 4.4.8 The impact rating for glass protectors shall be IK08 minimum in accordance with IEC 62262:2002
- 4.4.9 All lanterns shall be fitted with bowls of sound and robust construction capable of being easily dismantled for maintenance or repair purposes. All lanterns shall be fitted with bowls manufactured from vandal resistant material and stabilized to minimize loss of transparency due to weathering and exposure to ultra violet light.
- 4.4.10 All hinges, toggle catches, captive screws and nuts shall be made of non-corrosive material.
- 4.4.11 Lanterns shall be reasonably weather and dust-proof and shall be fitted with a suitable gasket between the body of the lantern and the bowl. The IP Rating of the lantern shall not be less than IP 65. They shall have tiltable mounting base and easy to access ballast compartment to make installation easy.
- 4.4.12 The means of supporting the lamp shall be 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.
- 4.4.13 The optical equipment controlling distribution should include high purity aluminum reflectors and/or prismatic refractors and these shall have a smooth exterior surface or be protected by hermetically sealed cover plates to prevent an accumulation of dirt and to facilitate cleaning. Refractors wholly within a totally enclosed lantern need not be sealed.
- 4.4.14 All lanterns 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.
- 4.4.15 All lanterns 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.

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- 4.4.16 Electrical equipment shall be installed so that levels of radio interference given in IEC 61547 are not exceeded.
- 4.4.17 The downward light output ratio shall be a minimum of 70%
- 4.4.18 The lanterns 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
- 4.4.19 The lantern shall be suitable for fixing onto bracket arms of $\Phi 42-60\text{mm}$.
- 4.5 High Pressure Sodium Lamps**
- 4.5.1 High pressure sodium lamps shall comply with EN 60235 & IEC 60662
- 4.5.2 EC Declaration of conformity certificate shall be provided.
- 4.5.3 High pressure sodium lamps shall be of the "Plus" type with higher xenon pressure for increased lm/W
- 4.5.4 High pressure sodium lamps shall incorporate a solid state getter with clear lamp bases (getter –blackened lamp bases shall not be accepted)
- 4.5.5 High Pressure Sodium Lamps shall be of the single arc-tube type to ensure the light source is always at the centre of the luminaire optic for consistent photometric performance. Elements within the lamp construction shall not give rise to shadows cast.
- 4.5.6 The construction shall be sturdy and robust with as few as welds as possible in order to reduce the risk of early failures due to external shock and vibration during transportation and installation

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4.5.7 Minimum Performance Criteria

Table 6.0: Performance Criteria

High Pressure Sodium Lamps	Rated Luminous Efficacy lm/W (100hrs)	LSF @ 16,000hrs	LLMF @ 16,000hrs	Correlated Color Temp. Tc (K)	Max. Color Rendering (Ra)
100W	107	0.96	0.94	2000	25
150W	110	0.96	0.94	2000	25
250W	128	0.96	0.94	2000	25
400W	140	0.96	0.94	2000	25

4.6 High Pressure Sodium Flood lights with integral ballast

- 4.6.1 The High Pressure Sodium Flood lights units shall be of rated voltage/frequency of 240V, 50HZ $\pm 6\%$
- 4.6.2 The unit shall be compact in size, attractively styled contemporary design, rugged and dependable, easy to install and service.
- 4.6.3 The unit shall be Integral ballast, one-piece housing, and one-piece lens cover
- 4.6.4 The unit shall be secured by four 1/4" Dia. Captive stainless steel slotted hex-head bolts.
- 4.6.5 The unit shall have thermal shock and impact resistant glass lens sealed with heavy duty, high temperature silicone rubber gasket, firmly seated.
- 4.6.6 The unit 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.
- 4.6.7 The unit shall have a compound parabolic, double segment, finished aluminum reflector for optimum efficiency.
- 4.6.8 The unit shall be for pole mounting, built-in slip-fitter, for internal wiring, adjustable laterally and vertically, with bronze polyester finish.

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4.7 Photoelectric Controller for Streetlights

4.7.1. Photoelectric control shall fit an EEI/NEMA standard 3-terminal polarized twist locktype receptacle and shall be furnished complete with a neoprene receptacle gasket.

4.7.2 Photo-electric controllers must be manufactured using non-hazardous materials

4.7.3 ELECTRICAL RATINGS

Table 7.0 Photoelectric cell Electrical Parameters

s/no	Parameter	specification
1	Operating Voltage	230-250V, 50Hz
2	Contacts	Single-pole/single-throw; normally closed at night
3	Contact load rating	1000 Watts incandescent; 1800 VA H.I.D
4	Surge Protection	Expulsion or Metal-Oxide-Varistor type arrestor
5	Turn-on level	1.0-1.5 lumens
6	Turn-on to Turn-off ratio	1:2- 1:5
7	Temperature range	-40°C TO +70°C.

4.8 Light Emitting Diodes (LEDs) fittings and Luminaire

4.8.1 The LEDs fittings and luminaire shall be manufactured and tested as per the requirements of IEC 62031, IEC 61547 and 60598-1 and the requirements of this specification

4.8.2 The LEDs shall be of different lumen output and power ranges as alternative solution for existing 100w~400W classical system sodium lights

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4.8.3 The housings shall be die cast and extruded aluminum housing with universal two-bolt slip fitter mounts to 1-1/4" to 2" (1-5/8" to 2-3/8" O.D.) diameter mast arm. The Leveling adjustment shall be $\pm 5^\circ$.

4.8.4 The LEDs housing shall receive a fade and abrasion resistant, epoxy polyester powder coat, light gray finish standard. Aluminum extruded components shall be anodized.

4.8.5 The housing shall meet the 3000 hours salt spray test to IEC 60598-1

4.9 Light Emitting Diodes

4.9.1 The LEDs shall be of Hi-flux/Hi-power white LEDs producing a minimum of 95% of initial intensity at 100,000 hours of life.

4.9.2 The LEDs shall be tested in accordance with IES LM-80 testing procedures.

4.9.3 The LEDs shall have a mean correlated color temperature of 4000K (standard) and 70 minimum CRI.

4.9.4 The LEDs shall be 100% mercury and lead free

4.9.5 Led System performance

The LEDs shall comply with the following minimum system performance criteria

- The T_c life shall be $+ 65^\circ\text{C}$
- The LEDs shall have a system lifetime T_c life of at least 50,000 hrs
- The T_c min shall be at least $- 20^\circ\text{C}$ (start up at $- 40^\circ\text{C}$)
- The T_c max shall be $+ 75^\circ\text{C}$
- The T_c thermal cutoff module shall be $+ 75^\circ\text{C}$ (starts dimming)
- The T_c thermal cutoff driver shall be $+ 85^\circ\text{C}$ (maximum dimming)
- The input voltage shall be 220-250 V
- shall be suitable for at least class II

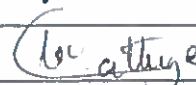
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4.10 LedOptical Systems

4.10.1 The LEDs micro-lens systems shall produce IESNA Type 2 or Type 3 distributions. The Luminaire shall produces 0% total lumens above 90° (BUG Rating, U=0).

4.10.2 Optional house side shield cuts light off at ½ mounting height behind luminaire shall be provided.

4.10.3 For flood lights the available beam angles shall be either 15°, 60° or asymmetrical

4.10.4 10-year limited warranty shall be provided for the luminaire and components.

Note: both driver & LED module shall be able to be replaced independently

4.11 Performance data for LEDs

Table 8.0 Performance data for LEDs

			Type 2			Type 3		
	Current(mA)	Watts(w)	Lumens (Lm)	Efficacy (lm/W)	BUG Rating	Lumen (Lm)	Efficacy (lm/W)	BUG Rating
1	700	163	15000	92	B2 U0 G2	14800	91	B2 U0 G2
2	700	215	20000	93	B3 U0 G3	19700	92	B3 U0 G3
3	700	260	24000	92	B3 U0 G3	23700	91	B3 U0 G3

4.12. Timers

4.12.1 The timers shall be Single Phase (230V AC) version in single frame size capable of carrying a load of 6 kW to 12 kW manufactured to IEC60439-3

4.12.2 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.

4.12.3 The timers shall have a Programmable Time Switch 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

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when sun rises. This time switch is programmed on latitude base for whole year for sun rise and sun set timing.

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

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

4.13 High Intensity Discharge Ballasts

4.13.1 Ballasts shall comply with IEC 922 and IEC 60923 and shall bear the IEC Mark and wiring connection type on the casing.

4.13.2 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. 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.

4.13.3 The HID ballasts shall be Vacuum impregnated 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.)

4.13.4 The ballasts shall conform to the following electrical characteristics

Table 9.0 Ballasts electrical characteristics

WATTAGE (W)	Current (A)	POWER FACTOR (λ)	TEMP RISE ($^{\circ}\text{C}$)	CONNECTION TYPE
100	1.2	0.42	70	CWA-constant wattage autotransformer
150	1.8	0.40	70	CWA
250	3.0	0.40	70	CWA
400	4.45	0.43	70	CWA

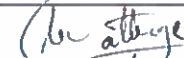
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- 4.13.5 The bidders shall provide the HID ballasts characteristic curves to support their offers
- 4.13.6 The HID ballasts shall date stamped on either the top surface or the side surface of the ballast core
- 4.13.7 The HID ballasts shall be component recognized by the  U_L (underwriter's Laboratory) and shall meet the  88% efficiency requirements of EISA (ACT, 2007)

4.14 Capacitors

- 4.14.1 Capacitors shall comply with IEC 61048 and IEC 61049 and shall bear the IEC mark
- 4.14.2 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).
- 4.14.3 All capacitors shall be fully encapsulated and filled with self-extinguishing resin.
- 4.14.4 The capacitors shall be of the ratings shown in the table below for the corresponding High Pressure Sodium lamps

Table 10.0: Capacitors Electrical parameters

LAMP		CAPACITOR
Wattage(W)	Current	μF± 5%
100	1.2	13
150	1.8	20
250	3.0	33
400	4.4	45

4.15 Ignition Devices

- 4.15.1 Igniters shall comply with IEC 60927 and shall bear the IEC mark. Igniters shall be of the superimposed-pulse solid-state electronic trigger type.

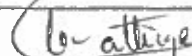
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4.15.2 The igniters shall be capable of operating lamps of the following wattage range
150W, 250W and 400W

4.15.3 Igniters shall be of the standard type to allow striking of the lamp without
switching the power off after replacement of a faulty igniter.

4.15.4 Igniters shall be suitable for operating any make of lamp in conjunction with any
make of ballast at temperatures up to 90° C. The igniter shall be connected in
series with the ballast and installed between the ballast and lamp holder.
Systems that operate with the igniter in parallel with the lamp, or with special
tapped ballasts, will not be acceptable.

4. 15.5.All igniters shall be suitable for connection in the circuit so that the ignition
pulse is confined between the igniter and lamp holder.

4.15.6 The igniters shall conform to the following electrical characteristics.

Table 11.0 Igniters electrical characteristics

1	Lamp wattage (w)	100,150, 250 and 400
2	Switch on voltage (v)	≤ 200
3	Switching off voltage	>168
4	KV peak	3.4
5	Load capacitance pF	155
6	Losses at peak current of 4.5A in watts	2.7

4.16 Consumer Unit

4.16.1 The consumer unit shall be manufactured in accordance with IEC 60439-1

4.16.2 The unit shall be complete with blanking plates, busbars, busbarcover,terminal
blocks, and hinged door complete with installation instructions.

4.16.3 The unit shall be supplied complete with a suitably rated double pole isolator
Switch mounted on DIN metal plates (mild steel or phosphor bronze) rails with
spare space on DIN rail (35mmx 7.5mmx1.0mm) for mounting thecircuit
breakers and contactors.

4.16.4 The consumer unit shall be for surface mounting type and outdoor installation
inside a streetlighting control pillar.

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4.16.6 The consumer unit shall comply with the following technical requirements

Table 12.0 consumer unit technical parameters

	DESCRIPTION	REQUIREMENT
1	Standard	IEC 439 AND BS 60439
2	Max load/ No of ways	80A, 4Way SPN
3	Degree of protection	IP 46
4	Enclosure material	Cold rolled sheet steel
5	Finish	Gray Ral 7015

4.17. Earth Leakage circuit Breaker

4.17.1 The Earth Leakage Circuit Breaker (ELCB) shall conform to IEC 61008 and BS4293

4.17.2 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 $I_{\Delta n}$

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

4.17.4 The ELCB shall have overload, short circuit and over voltage protect functions.

4.17.5 The ELCB shall be used in electrical distribution system to prevent electric shock.

4.17.6 The ELCB shall conform to the electrical characteristics shown below.

Technical characteristics

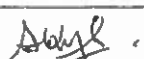
Table 13.0: ELCB Technical Characteristics

Number of Poles	1P+N
Rated Current I_n (A)	40
Rated Residual Operating Current($I_{\Delta n}$)(mA)	30
Rated insulation(V)	600
trip time	$I \times I_{\Delta n} < 300ms$
Rated Voltage(V)/Frequency	230/400;50Hz
Residual Current Off-time	0.1S
Short Circuit Capacity(Isc)	10KA
Mechanical Endurance/Electrical Endurance	3000/2000

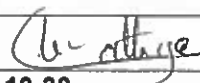
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Tripping Curve	C,D
Vibration Resistance(g)	5
Degree of protection	IP20
Terminals capacity(mm ²)	≥25

4.18. Contactor

4.18.1 The contactor shall be manufactured to IEC 60947-4-1 and Kenyan standards.

4.18.2 The contactor shall be an ac current operated type rated 40A double pole.

4.18.3 The contactor shall be suitably rated for operating lighting circuits of High Pressure Sodium of ratings 150W, 200W and 400W respectively

4.18.4 The contactors shall comply with the technical parameters shown below

Table 14.0: Technical Parameters of Contactors

	Description	Requirements
1	Type	AC operated Double pole
2	Rated operational voltage U _{max}	690V
3	Rated insulation voltage	1000V
4	Rated operational current	40A
5	Impulse withstand voltage	8KV
6	Maximum breaking capacity	250A
7	Maximum electrical switching frequency for AC-1	600 cycles/h
8	Heat dissipation per pole	1.8W
9	Mechanical durability	3 million operating cycles
10	Degree of enclosure	IP 56

4.18.5 The bidder shall provide the relevant electrical durability curves to support the offer.

4.19 High pressure mercury lamp

4.19.1 The bulbs shall be manufactured and tested in accordance with IEC 60188

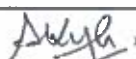
4.19.2 EC Declaration of conformity certificate shall be provided.

4.19.3 The glass of lamps shall be free from defects detrimental to service

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4.19.4 The cap on finished lamp shall comply with the dimensional requirements as given in the reference standard .The dimensions of the caps shall be checked with the 'Go' and 'No Go' gauges of lamp caps as specified in the standard

4.19.5 The shells of caps may be made of brass or any other superior material, provided the caps are ordinarily resistant to atmospheric corrosion and withstand the tests specified

4.19.5 Contacts shall be evenly soldered or welded to ensure satisfactory engagement and electrical contact in the appropriate holder

4.19.6 The cap shall be so constructed and attached to the bulb that it withstands the torsion test specified in the reference standard i.e. 30Nm for E27 and 50Nm for E40.

4.19.7 The recommended bulb ratings / manufacturing details shall be as shown the table below:

Table 15: Technical Parameters of High Pressure Mercury lamps

BULB WATTAGE	VOLTAGE	CAP	BULB FINISH
125	200 to 250	E27	Fluorescent coated or clear
250	200 to 250	E40	Fluorescent coated or clear
400	200 to 250	E40	Fluorescent coated or clear
700	200 to 250	E40	Fluorescent coated or clear

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4.19.8 Minimum Performance Criteria

Table 16: Minimum Performance Criteria

High Pressure Mercury Lamp-wattage	Rated Luminous Efficacy lm/W	LSF @ 16,000hrs	LLMF @ 16,000hrs	Correlated Color Temp. Tc (K)	Color rendering index	Design version)
125W	50	0.92	0.63	4000	50	coated
250W	52	0.87	0.85	3900	41	coated
400W	55	0.88	0.75	3800	39	coated

4.20 Quality Management System

- 4.20.1 The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that tests and documentations will fulfill the requirements stated in the contract documents, standards, specifications and regulations.
- 4.20.2 The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications shall be submitted with the tender for evaluation.
- 4.20.3 The bidder shall indicate the delivery time of the items, manufacturer's monthly&annual production capacity and experience in the production of the type and size of items being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar type of the goods sold in the last five years as well as reference letters from customers shall be submitted with the tender for evaluation.

5. TESTS AND INSPECTION

- 5.1 The accessories shall be inspected and tested in accordance with the requirements of the reference standards and this specification. It shall be the responsibility of the supplier to perform or to have performed all the tests specified.

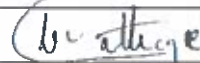
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- 5.2 Copies of previous Test Reports for the accessories issued by a third party testing laboratory that is accredited to ISO/IEC 17025 shall be submitted with the tender for the purpose of technical evaluation. The accreditation certificate for the third party testing laboratory shall also be submitted with the tender (all in English Language).
- 5.3 Copies of type test reports to be submitted with the tender (by bidder) for evaluation shall be specified by the tender for each accessory on offer
- 5.4 Routine and sample test reports for each accessory to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods.
- 5.5 KPLC Engineers will witness tests at the factory before shipment where necessary.
- 5.6 Tests to be witnessed by KPLC Engineers at the factory before shipment shall be in accordance with relevant standards and this specification..
- 5.7 On receipt of the goods KPLC may perform any of the tests specified in order to verify compliance with this specification.
- 5.8 The supplier shall replace without charge to KPLC any accessory, which upon examination, test or use; fail to meet any of the requirements in the specification.

6. MARKING AND PACKING

6.1. Marking

The accessories shall be indelibly and permanently marked with the following information:

- a) The manufacturer or supplier identity,
- b) The designation of lighting accessory
- c) The order number or equivalent;
- d) The product dimensions in millimeters;
- e) The words "**Property of KPLC**".

6.2. Packing

6.2.1 The package where applicable shall be clearly marked with the following information;

- a) The manufacturer's and/or supplier's identification;
- b) Name of country of manufacture;
- c) Dimensions in millimeters;

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d) Quantity per box;

e) The words "Property of KPLC".

7. DOCUMENTATION

7.1. The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) 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 description of the item on offer as per Annex A (Guaranteed Technical Particulars) and signed by the manufacturer;
- b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
- c) Sales records for the last five years and customer reference letters;
- d) Details of manufacturing capacity and the manufacturer's experience;
- e) Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025;
- f) Copy of accreditation certificate to ISO/IEC 17025 for the third party testing laboratory;
- g) Manufacturers letter of authorization, quality certificate and other technical documents required in the tender.


7.2. The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

- a) Guaranteed Technical Particulars signed by the manufacturer;
- b) Design Drawings with details of accessories 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 fulfill the requirements stated in the contract documents, standards, specifications and regulations.
- d) Detailed test program to be used during factory testing
- e) Manufacturer's undertaking to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations

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as well as ensuring good workmanship in the manufacture of the accessories for
The Kenya Power & Lighting Company;

f) Packaging details and quantity per package.

7.3. The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the accessories to KPLC stores

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ANNEX A: 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, customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of complete type test reports for tender evaluation, all in English Language)

Tender No.

Clause number / KPLC Requirements	Bidder's offer (indicate full details of the values offered)
Manufacturer's Name and address	
Country of Manufacture	
Bidder's Name and address	
4.1. Service conditions- compliance	
4.2 The columns	
4.2.1 Column size	
4.2.2 Manufacturing standard	
4.2.3 Material of the columns	
4.2.4 to 4.2.10 Compliance to all clauses	Indicate item by item and support with drawing
4.2.11 Means of preventing undesirable rotation	
4.2.12 Method of joining base section and the shaft	
4.2.13 Door lock patterns and provision of 5% keys	
4.2.14 Description of base board and fixing	
4.2.15 Provision and fixing of earth studs	
4.2.16 Finishing on edges and anti-chafe ring provision	
4.2.17 Galvanizing standards	
4.2.18 Dry film thickness	
4.2.19 Ground line indication	
4.3 :Street lighting bracket	
4.3.1:Material of bracket and level of galvanization	
4.3.2: standard of manufacture:BS EN 40-3	
4.3.3 compliance to set parameters	Indicate item by item
4.3.4 Method of securing and angle of lamp and lantern	
4.3.5 Length of bracket outreach	
4.3.6 Angle of incline under environment zone E1 when fitted to specified ingots	
4.3.7 Provision of drawings	

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**SPECIFICATION FOR STREET
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Clause number / KPLC Requirements	Bidder's offer (indicate full details of the values offered)
4.3.8 Compliance with stated parameters	Indicate item by item
4.3.9 Wood/concrete bracket drawings	
4.3.9.1 Material requirements	
4.3.9.2 Compliance to technical details specified	
4.3.9.3 compliance to dimensional requirements	
4.4 Lanterns	
4.4.1:Fitted with electronic control equipment and Centrally Managed Control Systems	
4.4.2: Manufacturing standards(IEC 60598-1,2 &3)	
4.4.3:side entry and post mounting	
4.4.4 Environmental friendly and recyclable	
4.4.5: Lanterns body material and installation instructions	
4.4.6 Material for body frame and canopy of lanterns	
4.4.7: Body to be UV stabilized polycarbonate	
4.4.8: Impact rating for glass protectors to be IK08 as per IEC 62262:2002	
4.4.9 Bowl fitting ,robustness and antivandal resistant material	Detailed description
4.4.10 Non corrosive material for hinges, toggle ,catches, captive screws and nuts	State material
4.4.11:IP Rating of the lantern to be IP 65	
4.4.12 Means of supporting the lamp and suitability	
4.4.13: Optical equipment controlling	
4.4.14 : Wiring accessories installed	
4.4.15 Fitting of integral control gear and heat barrier	
4.4.16 EMC compatibility as per IEC 61547	
4.4.17 Downward light output ratio minimum 70%	
4.4.18 Secure fitting of lanterns to bracket and clean condition of parts affecting photometric performance	
4.4.19 Dimmable ballasts and enabled for connection to central Management System but able to be connected to standard electronic photocell control	
4.4 Bulbs	
4.4.1: compliance to specified attributes	
4.5High pressure sodium lamps	
4.5.1 Manufacturing standard (EN 60235 & IEC 60662)	

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4.5.2 EC Declaration conformity certificate	
4.5.3. Type of lamps	
4.5.4 : solid state getter and clear lamp bases	
4.5.5 Single arc-tube type and no shadow casts	
4.5.6 Evidence of robustness and resistance to shock	
4.5.7: Compliance to performance criteria	Indicate item by item
4.6 High pressure sodium flood lights	
4.6.1 Rating Voltage/frequency	
4.6.2: construction and design	
4.6.3. Housing details	
4.6.4 Securing by four 1/4" diameter captive stainless steel hex bolts	
4.6.5: Thermal shock and impact resistant of the glass	
4.6.6: Heavy duty mogul-base porcelain socket with heavy gauge brass, nickel plated , double lamp grip	
4.6.7 Reflector design	
4.6.8 Mounting design and provisions	
4.7 Photo electric controller	
4.7.1 :Compliance to EEI/NEMA	
4.7.2 :Type-standard 3-terminal polarized twist lock receptacle	
4.7.3: Compliance to electrical parameters	Indicate item by item
4.8 LED fitting and Luminaire	
4.8.1 Standards: IEC 62031 IEC 6154 and 60598-1	
4.8.2 Lumen output equivalent to existing 150w ,250w and 400w HPS lamps	
4.8.3 Housing material and arm dimension	
4.8.4 Provision of abrasion resistant, epoxy polyester powder coat	
Environmental protection against rust and salinity.	
4.8.5 Spray test for 3000 hours salt spray test	
4.9 LEDs	
4.9.1: Type: Hi-flux/Hi-power white LEDs & minimum of 95% of initial intensity at 100,000 hours of life.	
4.9.2: Test to IES LM-80	
4.9.3: mean correlated color temperature of 4000K and a	

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Clause number / KPLC Requirements	Bidder's offer (indicate full details of the values offered)
CRI.≥70	
4.9.4 Mercury and Lead free	
4.9.5 Compliance to technical requirements	Indicate item by item
4.10 Led Optical System	
4.10.1: BUG rating at 90% lumens	state
4.10.2 LEDS micro-lens systems to IESNA Type 2 or Type 3	
4.10.3: Provision of optical house shield	
4.10.4: Beam angles for flood lights	specify
4.10.5: 10 year warranty for optical system	specify
4.11 system performance	
Compliance to specified parameters	Indicate item by item
4.12 Timers	
4.12.1 Manufacturing standard	
4.12.2 : programmable switching to ON/OFF by light intensity	
4.12.3: Selectable season option	
4.12.4 Timer selection switch for either auto or manual mode	
4.12.15 Wall mounting and prewired	
4.13 Ballasts	
4.13.1 Standards complied with	
4.13.2 Type of ballast and description	
4.13.3 Class of insulation	
4.13.4 Conformance to electrical characteristics	Indicate item by item
4.13.5 Characteristic curves	
4.13.6 Stamping on the ballasts	
4.13.7 Component recognition as described	
4.14 Capacitors	
4.14.1 Standards complied with	
4.14.2 Connection type and power factor	
4.14.3 Encapsulation and resin type	
4.14.4 Compliance to stated characteristics	Indicate item by item
4.15 igniters	
4.15.1 Standards complied with and marking	
4.15.2 Range of operation	
4.15.3 Type of igniters	
4.15.4 Description of operation	

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4.15.5 Suitability and mode of connection	
4.15.6 Compliance to electrical characteristics	Indicate item by item
4.16 Consumer unit	
4.16.1 Standards complied with	
4.16.2 Completeness of unit	Indicate item by item
4.16.3 Din rail(Size and Material)	
4.16.4 Type of unit	
4.16.5 Compliance with electrical characteristics	Indicate item by item
4.17 Earth Leakage Circuit Breaker	
4.17.1 Standards complied with	
4.17.2 earth leakage fault detection mechanism	
4.17.3 Voltage and frequency	
4.17.4 Other protection functionalities	
4.17.5 Suitability to prevention of electric shock	
4.17.6 Compliance with technical characteristics	Indicate item by item
4.18 Contactors	
4.18.1 Standards complied with	
4.18.2 Type and rating	
4.18.3 Suitability for HPS lamps	
4.18.4 Compliance with stated technical parameters	Indicate item by item
4.18.5 Provision of durability curves	
4.19 High Pressure Mercury vapor lamps	
4.19.1 Standards complied with	
4.19.2 EC declaration	
4.19.3 Bulb glass free from defects	
4.19.4 Cap dimensions	
4.19.5 Shell caps made of brass or superior material	
4.19.6 Torsion test compliance	
4.19.7 Ratings compliance	
4.19.8 Performance criteria compliance	Indicate item by item
4.20 Quality Management Systems	
4.20.2 – 4.20.3	Specify
5.0 Tests and Inspection	
5.1 – 5.4	Specify
6. Marking & Packaging	
6.1. Marking	Specify
6.2 Packaging	Specify
6.2.1 – 6.2.3	Specify

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TITLE:

**SPECIFICATION FOR STREET
LIGHTING ACCESSORIES**

Doc. No.

KP1/3CB/TSP/15/002

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Clause number / KPLC Requirements		Bidder's offer (indicate full details of the values offered)
7. Documentation		
7.1 – 7.3		Specify
	Manufacturer's Guarantee and Warranty	Specify
	List catalogues, brochures, technical data and drawings submitted to support the offer.	Specify
	List customer sales records and reference letters submitted to support the offer.	Specify
	List Test Certificates submitted with tender	Specify
	Statement of compliance to specification	Specify

Manufacturer's Name, Signature, Stamp and Date

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TITLE:

**SPECIFICATION FOR ALUMINUM
AND COPPER 2-CORE PVC
INSULATED, STEELWIRE
ARMoured CABLES**

Doc. No.

KP1/3CB/TSP/05/032

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0.1 Circulation List

COPY NO.	COPY HOLDER
1	Standards Manager
2	Procurement Manager
Electronic copy (pdf) on Kenya Power server (currently: Network→stima-fprnt-001→techstd&specs)	

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)

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FOREWORD

This specification has been prepared by the Standards Department of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for both Aluminum and Copper 2-core, PVC insulated, steel wire armored cables. It is intended for use by KPLC in purchasing the cables.

1. SCOPE

1.1 This specification is for two core, stranded and compacted circular aluminum and Copper conductors, PVC insulated, galvanized steel wire armored, PVC outer sheathed power cables for operation at a.c. voltages of 600 Volts to sheath, 1000 Volts between conductors and highest system voltage of 1200 Volts for use in KPLC distribution network.

1.2 This specification covers the following cable sizes:

Aluminum

2 x 10 mm² AL/PVC/SWA/PVC

2 x 16mm² AL/PVC/SWA/PVC

2 x 25 mm² AL/PVC/SWA/PVC

Copper

2 x 4 mm² CU/PVC/SWA/PVC

2 x 6 mm² CU/PVC/SWA/PVC

2 x 10 mm² CU/PVC/SWA/PVC

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- 1.3 The specification also covers inspection and test of the cables as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation.

The specification stipulates the minimum requirements for both Aluminum and Copper 2-core PVC insulated, steel wire armoured cables acceptable for use in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good engineering practice, adherence to the specification, applicable standards and applicable regulations as well as ensuring good workmanship in the manufacture of the cables for The Kenya Power & Lighting Company.

The specification does not purport to include all the necessary provisions of a contract.

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) apply.

BS 6346: 600/1000V and 1900/3300V armored electric cables having PVC insulation;

IEC 60502-1: Power cables with extruded insulation and their accessories for rated voltages from 1kV ($U_m=1.2kV$) up to 30kV ($U_m=36kV$) - Part 1: Cables for rated voltages from 1kV ($U_m=1.2kV$) up to 3kV ($U_m=3.6kV$);

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IEC 60228: Conductors for insulated cables;

IEC 60811-1-1: Common test methods for insulating and sheathing materials of electric cables:–

Part 1: Methods for general application;

Section 1: Measurements of thickness and overall dimensions –

Tests for determining the mechanical properties;

KS 04-187: Specification for conductors of insulated cables.

3. TERMS AND DEFINITIONS

For the purpose of this specification the definitions given in BS 6346, IEC 60228, IEC 60502-1 and KS 04-187 apply, together with the following:

Al: Aluminum

CU: Copper

PVC: Polyvinyl Chloride

SWA: Steel Wire Armor

4. REQUIREMENTS

4.1 SERVICE AND SYSTEM CONDITIONS

4.1.1 Cable Application

- a) The cable shall be a street lighting cable for use in outdoors installations and tropical conditions (temperature range of -1°C to +40°C, humidity of up to 90% and saline conditions along the coast).

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- b) The cable shall be suitable for laying in cable ducts and in the ground along the roads and streets .
- c) The cable shall also be suitable for laying on slopes.
- d) Permissible continuous loading operating temperature shall be 70°C.

4.1.2 Operating Voltage

The rated operating voltage (U_o/U), required by this specification is 600/1000 V at 50Hz a.c.

4.2. CABLE CONSTRUCTION

4.2.1. Design

4.2.1.1 The cable shall be designed and manufactured in accordance with requirements of IEC 60228 and IEC 60502-1 and the requirements of this specification.

4.2.1.2 All materials used shall be compatible and suitable for the continuous operating temperature of the cable of 70°C and short circuit temperature of 160°C (5 seconds max duration) as per IEC 60502-1.

4.2.2. Conductors

i. Aluminum

The cable shall be made from stranded circular compact plain aluminum conductors, class 2 in accordance with IEC 60228 and KS 04-187, and as specified in the table 1 in clause 4.3 of this specification.

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ii. Copper

The cable shall be made from stranded circular compact plain copper conductors, class 2 in accordance with IEC 60228 and KS 04-187, and as specified in the table 1 in clause 4.3 of this specification

4.2.3. Insulation

4.2.3.1 Material

The insulation shall be extruded dielectric of type PVC/A in accordance with the requirements of IEC 60502-1.

The insulation shall be applied by extrusion to form a compact and homogeneous layer.

4.2.3.2 Insulation Thickness

The average thickness of insulation when determined in accordance with IEC 60811-1-1, shall not be less than the nominal values given in table 1 of clause 4.3 as appropriate, and the smallest of the measured values shall not fall below the nominal value by more than (10%+0.1mm).

4.2.3.3 Identification of Cores

Cores shall be identified by coloring throughout the insulation material. Colors of the cores shall be in the following sequence:— Red and Black.

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4.2.4. Laying up

Cores shall be laid up with a right hand direction of lay. Non-hygroscopic fillers shall be applied integrally with the bedding of armored cable to form a compact and circular cable.

A plastic binder tape shall be applied over the laid up cores of the cable.

There shall be no adhesion between the bedding of armored cable or the sheath and insulation. Where the bedding or sheath is applied integrally with fillers, it shall be possible to strip it from the cable without damaging the insulation.

4.2.5. Bedding

4.2.5.1 Material

Bedding of four core cables shall comprise of extruded layers of polymeric material compatible with the underlying insulation and suitable for use at the operating temperatures of the cable.

The bedding shall not adhere to the underlying cores.

4.2.5.2 Bedding Thickness

The average thickness of the bedding, when determined in accordance with IEC 60811-1-1 shall not be less than the nominal value given in table 1 of clause 4.3 as appropriate and the smallest of the measured values shall not fall below the nominal value by more than ($20\% + 0.2\text{mm}$).

4.2.6. Armor

4.2.6.1 General

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- i. Armor for the two core cable shall comprise a single layer of circular galvanized steel wires. The armor wires shall be applied helically with a left hand lay and shall fully comply with the requirements of BS 6346 and IEC 60502-1.
- ii. The armor shall be used as the neutral conductor and shall be suitable for carrying the equivalent phase currents.

4.2.6.2 Wire diameter

The nominal diameter of the wires shall be as specified in clause 4.3 table 1.

4.2.6.3 Electrical Resistance

When measured and corrected to 20⁰ C, the electrical resistance of the armor of the completed cable shall not exceed the appropriate value given in clause 4.3 table 1.

4.2.7. Outer Sheath

4.2.7.1 General

The outer sheath of the cable shall comprise an extruded layer of BLACK PVC in accordance with the requirements of BS 6346. The PVC shall be of type ST1 with maximum conductor temperatures in normal operations of 80⁰C as per the requirements of IEC 60502-1.

4.2.7.2 Thickness

The average thickness of the outer sheath, when determined in accordance with IEC 60811-1-1, shall be not less than the nominal value given in table 1 of clause 4.3 as

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appropriate and the smallest of the measured values shall not fall below the nominal value by more than (20%+0.2mm).

4.2.7.3 Marking

The external surface of the cable shall be legibly embossed with the following information on two lines running parallel to the length of the cable, approximately equally spaced around the circumference of the cable.

Electric Cable 600/1000 V Manufacturers Name Description of Cable
PROPERTY OF KPLC

For example, for aluminum 2-core, 10mm², PVC insulated cable manufactured by manufacturer XYZ, the legend would read as follows: Electric Cable 600/1000V XYZ 2x10mm²AL PVC/SWA/PVC
PROPERTY OF KPLC

Note: The bedding material is not included in the PVC/SWA/PVC naming convention.

Letters and figures shall be raised and consist of upright block characters. Minimum size of characters shall be not less than 15% of average overall cable diameter and the distance between one set of markings and the next shall not exceed 500mm.

In addition, each cable shall be sequentially marked by indelible printing, indenting or other suitable means, at 1m intervals, to indicate the approximate length of cable remaining on the drum. The numbers shall start with 001, 1m from the inner end of cable and continue every metre to the outer end.

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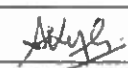
4.3. STANDARD SIZES AND CHARACTERISTICS

Table 1: Mechanical and Electrical characteristics of standard sizes of PVC cables

Conductor nominal sectional area	mm ²	4	6	10	16	25
Number of cores		2	2	2	2	2
Voltage Designation U ₀ /U (U _m)		600/1000 (1200) V				
Conductor shape		Stranded shaped compacted				
Nominal insulation thickness	mm	0.8	0.8	1.0	1.0	1.2
Bedding thickness	mm	0.8	0.8	0.8	0.8	1.0
Average outer sheath thickness	mm	1.4	1.5	1.6	1.6	1.6
Armour wire diameter	mm	0.9	0.9	1.25	1.25	1.6
Maximum Armour wire resistance at 20°C	Ω/km	7.9	7.0	6.0	3.7	3.7
Minimum number of wires in the conductor	no	7	7	7	7	19
Diameter of wire	mm	0.85	1.04	1.35	1.70	1.35
Approx overall diameter of cable	mm	15.1	16.5	20.1	21.9	23.0
Maximum conductor resistance at 20°C	Cu- Ω/km	4.61	3.08	1.83	1.15	0.727
	Al- Ω/km			3.08	1.91	1.2
Minimum insulation resistance of cable for 1000m at 20°C	MΩ	8	7	7	6	5
Approximate weight of cable	Cu- Kg/Km	450	541	862	950	1474
	AL- Kg/Km			235	310	450

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Note:

The Current Carrying Capacity of the cable underground, in ducts and in air shall be stated by the manufacturer in the Guaranteed Technical Particulars as per Annex A

Table 2: Mechanical characteristics of Insulating and Sheathing compounds (before and after ageing)

Designation of compound	Unit	PVC/A	ST1
Maximum conductor temperature in normal operation	$^{\circ}\text{C}$	70	80
Without ageing (IEC 60811-1-2, sub clause 9.1)			
Tensile strength, minimum	N/mm^2	12.5	12.5
Elongation-at-break, minimum	%	150	150
After ageing in air oven IEC 60811-1-2, sub clause 8.1 After ageing without conductor			
Treatment			
➤ Temperature	$^{\circ}\text{C}$	100	100
➤ Tolerance	$^{\circ}\text{C}$	± 2	± 2
➤ Duration	h	168	168
Tensile strength			
➤ Value after ageing, minimum	N/mm^2	12.5	12.5
➤ Variation, maximum	%	± 25	± 25
Elongation-at-break			
➤ Value after ageing, minimum	%	150	150
➤ Variation, maximum	%	± 25	± 25

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5. TESTS AND INSPECTION

5.1 The cable shall be inspected and tested in accordance with the requirements of this specification, BS 6346, IEC 60811-1-1 and IEC 60502-1. It shall be the responsibility of the supplier to perform or to have performed the tests specified and whatever other tests he normally performs at works.

5.2 Copies of previous Type Tests 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 accreditation certificate to ISO/IEC 17025 for the same third party testing laboratory used shall also be submitted with the tender (all in English Language)

5.2.1 Copies of type test reports to be submitted with the tender (by bidder) for evaluation shall include the following:

5.2.1.1 Electrical Type Tests

- a) Insulation resistance measurement at ambient temperature tests.
- b) Insulation resistance measurement at maximum conductor temperature test.
- c) Voltage test for 4h.
- d) Impulse test for completed cable.

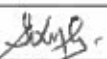
5.2.1.2 Non Electrical Type Tests

5.2.1.2.1 Mechanical strength tests for PVC insulation and ST1 over sheath.

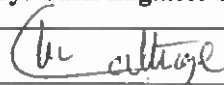
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- a) Tensile strength and elongation-at-break tests: without ageing; after ageing in an air, oven and after ageing of pieces of complete cable.

5.2.1.2.2 Thermoplastic properties of insulation and over sheath.

- a) Hot pressure tests (indentation) test.
b) Behavior at low temperatures tests.

5.2.1.2.3 Heat shock tests

5.2.1.2.4 Water absorption tests

5.2.2 Routine and sample test reports for the cables to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. KPLC Engineers will witness tests at the factory before shipment.

5.2.3 Tests to be witnessed by KPLC Engineers at the factory before shipment shall be in accordance with BS 6346, IEC 60228, IEC 60502-1, this specification and shall include the following:

5.2.3.1 Routine Tests

- a) Spark test on cores.
b) Spark test on over sheath of armored cables.
c) Voltage test on completed cables.
d) Insulation resistance tests.
e) Conductor resistance tests.
f) Armor resistance tests.

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5.2.3.2 Sample Tests

- a) Measurement of insulation thickness
- b) Measurement of extruded bedding and over sheath thickness
- c) Conductor examination – physical tests and check of dimensions

6. SEALING, PACKING AND MARKING

6.1 Sealing

Before dispatch, the ends of the cable shall be sealed with closing fitting PVC end caps to prevent the ingress of water during transportation and storage.

The sealing shall enclose the over sheath completely.

6.2 Packing

Cables shall be wound on to non-returnable wooden drums, close battened to prevent damage during transportation or storage. The wood shall be treated to resist biological attacks. The drums shall have wooden lagging all round, with no gaps.

Each drum shall contain only one continuous length of cable which shall be of the length indicated in table 1, clause 4.3 above in length. The actual length of cable shall not be less than the length indicated on the drum

Both ends of the cable shall be secured to the drum to prevent mechanical damage

6.3 Marking

6.3.1 Each drum shall be legibly and indelibly marked with the following information on the flange:

- a) The manufacturer's trade name;
- b) The year of manufacture.
- c) The rated voltage of the cable, 600/1000 (1200) V
- d) The type of cable. For example AL 2 core PVC/SWA/PVC;

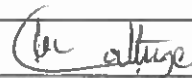
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- e) The conductor cross-sectional areas in mm²;
- f) The length of the cable, in metres;
- g) The identifying serial number;
- h) The words "NOT TO BE LAID FLAT" or a suitable pictogram;
- i) An arrow and words, "ROLL THIS WAY", on each flange of the drum to indicate in which direction the drum shall be rolled in order to prevent the cable from unwinding.
- j) A capital letter "T" approximately 50mm high surrounded by a circle with an approximate outside diameter of 65mm, if the wood has been treated to resist biological attack.
- k) The gross mass of the drum and net mass cable, in kilogram;
- l) The words "PROPERTY OF THE KENYA POWER & LIGHTING CO."

6.3.2 The following information shall be printed on a suitable label. This label shall be firmly attached to one of the flanges of the drum:

- a) The year of manufacture;
- b) The rated voltage of the cable 600/1000 V;
- c) The type of cable. For example 2-core PVC/SWA/PVC;
- d) The conductor size in mm²;
- e) The length of the drum in metres;
- f) The gross mass of the cable and drum in Kg.
- g) An identifying serial number;
- h) The purchasers name. For example, "PROPERTY OF KENYA POWER & LIGHTING CO."
- i) The order number;
- j) Any other contract particulars.

Note: The cable shall have been marked in accordance with clause 4.2.7.3

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7. DOCUMENTATION

7.1 The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) for tender evaluation.

- a) Guaranteed Technical Particulars;
- b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
- c) Sales records for the last five years and at least four customer reference letters;
- d) Details of manufacturing capacity and the manufacturer's experience;
- e) Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025; the Type Test Reports shall not be more than five years old.
- f) Copy of accreditation certificate for the testing laboratory.

7.2 The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

- a) Guaranteed Technical Particulars,
- b) Design drawings and construction details of the cable,
- c) Quality Assurance Plan (QAP) that will be used to ensure that the cable design, material, workmanship, tests, service capability, maintenance and documentation will fulfill the requirements stated in the contract documents, standards, specifications and regulations.
- d) Test Program to be used after manufacture,
- e) Marking details and method to be used in marking the cables,
- f) Manufacturer's undertaking to ensure adequacy of the design, good workmanship, good engineering practice and adherence to applicable standards in the manufacture of the cables for KPLC,
- g) Packaging details (including packaging materials, lagging and length on drum).

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ANNEX A: 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, four customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of complete type test certificates and type test reports for tender evaluation, all in English Language)

Table 3: Guaranteed Technical Particulars.

1	2	3	4
Item	Description	Units	Schedule 1 (KPLC)
1	Manufacturer		Specify
2	Country of manufacture		Specify
3	Name and address of Bidder		Specify
4	Service conditions		
	a) Cable application		Specify
	b) Operating voltage	V	Specify
5	Cable construction		
	a) Design		
	• Standards applicable		Specify
	• Materials characteristics		Specify
	b) Conductors types	mm ²	4, 6, 10, 16, 25
	c) Insulation		
	• Materials		PVC/A
	• Insulation thickness	mm	Specify
	• Identification of cores	no	Specify
	d) Laying up		Specify
	e) Bedding		

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Date: 2014-11-03

Date: 2014-11-03



Kenya Power

TITLE:

**SPECIFICATION FOR ALUMINUM
AND COPPER 2-CORE PVC
INSULATED, STEELWIRE
ARMoured CABLES**

Doc. No.

KP1/3CB/TSP/05/032

Issue No.

1

Revision
No.

0

Date of
Issue

2014-11-03

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	• Bedding material		Specify	
	• Bedding thickness	m	Specify	
	f) Armor			
	• Armor material		Galvanized steel	
	• Armor wire diameter	mm	Specify	
	• Armor wire electrical resistance at 20°C	Ω/km	Specify	
	g) Outer sheath			
	• Outer sheath material		PVC type ST1	
	• Thickness	mm	Specify	
	• Marking		Specify	
6	Standards and Characteristics			
	a) Conductor nominal x-sectional area	mm ²	Specify	
	b) Number of cores	no	Specify	
	c) Voltage designation U ₀ /U(U _m)	V	Specify	
	d) Conductor shape		Specify	
	e) Nominal insulation thickness	mm	Specify	
	f) Inner sheath thickness	mm	Specify	
	g) Average sheath thickness	m	Specify	
	h) Armor wire thickness	mm	Specify	
	i) Number of wires in the conductor	no	Specify	
	j) Average diameter of the conductors	mm	Specify	
	k) Outer diameter of conductors	mm	Specify	
	l) Maximum conductor resistance at 20°C	Ω	Specify	
	m) Minimum insulation resistance of cable for	MΩ	Specify	

Issued by: Senior Engineer Standards

Authorized by: Chief Engineer Standards

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AND COPPER 2-CORE PVC
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	1000m at 20 ⁰ C			
	n) Approximate weight of cable	Kg	Specify	
	o) Approximate length of cable on drum	m	Specify	
	p) Current carrying capacity			
	• air	A	Specify	
	• duct	A	Specify	
	• underground	A	Specify	
	q) Power frequency withstand voltage	V	Specify	
7	Copies of type test reports to be submitted with tender for evaluation		As per clauses 5.2.1.1 and 5.2.1.2	
8	List of Tests to be witnessed by KPLC Engineers at the factory before shipment		As per clauses 5.2.3.1 and 5.2.3.2	
9	Embossing of the cable over sheath (parameters to be indicated and method of marking)		Specify	
10	Marking of cable drum (parameters to be indicated and method of marking)		Specify	
11	Packing (treated wooden drum and lagging)		Specify	
12	Length of cable on the drum (shall be in one continuous length)		Specify	
13	Installation and technical manuals to be provided during delivery		Specify	
14	List of catalogues, brochures, drawings, technical data and customer sales records submitted to		Specify	

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	support the offer.			
15	Statement of compliance to tender specifications		Specify	
16	Deviations from tender specifications		Specify	
17	Inspection/Tests by KPLC during delivery before acceptance to stores/site.		Specify	

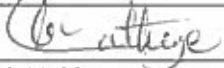
NB: - *This schedule does not in any way substitute for detailed information required elsewhere in the specification.*

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

Issued by: Senior Engineer Standards

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