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3 PROJECT SPECIFIC DATA

3.1 Definitions

Whenever the following terms or words are found in the specifications and/or other documents, they shall have the following meaning:

"High Voltage Equipment" (HV):
Mostly used for equipment provided for a maximum operating voltage higher than 52.5 kV (generically also used for voltages down to 1000 V).

"Medium Voltage Equipment" (MV):
Equipment provided for a maximum operating voltage higher than 1000 V and up to 52.5 kV.

"Low Voltage Equipment" (LV):
Equipment provided for operation at 1000 V or below. (For transformers the term Low Voltage Winding is used for the side with lowest rated voltage regardless value)

AC means Alternating Current, DC means Direct Current, Where protection degree IP xx is mentioned it shall generally be according to IEC 60529 “Degree of Protection Provided by Enclosure”.

3.1.1 Design Data, High and Medium Voltage

The contractor shall give data in the following data specifications
Coordinate system: UTM
Datum : Arc 1960
Zone : Zone 37°south (for the whole country)
Drawing Format: AutoCAD DXF, lowest version (LT 2000)

The rating and design criteria for the HV and MV plant and equipment shall be as follows:

Item	Parameters	SYSTEM VOLTAGE			
			66 kV	33KV	11KV
1	System	50 Hz, 3 phase			
2	Neutral point earthing	Solid earthed			
3	Nominal voltage of networks		66 kV		
4	Highest system voltage as defined by IEC-60038		72.5 kV		
5	Short circuit and earth fault current, symmetrical r.m.s. value (min breaking current) not less than		31.5 kA		
6	Thermal short-circuit current, 3 second not less than		31.5kA		
7	Dynamic peak current (min making current)not less than		80 kA		
8	Rated current of busbars and bus coupler if not given in Scope of Works, for each individual substation		1250 A		
9	Minimum rated current of isolating switches and circuit breakers if not given in Scope of Works		800 A		

Item	Parameters	SYSTEM VOLTAGE			
			66 kV	33KV	11KV
10	Insulation level according IEC 60071:				
10a	Switching surge withstand voltage				
	Phase-to-earth	N/A	N/A		
	Longitudinal impulse component of combined test	N/A	N/A		
10b	Lightning impulse withstand voltage (1.2/50 m/s kV_{peak})		325 kV		
10c	Test voltage at power frequency 1 min dry and wet. To earth and between phases		140 kV		
11	For the design and erection of the conductors in the switchyard the following minimum distances shall be observed				
11a	Phase to earth [mm]		700	500	500
11b	Phase to phase [mm]		790	435	250
11c	Busbars phase to phase [mm]				1250
11e	Height to live parts above ground [mm]		3500	2900	2900
11f	Height to live parts above ground at transformer transport routes [mm]				5000
12g	Lowest part of insulators above ground [mm]	2 500			
12h	Minimum Ground Clearances	All Concrete Poles for 66KV lines shall be 15M			
12	Maximum temperature rise of conductors above ambient temperature (40 ºC)	40 ºC			
13	Maximum wind pressure on conductors and cylindrical objects	400 N/m^2			
14	Maximum wind pressure on flat surfaces	820 N/m^2			
15	Minimum nominal creepage distance as defined in IEC 60815, Table II	25 mm/kV (inland area) 31 mm/kV (in coast and industrial area)			

Note 1)
Ref IEC 60038)

Note 2)
For all current carrying parts the permissible short circuit duration shall be at least 1 second. Indoor equipment shall be arch tested in accordance with IEC 60298 amendment 2. The dynamic or momentary short circuit current on which the equipment design shall be based shall be computed by multiplying the r.m.s. value of the symmetrical short circuit current by the factor 1.8 x $\sqrt{2}$.

Note 3)
Ref IEC 60071)

All High and Medium Voltage equipment shall be designed for installation at 2200 m above sea level. IEC 60071 shall apply with the specified correction factor for the altitude above sea level.

3.1.2 Design Data, Low Voltage Equipment

Low voltage installation shall be in accordance with EMC directives. The rating and design criteria for low voltage equipment shall be as follows:

AC Voltage	
Nominal system voltage	415/240 V -15%, +10% (+ or – 6%), TN - CS
System frequency	50 Hz (+ or – 2%)
DC System	110 V,& (48V for communication)
Power frequency Test Voltage 1 min	2.5 kV
Thermal rating of conductors	120 % of load
Max short-circuit Current	25 kA

AC LV equipment can, after the Project Manager's approval, be rated for lower short-circuit current if calculation demonstrates that lower values are applicable at the place of installation. DC equipment shall be adapted to the actual values at sites as shown in calculations.

3.1.3 Phase Relationship

The phase relations and designations shall be in accordance with the existing system of the Employer. The phase sequences will be made known to the Contractor at a later date, but not later than 1 month from date of commencement. The standard phase colours are Red, Yellow, Blue (RYB).

3.1.4 Colour Coding

All wires must have ferrules at all terminations to distinguish each signal. In addition the wires shall have the following colours:

Circuit	**Colour of Wire**
Voltage transformers	Red
Current transformers	Black
A.C. Circuit	Yellow
D.C. Circuit	Blue
Grounding circuit	Green with yellow stripe

(Following coloured ferrules shall be provided on each wire in order to identify phase and polarity.

Phase and Polarity		**Colour of ferrules**
A.C.	First phase	Red
	Second phase	Yellow
	Third phase	Blue
	Neutral	Black
	Grounded	Green with yellow stripe
Auxiliary DC Supply	Positive	Red
	Negative	Black

Ferruling system should be submitted to the Employer for approval before commencement of works.

3.1.5 Environment

Unless otherwise specifically stated in Particular Technical Specifications or Scope of Works, any equipment, component and assembly shall be designed for the following service conditions:

Parameter	Max	Min
Ambient air temperature		
Outdoor	+40°C	-1°C
Indoor	+40°C	-1°C
24 hour average maximum	+30°C	-1°C
Ambient temperature for cables in the ground	+40 °C	-1°C
Relative humidity	90%	
Height above sea level	2200 m	Below 1000m
Cooling water temperature	N/A	N/A
EMC Class (IEC 61000)	Industrial environments	
Seismic coefficient	0.15	
Wind pressure on project area of conductors and cylindrical objects	430 N/m²	383N/m^2
Maximum wind pressure on steel members on 1.5 times projected area	820 N/m²	
Rainfall conditions		
Average	800-1700 mm/year	
Maximum	160mm in 24 hrs	
Annual mean isokeraunic level	Max 180 thunderstorm days	
Pollution (IEC 60815)	Heavy :class II	

Wherever any of these maximum or 24 hour average temperatures exceed the normal service condition temperatures of the IEC Recommendations for the relevant equipment, or of such other standard which is approved to be applied, the permissible temperature rises of the IEC Recommendations or the standard shall be reduced by the same amount as the difference between the above figures and the normal service condition temperatures. The Contractor shall guarantee these reduced temperature rises.

All air cooled equipment shall be cooled with convection (i.e. without fans) provided other cooling methods are not explicitly allowed for in the specifications.

3.1.6 Noise

The equipment shall as far as possible not generate undue vibrations or bothersome noise. Provided nothing else is specified the following requirements shall not be exceeded:

- Machine hall, workshop etc. (one meter from the machine) max 85 dB(A)
- Office, control room, day room etc. max 55 dB(A)
- Emergency diesel generator (7 meter from engine room) max 85 dB(A)

3.1.7 Auxiliary Power

3.1.8 Electric Service During Construction

Metered electric supply at 415/240V, 3-phase, 50 Hz TN-S will be available at the substation sites. All tools and equipment supplied by the Contractor shall be suitable for this supply system. The Employer, while endeavouring at all times to maintain the supply, can accept no responsibility for the consequences that may arise from the failure or cessation of the electric supply.

3.1.8.1 **Power Supply**

On HV substations the power for the auxiliary service is in general supplied from the station transformers connected to the tertiary windings of the transformers whereas on MV substations the. Power is supplied from station transformers connected to the MV busbars. The system is shown in detail on the single-line diagrams enclosed in the drawing section and further specified in Scope of Work. Less important MV substations may take the auxiliary voltage from the general surrounding grid. Equipment needing uninterrupted supply shall be fed from permanently charged station batteries. If other voltage sources or voltage levels then given below, are required they shall be included in the Bid. Such voltages shall not be brought out of the cabinet where they are used.

All the substations shall have an automatic change over scheme for the two 415V power supply sources at the substations

3.1.8.2 **AC Auxiliary Supply**

Components in the AC low voltage main distribution system shall have a voltage rating of 415/240 volts, 50 Hz. The system shall be 3-phase, the transformer neutral grounded (TN-CS)

For lighting, small power socket outlets, domestic appliances and other small power, 230V shall be used. 16 A sockets shall be of the British Standard type with square pins.

3.1.8.3 **DC Auxiliary Supply**

The DC auxiliary supply shall be (unless otherwise stated in Scope of Works):

- For control, protection and alarm circuits 110V-IT

All bulbs and any voltage sensitive relays shall be rated 125/52 V.

3.1.9 220 V AC Un-interrupted supply (UPS)

DC/AC UPS shall supply dedicated computer and measuring equipment. The supply shall be 230 V – IT.

3.1.10 Operation and Control

The operations, control procedures, monitoring and protective devices for the plants are described in Particular Technical Specifications.

The Contractor shall take all measures and furnish all requirements necessary for effecting the intended method of operation and control.

The station functional control shall be possible in a hierarchic structure as follows:

- Supervisory Control from a Supervisory Control and Data Acquisition (SCADA) System. The old system is outdated and a new will be established where 66 kV and below will be connected to Regional Control Centres (RCCs) in Nairobi. All equipment and stations to be refurbished under this project shall be prepared for normal day-to-day operation from these centres. The RCCs are subordinated to the National Control Centre (NCC). The station HV and LV switchgear shall be controlled from RCC. Indications shall be available both in NCC and RCC.

- Local Control from the local relay and protection panels and from the instrument sections on MV switchboards. If these contains full mimic and display functions the remote control can be omitted in MV panels.
- Direct Control/Emergency Control from the apparatus itself.

The stations shall function without interruptions even if connection to higher levels fails. A local/remote switch shall be accommodated on each control position blocking remote operation but not indication. The position of this switch shall be indicated in the higher levels of operation.

The control shall include operation of all circuit breakers and motorised disconnectors. Status indication shall be available in the supervisory system for all HV and MV breakers in the system as well as busbar voltages, line and transformer load in A (plus MW and MVAr). For on-load tap changers position indication and raising/lowering of the tap changer position shall be possible supervisory and remotely. MV transformers may be equipped with automatic voltage control functions and manual override shall then only be possible if the automatic function is blocked locally. Relay trips and other relevant alarms shall also be transferred.

Direct control of all station switchgear at the respective switchyards/panels shall be possible.

Interlocking devices and automatic change-over systems shall be incorporated in the control circuits in the quantity needed to guarantee non-interruption and correct sequence of operation of the equipment. Protective devices shall be supplied in accordance with the Particular Technical Specifications, and the particular needs of such equipment furnished with the aim of ensuring a safe and reliable operation of the plants in the event of electrical and mechanical disturbances or in case of mal-operation by the plant personnel shall be taken into consideration.

The signals and command to be transmitted are given in Particular Technical Specifications

All equipment, instruments and devices in the substation necessary for supervisory, remote and local control as well as for protection, signalling and indication shall be included in the Bid and hence the Contract, it being understood so that the enumeration found in Scope of Works, in this respect is indicative but not limiting.

3.1.11 Interface between Contractors and towards Employer

For substations to be extended, all connections shall be made and all equipment and drawings be provided by the Contractor to ensure proper operation of the complete plants, although this should not be specifically mentioned in the Scope of Works Section. The Employer will for such stations, supply to the Contractor within one month from the date of commencement all documentation available for adaptation to the existing plant.

All equipment specified under the various lots within a plant. specified in the Particular Technical Specifications and Scope of Works shall constitute a complete and functioning system together with equipments covered by any other lot even if this lot is contracted by separate contractor. The Contractor shall pay special attention to the Power Transformers. All necessary equipment and

connections required to form a complete working plant and not mentioned under the Power transformer shall be included in the switchgear contract whether or not specifically mentioned in these Particular Technical Specifications.

The Contractor shall supply and execute all cable connections between the control room and the transformer marshalling boxes and cabinets as well as supply all AC power for motors and DC voltage for control, indication and alarm purpose. The Contractor shall also provide all necessary connections to the control system from other sources like voltage and current transformer terminals, etc.

The Contractor shall connect the transformer to the grid and supply clamps for the transformer bushing. He shall also design and construct the transformer foundations based on Transformer Contractor's specifications and drawings and supply and erect LV cables from auxiliary transformer terminals to the auxiliary voltage board.

For the substations to be refurbished or extended the Contractor shall provide and make drawings of the cable connections from actuators, sensors, transducers and relays to the Distributed Control Units as well as all materials required. He shall also document the adaptation to the existing plant with complete circuit diagrams, cable lists etc including proper cross references.

The Contractor shall connect the switchgear to the line landing span erected by the Line Contractor.