



REPUBLIC OF KENYA
MINISTRY OF HEALTH

**EAST AFRICA'S CENTERS OF EXCELLENCE FOR SKILLS AND TERTIARY
EDUCATION IN BIOMEDICAL SCIENCES**

**PROPOSED CONSTRUCTION OF EAST AFRICA'S KIDNEY
INSTITUTE COMPLEX AT KENYATTA NATIONAL HOSPITAL
(KNH) GROUNDS NAIROBI, KENYA**

Contract Identification No: MOH/EAKIP/ICB/004/2018-2019

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Works Programme No: D108 NB/NB/1801 JOB NO. 10398A

**BIDDING DOCUMENT-VOL 3.3
AUTOMATIC VOLTAGE REGULATOR (AVR) AND UNINTERRUPTIBLE POWER
SUPPLY (UPS) UNITS INSTALLATION
(ALL RATES EXCLUSIVE OF TAXES)**

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1 PART A: GENERAL SPECIFICATION

1.1 General:

The site of the proposed project shall be situated at Kenyatta national Hospital, Off Ngong Road, Nairobi.

1.2 Reference Sites:

The offered equipment shall have been sold in Kenya in sufficient quantities to provide good proof of a Tenderer's capability of handling similar projects. Tenderers shall supply a detailed record of similar equipment's that have been installed by them.

In addition to ensure continued support of the proposed equipment from the manufacturer, the Tenderer must submit documentary evidence that they are indeed authorised and accredited distributor/reseller of the manufacturer.

1.3 Cable Management:

The necessary infrastructure for the Proposed Systems shall be done by the Electrical Sub-Contractor, however additional requirements should be necessary the Sub-Contractor shall provide all the working drawings showing all the necessary conduit/trunking cable ways.

1.4 Systems Requirements:

The systems shall comprise but not limited to the following:

- 1 No. 1600kVA Automatic Voltage Stabilizer
- 2no. 200kVA Uninterruptible Power Supply Units
- 2no. 150kVA Uninterruptible Power Supply Units
- 1no. 70kVA Uninterruptible Power Supply Unit

1.5 Commencement of Works:

The Tenderer in submitting his bid shall be deemed to have allowed for commencing the works on site immediately upon appointment.

1.6 Scope of the Sub-Contract Works:

The Sub-Contract Works shall comprise the supply, delivery, erection, testing, commissioning and setting to work of the complete **systems** as detailed in this Specification and accompanying Sub-Contract Drawings.

The Tenderer shall include for all apparatus and appliances not particularly called for in this Specification or on the Sub-Contract Drawings but which are necessary for the successful completion and satisfactory functioning of the Sub-Contract Works.

It is deemed that if, in the opinion of the Sub-Contractor at the time of tendering there exists a discrepancy in the Specification, Drawing or both, that the Sub-Contractor clarifies this difference with the Engineer before tendering.

The Tenderer shall provide as an integral part of his bid a statement of compliance in which he shall clearly declare any items of the Specifications to which his offer does not comply and an alternative which is included in the offer.

The Sub-Contractor shall be obliged to liaise with other parties involved in the project and to provide any necessary information as and when required.

No claims for extra payment shall be accepted from the Sub-Contractor due to his failure to adhere to the above requirements.

All equipment as far as is practicable shall be designed and manufactured by a single preferred manufacturer. In any case equipment shall be of uniform standards compatible in operation and spare parts trained support and maintenance facilities being available. In this regard the Tenderer shall produce a letter of guarantee and commitment from the equipment manufacturer for production at tender opening. Any tender without such a commitment letter shall be rejected.

1.7 Ordering of Materials:

The Sub-Contractor shall order materials from quantities taken from his own approved working drawings and not from the quantities shown on the Sub-Contract Drawings or in the Specification.

1.8 Builder's Work Requirements:

All chasing, cutting away and making good of walls and slabs shall be by the Main-Contractor.

1.9 Tender Return Items:

Drawings and publications illustrating the systems and equipment being offered against the schedules shall be returned with the Tender, together with a comprehensive description of the systems being offered to meet the requirements detailed elsewhere in the Specification.

1.10 Standards and Regulations:

The design, manufacture, selection, installation, testing, commissioning and subsequent maintenance of all equipment and materials described in this Specification shall comply with internationally recognised standards.

1.11 Documentation:

Record Drawings, Operating instructions, log book and certificates of installation and commissioning shall be provided adjacent to the control and indicating equipment at the end of the Sub-Contract.

Operating and Maintenance Instructions shall be provided before the system is accepted. The instructions shall describe the system operation, zoning, routine care and maintenance, fault finding procedures and the function and settings of all controls.

The instructions shall include a full set of drawings, other manufacturer's handbooks and proprietary items and a complete list of spare parts provided and which are available. Full details shall be provided of all manufacturers and suppliers.

1.12 Defects Liability and Spares:

The Sub-Contractor shall provide a comprehensive routine and emergency call out service for the defects liability period, and shall confirm the response time to be provided. This service shall include routine examination and any adjustments, cleaning, replacement of parts as required to keep the system in full working order.

All equipment shall have a minimum 1 year warranty period from the manufacturer.

The Tenderer shall include details of a proposed Maintenance Sub-Contract to provide regular maintenance from the start of the defects liability period, in accordance with this specification. The Client is not bound to accept the offer from the Sub-Contractor.

An appropriate set of spares shall be provided, including consumable and modular items, which can be replaced by on-site maintenance staff. A list of the proposed spare parts shall be provided with the Tender.

1.13 Inspection, Testing and Commissioning:

The Sub-Contractor shall inspect, test and commission the works in accordance with the equipment manufacturer's recommendations. The results of all tests shall be recorded on the standard test forms unless otherwise specified.

Before completion of the installation the Sub-Contractor shall submit to the Engineer for acceptance, a method statement of the procedure to be used for testing and commissioning, which has been agreed with the equipment manufacturers.

Before cables are terminated each cable shall be tested for continuity, insulation resistance, polarity and markings. Following satisfactory testing, cables shall be terminated in the equipment only by the manufacturer's appointed representative.

Power supplies shall be tested prior to making connections to the control equipment. The Sub-Contractor shall allow for all necessary attendance during the testing and commissioning of any ancillary systems interconnected with the security system.

2 PART B: PARTICULAR SPECIFICATION INSTALLATION

2.1 SECTION 1: UNINTERRUPTIBLE POWER SUPPLY (UPS) INSTALLATION

2.1.1 General Specifications:

True-on-Line UPSs shall be installed at the Respective Power Centre for the necessary provision of no-break in power during mains failure.

The UPS(s) shall be rated as stipulated in the Bills of Quantities.

The UPSs shall be of the 12-pulse type, suitably rated to handle harmonics generated from the non-linear load equipment. The UPS shall incorporate active or passive filtering to handle the harmonics.

The system(s) configuration shall be the parallel redundant type with reverse transfer and designed for capacity expansion by addition of parallel modules on site with minimum downtime.

The UPS design shall conform to IEE 519 standards.

The UPSs shall be located at the different location as described in the Bills of Quantities.

2.1.2 Technical Specifications:

The UPS shall be rated as indicated in Section 2.1 above and as shown on contract drawings and shall maintain output voltage within the specified limits at any load from full load to no-load.

The UPS shall incorporate the following:

- Batteries: - Lead acid sealed type with a performance life of 10 years minimum.
- Automatic transfer switches (Both manual and static).
- 100% galvanic isolation between the incoming supply and the UPS supply.
- 15 Minutes Autonomy.
- Each module shall have its own batteries and charger system with an output circuit breaker.
- The batteries shall be installed on racks and shall be interconnected with double insulated cables and shrouded terminals. The cables shall be colour coded to distinguish between negative and positive leads. Each battery system shall be wired as dual string to allow maintenance to be undertaken.
- The UPS system shall be integrated to the LAN and BMS to allow for remote monitoring.

2.1.3 System Ratings and Operating Characteristics

- a. System Continuous Rating: As indicated on Drawings, over entire battery voltage range at specified power factor. Maintain output voltage within specified limits at any load from full load to no-load.
- b. Battery Capacity: Capable of operating at full load for 15 minutes.
- c. Voltage Rating: 240/415 volts, 3 phases as indicated on drawings.
- d. Input Voltage Operating Range: Plus or minus 15 percent.
- e. Input Frequency Operating Range: 50 Hz. plus, or minus 10 percent.
- f. Input Current Limit: Adjustable to maximum of 125 percent of that required to operate at full load with battery bank on float charge.
- g. Current Walk-in: 0 to 100 percent in ten seconds.
- h. UPS Power Factor Over Full Range of Loads and Input Voltages: 80 to 100 percent, lagging.
- i. Harmonic Distortion of Input Current Wave Form: 5 percent maximum at full load.
- j. Output Voltage regulation:
 - 1. Plus or minus ± 1 percent for balanced load, full range of DC input and no load to full load variations.
 - 2. Plus or minus ± 1.75 percent for 50 percent unbalanced load, full range of DC input and no load to full load variations.
 - 3. Plus or minus ± 2.5 percent for 100 percent unbalanced load.
- k. Output Voltage Adjustment: Plus or minus ± 5 percent.
- l. Output Free Running Frequency: 50 Hz Plus or minus 0.1 percent.
- m. Frequency Adjustment: Plus or minus .1 Hz.
- n. Output Harmonic Distortion: Maximum 5 percent rms total harmonic distortion (THD) and maximum 3 percent any single harmonic, at rated frequency and voltage, from 10 percent load to full load and over battery voltage range, measured into a linear load.
- o. Voltage Transient Response for Application of 0 to 50 Percent, 50 to 100 Percent, 100 to 50 Percent, and 50 to 0 Percent Step Loads, and Transfer To and From Bypass Line:
 - 1. Plus 8, minus 10 percent for maximum of 8.3 milliseconds.
 - 2. Plus or minus 5 percent for maximum of 25 milliseconds.
 - 3. Plus or minus 3 percent for maximum of 50 milliseconds.
 - 4. 1 percent for maximum of 50 milliseconds.
 - 5. Recovery to steady state within 100 milliseconds after any out-of-tolerance variation.
- p. Phase Displacement:

1. 120 plus or minus 1 degrees for balanced loads.
 2. 120 plus or minus 3 degrees for unbalanced load.
- q. Three-phase Overload Ratings:
1. 150 percent for 30 seconds.
 2. 125 percent for 10 minutes.
- r. Output Current Limit: 150 percent of rated output current.
- s. Voltage Unbalance: 3 percent maximum line-line with 100 percent load unbalance.
- t. Efficiency: 90 percent at full load, 85 percent at 80 percent load, minimum. Measure efficiency of unit including battery and isolation transformer losses.

2.1.4 System Design

- a. Inverter Type: Pulse-width modulated.
- b. Rectifier/Charger Capacity: Sufficient to supply full load to inverter while recharging fully-discharged battery to 95 percent of full capacity in four hours or less; and within the input current limits specified.
- c. Provide means for on-line testing of UPS, including test points to allow adjusting and servicing. Provide means for testing static switch while load is bypassed to utility.
- d. Mean Time Between Failures: 60,000 hours, minimum.
- e. Cooling: Provide forced air cooled unit with redundant cooling so that failure of any one cabinet cooling fan or fan circuit will not affect continued operation at full load and ambient temperature of 77 degrees F (25 degrees C) or lower.
- f. Operate battery floating, isolated from the UPS AC input and AC output. The battery may be resistance grounded through 5,000 - 10,000 ohms for the purpose of ground fault sensing.
- g. Do not use continuous moving parts or electron tubes. Accomplish power switching using semiconductor devices.
- h. Construct equipment so each power component can be replaced without a soldering iron or special tools.
- i. Use front-panel removable plug-in control modules.

2.1.5 Fabrication

- a. Electroplate brackets and securing hardware with corrosion resistant material. Secure bolts, studs and nuts with lock washers.
- b. Identify internal wiring at each end of conductor. Provide cabinet grounding lug.

- c. Conversion Equipment Enclosure: NEMA 250, Type 1 enclosure allowing access from front for servicing adjustments and connections. Access through hinged door equipped with tumbler lock and latch handle. Equip cabinet for fork truck lifting.
- d. Equip air inlet with permanent type filters and pressurize cabinet, or use gaskets around door and panel openings to prevent entry of dirt.
- e. Cabinet finish: Primed and painted inside and outside with suitable semi-gloss enamel.

2.1.6 Controls and Indicators

A. Controls:

1. AC input circuit breaker.
2. "Inverter operate" switch to initiate inverter operation.
3. "Inverter standby" switch to cause inverter to cease operation
4. "Static switch transfer" switch to permit manual actuation of static transfer switch.
5. "Static switch lock-out" switch to inhibit automatic retransfer of load to inverter.
6. Battery charge timer.
7. "Indicator test" switch.
8. Static switch preferred input circuit breaker
9. Static switch output circuit breaker
10. Static switch bypass circuit breaker.
11. Controls for maintenance bypass switch.

B. Indicators:

1. "Inverter synchronized to utility."
2. "Load connected to utility."
3. "Static transfer switch inhibited."
4. "High/low DC voltage."
5. "Overtemperature."
6. "Inverter output overload."

C. Meters: Use 1 percent accuracy meters to indicate the following:

1. Rectifier/charger DC voltage and current.
2. Utility, inverter output, and load AC voltage.
3. Load AC current.
4. Inverter output and utility frequency.

5. UPS output watts.

D. UPS Integral Panel Mounted, Alarms/Indications:

1. "Utility power available."
2. "Utility bypass power available."
3. "Inverter outputs available."
4. "Inverter synchronized to utility."
5. "Load connected to inverter output."
6. "Load connected to utility bypass power (alarm)."
7. "Static transfer switch inhibited (alarm)."
8. "High/low DC voltage (alarm)."
9. "Over temperature (alarm)."
10. "Inverter output overload (alarm)."
11. Audible alarm (sounds when any of the above alarm conditions occur).
12. Alarm/indicator "silence/test" switch.

E. BMS Interface: All the alarms noted in 2.6 D shall have contacts for connection to Building Management system.

2.2 SECTION 2: AUTOMATIC VOLTAGE REGULATOR (AVR) INSTALLATION

The 1No. Automatic AC 1600kVA voltage stabilizer will be as manufactured by IREM, ABB or other equal and approved manufacturers.

The stabilizer shall comprise the following major units

- (a) A transistorized servo amplifier
- (b) A geared reversing motor
- (c) A continuously adjustable auto-transformer
- (d) A fixed ratio auxiliary transformer

The stabilizer shall conform to the following requirements:

Nominal input	:	415V, three phases
Supply frequency	:	50Hz
Input voltage Correction range:		
Selectable taps	:	A -17.5% + 7.5% B +12.5% C -7.5% +17.5%
Output Voltage	:	415V
Output Accuracy	:	Better +0.5 Zero to full load
Current rating	:	2500A
Wave Distortion	:	None
Effect of load power Factor	:	None
Nominal Power rating	:	1600kVA
Speed of Correction	:	39.5V/Sec
Temperature coefficient	:	0.025% per °C
Environment	:	Maximum Temperature 31.5°C Minimum Temperature 5.2°C
Humidity	:	48% - 93%
Altitude	:	1675m above sea level.

PART C
BILLS OF QUANTITIES

3 PART C: BILLS OF QUANTITIES

3.1 GENERAL NOTES TO TENDERERS

1. The Bills of Quantities form part of the contract documents and are to be read in conjunction with the contract drawings and general specifications of materials and works.
2. The prices quoted shall be deemed to include for all obligations under the sub-contract including but not limited to supply of materials, labour, delivery to site, storage on site, installation, testing, commissioning (**excluding 16% VAT**).
3. All prices omitted from any item, section or part of the Bills of Quantities shall be deemed to have been included to another item, section or part thereof.
4. The brief description of the items given in the Bills of Quantities are for the purpose of establishing a standard to which the sub-contractor shall adhere. Otherwise alternative brands of **equal** and **approved** quality will be accepted.
5. Should the sub-contractor install any material not specified here in before receiving **written approval** from the Project Manager, the sub-contractor shall remove the material in question and, **at his own cost**, install the proper material.
6. The grand total of prices in the price summary page must be carried forward to the **Form of Tender for the tender to be deemed valid**.
7. The Bills of Quantities are divided generally into three sections:-

a. Contractual Requirements – Bill 1

Sub-contractors contractual requirements as called for the bill of quantities shall be priced and included in the tender. However the Tenderer is free to include and price any other items he deems necessary taking into consideration conditions he is likely to encounter on site.

b. Installation Items – Other Bills

The brief description of the items in these Bills of Quantities should in no way modify or supersede the detailed descriptions in the contract Drawings, conditions of contract and specifications. The unit of measurements and observations are as per Volume 1 or as indicated in the Bills of Quantities.

c. Summary

The summary contains tabulation of the separate parts of the Bills of Quantities carried forward with provisional sum, summary volume included. The sub-contractor shall insert his totals and enter his grand total tender sum in the summary of prices of Volume 1.

3.2 BILLS OF QUANTITIES

SECTION D.W. 1.0 TITLE: PRELIMINARIES & CONTRACTUAL REQUIREMENTS

Item	Description	Unit	Qty	Rate	KShs.
D.W.1	<u>CONTRACTUAL REQUIREMENTS</u>				
A.	Preparation of working drawings, printing and distribution.	Sum			
B.	Preparation of ‘As Installed Drawings’, printing and distribution as specified. Drawings to include:	Sum			
	(a) Blue Prints - 4 sets of each.	Sum			
	(b) AutoCAD on CD – 2 No.	Sum			
	(c) Operational Instructions, manuals and test certificates	Sum			
C.	Allow Kshs. 4,200,000.00 Provisional sum for overseas factory inspection to cater for 6 No. persons (Client Rep- 1, No., SDPW Electrical Engineer – 1, No. SDPW Technical – 1 No., User Departments Reps – 2 No., Consulting Electrical Engineer – 1 No.) for UPS & AVR	Sum			4,200,000.00
D.	Any other item necessary to complete the installations in this section (please state)	Sum			
Total Carried to Main Summary of Prices					

SECTION D.W. 2.0 TITLE: UNINTERRUPTIBLE POWER SUPPLY (UPS) UNIT

Item	Description	Unit	Qty	Rate	Cost
D.W.2	Uninterruptible Power Supply (UPS) Supply & Installation of the following complete as specified:				
A.	200kVA 3 Phase in 3 phase out True-on-line double conversion uninterruptible Power Supply unit (UPS) complete with dual power supply unit and accessories as specified and shown on the drawings.	No.	2		
B.	150kVA 3 Phase in 3 phase out True-on-line double conversion uninterruptible Power Supply unit (UPS) complete with dual power supply unit and accessories as specified and shown on the drawings.	No.	2		
C.	70kVA 3 Phase in 3 phase out True-on-line double conversion uninterruptible Power Supply unit (UPS) complete with dual power supply unit and accessories as specified and shown on the drawings.	No.	1		
D.	Allow for interconnection and programming of the the above System	Sum	.		
E.	Allow for interfacing with other System like Fire Detection & Alarm System and BMS as call for and approved by Engineer and shown on the drawings.	Sum	.		
F.	Installation, testing & commissioning	Sum			
Total Carried forward to Summary of prices					

SECTION D.W. 3.0 TITLE: AUTOMATIC VOLTAGE REGULATOR (AVR) UNIT

Item	Description	Unit	Qty	Rate	Cost
3.0	Automatic Voltage Regulator Unit Supply & Installation of the following complete as specified:				
A.	Supply only of 1600kVA, AC 415V, 50Hz automatic voltage stabilizer complete with Manual by-pass system . The stabilizer should have the following but not limited standard items and options <ul style="list-style-type: none"> • 3-Analogue voltmeters for output phase voltages • 3-Analogue Ammeters for phase currents • 3- Spike suppressors for input, class C • Output voltage preset +/-10% • Isolation Transformer • Independent regulation on each phase • Alarm card • Thermal magnetic input circuit breaker release coil • Safety door block • Output fuses • Indicating lights • Surge suppressors, class D for control card • Sectionalizing input circuit breaker with fuses 	No.	1		
B.	Allow for interconnection and programming of the the above System	Sum			
C.	Allow for interfacing with Other system like Fire Detection & Alarm System and BMS as call for and approved by Engineer.	Sum	.		
D.	Installation, testing & commissioning	Sum			
E.	Labeling, Documentation, 2 year Warranties, associated Training and certification.	Sum			
F.	N.B; Provide comprehensive list of spare part and associated part numbers for above system Any other item necessary to complete installation in this section (Please state)	Sum	.		
Total Carried forward to Summary of prices					

UNINTERRUPTIBLE POWER SUPPLY (UPS) UNITS INSTALLATION

MAIN SUMMARY OF PRICES

DW.1.0	<u>SECTION 1</u> Preliminaries and Contractual Requirements				
DW.2.0	<u>SECTION 2</u> Uninterruptible Power Supply (UPS) Unit				
DW.3.0	<u>SECTION 3</u> Automatic Voltage Regulator (AVR) Unit				
	<u>Sub - Total</u>				
Total Carried Forward to Main Summary of Volume I					

4 PART D: TECHNICAL SCHEDULE

4.1 Documentation Requirements

Document	With Bid	Before Manufacture	During FAT	Upon Delivery
Preliminary general arrangement drawing (with dimensions)	YES			
QA / QC Plan in accordance with ISO 9001:2008		YES		
General arrangement drawing (with dimensions)		YES		
Schematics/Line diagrams for construction	N/A	YES	N/A	N/A
Recommended Spares List	N/A	N/A	N/A	YES
Routine Test Reports / Certificates			YES	
Type Test Reports / Certificates	N/A	N/A	YES	N/A
Commissioning Procedure	N/A	N/A	N/A	YES
As-built General arrangement drawing			YES	
As-built Schematics			YES	
Site Test Reports / Certificates				YES
Special Test Reports / Certificates	N/A	N/A	YES	NO

4.2 Technical Schedule

The tenderer **MUST SUBMIT** comprehensive manufacturer's technical brochures and performance details for all items listed in this schedule (fill forms attached).

ITEM No.	Description	Remarks
A	UPSs	
B	AVRs	

5 PART E: DRAWING SCHEDULE

5.1 DRAWING SCHEDULE:

As shall be provided during project implementation.