Technical Specifications

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Employer's Requirements

I – General Description of the Project

1. Introduction

The works covered by these Technical Specifications form part of the Kenya Last Mile Connectivity Project

The scope of work includes: Service connection of approximately 170,361 households through the erection of approximately 313,559 poles, stringing of approximately 34,321 kms of 50mm2 aluminum conductor, installing a total of 5,113 km of 16mm2 aluminum single core cable, and installation of approximately 255,545 electronic energy meters.

2. Extent of Work

The Contract shall comprise of, but is not limited to:

The clearing of all working areas includes check-survey of low voltage line, design, quality assurance management, manufacture, supply, delivery to site, unloading, erection, setting to work, testing at site, commissioning and trial operation, complete in every respect and suitable for reliable operation in the respective environmental and climatic conditions, including and/or adjustment of defective material and workmanship for duration of the Defects Liability period of the distribution lines detailed in "Definite Work"

The Definite Work is described in detail in the following clauses, in the Specifications and Schedules. All work not expressly called for in the Specification and/or Schedules but are necessary for the complete and proper supply, erection, operation and maintenance of the Works shall be performed and furnished by the Contractor at no additional cost to the Employers.

3. Definite Work

The Definite Work comprises:

The component includes: (i) the construction of the distribution system, which entails 17,000 kilometre meters of low voltage distribution lines; (ii) the installation of equipment for the connection of 225,545 residential customers and 30,000 commercial customers.

The work covered under the project is divided into ten lots. The contractor shall produce survey of the low voltage lines and locate the low voltage lines according to KPLC directives.

III - General Information

4. Intent

This section furnishes the Contractor with pertinent information and data to provide a better understanding of working conditions. Notwithstanding this information, however, the Contractor is obliged to make independent inquiries as to the scope of work and to base the work on reliable data concerning hydrological, physical and climatic conditions of the Site. The Contractor shall have satisfied himself as to the true nature of the ground and subsoil, the form and nature of the sites and the work, the means and access to the sites, the construction camps and accommodation which might be required and, in general, shall have obtained all necessary information as to risks, contingencies and other circumstances which may influence the work.

5. Labour Market, Labour Law

New employment of all local labour can be arranged by the contractor on the local market.
The Contractor shall be responsible for acquainting himself with and observing all Labour Legislation of the Governments of Kenya including the Code of Labour and any amendments and additions thereto. The Contractor's local labour will consists of 30% women

6. Concrete or Wood Poles

The contractor shall procure the concrete or wood poles in the local market or import outside of the country.

7. Photographic Records

At monthly intervals, the Contractor shall take adequate digital photographs (at least 10 exposures) showing the progress of the works at the various sites the report shall be submitted in hard and electronic copy. As and when required by the client, the Contractor shall take additional photographs showing particular features of the Works.

8. Meetings

During the period of Contract, the Contractor shall send representatives to meetings to be held at the Offices of the Engineer.
The meetings will be called as necessary during the design, manufacture and testing phase of the Contract to address design issues and progress. Once work commences, regular progress meeting will be held in Nairobi or on site. The Engineer shall decide the number and frequency of these meetings, but they will normally be held monthly.

9. Progress Meetings

The Contractor shall submit to the Engineer and in such for as he may require:-

At monthly intervals during the contract period a detailed progress report on the design, manufacture and delivery status of all the plant included in the Contract. This report shall be related to the approved programme and shall be issued within 5 days of the calendar month to which the report refers.
All reports shall include digital photographs (at least 10 exposures) showing the progress of the works at the various sites. As and when required by the client, the Contractor shall take additional photographs showing particular features of the work. An updated program in bar form shall show the progress of the works against the original program. It shall show the work-completed deviation from the original program and any constraints in the future program that are critical, in particular constraints that are outside of the control of the Contractor.
The program should preferably be run on a recognized computer planning software such as Microsoft Project.

10. Facilities for the Client/Engineer

a) General

The Contractor shall afford the Employers/ Engineer and his Representatives at a cost deemed to be covered by his Bid price, plant, labour, materials and apparatus as may be required in performing operations in connection with the execution, examination, inspection, and testing of the Works supply:

1. Office including full services at a location directed by the Engineer

2. Transport shall be supplied, including all maintenance and repair costs.

3. Communication Equipment for Site Works

The facilities will be purchased from local authorized distributor of the concerned item and the cost shall including all local custom duties and charges. The Contractor shall provide full/detailed specifications and supporting documents (catalogues, descriptions and technical documentation) with model/type and product for the evaluation of each item. If the specified type/model of items will not be available at the time of supply the contractor will supply the higher model of the concerned item in its range.

Any plant, equipment or facilities provided shall, unless specified to the contrary, become the property of the client, and shall be required for use solely by the Client' sand/ or Engineer's personnel and shall be handed over in good working order and condition upon completion of the Contract.

The Contractor shall provide all necessary cleaning and maintenance services, including labor, and provide all the required consumable such as, but not limited to water, electricity, cleaning gear and washroom equipment etc.

b) Site Office

The Contractor shall provide for the entire duration of the Contract for the sole use of the Client and Engineer for each lot and at localized area as directed by the Client/ Engineer, fully furnished, complete with all electrical fittings, plumbing and sanitary systems clean and provided with windows to give a sufficient supply of natural light.

The Contractor shall provide for each lot office of at least $45m^2$ in the location advised by the client/.

Each office block shall accommodate four persons. The office blocks shall be subject to the approval of the Client/ Engineer.

The each office shall be provided with the following equipment for each lot

Item	Description	Quantity
1	Writing desk	4
2	Swivel arm chair	6
3	Filing cabinet for A4 hanging file	1
4	Bookshelves	1
5	Drawing table	1
6	Desktop photocopying machine (A4 size), min 40ppm or above	1
7	Set Window curtains for all windows	1 set
8	Desktop Computer, latest model or equivalent	1
9	Laser printer A4, minimum capacity of 40 pages/min	1

The contractor shall provide 24 hour security to the office facilities for the entire duration of the Contract.

c) Transport

The Contractor shall provide the following vehicles for the exclusive use of the Client/Engineer:

Description	Qty Per Lot
The vehicles shall be new 4 wheel drive 4.0 V6 4x4 Auto DC Legend 45 or equivalent Double Cabin with 5 Seating capacity. The vehicles shall satisfy the following minimum specification. Number of Cylinders and Arrangement V-Type 6 and Engine capacity 4.0 litre and Maximum Power (kW@r/min) 175 @ 5200, Maximum Torque (Nm @ r/min) 376 @ 3800, Wheel base (mm) 3085, Minimum Ground Clearance (mm) 222, height 1860 Length (mm) 5260, Width (mm) 1835, and Fuel System Petrol. The vehicle shall be fitted with the manufacturer standard Interior Features, Safety and Security	2

All Vehicles shall be equipped with the latest provisions for safety, off-road use and comfort as agreed upon with the Engineer.

The Contractor shall deliver the vehicles not later than one month after receipt of advance payment.

The Contractor shall also provide:

- An efficient licensed driver for each vehicle;
- All necessary fuel, lubricant, tools, spares and full maintenance;
- Temporary replacement vehicles for any vehicle under repair or maintenance for more than twenty hours;
- Permanent replacement vehicles for vehicles beyond repair or during extensive repair period;
- Insurance and licenses for normal operation on and off site and on and off duty.

All vehicles shall be bought from local dealers and the price shall include all associated costs as listed above.
The Contractor shall hand over all the vehicles to the Employer in good condition within one month of the date of issue of the taking over certificate.

d) Safety at site

At each control equipment, each site and place the Contractor is performing his work, facilities shall be provided to allow provision of suitably approved danger notices such as "Men at work" or "Do not operate" or the like, to be attached securely. Approved danger notices should be on both English and Swahili. Details of the respective danger notices will be submitted to the Contractor upon request.

e) Test Witnessing

The Client/Engineer has the right to witness factory tests of any equipment included in this Contract. The Contractor shall state the price for two trips for the Employer's/Engineer staff consisting of two Engineers in each trip to witness the tests.

The price shall include food, accommodation, daily allowance, round trip air fare between Nairobi and any other countries where equipment are tested and internal transportation within the country of the test.

Each consignment of material shall be inspected and tested in the presence or representatives of the Client and the Engineer.

For each inspection, the following are to be provided for each representative for testing provided conducted abroad:

1. Economy class returns air ticket from Nairobi to hotel shall be provided for by the contractor.
2. Transport expenses from hotel to places of Test and/or Inspection shall be provided for by the contractor.
3. Visa expenses, hotel accommodation including boarding plus daily allowances will be provided for by the employer (KPLC)

Prior to the tests, the Contractor shall submit an outline of the procedures and tests in its plans, to demonstrate fulfilment of the requirements specified in subsequent sections of the detailed technical specification.

III Technical Specifications

11. Special Requirements for LV Lines and Low Voltage Equipment

This part of the Specification shall cover the specific requirements for design, manufacture, work testing, delivery, transport, installation, site testing of 0.433 kV and 0.245 kV overhead distribution lines

Design and manufacture of all the line equipment shall be in accordance with the attached specifications and drawings for the following items.

(i). Specification for Low Voltage Cartridge Fuses (Fuse Links)

(ii). Specification for Safety Pole Signs & Accessories

(iii). Specification for Low Voltage Insulators (Shackle Insulators, LV)

(iv). Specification for Concrete Poles

(v). Specification for All Aluminum Conductors (Soft Drawn)

(vi). Specification for All Aluminum Conductors (Bare & PVC Covered) Part 2: without laser marking on center strand

(vii). Specification for Stay Wires & Guy Grips

(viii). Specification for Treated Wood Poles. Part 1: Eucalyptus Poles

(ix). Specification for Steel Structures for Overhead Lines

(x). Specification for Aluminum Binding Wire and Strirrups

(xi). Specification for PVC Insulated Single Phase Concentric Aluminum Cables with 2-Core Copper Communication Cable.

The following drawings are attached;-

(i). Binding (In arrangement for through Conductors)

(ii). House Termination (Aerial attachment to Buildings)

(iii). LV Intermediate Pole (for angles up to 60^0)

(iv). LV Intermediate Pole (With Tee-off connection)

(v). LV Section Pole (For angles over 30^0 and showing 3 or 4 – way arrangement)

(vi). LV Section Pole (for angles up to 30^0)

(vii). LV Termination Pole (With Aerial Cable Connection)

(viii). LV Terminal Pole (With Underground Cable Connection)

(ix). Standard LV Pole Drilling

(x). Termination for Service Cable

(xi). Overhead Service Line Connection Prepayment Drawing

(xii). MV/LV – Overhead Lines – Tree Cutting Specifications

12. Earthing

The neutral conductor of LV lines shall be grounded at the transformer station, every dead-end and every 200 meters distance.

All line equipment installations shall be appropriately grounded and equipment grounds be interconnected with system neutrals.

All customer services shall be provided with neutral grounds.

Stay wires on distribution lines shall be solid and bonded with system neutrals.

Grounds rods shall be driven in undisturbed earth in accordance with the construction drawings. The ground wire shall be attached to the rod with a clamp and secured to the pole with staples. The staples on the groundwire shall be spaced 600 mm apart except for a distance of 2.5 m above the ground rod and 2.5 m down from the top of the pole where they shall be 150 mm apart.

The equipment ground, neutral wire, and lightning protective equipment shall be interconnected and attached to a common ground wire.

Equipment grounds and grounds at MV or LV circuit poles shall be in any case separated and/or insulated and shall employ ground rod or trench type ground electrodes for each system (MV and LV). Separation of HV and LV ground rods shall not be less than 5m in any direction. The total impedance of the service ground shall be less than 2 Ω according to VDE-Standard.

In case these requirements cannot be fulfilled by installing a reasonable amount of grounding material, step and touch voltages have to be measured after finalisation of the installations and depending on the results of these measurements additional protection measures might become necessary. These measures could include gravelling of an area around electrical installations or application of additional ground wires and ground rods.

13. Service connections

Service connections are the link between the LV network and the consumers. The meters shall be of single phase type or three phase type, depending on the consumer's load

The low voltage service connections include the supply and work:

The prepayment meter comprises of two detached parts, namely, the MCU, and the CIU (UIU).

MCU: Part of the split prepayment meter that does all the metrology functions including the storage of energy used and display of remaining units.

CIU: Part of the split prepayment meter that does the meter display function and also allows keying of electricity token.

It should be noted that all meter boards must be installed outside the customer's premises so as to facilitate ease of access by Kenya Power personnel and to also prevent bypassing of the meters.

Customers will be supplied via a cable connected from an LV line at pole. The prepaid meter shall be installed at a meter board mounted on the pole.

14. Units of measurement and governing dimensions

All documents shall be prepared and all Works shall be carried out using SI (System International) units of measurement with the sole exception of manufactured components not readily available in the SI units.

Dimensions in the Imperial System may be added in brackets following the Metric dimensions. The Governing dimensions to which the equipment shall be designed are as shown on the drawings.

15. Basic standards

The equipment, materials and labour employed in the fabrication, delivery, erection or installation and testing of the parts of the project shall comply with applicable and approved standards. The principal basis for reference shall be the appropriate portions of the latest revision of internationally recognized standards,

16. Inspections and tests during manufacture

As far as practicable, quality of material, workmanship and performance of all items of the equipment furnished under the present Contract shall be inspected at the places of manufacture by the Contractor's QC inspectors and, if so laid down, by the inspectors representing the Employers and the Engineer.

Equipment shall wherever practical be subject to tests on completion in the Manufacturer's Works to prove that the reliability, operation and performance conforming to the requirements of this Specification and the provisions of the appropriate standards.

Every facility is to be provided by the Contractor to enable the Employers and the Engineer to carry out the necessary inspection of the equipment components and the costs of all tests during manufacture and preparation of test records are to be borne by the Contractor.

The Contractor shall on request submit for approval procedures describing the proposed test methods to be used. Type and layout of test facility, location of instrumentation, formula for calculation of results and correction to Site conditions, etc. shall be included where appropriate.

All instruments and apparatus required for the inspection or used for the performance of tests shall be calibrated to an agreed standard at a laboratory of National standing. The cost of making such calibrations shall be borne by the Contractor in all cases. Records shall be available for examinations by the Employers/Engineer or his Representative.

The passing of the inspection test will not, however, prejudice the right of the Employers/Engineer to reject the equipment components if they do not comply with the Specification when erected, or given complete satisfaction in service.

Where the Contractor desires to use stock material, not manufactured specifically for the work, satisfactory evidence that such material conforms to the requirements of the Contract shall be submitted. In this case tests on these materials may be waived, but certificates are to be submitted. Arrangements shall be made for expediting the shop inspection by having all shop assemblies or pieces covering a single shipment ready at one time. Any packing work as well as transport to the Site of the equipment concerned shall not be started before the approval of the

Employers/Engineer has been obtained and all QC certificates due at this time for the equipment concerned have been received and reviewed by the Employers/Engineer.

The Test Objects and the tests to be carried out as detailed in the attached specifications for each item.

17. Packing

The Contractor shall prepare, pack, and load all materials and equipment for shipment in such a manner that they are protected from damage during shipment and shall be responsible for and make good any and all damage resulting from improper packing until final acceptance of the Works. Items subject to open storage for several months at the sites shall be suitably protected from weather damage. All electrical parts and mechanical parts subject to damage from moisture shall be packed together with an appropriate quantity of desiccant in hermetically sealed metal containers, plastic envelopes, or other appropriate containers, with all machined surfaces heavily coated with rust preventing compound.

Each case, crate, bundle, or single item shall be marked clearly with the name of the installation for which it is intended. Each container shall be clearly marked and the contents identified for proper warehousing.

The Contractor shall take all necessary precautions to ensure that all materials, which may be subject to deterioration in humid tropical conditions, are packed in such a manner as to prevent such deterioration.

All parts shall be carefully boxed or otherwise suitably prepared for shipment to a tropical climate. All openings shall be tightly closed before shipment. Equipment that will be vulnerable to damage due to seawater or moisture during transportation or storage at the Site shall be protected by a suitable vapour barrier and, if considered necessary by the Engineer, by an internal atmosphere of inert gas or approved desiccant.

All parts exceeding 100 kg gross weight shall be prepared for shipment so that slings for handling by crane may be readily attached while the parts are on railway cars or on board ship. The Contractor shall paint or mark the weight of all pieces in excess of 5 tonnes

The Contractor shall take necessary measures to avoid ingress of moisture during transportation, storage and installation.

The Contractor shall bear the risk of loss or damage to material prior to and including off loading on the dock at the port of entry.

18. Drum handling instructions

Following instructions should be followed for handling conductor drums:

- Generally conductor ends should be available for inspection and testing.

- During unloading operation drums must not be thrown or dropped from a height, from wagons, trucks and ships. A ramp or crane may be used for unloading operation. If neither is available a temporary ramp may be arranged.

- The drums should be rolled only the way arrow mark on the drum is shown. If it is rolled the other way the cable will start unwinding and will become loose.

- The drums should be stored on a firm surface, preferably on concrete surface. Storage of drums on a soft surface may result in drums sinking, making it extremely difficult to move the drums later on.

- The drums should never be stored flat i.e. the flanges being kept horizontal to the ground. The cables should also never be wound from this position. Unwinding of cable from this position may result in the cable getting twisted which is not rectifiable.

If for some reason it is necessary to rewind the cable on a different drum, the barrel of the new drum should not be less than the existing drum.

19. Packing list

The contents of each shipping package shall be itemised on a detailed list showing the exact weight, extreme outside dimensions, length, width, and height of each container. If all containers are uniform in size and weight, the dimensions and weight of only one may be shown.

One copy of the detailed packing list shall be enclosed in each package delivered. There shall also be enclosed in one package a master packing list summarising and identifying each individual package which is a part of the shipment.

The box number in which the master packing list is contained should be shown on each packing list. On barrels, bags, drums, or kegs where it is not feasible to place the packing list inside the container, all pertinent information is to be stencilled on the outside and this will thus constitute a packing list.

20. Submission of drawings

Drawings shall be submitted to the Employers for approval one (1) months prior to the date on which they will be required at the manufacturer's works, to ensure that the work is carried out in compliance with the program of Works.

The Engineer, for approval of all design calculations and drawings, requires a minimum period of 28 days.

Before commencing the manufacture, the Contractor shall submit to the Employers, for approval, four copies of prints of drawings in sufficient detail to show:

- The general arrangement and outline of dimensions of the parts to be supplied under the Contract;
- On detail drawings, the weights of components over one tonne to be shipped separately;
- The material specifications from which the various parts are to be made and their machined surface finished;
- The welding details and machining and assembly tolerances of all assemblies;
- The manner in which such parts are designed to function;
- Diagrams, performance curves and catalogue numbers of all electrical and mechanical equipment.

The Contractor shall submit to the Engineer, for approval, all drawings and technical documents as follows:

	Prints	**Electronics copy (CD)**
For approval		
Calculations and drawings	4	1
As-built drawings	2	1
Other documents	2	1
Supervision formats	2	1
Commissioning procedures	2	1
For Final issue		
Calculations and drawings	3	1
As-built drawings	3	1
Other documents	3	1
Supervision formats	3	1
Commissioning procedures	3	1

21. Site Installation and Commissioning

The Contractor shall ensure that all Site installation and commissioning controls, inspections and tests, are carried out in accordance with the planned program, and that data recorded are adequate to permit the Engineer to verify that the whole of the Contract Works are in full compliance with all Contract requirements.

22. Inspection and Testing

The Contractor shall ensure that measures are established for all material and items that will provide the ability, at any point of manufacture, to determine that the manufacturer's planned inspections and tests up to that point have been carried out.

Detailed foundation records shall include depth and details of the foundation, soil description,

23. Measurement and Payment

The quantities in the Schedule of Prices are estimated quantities, and they are not to be considered as limiting or extending the amount of work to be done by the Contractor.

The measured items in the Schedule of Prices are to be accepted as the full interpretation of the requirements of the Technical Specifications and Drawings.