



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

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BIDDING DOCUMENT – VOL 4.4
RENAL UNIT INSTALLATIONS
(ALL RATES EXCLUSIVE OF TAXES)

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1. PART A: GENERAL MECHANICAL SPECIFICATION

1.1. GENERAL

This section specifies the general requirements for plant, equipment and materials forming part of the Sub-Contract Works and shall apply except where specifically stated elsewhere in the Specification or on the Sub-Contract Drawings.

1.2. QUALITY OF MATERIALS

All plant, equipment and materials supplied as part of the Sub-Contract Works shall be new and of first-class commercial quality, shall be free from defects and imperfections and where indicated shall be of grades and classifications designated herein.

All products or materials not manufactured by the Sub-Contractor shall be the products of reputable manufacturers and so far as if they had been manufactured by the Sub-Contractor.

Materials and apparatus required for the complete installation as called for by the Specification and Sub-Contract Drawings shall be supplied by the Sub-Contractor unless mention is made otherwise.

Materials and apparatus supplied by others for installation and connection by the Sub-Contractor shall be carefully examined on receipt and stored. Should any defects be noted, the Sub-Contractor shall immediately notify the Engineer.

Defective equipment or that damaged in the course of installation or tests shall be replaced or repaired to the approval of the Engineer.

1.3. REGULATIONS AND STANDARDS

The Sub-Contract Works shall comply with the current editions of the following:-

- (a) The Kenya Government Regulations.
- (b) The United Kingdom Institution of Electrical Engineering Regulations for the electrical equipment of buildings.
- (c) The United Kingdom Chartered Institution of Building Services' Guides.
- (d) The Kenya Bureau of Standards Specifications.
- (e) British Standards and Codes of Practice as published by the British Standards Institution.
- (f) The Local Council By-laws.
- (g) The electricity Supply Authority By-laws.
- (h) The Kenya Building Regulations.

1.4. ELECTRICAL REQUIREMENTS

Plant and equipment supplied under this Sub-Contract shall be complete with all necessary motor starters, control boards, and other control apparatus. Where control panels incorporating several starters are supplied they shall be complete with a main isolator.

The supply power up to and including local isolators will be provided and installed by the Electrical Sub-Contractor. All other wiring shall be as described in the Particular Specification.

The Sub-Contractor shall supply three copies of all schematic, cabling and wiring diagrams for the Engineer's approval.

The starting current of all electric motors and equipment shall not exceed the maximum permissible starting currents described in the Kenya Power and Lighting Company Ltd.'s By-laws.

All electrical plant and equipment supplied by the Sub-Contractor shall be rated for the supply voltage and frequency obtained in Kenya, that is 415 volts, 50HZ, 3-phase or 240 volts, 50HZ, 1-phase as specified in the particular specification.

Any equipment that is not rated for the above voltage and frequencies may be rejected by the Engineer.

1.5. TRANSPORT AND STORAGE

All plant and equipment shall, during transportation be suitably packed, crated and protected to minimise the possibility of damage, and to prevent corrosion or other deterioration.

On arrival at site all plant and equipment shall be examined and any damage to parts and protective priming coats made good before storage or installation.

Adequate measures shall be taken by the Sub-Contractor to ensure that plant and equipment do not suffer any deterioration during storage.

Prior to installation all piping, plant and equipment shall be thoroughly cleaned.

If, in the opinion of the Engineer any equipment has deteriorated or been damaged to such an extent that it is not suitable for installation, the Sub-Contractor shall replace this equipment at his own cost.

1.6. SITE SUPERVISION

The Sub-Contractor shall ensure that there is an English-speaking supervisor on the site at all times during normal working hours.

1.7. INSTALLATION

Installation of all special plant and equipment shall be carried out by the Sub-Contractor under adequate supervision from skilled staff provided by the plant and equipment manufacturer or his appointed agent, in accordance with the best standards of modern practice to the relevant regulations and standards described under clause 2.3 of this section.

1.8. TESTING

1.8.1. General

All testing shall be carried out to the entire satisfaction of the Engineer.

The following sub-clause are intended to define the Sub-Contractor's responsibilities with respect to testing and inspection.

1.8.2. Materials Tests

All materials for plant and equipment to be installed under this Sub-Contract shall be tested, unless otherwise directed, in accordance with the relevant B.S. Specification concerned.

For materials where no B.S Specification exists tests are to be made in accordance with the best modern commercial methods to the approval of the Engineer having regard to the particular type and application of materials concerned.

The Sub-Contractor shall prepare specimens and performance tests and analyses to demonstrate conformance of the various materials with the applicable standards.

If stock material, which has not been specifically manufactured for the plant and equipment specified is used, then the Sub-Contractor shall submit satisfactory evidence to the Engineer that such materials conform to the requirements stated herein in which case test of material may be partially or completely waived. Certified mill test reports of plates, piping and other materials shall be deemed acceptable.

1.8.3. Manufactured Plant and Equipment - Works Tests

The rights of the Engineer relating to the inspection, examination and testing of plant and equipment during manufacture shall be applicable to the Insurance Companies or Inspection Authorities so nominated by the Engineer.

The Sub-Contractor shall give two weeks' notice to the Engineer of the manufacturer's intention to carry out work tests and inspection.

The Engineer or his representative shall be entitled to witness such tests and inspections. The costs of such tests and inspections shall be borne by the Sub-Contractor.

Six copies of all test and inspection certificates and performance graphs shall be submitted to the Engineer for his approval as soon as possible after the completion of such tests and inspections.

Plant and equipment which is shipped before the relevant test certificate has been approved by the Engineer shall be shipped at the Sub-Contractor's own risk and should the test and inspection certificate not be approved, new tests may be ordered by the Engineer at the Sub-Contractor's expense.

1.8.4. Pressure testing

All pipework installation shall be pressure tested in accordance with the requirements of the various sections of this Specification. The installation may be tested in sections to suit the progress of the works but all tests must be carried out before the work is buried or concealed behind building finishes. All tests must be witnessed by the Engineer or his representative,

and the Sub-Contractor shall give 48 hours' notice to the Engineer of his intention to carry out such tests.

Any pipework that is buried or concealed before witnessed pressure tests have been carried out shall be exposed at the expense of the Sub-Contractor and the specified tests shall then be applied.

The Sub-Contractor shall prepare test certificates for signature by the Engineer and shall keep a progressive and up-to-date record of the sections of the work that have been tested.

1.9. COLOUR CODING

Unless stated otherwise in the Particular Specification all pipework shall be colour coded in accordance with the latest edition of B.S.1710.

1.10. WELDING

1.10.1. Preparation

Joints to be made by welding shall be accurately cut to size with edges sheared, flame cut or machined to suit and the required type of joint. The prepared surfaces shall be free from all visible defects such as laminations, surface imperfections due to shearing or flame cutting operation, etc., and shall be free from rust scale, grease and other foreign matter.

1.10.2. Method

All welding shall be carried out by the electric arc process using covered electrodes in accordance with B.S. 639.

Gas welding may be employed in certain circumstances providing that prior approval is obtained from the Engineer.

1.10.3. Welding Codes and Construction

All welded joints shall be carried out in accordance with the following specification:-

a) **Pipe Welding**

All pipe welds shall be carried out in accordance with the requirements of B.S. 806.

b) **General Welding**

All welding of mild steel components other than pipework shall comply with the general requirements of B.S.5135:1974.

1.10.4. Welder's Qualifications

Any welder employed on this Sub-Contract shall have passed the trade test as laid down by the Government of Kenya.

Trade engineer may require to see the appropriate certificate obtained by any welder and should it be proved that the welder does not have the necessary qualifications the Engineer may instruct the Sub-Contractor to replace him by a qualified welder.

PART B:

PARTICULAR SPECIFICATIONS FOR RENAL UNIT

2. PART B: PARTICULAR SPECIFICATION FOR RENAL UNIT

2.1. WATER TREATMENT

2.1.1. Dialysis Water Treatment System

The Dialysis Water Treatment System is mainly formed by: sand removal filter; automatic dosage of sodium hypochlorite; water tank with a volume of 3 m³; n^o1 pressurization pumping station with n^o2 pumps inverter with 6 cm/h of flow rate each; n^o2 automatic softener 9 cm/h of flow rate and 13.5 cm/h of maximum flow rate; n^o2 automatic declarator filter with activated carbon; pressure regulator; n^o1 reverse osmosis double-stage unit for dialysis treatment certified with a salinity content of 1000 ppm (4 cm/h of flow rate); automatic dosage of disinfection product; n^o1 control redox potential. It is also includes electro-instrumental connections and any other accessory and / or processing required for a perfect installation of the system and any other system reported in the drawings. The reverse osmosis desalination system is with n^o4 membranes: n.1 High-pressure pressurisation set formed by a multistage centrifugal pump, with an electrical engine. The pump is fully stainless alloy AISI 316 made, n.1 Set of aromatic polyamide osmotic diaphragms, placed in a reinforced glass fiber pressure vessels, n.1 Hydraulic circuit, made of PVC (low pressure part) and in stainless steel AISI 316 (high pressure part). It includes tubing, valves and regulation and control devices (pressure gauges, manostats, flowmeters), n. 1 support frame made of electrically soldered carbon steel and properly treated against corrosion, n. 1 Dual read digital meter (input and output), n. 2 Digital flow transmitters (production and rejection), n. 1 Direct read flowmeter (recirculation). Including power connection to main electrical board.

2.1.2. Raw Water Tank

Water tank with a volume of 3 m³ as the initial reservoir for the renal unit system. As per the specialized nature of dialysis equipment, the raw water tank is design to store water from approved source and supply to the renal unit only. To achieve the standard, chemical water analysis from the local water authority should be obtained and if on a hospital site, hospitals should conduct their water analysis.

2.1.3. Feed Pump and Automatic Pump Controller.

1No. pressurization pumping station with 2No. pumps inverter with 6 cm/h of flow rate each; This is introduced in order to maintain constant pressure required, reduce fluctuation or decreased incoming water pressure and flow.

2.1.4. Softener.

2No. automatic softener 9 cm/h of flow rate and 13.5 cm/h of maximum flow rate.

Water containing calcium or magnesium form scale deposits on RO membrane and eventual foul the membrane.

Softener work on an ion exchange basis. The resin beads within the tank have high affinity for the cations calcium and magnesium (both divalent) present in the source water and release two sodium ions (monovalent) for one calcium or magnesium capture

2.1.5. Carbon Filter.

1No. automatic declarator filter with activated carbon One of the most critical tasks regarding the patient safety in the day of a dialysis technician is checking the water treatment system for chlorine and chloramines.

Chlorine and its combined form, chloramine, are high level oxidative chemicals. They are added to municipal water system to kill bacteria but they also kill red blood cells.

Injection of sodium met bisulfite.

2.1.6. Reverse Osmosis.

1No. reverse osmosis double-stage unit for dialysis treatment certified with a salinity content of 1000 ppm (4 cm/h of flow rate). RO membranes reject dissolved inorganic elements such as ions metals, salts, chemical and organics including bacteria, endotoxin and viruses.

Rejection of charged ion particles ranges from 95-99%, whereas contaminants such as organics that have no charge are rejected at a greater than 200 molecules weight cut-off.

Ionic contaminants are highly rejected compared to neutrally charged particles and polyvalent ions are more readily rejected than monovalent.

Other equipment such as, automatic dosage of disinfection product, control redox potential to comply with HTM 02-01 and relevant health related organs.

2.2. DIALYSIS PIPE WORK

2.2.1. Water Supply Pipe Work.

For a main renal unit, the central installation providing water for dialysis should be distributed through a recirculation pipework ring. The design of this ring should minimize the number of direction changes and dead-legs so that the risks from bacteriological infection are reduced, and should also minimize sharp bends and shoulders in joints. The rings should be installed above the floor in the dialysis area and the maintenance room. Installations that utilize ceiling or floor voids are not advised, as these introduce unnecessary dead-legs within the ring:

- The pipework should be constructed from rigid ABS, food-quality PEX tubing, hardwearing PYC or stainless steel, depending on the disinfection process to be used;
- The pipework should be capable of being cleaned and/or disinfected by either chemical or heat treatment to maintain hygiene:
 - PEX can support both chemical and heat treatment;
 - It will be possible to use only chemical decontamination with ABS and PYC pipework (not heat);
- All treated water connections to dialysis machines should be of the dead-free-space design or have an automated facility to disinfect the tubing connecting to the dialysis machine on a regular basis.

Flexible hoses connecting the dialysis machine to the water supply and drainage outlet points should be provided with quick-release couplings. To avoid the risk of accidentally dislodging the drainage hoses from dialysis machines, it is recommended that the quick-release coupling be of a different size to the water-supply coupling to avoid confusion and cross-connection.

The water-supply outlet point for each dialysis station and, as appropriate, in the maintenance room, should be kept as short as possible. This outlet point should also incorporate a means of isolation and a quick-release coupling.

1.10.5. Drainage Pipe Work.

The used dialysis solution should be discharged to a drainage outlet point and drainage system for each dialysis station and, as appropriate, in the maintenance room. This outlet point should incorporate a suitable air break, means of isolation, and a quick-release coupling of a different size to that of the water supply outlet point. Drainage pipework materials should be suitable for high-temperature waste at times of automatic cleaning and disinfection (and also a range of disinfecting chemicals).

It is possible that a protein-type residue will build up in the dialysis (solution) drainage pipework. It is therefore recommended that the pipework gradient from the discharge outlet point to the drainage system be greater than the usual 1 in 50.

At an early stage in the design process, designers should familiarize themselves with the types of discharge produced, and check with the client what effect the mixing of various chemical discharges may have upon the drainage system.

Proposals for the collection and discharge of chemical-contaminated effluent should be discussed and verified with the sewerage undertaker. Some water authorities may impose restrictions on the quantity and rate of discharge of such effluent into public sewers.

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 Summary of Volume 1 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 QUANTTIES

SECTION D.W. 1 DIALYSIS WATER TREATMENT PLANT

Item	CODE	Description	Unit	Qty	Rate	KShs.
1		<p><u>Supply, assemble, fix, test and commission the following equipment as described and shown on the drawings</u> <u>Tenderers must allow for all ancillaries and manufacturers installation recommendations, base plates, bolting down, clamping etc. necessary for the complete and proper functioning of the installation when pricing.</u></p>				
A		<p>Supply, deliver and install a dialysis water treatment plant of the following Specifications:</p> <ul style="list-style-type: none"> •sand removal filter; automatic dosage of sodium hypochlorite •water tank with a volume of 3 m³ •1No. Pressurization pumping station with 2No. pumps inverter with 6 cm/h of flow rate each •2No. automatic softener 9 cm/h of flow rate and 13.5 cm/h of maximum flow rate; •2No automatic declarator filter with activated carbon •pressure regulator •1No. reverse osmosis double-stage unit for dialysis treatment certified with a salinity content of 1000 ppm (4 cm/h of flow rate) •Automatic dosage of disinfection product •1No. control redox potential •The system includes electro-instrumental connections and any other accessory and / or processing required for a perfect installation of the system and any other system reported in the drawings. <p>(Recirculation). Including power connection to main electrical board.</p>				
		Sub-total Carried to Next Page				

SECTION D.W. 1Cont...: DIALYSIS WATER TREATMENT PLANT

	CODE	Description	Unit	Qty	Rate	KShs.
A		<p>Sub-total carried from Previous Page:</p> <ul style="list-style-type: none"> • The reverse osmosis desalinization system is with 4No. membranes :1No. High-pressure pressurisation set formed by a multistage centrifugal pump, with an electrical engine. •The pump is fully stainless alloy AISI 316 made, 1No. Set of aromatic polyamide osmotic diaphragms, placed in a reinforced glass fiber pressure vessels, 1No. Hydraulic circuit, made of PVC (low pressure part) and in stainless steel AISI 316 (high pressure part). It includes tubing, valves and regulation and control devices (pressure gauges, manostats, flowmeters), 1No. Support frame made of electrically soldered carbon steel and properly treated against corrosion, 1No. Dual read digital meter (input and output), 2No. Digital flow transmitters (production and rejection), 1No. Direct read flowmeter 	Set	1		
		Sub-total Carried Main Collection Page				

Item	Description	Unit	Qty	Rate	KShs.
2	<p><u>RENAL PIPEWORK</u></p> <p><u>To supply, deliver and install Cross Linked Polyethylene (PEX) tubing and fittings as described and shown on the drawings.</u></p> <p><u>Pipework in this section to be BS 1387 and fittings to BS 143 PEX Dialysis piping</u></p> <p><u>All covered in trunking to health technical memorandum standards to approval</u></p> <p><u>Tenderers must allow for push-fit fittings, in-line fittings, Crimp rings, jointings, clippings, couplings ,reducers manifolds, support brackets, male/female adaptors etc. necessary for the proper and satisfactory functioning of the installation when pricing.</u></p> <p><u>The Following in PEX and Pex Crim Tools</u></p>				
A	25mm PEX tubing	LM	40		
B	32mm ditto	LM	320		
C	40mm ditto	LM	160		
	<u>Extra over tubing for:-</u>				
	<u>To be Brass Composite Compression Pex Fittings</u>				
D	25mm dia elbow	No.	56		
E	32mm dia ditto	No	68		
F	40mm dia ditto	No.	17		
G	25 mm dia tee	No.	17		
H	32mm dia ditto	No.	56		
I	40 dia ditto	No.	6		
J	25mm dia straight connectors c/w crimp rings	No.	4		
K	32mm dia ditto	No.	32		
L	40 mm dia ditto	No.	16		
M	25 mm dia reducing coupling	No.	56		
N	32 mm dia ditto	No.	56		
O	40 mm dia ditto	No.	6		
	<u>Brass work</u>				
P	25 mm dia PEX Shut-off Ball Valve	No.	6		
Q	32mm dia PEX Shut-off Ball Valve	No.	8		
R	40mm dia PEX Shut-off Ball Valve	No.	4		
	<u>Sundries</u>				
S	200 x 50mm 2 compartment plastic trunking	LM	210		
T	Tundish drain S.S	No.	40		
	Sub-Total Carried to Main Collection page				

Item	Code	Description	Unit	Qty	Rate	KShs.
3		<u>INTERNAL SOIL AND WASTE DRAINAGE</u> - <u>Supply and install the following drainage UPVC pipe system as described and shown on the drawings</u> <u>Pipes and fittings shall be upvc to BS 5572:1978 and B.S.5750 as manufactured by “Key Terrain” or equal and approved. All jointings and fixings shall be in accordance with the manufacturer’s instructions and as described.</u> <u>Tenderers must allow for jointings, clippings, couplings, holders bats, pluggings, reducers, spacers etc. necessary for the proper functioning of the installation when pricing</u> <u>Pipe measurements are given in DN</u>				
A		75 mm dia. pipe	LM	118		
B		50 mm dia. pipe	LM	53		
		<u>Extra over pipe for:-</u>				
C		75mm dia. sweep bend	No.	90		
D		50mm dia. sweep bend	No.	35		
E		75mm dia. access plug	No.	43		
F		50mm dia. access plug	No.	25		
G		75mm dia. swept tee	No.	85		
H		50mm dia. swept tee	No.	50		
		Sub-Total Carried to Main-collection page				

MAIN COLLECTION PAGE

Item	Description	Unit	Qty	Rate	KShs.
(i)	<p><u>PROPOSED EAST AFRICAN KIDNEY UNIT INSTITUTE RENAL WATER SUPPLY</u></p> <p><u>MAIN COLLECTION PAGE</u></p> <p>Contractual requirements and General Conditions</p>		A/26		
D.W.1	Dialysis water treatment plant				
D.W.2	Dialysis water plumbing				
D.W.3	dialysis water drainage				
	TOTAL				
Total Carried Main Summary Page of Vol.1					

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	Pex pipe	
B	Dialysis water treatment plant	
C	drainage pipe	

5. PART E: DRAWING SCHEDULE

5.1. DRAWING SCHEDULE:

As shall be provided during project implementation.