SCOPE OF WORK - SUBSTATIONS

As required for effective and completeness of the works relating to installation, testing and commissioning of the transformer and associated switchgear

TABLE OF CONTENTS

4.2 SCOPE OF WORK - SUBSTATIONS

4.2.1 General

The Bidder shall examine the scope of works in this section in close connection with the other documents and particulars forming these Bidding Documents.

Special attention shall be paid to General Specifications and Particular Technical Specifications, in which the general technical requirements are specified. The drawings enclosed in are for bidding purposes only.

If the Specifications and/or Drawings do not contain particulars of materials or goods, which are necessary for the proper and safe completion, operation, and maintenance of the equipment in question, all such materials shall be deemed to be included in the supply.

In the event of any conflict between the Drawings and the Specifications, the latter shall prevail.

In the event of any conflict between scaled dimensions and figures on the Drawings, the figures shall prevail.

Should the Bidder find discrepancies in or omissions from these Specifications or from the other Documents, or should he be in doubt as to their meaning, he should immediately contact the Project Manager for interpretation, clarification or correction thereof before submitting his Bid. Such action shall, however, in no case be considered as a cause for altering the closing date of the Bid.

The scope of work for equipment shall cover engineering design, manufacture, testing before shipment and packing sea worthy or otherwise as required, delivery CIP site, of all equipment as specified in the preceding chapters.

For substations contracted on turnkey basis the substation contractor shall be responsible for design, material supply, transport, erection, and installation and commissioning as well as having the full responsibility for civil works including design and construction of transformer foundations and control building.

The Contractor shall design and construct the transformer foundations with oil collection pit, oil trap and fire damper consisting of crushed stones laying on a galvanised steel grating.

Loose equipment for the Employer’s rehabilitation shall be complete with documentation and ancillaries like programs, licences and programming tools.

Equipment that is to be dismantled and removed from existing substations is to be recovered by the Contractor and deposited to sites within or in the immediate vicinity of each substation. Such sites are to be designated by the Employer. The recovered equipment is to be taken over by the Employer at these sites.

KPLC has a SCADA (Supervisory, Control & Data Acquisition) system that is controlled from the Regional Control Centres& the National Control Centre. The National Control Centre (NCC) is at Juja Rd and controls the entire transmission network & substations (ie some 66kV, all 132kV, all 220kV & soon to be introduced 400kV stations.)

There are 4 regional control centres in total. These are located in the following locations; Juja Rd (Nairobi region), Rabai (Coast region), Lessos (West Kenya region) & Kiganjo (Mt Kenya region). These Regional Control Centres monitor & control the 11KV, 33kV & 66kV Distribution networks &substations in their specific regions.

The Control Centres all run ABB's Network Manager WS500 which is the software used for monitoring & Control of all the incorporated substations. The Communication protocol currently supported by KPLCs front end servers is ABBs PCU 400, for data telegram exchange with Remote Terminal Units (RTUs). Whereas, the Station Control Management Systems (SCMS) in the substations in its SCADA system are **IEC 60870-5-101**&**IEC 60870-5-104**.

The automated 132/66/33/11kV Transmission and Distribution substations will be required to communicate with the front end server (ABB's PCU400) via the communication protocols outlined above. The automated sub-Station must communicate with the Regional Control Centre under which it shall be monitored & controlled.

The interconnected KPLC's telecommunications system is based on a backbone of SDH STM1/4 terminal equipment, FOX 515 from ABB. A network management system (NMS) for the telecommunication system has been installed at NCC.

4.2.2 Standard Substation

This section defines the standard substation components. The actual quantities to be included in the price schedules are found for each substation in the subsequent sections.

4.2.3 132 kV Bay

4.2.3.1 Transformer Bay

1 (one) complete bay shall be equipped with:

(a) 1 (one) circuit breaker
(b) 2 (two) isolator with motor operation
(c) 1 (one) earthing switch
(d) 1 (one) set of busbars
(e) 1 (one) complete set of three-phase line including clamps for the flying busbars and for connection between the gantries, to the transformer bushings, to the busbars and to and between the apparatus.
(f) 1 (one) set of current transformers
(g) 1 (one) set of surge diverters
(h) 1 (one) set of steel structures for support
(i) 1 (one) bay control unit with proper display, for measurements (V,I,MVAR,MW)
(j) Tap changer voltage regulating relay (AVR)
(k) 1 (one) multifunctional protection unit as per 4.1.2.4.2.2 Section VI Particular Technical specifications substations control, and Protection
(l) HV overcurrent protection relay.
(m) 1 (one) lock-out trip relay with electrical/hand reset facilities
(n) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.

4.2.3.2 66Kv FeederBay

1 (one) complete bay shall be equipped with:

a. 1 (one) circuit breaker
b. 2 (two) isolator with motor operation
c. 1 (one) earthing switch
d. 1 (one) set of busbars
e. 1 (one) complete set of three-phase line including clamps for the flying busbars and for

connection between the gantries, to the busbars and to and between the apparatus.

f. 1 (one) set of current transformers
g. 1 (one) set of voltage transformers
h. 1 (one) set of surge diverters
i. 1 (one) set of steel structures for support
j. 1 (one) set of control/protection panel
k. 1 (one) bay control unit with display and measuring functions
l. 1 (one) multifunctional protection unit as per 4.1.2.4.2.1
m. 1 (one) lock-out trip relay with electrical/hand reset facilities
n. 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.

4.2.4 33 kV Switchgear Outdoor Type

4.2.4.1 Transformer Bay

1 (one) complete bay shall be equipped with:

a. 1 (one) circuit breaker
b. 2 (two) isolator with motor operation
c. 1 (one) earthing switch
d. 1 (one) set of busbars
e. 1 (one) complete set of three-phase line including clamps for the flying busbars and for connection between the gantries, to the transformer bushings, to the busbars and to and between the apparatus.
f. 1 (one) set of current transformers
g. 1 (one) set of surge diverters
h. 1 (one) set of steel structures for support
i. 1 (one) bay control unit with proper display, for measurements (V,I,MVAR,MW)
j. Tapchanger voltage regulating relay (AVR)
k. 1 (one) multifunctional protection unit as per 4.1.2.4.2.2 Section VI Particular Technical specifications substations control, and Protection
l. HV overcurrent protection relay.
m. 1 (one) lock-out trip relay with electrical/hand reset facilities
n. 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation

4.2.4.2 FeederBay

1 (one) complete bay shall be equipped with:

a. 1 (one) circuit breaker
b. 2 (two) isolator with motor operation
c. 1 (one) earthing switch
d. 1 (one) set of busbars
e. 1 (one) complete set of three-phase line including clamps for the flying busbars and for connection between the gantries, to the busbars and to and between the apparatus.
f. 1 (one) set of current transformers
g. 1 (one) set of surge diverters
h. 1 (one) set of voltage transformers
i. 1 (one) set of steel structures for support
j. 1 (one) set of control/protection panel
k. 1 (one) bay control unit with display and measuring functions
l. 1 (one) multifunctional protection unit as per 4.1.2.4.2.1

m. 1 (one) lock-out trip relay with electrical/hand reset facilities
n. 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.

4.2.4.3 Bus Bar Protection

1 (one) bus bar protection unit included in the control panel for all 66 kV and 33KV bus bars.

4.2.5 11 kV Switchgear Outdoor Type

4.2.5.1 11 kV Transformer Bay

1 (one) complete bay shall be equipped with:

(a) 1 (one) Autorecloser/circuit breaker
(b) 1 (one) earthing switch
(c) 1 (one) set of busbars
(d) 1 (one) set of current transformers
(e) 1 (one) set of surge diverters
(f) 3 (three) sets of air break switches
(g) 1 (one) neutral current transformer
(h) 1 (one) bay control unit with display and measuring functions
(i) 1 (one) restricted fault relay function
(j) 1 (one) neutral point earth fault relay function
(k) 1 (one) lock-out trip relay with electrical/hand reset facilities
(l) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.
(m) 1 (one) set of voltage transformers (with a facility for primary isolation)

4.2.5.2 11 kV Feeder Bay

1 (one) complete bay shall be equipped with:

(a) 1 (one) Autorecloser/circuit breaker
(b) 1 (one) earthing switch
(c) 1 (one) set of busbars
(d) 1 (one) set of current transformers
(e) 1 (one) set of surge diverters
(f) 1 (one) bay control unit with display and measuring functions
(g) 1 (one) 3-phase over current relay function with auto re-close function. The auto-reclose function must be selectable with an external switch
(h) 1 (one) Earth fault relay function
(i) 1 (one) sensitive Earth fault function
(j) 1 (one) restricted fault relay function (if not provided on the HV transformer bay panel)
(k) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.

Note: 11KV Capacitor bank switchgear shall be equipped with the necessary protection and control relays for Capacitor banks. .

4.2.5.3 Auxiliary Transformer bay

1 (one) complete bay equipped with:

(a) 1 (one) set of expulsion fuses
(b) 1 (one) set of busbars jumpers

4.2.6 11 kV Switchgear Indoor Type

4.2.6.1 Switch Board Panel for 11 kV Transformer Bay

1 (one) complete bay shall be equipped with:

a) 1 (one) Withdrawable circuit breaker
b) 1 (one) earthing switch
c) 1 (one) set of busbars
d) 1 (one) set of current transformers
e) 1 (one) bay control unit with display and measuring functions
f) 1 (one) restricted fault relay function
g) 1 (one) neutral point earth fault relay function
h) 1 (one) lock-out trip relay with electrical/hand reset facilities
i) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.
j) 1 (one) set of voltage transformers (with a facility for primary isolation)

4.2.6.2 Switch Board Panel for 11 kV Feeder Indoor panel

1 (one) complete bay shall be equipped with:

a) 1 (one) circuit breaker
b) 1 (one) earthing switch
c) 1 (one) set of busbars
d) 1 (one) set of current transformers
e) 1 (one) bay control unit with display and measuring functions
f) 1 (one) 3-phase over current relay function with auto re-close function. The auto-reclose function must be selectable with an external switch
g) 1 (one) Earth fault relay function
h) 1 (one) sensitive Earth fault function
i) 1 (one) restricted fault relay function (if not provided on the HV transformer bay panel)
j) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.

Note: 11KV Capacitor bank switchgear shall be equipped with the necessary protection and control relays for Capacitor banks.

4.2.6.3 Switch Board Panel for Indoor Bus- Sectionaliser

1 (one) complete bay shall be equipped with:

(a) 1 (one) circuit breaker
(b) 1 (one) set of protection current transformers.
(c) 2 (two) earthing switches (one on each busbar section if not located elsewhere)
(d) 1 (one) set of busbars including droppers and risers
(e) 2 (two) set of voltage transformers (one on each busbar section if not located elsewhere)
(f) 1 (one) bay control unit with display
(g) 1 (one) overcurrent function and 1 (one) relay function
(h) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for remote operation.

4.2.6.4 Switch Board Panel for Auxiliary Transformer

1 (one) complete bay equipped with:

a) 1 (one) fuse switch disconnector, manual
b) 1 (one) set of fuses
c) 1 (one) earthing switch
d) 1 (one) bay control unit
e) 1 (one) set of busbars
f) 1 (one) set of wiring, terminal blocks, etc. to form a complete bay control.

4.2.6.5 Current Transformers for Neutral current measurements

(a) 2 (two) current transformers for neutral current measurements one on each winding

4.2.6.6 Lightning Arresters

(a) 66kV and 33kV lightning arrestors erected close to HV side of power Transformer
(b) 3 (three) 11 kV lightning arresters erected close to LV side of power transformer

4.2.7 Auxiliary transformer for 33/11kV Substations and 66/11kV Substations

(a) 1 (one) 33/0.4 kV auxiliary transformer, 100 kVA, Dyn11 with built on low voltage fuses. The transformers shall be installed outdoor on the 33kV Busbar.
(b) 2 (two) 11/0.4kV auxiliary transformers 100kVA, Dyn11 shall be installed in the 66/11kV Substations. The transformers shall be installed indoor and shall be of enclosed bushing type.

4.2.8 MV Power Cables from Transformer to Indoor Switchgear

(a) 1 (one) lot of 11 kV cable from main transformers to 11 kV switchgear, rated for 120 % of nominal transformer rating

(b) 1 (one) lot of 11 kV cable terminations for transformer and switchgear connection
(c) 1 (one) lot of support structures for lightning arresters and transformer connection
(d) 1 (one) lot of 11 kV cable from switchgear to auxiliary transformer
(e) 1 (one) lot of 11 kV cable terminations for auxiliary transformer and switchgear connection
(f) 1 (one) lot of support structures for auxiliary transformer.

4.2.9 MV Power Cables from Indoor Switchgear to line termination tower

a) 1 (one) lot of 11 kV cable from indoor 11 kV switchgear to terminal tower
b) 1 (one) lot of 11 kV cable terminations for switchgear connection and line connection
c) 1 (one) lot of support structures for cable terminations in terminal tower and surge arrestors

4.2.10 Control, Protection, Metering and Signalling

4.2.10.1 Substation Automation System

General

1 (one) lot complete system (equipment and software) for substation control.

To the extent the internal control and interlocking system for the equipment supplied is not included for that particular equipment, it shall be included herein. All interconnections

needed to form a complete installation shall also be included herein.

The control system specified hereunder shall include all necessary equipment for control, protection, metering and signalling. The system shall include all instruments, meters, switches, position indicators, inscriptions and mimic diagrams, protective and auxiliary relays, terminal blocks, internal wiring and any other equipment required to form a complete installation.

Drawings showing the control system, protection units and the boards as they are proposed shall be supplied with the Bid.
The space needed for the boards should not exceed the available space.
Information defining the internal local control communication protocol shall be submitted with the Bid.

Complete sets of schematic diagrams for control, protection, indication, metering, signalling, alarms, etc. shall be supplied as part of the project and shall be subject to the Project Manager's approval.
The requirements as to submission of diagrams, drawings and other documents with the Bid and after award of Contract are stated in the standard form of contract.

4.2.10.1.1 Scope SCADA/SAS.

(a) For New substations: 1 (one) lot complete system (equipment and soft ware), with communication gateway, data concentrator etc. for interface to a regional (RCC) SCADA system and to the national (NCC) SCADA system.
(b) For existing Substations with SAS/RTU in operation. One complete (lot) extension of the SAS/RTU to accommodate the additional switchgear. This shall include Hardware and software and necessary Engineering.

For a point-to-point communication link the IEC 60870-5-101 protocol shall be implemented.
As part of the supply necessary engineering of the substation signal list (I/O list) shall be included. The engineering shall be carried out on the format prescribed to KPLC by the SCADA contractor.

4.2.10.2 Control and Measuring Cables

(a) All external cables, conventional or fibre optical, for control, protection, measuring, indication, etc., for the complete plant. Wiring between the switchyard apparatus, transformers, the board(s) and the control system in the control building and the interconnections between the various apparatus in the switchyard shall be included.

4.2.10.3 Telecommunications

a) In order for the SCADA data to be transferred to the Regional control centres, the bidder shall design and commission an appropriate communication system based on Fibre, PLC, Radio or other approved communication media for data and speech requirement.

Equipment supplied shall be digital and latest technology and shall comply to the latest ITU-T, IEC, ITU-R, IEEE and ETSI standards.

It is required that one remote subscriber be implemented in each substation.
Interface for data transmission shall be according to ITU-T recommendation V.24 or V.35
Bit error rates of $1x10^{-6}$ shall not be exceeded.

b) It is the responsibility of the contractor to interconnect with existing SCADA and Telecommunications system. However use and extension of existing infrastructure where possible shall be encouraged.
c) The Tenderer shall acquaint himself with all the sites and determine the requirements for towers or masts to suit his design. When a new tower or mast is necessary is necessary, the Tenderer shall supply drawings for the proposed installation. All towers shall be 36 m and self supporting. The tenderer shall provide details of loading and guy stresses for masts or towers to be erected on buildings. All antennae mounting components including wave-guides, cables, cable clamps and external cable connectors shall be specified.
d) Where PLCs are to used or where the T-offs affect existing PLC communication links, blocking line-traps including support strucures shall be in scope of supply.
e) All communications equipment installed in the country must be type approved by the Communications Commission of Kenya (CCK). The Contractor will obtain the type approval.
The CCK has to be consulted and give approval for each new project and an application has to be submitted stating the location of the sites and request for the frequencies to be used. Unless otherwise stated this application for frequencies is normally done by KPLC.
The radio frequency plan shall be prepared by the Contractor and closely coordinated with KPLC during the project design stage. All path surveys shall be carried out by contractor.
f) The Contractor shall provide a list of recommended spares, the quantities and prices to last for a period of five (5) years after expiry of guarantee period.
g) The contractor shall offer training for four (4) technical appointees of the employer for 2 weeks at manufacturer's premises. Terms and conditions similar to 4.2.15
h) The contractor shall provide necessary configuration software pre-installed on a maintenance laptop with a one time software license.

4.2.10.3.1 Scope of works - Telecommunication

The scope as described shall include detailed system design, manufacture, supply, installation, testing, commissioning, remedying of defects, maintaining the works during the defects liability period and any incidental work necessary for the proper completion of the work in accordance with this contract. Scope shall include integration of STM-4, to the existing KPLC Network Management System. In some cases there shall be need to upgrade existing Telecommunication equipment in order to achieve data and speech routing to Regional and National control centres. Survey and necessary preparation works on existing systems, Equipment and substations to achieve specified functionality shall be in the scope of supply. Contractors shall be required to submit for approval detailed design of system before manufacture.
The STM 4 equipment shall include Tele-protection modules (4 Command), High Speed Ethernet modules and 1+1 protection.
Necessary upgrade of communication and SCADA Front Ends (PCUs) equipment at terminal stations and at Control centres shall achieve complete Data and Speech to RCC/NCC shall be included in scope.

In addition all substations (irrespective of whether SCADA functionality to control centre is established) shall be equipped with a Base Radio capable of communicating with the ASTRO trunking radio system for use during switching operations. Where OLTEs are the terminal equipment, additional Ethernet capability shall be established to cater for other corporate data. All stations shall be equipped with two (2N0.) telephone extensions originating from existing PAXes in Regional control centres.

All communication equipment supplied under this project shall be type approved by the regulator, Communication Commission of Kenya (CCK) and the Kenya Bureau of Standards (KBS) where applicable. It is the responsibility of the contractor to obtain these necessary approvals.

The type of required communication link shall be detailed in scope of supply for individual stations.

4.2.11 Auxiliary AC Supply Equipment

4.2.11.1 Main AC Distribution Board

1 (one) main distribution board designed for minimum 200 A with the necessary number of panels for:

(a) 1 (one) circuit breaker, manual operated, minimum 200 A, for the feeder from the station supply transformer.
(b) 2 (two) current transformers 200/1/1 A with two cores, one core for measuring and one for protection.
(c) 1 (one) constant time overcurrent relay.
(d) 1 (one) earth fault relay.
(e) 1 (one) A-meter function with selector switch.
(f) 1 (one) V-meter function with selector switch.
(g) 1 (one) lot of feeder circuit breakers with electro-BAHnetic and thermal releases. The breaker ratings shall be chosen to suit the different consumers to be connected. 20% of the breakers of each size shall be spare and readily mounted.

4.2.11.2 Sub-distribution Boards and Panels

(a) 1 (one) lot of all necessary sub-distribution boards and panels (including the distribution panel for lighting and small power of the control building).

The boards shall be completely equipped with busbars, circuit breakers, miniature circuit breakers etc. Contactors, motor starters, instruments, operating switches, push buttons, indicating lamps, etc., shall be included whenever required. 20% of the breakers of each size shall be spare and readily mounted.

4.2.11.3 Cables

(a) 1 (one) lot of all necessary armoured power and control cables for supply to the main distribution board and to the sub-distribution boards, panels and equipment except for the cables for lighting and small power which are included in the civil Goods under separate contract.

4.2.12 DC Supply System

4.2.12.1 Battery

i. (1 (one) 110 V battery. Capacity at least 200 Ah/10h for substations with more than 10 MVA installation of transformer capacity

ii. The 48V batteries shall be included in the bid for communication equipment and the RTU. The battery shall be at least 100A/10Ah

The capacities to be recommended by the Bidder, based upon the calculated consumption considering a fully developed substation.
Batteries shall be installed in separate room with EX proof ventilation fan (for 110 V batteries only).

4.2.12.2 Charger

(a) 1 (one) DC charger for the 110 V battery.
(b) 1 (one) DC charger for the 48 V Battery.

The chargers shall be complete with instruments, breakers on AC and DC side, and protection.

4.2.12.3 Switchboard

1 (one) switchboard 110 V DC.

The board shall have:
(a) 1 (one) circuit breaker with BAHnetic and thermal release for the feeder from earache charger and battery.
(b) 1 (one) A-meter with shunt for each battery.
(c) 1 (one) V-meter with selector switch for the voltage between the poles and between poles and earth for each battery.
(d) 1 (one) set of contacts on the front for banana jacks for the battery voltage and earth.
(e) 1 (one) battery monitoring devices with alarm contacts.
(f) 1 (one) lot of all necessary circuit breakers and miniature circuit breakers for the outgoing feeders and circuits.

20% of the breakers of any size shall be spare and readily mounted.

4.2.12.4 Battery Conductors and Fuses

(a) 1 (one) set of conductors for the battery in the battery room.
(b) 2 (two) single pole fuse boxes with main fuses for the battery, placed on the wall outside of the battery room, and two fuses for the battery monitoring device.

4.2.12.5 Sub-distribution Boards and Panels

(a) 1 (one) lot of all necessary sub-distribution boards and panels.

The boards shall be completely equipped with busbars, miniature circuit breakers, fuses, etc. Contactors, motor starters, instruments, operating switches, push buttons, indicating lamps, under-voltage relays with alarm contact, etc., shall be included whenever needed.

4.2.12.6 Cables

(a) 1 (one) lot of all necessary DC power supply cables, including wiring to the apparatus in the switchyard.

4.2.13 Earthing System

An earthing network shall be installed comprising the following:
(a) 1 (one) lot of underground earthing system covering the platform and control building with risers
(b) 1 (one) complete set of "above-floor" earthing system for the control building, as applicable, with connections to the risers from the under-ground system.

4.2.14 Ancillary Equipment

4.2.14.1 Station Equipment

(a) 2 (two) self-contained, rechargeable, portable hand-held lights.
(b) 1 (one) audible alarm system with the necessary wiring.

4.2.14.2 Earthing Devices

(a) 1 (one) set of three phase portableearthing devices for outdoor 33kV with operating rods suitable for earthing of the bay conductors and busbars.
(b) 1 (one) set of voltage indicator for 33 kV and 11KV with audible and visual indication for voltage

4.2.14.3 Cable Accessories

(a) 1 (one) lot of all connecting material, cable boxes and material for fixing the cables. Terminals and terminal labels to the extent that this is not included in other sections.

4.2.14.4 Racks, Conduits, Ducts, etc

(a) 1 (one) lot of all cables, racks and trays to the extent necessary for the proper distribution of cables.

All the conduits and protection tubes, wherever cables may deteriorate or where cable laying may otherwise present difficulties.

4.2.15 Power transformers

To be supplied as specified for each sub station, and in accordance with below data.

4.2.1.1 Type of transformers

Main data for the transformers that shall be supplied:

Pos.	Rating MVA (ONAN/ONAF)	Voltage	Tapping range	OLTC
1	35/45	66/11	8 x 1.67%	yes
2	18/23	132/33	8 x 1.67%	yes
3	18/23	66/11	8 x 1.67%	yes
4	18/23	33/11	8 x 1.67%	yes
5	15/n.a	132/33	8 x 1.67%	yes
6	7.5/n.a	33/11	8 x 1.67%	yes
7	2.5/n.a	33/11	± 2*2.5 %	no

Transformers in Coastal region- shall be of vector group: Ynynd1 (with stabilizing winding).
Transformers in Nairobi region- shall be of vector group: Dyn1
Transformers in West Kenya region -shall be of vector group: Dyn11

4.2.2 Civil Works

4.2.2.1 Platform works

Platform with fence roads and ditches shall be constructed as specified in particular specifications and in scope of work.

4.2.2.2 Switchgear buildings

Switchgear buildings shall be constructed as specified in particular specifications and in scope of work.
Control Panels and medium voltage indoor switchgears of different Voltage levels shall be installed in separate rooms

4.2.2.3 Transformer foundations

Transformer foundations shall be constructed as specified particular specifications and in scope of work.

4.2.2.4 Cable Trenches

Cable trenches shall be constructed as specified in particular specifications and in scope of work.

4.2.3 Training in control (SAS), Telecommunication and protection system (LS-008a, 008b)

The training includes travel for the 4 (four) KPLC engineers as well as all course material and other expenses shall be catered by the Contractor. The training shall be held at the manufacturer's place. The training shall cover design, application, testing, commissioning and maintenance of the relevant digital control and protection systems. The training course shall have a minimum of 2 (two) weeks duration for SAS and Protection and one week for communication. The cost of per diem and accommodation shall be met by KPLC.

4.2.4 Factory Acceptance Test (LS – 001,002,003,004,005,006,007)

The Contractor shall arrange for 2 participants from KPLC and the Project Manager to witness tests of major equipment listed below in the manufacturer’s plant. All routine tests shall be carried out in the presence of the Employer’s representatives. The representatives shall approve shipment of the equipment if they are satisfied that the requirements of the specification are fully met
The Contractor shall arrange and meet the full cost of the air tickets and local transportation

- **Circuit breakers**
- **Protection and control system**
- **Transformers**
- **Indoor switchgear**
- **Power Cables**
- **Instrument transformers**
- **Disconnectors/ Isolators**
- **SAS**
- **Telecommunications Equipment**

FAT shall be carried out as prescribed in the particular technical specifications of the equipment. The cost of per diem and accommodation shall be met by KPLC.

4.2.5 Test Equipment (TS –001)

- Lap top computers: Two units per Lot, set up with comprehensive software. The pc shall be supplied with all the necessary accessories and ports and loaded with latest operating system. The Lap top must be able to run all the relay and equipment software's supplied under the contract. The lap top specifications shall be approved by the project manager. The Test equipment for Telecommunications shall be as described in 4.1.6

4.2.6 Final documentation

As built drawings: 5 paper copies delivered in binders
3 CD-ROM copy (all drawings in auto card)
1 set of transparencies

Operation and maintenance manuals: 2 copies per equipment

4.2.7 Site Offices and site facilities(LS-010, -011)

At the location where the Contractor will establish his main site administration:

- At the location where the Contractor will establish his main site administration, an office for site supervisors from the Project Manager with basic office furniture, internet, telephone and access/use of fax and copier shall be provided by the contractor for the implementation period
- The contractor shall provide mobile phone for coordination of activities with project manager and KES 10,000(ten thousand) monthly.

4.2.8 Scope of Works

4.2.8.1 Lot KP1/6A-2/PT/1/15/A39A – Diani and Miritini 33/11kV Substations

4.2.8.1.1 Diani 33/11kV Substation

The scope of works include

- Reconstruction and realignment of 33kV Busbar with 6No incomer bays
- Establishment of 2No transformer bays complete with protection and control equipment.
- Repositioning of existing transformer bay and unit to the new platform.
- Transportation, positioning testing and commissioning of new transformer.
- Extension of the switchgear room and rearrangement of the equipment to accommodate additional feeder panels.
- Reconstruction of the access road up to the new transformer bays.
- Recovery of disused structures

	Diani 33/11kV Substation works		
Item no.	**Item**	**Unit**	**Quantity**
	Equipment/materials:		
DNI-001	23 MVA, 33/11 kV Transformer	Pc	1
DNI-002	33 kV Circuit Breaker	Pc	6
DNI-003	33 kV motorized Isolator without earth switch	Pc	10
DNI-004	33 kV motorized Isolator with Earth Switch	Pc	4
DNI- 005	33 kV Current Transformer	Pc	18
DNI-006	33Kv Voltage Transformer	Pc	6
DNI-007	33 kV Bay/Busbar Material	Lot	1
DNI-008	Steel Structures for support	Lot	1
DNI- 009	33 kV Surge Arresters	Pc	18
DNI-010	33 kV Transformer Protection and control Panel	Pc	1
DNI-011	33 kV Line protection and Control Panel	Pc	4
DNI-012	33 kV Bus Section protection and Control Panel	Pc	1
DNI-013	11 kV Neutral Current Transformer	Pc	1
DNI-014	11 kV Neutral Link	Pc	1
DNI-015	Switch Board Panel for 11 kV Transformer Bay	Pc	1
DNI-016	11 kV Surge Arresters	Pc	3
DNI-017	Auxiliary transformer 100 kVA, 33/0.415 kV, with HV fuse protection	Pc	1
DNI-018	Switch Board Panel for 11kV Feeders	Pc	5
DNI-019	Switch Board Panel for 11 kV Bus section	Pc	1
DNI-020	Adaptor Panel for 11kV switchboard panel	Pc	1
DNI-021	MV Power Cables between Transformer and switchgear -S/C 630 mm sq.	Lot	1
DNI-022	Substation control Management system extension	Lot	1
DNI-023	MV Power Cables between indoor switchgear and line termination tower (11 kV 3/C Cables, 300 mm2)	Lot	1
DNI-025	Control and measuring cables	Lot	1
DNI-026	Auxiliary AC supply panel	Lot	1
DNI-027	Earthing system	Lot	1
DNI-028	Ancillary Equipment	Lot	1

DNI-027	Switchyard Lighting system	Lot	1
DNI-028	Lightning protection system	Lot	1
	Works		
DNI-103	Transformer Foundations	Lot	2
DNI-104	Switchgear Building extension	Lot	1
DNI -105	Platform works (earth work, foundations, trenches, fence, etc)	Lot	1
DNI-106	Cable trenches (excavating, protection, backfill, etc)	Lot	1
DNI -107	Erection and commissioning	Lot	1
DNI -108	Reconstruction and realignment of 33kV busbar	Lot	1
DNI -109	Telecoms / SCADA Installation and commissioning	Lot	1
DNI -110	Relocation of existing transformer and accessories	Lot	1
	Relocation of Communication mast and accessories	Lot	1
DNI -111	Access road works	Lot	1
DNI -112	Automation Engineer for substation automation integration	Lot	1
DNI -113	Site adaptation works	Lot	1

4.2.8.1.2 Miritini 33/11kV Substation

The scope of works include

- Extension and modification of 33kV Busbar to provide 5No incomer bays
- Establishment of 1No new transformer bays complete with protection and control equipment.
- Repositioning and realignment of the existing transformer and associated equipment to the platform
- Transportation, installation, assembly and testing of a new transformer
- Extension of the switchgear room and rearrangement of the equipment to accommodate additional feeder panels. Rehabilitation of the toilet and water tank
- Reconstruction of the access road to the new transformer bays and new access road to the switchgear room and parking area.
- Recovery of equipment and line materials and demolition of existing disused structures.
- Construction of boundary wall, gate and rehabilitation of cable trenches.

	Miritini 33/11kV Substation works		
Item no.	**Item**	**Unit**	**Quantity**
	Equipment/materials:		
MRTN-001	23 MVA, 33/11 kV Transformer	Pc	1
MRTN-002	33 kV Circuit Breaker	Pc	2
MRTN-003	33 kV motorized Isolator without earth switch	Pc	5
MRTN-004	33 kV motorized Isolator with Earth Switch	Pc	2
MRTN- 005	33 kV Current Transformer	Pc	9
MRTN-006	33Kv Voltage Transformer	Pc	3
MRTN-007	33 kV Bay/Busbar Material	Lot	1
MRTN-008	Steel Structures for support	Lot	1
MRTN- 009	33 kV Surge Arresters	Pc	9

MRTN-010	33 kV Transformer Protection and control Panel	Pc	1
MRTN-011	33 kV Line protection and Control Panel	Pc	1
MRTN-012	11 kV Neutral Current Transformer	Pc	2
MRTN-013	11 kV Neutral Link	Pc	2
MRTN-014	Switch Board Panel for 11 kV Transformer Bay	Pc	2
MRTN-015	Switch Board Panel for 11kV Feeders	Pc	5
MRTN-016	Switch Board Panel for 11 kV Bus section	Pc	1
MRTN-017	11 kV Surge Arresters	Pc	15
MRTN-018	Adaptor panel for 11kV switchgear	Pc	1
MRTN-019	MV Power Cables between Transformer and switchgear -S/C 630 mm sq.	Lot	1
MRTN-020	Substation control Management system extension	Lot	1
MRTN-021	MV Power Cables between indoor switchgear and line termination towers (11 kV 3/C Cables, 300 mm2) and terminations	Lot	1
MRTN-022	Control and measuring cables	Lot	1
MRTN-023	Auxiliary AC supply	Lot	1
MRTN-024	DC supply	Lot	1
MRTN-025	Earthing system	Lot	1
MRTN-026	Ancillary Equipment	Lot	1
MRTN-027	Switchyard Lighting system	Lot	1
MRTN-028	Lightning protection system	Lot	1
	Works		
MRTN-101	Transformer Foundation	Lot	1
MRTN-102	Switchgear Building extension	Lot	1
MRTN 103	Platform works (earth work, foundations, trenches, fence, etc)	Lot	1
MRTN-104	Cable trenches (excavating, protection, backfill, etc)	Lot	1
MRTN -105	Erection and commissioning	Lot	1
MRTN -106	Extension and realignment of 33kV Busbar	Lot	1
MRTN -107	Relocation of existing transformer and accessories	Lot	1
MRTN -108	Disassembly, reassembly and testing of existing transformer	Lot	1
MRTN -109	Access road, Gate and boundary wall works	Lot	1
MRTN -110	Recovery works for structures to be removed	Lot	1
MRTN -111	Transportation and Positioning of new Transformer	Lot	1
MRTN -112	Assembly and testing of new transformer	Lot	1
MRTN -113	Substation Telecoms / SCADA extension works	Lot	1
MRTN -114	Substation Automation Integration	Lot	1
MRTN -115	Site adaptation works	Lot	1

4.2.8.2 Lot KP1/6A-2/PT/1/15/A39B/1 – Matasia, Kabete and Syokimau 66/11kV Substations

4.2.8.2.1 Matasia 66/11kV Substation

The works involve construction of a new 66kV transformer bay; installation of 1No new transformer 23 MVA, 66/11 kV complete with a control panel; Installation of 6No additional 11kV Feeder panels and associated control switchgear.
The additional 11kV feeder panels will be provided by KPLC but the contractor will be responsible for coupling them to the existing board.
The existing switchgear room will be modified and the equipment rearranged to accommodate the additional equipment.
The lighting masts and lightning arrestor masts on wooden poles will be recovered and new steel structure masts erected at the designated locations.

	Second Transformer at Matasia Substation	
Item no.	**Item**	**Quantity**
	Equipment/materials:	
MTS-001	66 kV Circuit Breaker	2
MTS-002	66 kV Isolator	2
MTS-003	66 kV Isolator with Earth Switch	1
MTS-004	66 kV Current Transformer	6
MTS-005	66 kV Bus bar Material and Bay Material (lot)	1
MTS-006	Steel Structures for support (lot)	1
MTS-007	66kV Surge Arrestors	6
MTS-008	66 kV Transformer Protection Panel with multifunctional protection unit as 4.1.2.4.2.2	1
MTS-009	66 kV Line Protection Panel with multifunctional protection unit as per 4.1.2.4.2.1	1
MTS-010	11 kV Neutral Link	1
MTS-011	11 kV Neutral CT	1
MTS-012	Switch Board Panel for 11 kV Transformer Bay	1
MTS-013	Switch Board Panel for 11 kV Bus sectionaliser	1
MTS-014	Switch Board Panels for 11 kV Feeder	5
MTS-015	Adaptor Panel for 11kV Switchboard	1
MTS-016	11 kV Surge Arresters	3
MTS-017	Auxiliary transformer 100 kVA, 11/0.415 kV	1
MTS-018	11 kV Fuse Switch for auxiliary transformer	1
MTS-019	MV Power cables between Transformer and Switchgear (Lot)	1
MTS-020	Substation control system extension (Lot)	1
MTS-021	Control and Measuring cables (Lot)	1
MTS-022	Earthing System (Lot)	1
MTS-023	Ancillary Equipment (Lot)	1
MTS-024	Lighting mast	2
MTS-025	Lightning Arrestor Mast	1
MTS-026	23 MVA, 66/11 kV transformer	1
	Works:	
MTS-100	Transformer Foundation	1
MTS-101	Switchgear Building Extension	1
MTS-102	Platform works (earth work, foundations, trenches, etc)	1 Lot

MTS-103	Cable trenches (excavating, protection, backfill, etc) (m)	180
MTS-104	Transportation and positioning of transformer	1 Lot
MTS-105	Assembly and testing of transformer	1 lot
MTS-106	Erection and commissioning	1 Lot
MTS-107	Telecoms / SCADA Installation and commissioning	1 Lot
MTS-108	Substation automation integration	

4.2.8.2.2 Kabete 66/11kV Substation

The works involve construction of a new 66kV transformer bay; installation of 1No new transformer 23 MVA, 66/11 kV; Installation of 2No additional 11kV Feeder panels and associated control switchgear within the existing switchgear room.
The additional 11kV feeder panels will be provided by KPLC but the contractor will be responsible for coupling them to the existing board. The equipment will be rearranged to fit the spaces available.

	Second Transformer at Kabete Substation	
Item no.	**Item**	**Quantity**
	Equipment/materials:	
KABT-001	66 kV Circuit Breaker (Kenya Power to provide)	2
KABT-002	66 kV Isolator (Kenya Power to provide)	3
KABT-004	66 kV Current Transformer	6
KABT-005	66 kV Bus bar Material and Bay Material (lot)	1
KABT-006	Steel Structures for support (lot)	1
KABT-007	66kV Surge Arrestors (Kenya Power to provide)	3
KABT-008	66 kV Transformer Protection Panel with multifunctional protection unit as 4.1.2.4.2.2	1
KABT-009	66 kV Voltage Transformer, at least 2 of capacitive type for LMU	6
KABT-010	66 kV Line Protection Panel with multifunctional protection unit as per 4.1.2.4.2.1	1
KABT-011	11 kV Neutral Link	1
KABT-012	11 kV Neutral CT	
KABT-013	Switch Board Panel for 11 kV Transformer Bay	1
KABT-014	Switch Board Panel for 11 kV Bus sectionaliser	1
KABT-015	Switch Board Panels for 11 kV Feeder	2
KABT-016	Adaptor panel for 11kV switchboard	1
KABT-017	11 kV Surge Arresters	3
KABT-018	Auxiliary transformer 100 kVA, 11/0.415 kV	1
KABT-019	11 kV Fuse Switch for auxiliary transformer (Lot)	1
KABT-020	MV Power cables between Transformer and Switchgear (Lot)	1
KABT-021	Substation control system extension (Lot)	1
KABT-022	Control and Measuring cables (Lot)	1
KABT-023	Earthing System (Lot)	1
KABT-024	Ancillary Equipment (Lot)	1
KABT-025	23 MVA, 66/11 kV transformer (Kenya Power to provide)	1
	Works:	
KABT-100	Transformer Foundation	1
KABT-101	Transportation and positioning of transformer	1 Lot
KABT-102	Assembly and testing of transformer	1 Lot
KABT-103	Platform works (earth work, foundations, trenches, etc)	1 Lot

KABT-104	Cable trenches (excavating, protection, backfill, etc) (m)	60M
KABT-105	Telecoms and SCADA installation and commissioning	1 Lot
KABT-106	Automation Engineer for substation automation integration	1 Lot
KABT-107	Erection and commissioning	1 Lot
KABT-108	Relocation of lighting mast	1 Lot
KABT-109	Site adaptation works	1 Lot

4.2.8.2.3 Syokimau 66/11kV Substation

The works involve:

- Construction of a new 66kV transformer bay;
- Installation of 1No new transformer 23 MVA, 66/11 kV;
- Installation of 5No additional 11kV Feeder panels and associated control switchgear within the existing control room. The additional 11kV feeder panels will be provided by KPLC but the contractor will be responsible for coupling them to the existing board. The equipment will be rearranged to fit the spaces available.
- Construction of approximately 100m of 66kV overhead Lines at the line tee off in 150mm2 ACSR Conductor with 2No Air break switches to provide alternate supply to the station from the two 66kV feeders. All sections, joints and terminations shall be of compression type.

	Second Transformer at Syokimau Substation	
Item no.	**Item**	**Quantity**
	Equipment/materials:	
SYOK-001	66 kV Circuit Breaker	1
SYOK-002	66 kV Isolator	2
SYOK-003	66 kV Earthing Switch	1
SYOK-004	66 kV Current Transformer	3
SYOK-005	66 kV Bus bar Material and Bay Material (lot)	1
SYOK-006	Steel Structures for support (lot)	1
SYOK-007	66kV Surge Arrestors	6
SYOK-008	66 kV Transformer Protection Panel with multifunctional protection unit as 4.1.2.4.2.2	1
SYOK-009	11 kV Neutral CT	1
SYOK-010	11 kV Neutral Link	1
SYOK-011	Switch Board Panel for 11 kV Transformer Bay	1
SYOK-012	Switch Board Panel for Bus Coupler	1
SYOK-013	Switch Board Panel for 11 kV Feeder	5
SYOK-014	Adaptor panel for 11kV switchgear	1
SYOK-015	11 kV Surge Arresters	3
SYOK-016	Auxiliary transformer 100 kVA, 11/0.415 kV	1
SYOK-017	11 kV Fuse Switch for auxiliary transformer	1
SYOK-018	MV Power cables between Transformer and Switchgear	1 Lot
SYOK-019	Substation control system extension	1
SYOK-020	Control and Measuring cables	1
SYOK-021	Earthing System	1
SYOK-022	Ancillary Equipment	1
SYOK-023	Lighting mast	2

SYOK-024	23 MVA, 66/11 kV transformer	1
SYOK-025	66kV Air Break Switches	2
SYOK-026	66kV Line materials and accessories	1 Lot
	Works:	
SYOK-100	Transformer Foundation	1
SYOK-101	Transportation and Positioning of transformer	1 Lot
SYOK-102	Assembly and testing of transformer	1 Lot
SYOK-103	Platform works (earth work, foundations, trenches, fence, etc)	1 Lot
SYOK-104	Cable trenches (excavating, protection, backfill, etc) (m)	120
SYOK-105	Substation control system extension works	1 Lot
SYOK-106	Substation automation integration works	1 Lot
SYOK-107	Erection and commissioning	1 Lot
SYOK-108	66kV Line works	1 Lot

4.2.8.3 Lot KP1/6A-2/PT/1/15/A39B/2 – Gigiri, Cianda and Steel Billets 66/11kV Substations

4.2.8.3.1 Gigiri 66/11kV Substation

The works involve

- Construction of a new 66kV transformer bay;
- Construction of a new 66kV line bay
- Installation of 1No new transformer 23 MVA, 66/11 kV complete with accessories
- Installation of 7No additional 11kV Feeder panels and associated control switchgear. The additional 11kV feeder panels will be provided by KPLC but the contractor will be responsible for coupling them to the existing board. The equipment will be rearranged to fit the spaces available.
- Extension of the switchgear room will be extended to accommodate the additional equipment.

	Second Transformer at Syokimau Substation	
Item no.	**Item**	**Quantity**
	Equipment/materials:	
GGR-001	66 kV Circuit Breaker	2
GGR-002	66 kV Isolator	3
GGR-003	66 kV Isolator with Earth Switch	1
GGR-004	66 kV Current Transformer	6
GGR-005	66 kV Bus bar Material and Bay Material (lot)	1
GGR-006	Steel Structures for support (lot)	1
GGR-007	66kV Surge Arrestors	6
GGR-008	66 kV Transformer Protection Panel with multifunctional protection unit as 4.1.2.4.2.2	1
GGR-009	66 kV Line Protection Panel with multifunctional protection unit as per 4.1.2.4.2.1	1
GGR-010	11 kV Neutral Link	1
GGR-011	11 kV Neutral CT	1
GGR-012	Switch Board Panel for 11 kV Transformer Bay	1
GGR-013	Switch Board Panel for 11 kV Bus sectionaliser	1
GGR-014	Switch Board Panels for 11 kV Feeder	7
GGR-015	Adaptor panel for 11kV switchboard	1
GGR-016	11 kV Surge Arresters	3
GGR-017	Auxiliary transformer 100 kVA, 11/0.415 kV	1
GGR-018	11 kV Fuse Switch for auxiliary transformer	1
GGR-019	MV Power cables between Transformer and Switchgear	1
GGR-020	Substation control system extension	1
GGR-021	Control and Measuring cables	1
GGR-022	Earthing System	1
GGR-023	Ancillary Equipment	1
GGR-024	Lighting mast	1
GGR-025	23 MVA, 66/11 kV transformer	1
	Works:	
GGR-100	Transformer Foundation	1
GGR-101	Switchgear Building extension	1

GGR-102	Platform works (earth work, foundations, trenches, etc)	1 Lot
GGR-103	Cable trenches (excavating, protection, backfill, etc) (m)	170
GGR-104	Transportation and positioning of Transformer	1 Lot
GGR-105	Assembly and testing of transformer	1 lot
GGR-106	Automation Engineer for substation automation integration	1 lot
GGR-107	Erection and commissioning	1 Lot
GGR-108	Telecoms / SCADA Installation and commissioning	1 Lot
GGR-109	Site adaptation works	1 Lot

4.2.8.3.2 Cianda 66/11kV Substation

The works involve

- Reconstruction of the existing 66kV line bay
- Construction of a new 66kV line bay
- Construction of a new 66kV transformer bay;
- Installation of 1No new transformer 23 MVA, 66/11 kV complete with a control panel;
- Installation of 6No additional 11kV Feeder panels and associated control switchgear. The additional 11kV feeder panels will be provided by KPLC but the contractor will be responsible for coupling them to the existing board.
- Modification of the existing switchgear room and rearrangement of equipment to accommodate the additional equipment.
- Repositioning the existing local transformer to make room for the expansion of the switchgear room.
- Recover of the lighting masts and lightning arrestor masts on wooden poles and replacement with new steel structure masts at the designated locations.

	Second Transformer at Cianda Substation	
Item no.	**Item**	**Quantity**
	Equipment/materials:	
CNDA-001	66 kV Circuit Breaker	3
CNDA-002	66 kV Isolator	6
CNDA-003	66 kV Isolator with Earth Switch	2
CNDA-004	66 kV Current Transformer	9
CNDA-005	66 kV Bus bar Material and Bay Material (lot)	1
CNDA-006	Steel Structures for support (lot)	1
CNDA-007	66kV Surge Arrestors	9
CNDA-008	66 kV Transformer Protection Panel with multifunctional protection unit as 4.1.2.4.2.2	1
CNDA-009	66 kV Line Protection Panel with multifunctional protection unit as per 4.1.2.4.2.1	2
CNDA-010	11 kV Neutral Link	1
CNDA-011	11 kV Neutral CT	1
CNDA-012	Switch Board Panel for 11 kV Transformer Bay	1
CNDA-013	Switch Board Panel for 11 kV Bus sectionaliser	1
CNDA-014	Switch Board Panels for 11 kV Feeder	6
CNDA-015	Adapter panel for 11kV Switchgear	1
CNDA-016	11 kV Surge Arresters	3
CNDA-017	Auxiliary transformer 100 kVA, 11/0.415 kV	1

CNDA-018	11 kV Fuse Switch for auxiliary transformer	1
CNDA-019	MV Power cables between Transformer and Switchgear (Lot)	1
CNDA-020	Substation control system extension (Lot)	1
CNDA-021	Control and Measuring cables (Lot)	1
CNDA-022	Earthing System (Lot)	1
CNDA-023	Ancillary Equipment (Lot)	1
CNDA-024	Lighting mast	4
CNDA-025	23 MVA, 66/11 kV transformer	1
CNDA-026	MV power cables between 11kv panels and overhead lines (Lot)	1
	Works:	
CNDA-100	Transformer Foundation	1
CNDA-101	Switchgear Building	1
CNDA-102	Platform works (earth work, foundations, trenches, etc)	1 Lot
CNDA-103	Cable trenches (excavating, protection, backfill, etc) (m)	180
CNDA-104	Transportation and Installation of transformer	1 Lot
CNDA-105	Erection and commissioning	1 Lot
CNDA-106	Telecoms / SCADA installation and commissioning	1 Lot
CNDA-107	Automation Engineer for substation automation integration	1
CNDA-108	Recovery works for indoor switchgear	

4.2.8.3.3 Steel Billets 66/11kV Substation

The scope of works includes replacement of a faulty 23 MVA, 66/11 kV Transformer and associated switchgear; Installation of a new 13 Panel 11KV switchboard and other control equipment; Laying and terminating 630mmsq S/C 11kV cables from the transformers to the switchgear; Transferring switchgear to the new switchgear room; Recovery of the faulty transformer and associated equipment to the stores; Laying and termination of 8No 300mmsq 3/C cables from the switchgear to the overhead lines; Restoration of local supplies.

	Second Transformer at Steel Billets Substation	
Item no.	**Item**	**Quantity**
	Equipment/materials:	
SBL-001	23 MVA, 66/11 kV transformer	1
SBL-002	66kV Transformer Protection Panel with multifunctional protection unit as 4.1.2.4.2.2	2
SBL-003	66kV Line Protection Panel with multifunctional protection unit as per 4.1.2.4.2.1	1
SBL-004	11kV Neutral Link	1
SBL-005	11kV Neutral CT	2
SBL-006	11kV Surge Arresters	3
SBL-007	Switch Board Panel for 11 kV Transformer Bay	2
SBL-008	Switch Board Panel for 11 kV Feeder	10
SBL-009	Switch Board Panel for Bus Sectionaliser	1
SBL-010	Necessary extensions in the ac and dc auxiliary supply.	1 Lot
SBL-011	Substation control system	1 Lot
SBL-012	Control and Measuring cables	1 Lot
SBL-013	11kV 3/C Cable, 300 mm2 for feeder connections	1 Lot
SBL-014	11kV S/C power cables 630mmsq between Transformer and	1 Lot

	Switchgear	
SBL-015	Lighting Masts	1 Lot
SBL-016	Lightning Arrestor Masts	1 Lot
	Works:	
SBL-100	Cable trenches (excavating, protection, backfill, etc) (m)	1 Lot
SBL-101	Erection and commissioning	1 Lot
SBL-102	Recovery of equipment to new switchgear room	1 Lot
SBL-103	Recovery of Faulty Transformer and old 26busbar to stores	1 Lot
SBL-104	Replacement of Lighting and lightning arrestor masts with steel structures	1 Lot
SBL-105	Laying and termination of new feeder cables	1 Lot
SBL-106	Restoration of local supplies	1 Lot
SBL-107	Transportation and positioning of Transformer	1 Lot
SBL-108	Assembly and testing of transformer	1 Lot
SBL-109	Substation control system / SCADA installation	1 Lot

4.2.8.4 Lot KP1/6A-2/PT/1/15/A39C – Mangu 132/66kV and Kamburu 132/33kV Substations

4.2.8.4.1 Mangu 132/66kV Substation works

The substation scope of works shall include the following

- Establish a 60MVA 132/66kV Transformer bay complete with associated switchgear and protection.
- Relocation, dis-assembly and assembly and Installation and commissioning of a 60MVA 132/66kV transformer and associated switchgear.
- Extension of the 132kV and 66kV kV busbars.
- Installation and commissioning of 4No 66kv feeder bays complete with the associated equipment and protection.
- Relocation of the guard house, substation road and fence.
- Rerouting and reorganization of the existing 66/ 11kv network to ensure optimal use of the substation.
- Installation of a new 66kV incomer bay from the relocated transformer.
- Design, supply installation and commission of new transformer panels and RTTC panel
- SCADA extension and integration

Item	Item Description	Unit	Qty
	Mangu 132/66kV substation expansion		
MAN-001	132kV busbar material and connections	lot	1
MAN-002	66 kV Busbar Materials for 66KV connections for one incomer bay and 4 outgoing bays	lot	1
MAN-003	Steel Structures for support for 132kV and 66kV structures.	lot	1
MAN-004	132 kV Transformer Protection and control Panel.	pc	1
MAN-005	132 kV transformer RTTC panel	pc	1
MAN-006	66 kV Line protection and Control Panel	pc	4
MAN-007	66 kV Neutral Current Transformer	pc	1
MAN-008	132 kV Surge Arresters	pc	3
MAN-009	132kV current transformers	pc	3
MAN-010	132kV motorized isolators	pc	2
MAN-011	132kV circuit breakers	pc	1
MAN-012	66kv circuit breakers	pc	5
MAN-013	Substation control Management system (SCMS) extension	lot	1
MAN-014	66kv Isolators without earth switch	no	10
MAN-015	Control and measuring cables	lot	1
MAN-016	66kV feeder and incomer panels complete	no	5
MAN-017	66kV motorized isolators with earth switch	lot	4
MAN-018	Earthing system extension	lot	1
MAN-019	Ancillary Equipment	lot	1
MAN-020	Switchyard Lighting system extension	lot	1
MAN-021	Lightning protection system	lot	1
MAN-022	66kV current transformers	no	15
MAN-023	66kv Capacitive voltage transformers	no	12

MAN-024	66kV surge arrestors	no	15
MAN-025	66kV line materials and fittings	Lot	1
MAN-026	66kV 400mmsq cable and accessories, termination kits	km	3
MAN-026	15m poles	lot	1
MAN-027	66kV line surge arrestors	no	18
	Works		
MAN -101	Transformer Foundation	Pc	1
MAN- 102	Transformer assembly and disassembly	pc	1
MAN -103	Transformer relocation	pc	1
MAN –104	Platform Work(includes excavation and back filling charges even were we have existing structures and roads/ drainage)	lot	1
MAN– 105	Cable trenches	lot	1
MAN –106	Erection and commissioning	lot	1
MAN –107	Guard house (relocation and demolishing existing guard house)	lot	1
MAN-108	Road and drainage works	lot	1
MAN-109	Equipment foundations	lot	1
MAN-110	Earthing extension costs	lot	1
MAN-111	66kv cable installation and termination costs	lot	1
MAN-112	66kV and 11kV line reorganization and rerouting costs	lot	1
MAN-113	Fencing	lot	1
MAN-114	SCADA extension and integration	Lot	1

4.2.8.4.2 Kamburu 132/33kV Substation works

The substation scope of works shall include the following

- Establish a 23MVA 132/33kV Transformer bay complete with associated switchgear and protection.
- Transportation and installation of a 23MVA 132/33kV transformer
- Lay 132kV XLPE cable to the transformer bay
- Extension of the 33kV busbar and introduction of 3No additional 33kV feeder bays and a local transformer.

Item	Item Description	Unit	Qty
	Kamburu 2nd 23MVA 132/33kV Transformer		
KBR-001	23 MVA 132/33kV Transformer	Pc	1
KBR-002	132 kV SF6 Circuit Breaker	Pc	1
KBR-003	132 kV motorized Isolator without earth switch	Pc	3
KBR-004	132kV Current Transformer	pc	3
KBR-005	132 kV XLPE cable	Lot	1
KBR-006	132 kV Bus bar Material and Bay Material (lot)	Lot	1
KBR-007	132 kV Steel Structures for support (lot)	Lot	1

Item	Item Description	Unit	Qty
KBR-008	132 kV Surge Arrestors	Pc	6
KBR-009	132kV Post Insulators	Pc	4
KBR-010	132 kV Line Protection Panel with multifunctional protection unit	Pc	1
KBR-011	132 kV Transformer Protection Panel with multifunctional protection unit as 4.1.2.4.2.2	Pc	1
KBR-012	Transformer Tap changer panels with associated accessories for complete functionality	Pc	1
KBR-013	132kV Circuit Breaker protection for two lines and one transformer complete with all function requirements	Pc	1
KBR-014	132kV Metering and control panel with necessary accessories for complete functionality	Pc	1
KBR-015	33 kV Neutral Link	Pc	1
KBR-017	33 kV Neutral CT	Pc	1
KBR-018	33kV Circuit breakers	Pc	4
KBR-019	33kv isolator without earth switch	Pc	8
KBR-020	33kv single phase Voltage transformers	Pc	3
KBR-021	33kV current transformers	Pc	12
KBR-022	33kV Surge Arrestors	Pc	12
KBR-023	33kv incomer Circuit breaker protection and control panels and associated accessories complete functionality	Pc	1
KBR-024	33kv bus coupler Circuit breaker protection and control panels and associated accessories complete functionality	Pc	1
KBR-025	33 kV Bus bar Material and Bay Material (lot)	Lot	1
KBR-026	33 kV Steel Structures for support (lot)	Lot	1
KBR-027	33kV Metering and control panel and associated accessories	Lot	1
KBR-028	33kV feeder protection and control panel with necessary accessories for complete functionality	Lot	4
KBR-029	33KV Auxiliary transformer 100 kVA, 33/0.415 kV	Lot	1
KBR-030	11 kV Fuse Switch for auxiliary transformer (Lot)	Lot	1
KBR-031	Substation control Management system (SCMS) extension	Lot	1
KBR-032	Control and Measuring cables	Lot	1
KBR-033	Substation Earthing System	Lot	1
KBR-034	Ancillary Equipment	Lot	1
KBR-035	Lighting mast	Lot	2
	Works		
KBR - 101	Transformer Foundation	Lot	1
KBR - 102	Transformer transportation and positioning works	Lot	1
KBR - 103	Transformer assembly and testing works	Lot	1
KBR - 104	Platform works (earth work, foundations, trenches, fence, etc)	Lot	1
KBR - 105	Cable trenches (excavating, protection, backfill, etc)	Lot	1
KBR - 106	Erection and commissioning	Lot	1

Item	Item Description	Unit	Qty
KBR - 107	33kV Busbar Extension and erection of 3No feeder bays	Lot	1
KBR - 108	Installation of local transformer	Lot	1
KBR - 109	Telecommunications & SCADA installation and commissioning	Lot	1
KBR - 110	Automation Engineer for substation automation integration	Lot	1
KBR - 111	Site adaptation works	Lot	1

4.2.8.5 Lot KP1/6A-2/PT/1/15/A39D – Naivasha and Makutano 132/33kV Substations

4.2.8.5.1 Naivasha 132/33kV Substation works

The substation scope of works shall include the following

- Establish a 23MVA 132/33kV Transformer bay complete with associated switchgear and protection.
- Extension of the 132kV busbar
- Replacement of the 33kV busbar on wooden poles with steel structures and copper tubes and repositioning of 33/.42kV Local transformer
- Rehabilitation of cable trenches across the substation.
- Installation of Indoor 33kV feeder control panels.
- Transportation of faulty transformers to stores.
- Construction of 132/33kv substation control room

Item	Item Description	Unit	Qty
	Naivasha 3rd 23MVA 132/33kV Transformer		
NVS-001	23 MVA 132/33kV Transformer	Pc	1
NVS-002	132 kV SF6 Circuit Breaker	Pc	1
NVS-003	132 kV motorized Isolator without earth switch	Pc	1
NVS-004	132kV Current Transformer	Pc	3
NVS-005	132 kV Bus bar Material and Bay Material (lot)	Lot	1
NVS-006	132 kV Steel Structures for support (lot)	Lot	1
NVS-007	132 kV Surge Arrestors	Pc	3
NVS-008	132 kV Transformer Protection Panel with multifunctional protection unit as 4.1.2.4.2.2	Pc	1
NVS-009	Transformer Tap changer panels with associated accessories for complete functionality	pc	1
NVS-010	132kV Circuit Breaker protection complete with all function requirements	Pc	1
NVS-011	132kV Metering and control panel with necessary accessories for complete functionality	Pc	1
NVS-012	33 kV Neutral Link	Pc	1
NVS-013	33 kV Neutral CT	Pc	1
NVS-014	33kV Circuit breakers	Pc	4
NVS-015	33kv isolator without earth switch	Pc	2
NVS-016	33kV isolator with earth switch	Pc	3
NVS-017	33kv single phase Voltage transformers	Pc	3
NVS-018	33kV current transformers	Pc	3
NVS-019	33kV feeder Metering and control panel and associated accessories	Pc	12
NVS-020	33kv Circuit breaker protection and control panels and associated accessories complete functionality	Pc	4
NVS-022	33 kV Bus bar Material and Bay Material (lot)	Lot	1
NVS-023	33 kV Steel Structures for support (lot)	Lot	1
NVS-024	Substation Control Management system extension	Lot	1
NVS-025	Control and Measuring cables	Lot	1
NVS-026	Substation Earthing System	Lot	1
NVS-027	Ancillary Equipment	Lot	1

Item	Item Description	Unit	Qty
NVS-028	Lighting mast	Lot	1
		Lot	2
	Works		
NVS - 101	Transformer Foundation	Lot	1
NVS - 102	Platform works (earth work, foundations, trenches, fence, etc)	Lot	1
NVS - 103	Cable trenches (excavating, protection, backfill, etc)	Lot	1
NVS - 104	Erection and commissioning	Lot	1
NVS - 105	Installation of 33kV indoor feeder control and protection panels	Lot	1
NVS - 106	33kV Busbar reconstruction and repositioning of local transformer	Lot	1
NVS - 107	Telecommunications & SCADA installation and commissioning	Lot	1
NVS - 108	Substation automation integration	Lot	1
NVS - 109	Transportation and positioning of Transformer	Lot	1
NVS – 110	Assembly and testing of transformer	Lot	1
NVS – 111	Transportation and return of 3No faulty transformers to stores	Lot	1
NVS – 112	Construction of substation control room	Lot	1
NVS – 113	132kV Busbar extension	Lot	1
NVS - 114	Site adaptation works	Lot	1

4.2.8.5.2 Makutano 132/33kV Substation works

The substation scope of works shall include the following

- Establish a 23MVA 132/33kV Transformer bay complete with associated switchgear and protection.
- Transportation, installation, assembly and testing of a 23MVA 132/33kV transformer and associated switchgear.
- Extension of the 33kV Busbar to provide for a bus section and incomer
- Establishment of 2No 33kV Feeder bays complete with control and protection panels.

Item	Item Description	Unit	Qty
	Makutano 2nd 23MVA 132/33kV Transformer		
MKTN-001	23 MVA 132/33kV Transformer	Pc	1
MKTN-002	132 kV SF6 Circuit Breaker	Pc	1
MKTN-003	132 kV motorized Isolator without earth switch	Pc	2
MKTN-004	132kV Current Transformer	pc	3
	132 kV Capacitive Voltage Transformer	Pc	3
MKTN-005	132 kV Bus bar Material and Bay Material (lot)	Lot	1
MKTN-006	132 kV Steel Structures for support (lot)	Lot	1
MKTN-007	132 kV Surge Arrestors	Pc	3
	132kV Post Insulators	Pc	9
MKTN-008	132kV Transformer Protection Panel with multifunctional protection unit as 4.1.2.4.2.2	Pc	1
MKTN-009	Transformer Tap changer panels with associated accessories for complete functionality	Pc	1
MKTN-010	132kV Circuit Breaker protection with all function	Pc	1

Item	Item Description requirements	Unit	Qty
MKTN-011	132kV Metering and control panel with necessary accessories for complete functionality	Pc	1
MKTN-012	33 kV Neutral Link	Pc	1
MKTN-013	33 kV Neutral CT	Pc	1
MKTN-014	33kV Circuit breakers	Pc	3
MKTN-015	33kv isolator without earth switch	Pc	4
MKTN-017	33kv isolator with earth switch	Pc	2
MKTN-018	33kv single phase Voltage transformers	Pc	3
MKTN-019	33kV current transformers	Pc	9
MKTN-020	33kV Surge Arrestors	Pc	9
MKTN-022	33kv Circuit breaker protection and control panels and associated accessories complete functionality	Pc	3
MKTN-023	33 kV Bus bar Material and Bay Material (lot)	Lot	1
MKTN-024	33 kV Steel Structures for support (lot)	Lot	1
MKTN-025	Substation control Management system (SCMS) extension	Lot	1
MKTN-026	Control and Measuring cables	Lot	1
MKTN-027	Substation Earthing System	Lot	1
MKTN-028	Ancillary Equipment	Lot	1
	Works		
MKTN - 101	Transformer Foundation	Lot	2
MKTN - 102	Platform works (earth work, foundations, trenches, fence, etc)	Lot	1
MKTN - 103	Cable trenches (excavating, protection, backfill, etc)	Lot	1
MKTN - 104	Erection and commissioning	Lot	1
MKTN - 104	Transportation and positioning of Transformer	Lot	1
MKTN - 106	Assembly and testing of transformer	Lot	1
MKTN - 107	33kV Busbar Extension and feeder bays	Lot	1
MKTN - 108	Telecommunications & SCADA installation and commissioning	Lot	1
MKTN - 109	Substation automation integration	Lot	1