*BANKI*

**KUU YA**
**KENYA**




**CENTRAL**
**BANK OF**

**KENYA**

**Haile Selassie Avenue**
**P.O. Box 60000 - 00200 Nairobi Kenya**
**Telephone: 2861000/2863000**
**Fax 340192/250783**

**Email: supplies@centralbank.go.ke**

**TENDER DOCUMENT**

# TENDER FOR PROPOSED ENHANCEMENTS AND IMPROVEMENT OF ELECTRICAL POWER SYSTEMS AND ASSOCIATED DATA CENTRE WORKS AT KISUMU BRANCH FOR CENTRAL BANK OF KENYA

## TENDER NO. CBK/056/2026-2027

## CLOSING DATE: 18TH NOVEMBER 2026 AT 10:30 A.M

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## INVITATION TO TENDER (ITT) BY CENTRAL BANK OF KENYA

1. The ***Central Bank of Kenya*** invites sealed tenders for proposed Enhancements and Improvement of Electrical Power Systems and Associated Data Centre works at Kisumu Branch for the Bank.
2. Tendering will be conducted under open National Tender using a standardized tender document. Tendering is open to all qualified and interested Tenderers.
3. Qualified and interested tenderers may obtain further information and inspect the Tender Documents during office hours *09: 00AM to4:00PM* at the address: **The Deputy Director, Head of Procurement, Tel: +254 20 2861000/2860000, 5th Floor, Central Bank of Kenya, Haile Selassie Avenue, Nairobi, Email: supplies@centralbank.go.ke** during normal working hours.

4. A complete set of tender document containing detailed information may be downloaded from the PPIP website: **www.tenders.go.ke OR Central Bank of Kenya website: www.centralbank.go.ke at no cost.** Bidders who download the tender document are advised to forward their particulars immediately using the **Email: supplies@centralbank.go.ke**. to facilitate any further clarification or addendum.

5. All Tenders must be accompanied by a **Tender Security of Kshs. 100,000.00,** valid for **170 days** from the date of tender opening**.**

6. Completed tender documents are to be enclosed in plain sealed envelopes marked with tender reference number and be deposited in the **Green Tender Box No. 3** at the main entrance, ground floor of **Central Bank of Kenya along Haile Selassie Avenue,** or posted using the address **Director, General Services Department, Central Bank of Kenya, P. O. Box 60000- 00200, Nairobi, Kenya, Haile Selassie Avenue** so as to be received on or **before 18th November 2026 at 10:30am.** Electronic Tenders *will not* be permitted.

7. Tenders will be opened immediately after the deadline date and time specified above or any deadline date and time specified later. Tenders will be publicly opened in the presence of the Tenderers' designated representatives and anyone who chooses to attend and has personal identification documents at the address below.
8. Late tenders will be rejected.
9. The addresses referred to above are:

**A. Address for obtaining further information and for purchasing tender documents**

**The Director, General Services Department**
Central Bank of Kenya, Head Office in Nairobi on Haile Selassie Avenue 5th Floor,
P. O. Box 60000 – 00200, Nairobi
Tel. No. 020 2860000, E-mail address: **supplies@centralbank.go.ke**.

***A. Address for Submission of Tenders.***
Central Bank of Kenya, Head Office in Nairobi, Ground
Haile Selassie Avenue
Green Tender Box No. 3 at the main entrance, ground floor
P. O. Box 60000 – 00200, Nairobi

***B. Address for Opening of Tenders.***
Central Bank of Kenya, Head Office in Nairobi, Senior Staff Canteen on 6th Floor

**DEPUTY DIRECTOR HEAD OF PROCUREMENT**

# PART1: TENDERING PROCEDURES

## SECTION I - INSTRUCTIONS TO TENDERERS

### A. GENERAL PROVISIONS

### 1.0 Scope of tender

**1.1** The Procuring Entity as defined in the Appendix to Conditions of Contract invites tenders for Works Contract as described in the tender documents. The name, identification, and number of lots (contracts) of this Tender Document are specified in the **TDS** .

**1.2** Throughout this tendering document:

a) The term "inwriting" means communicated in written form (e.g. by mail, e-mail, fax, including if specified in the **TDS** , distributed or received through the electronic-procurement system used by the Procuring Entity) with proof of receipt;
b) if the context so requires, "singular" means "plural" and vice versa;
c) "Day" means calendar day, unless otherwise specified as "Business Day". A Business Day is any day that is an official working day of the Procuring Entity. It excludes official public holidays.

### 2.0 Fraud and corruption

**2.1** The Procuring Entity requires compliance with the provisions of the Public Procurement and Asset Disposal Act, 2015, Section 62 "Declaration not to engage in corruption". The tender submitted by a person shall include a declaration that the person shall not engage in any corrupt or fraudulent practice and a declaration that the person or his or her sub-contractors are not debarred from participating in public procurement proceedings.

**2.2** The Procuring Entity requires compliance with the provisions of the Competition Act 2010, regarding collusive practices in contracting. Any tenderer found to have engaged in collusive conduct shall be disqualified and criminal and/or civil sanctions may be imposed. To this effect, Tenders shall be required to complete and sign the "Certificate of Independent Tender Determination" annexed to the Form of Tender.

**2.3** Tenderers shall permit and shall cause their agents (whether declared or not), subcontractors, sub-consultants, service providers, suppliers, and their personnel, to permit the Procuring Entity to inspect all accounts, records and other documents relating to any initial selection process, pre-qualification process, tender submission, proposal submission, and contract performance (in the case of award), and to have them audited by auditors appointed by the Procuring Entity.

**2.4** Unfair Competitive Advantage - Fairness and transparency in the tender process require that the firms or their Affiliates competing for a specific assignment do not derive a competitive advantage from having provided consulting services related to this tender. To that end, the Procuring Entity shall indicate in the **Data Sheet** and make available to all the firms together with this tender document all in formation that would in that respect give such firm any unfair competitive advantage over competing firms.

### 3.0 Eligible tenderers

**3.1** A Tenderer may be a firm that is a private entity, a state-owned enterprise or institution subject to ITT 3.8, or an individual or any combination of such entities in the form of a joint venture (JV) under an existing agree mentor with the intent to enter in to such an agreement supported by a letter of intent. In the case of a joint venture, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the

tendering process and, in the event the JV is awarded the Contract, during contract execution. Members of a joint venture may not also make an individual tender, be a subcontractor in a separate tender or be part of another joint venture for the purposes of the same Tender. The maximum number of JV members shall be specified in the **TDS .**

**3.2** Public Officers of the Procuring Entity, their Spouses, Child, Parent, Brothers or Sister. Child, Parent, Brother or Sister of a Spouse, their business associates or agents and firms/organizations in which they have a substantial or controlling interest shall not be eligible to tender or be awarded a contract. Public Officers are also not allowed to participate in any procurement proceedings.

**3.3** A Tenderer shall not have a conflict of interest. Any tenderer found to have a conflict of interest shall be disqualified. A tenderer may be considered to have a conflict of interest for the purpose of this tendering process, if the tenderer:

a) Directly or indirectly controls, is controlled by or is under common control with an other tenderer;

b) Receives or has received any director indirect subsidy from another tenderer;

c) Has the same legal representative as an other tenderer;

d) Has a relationship with an other tenderer, directly or through common third parties, that puts it in a position to influence the tender of an other tenderer, or influence the decisions of the Procuring Entity regarding this tendering process;

e) Any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the goods or works that are the subject of the tender;

f) Any of its affiliates has been hired (or is proposed to be hired) by the Procuring Entity as a consultant for Contract implementation;

g) Would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the contract specified in this Tender Document;

h) Has a close business or personal relationship with senior management or professional staff of the Procuring Entity who has the ability to influence the bidding process and:

   i) Are directly or indirectly involved in the preparation of the Tender document or specifications of the Contract, and/or the Tender evaluation process of such contract; or

   ii) May be involved in the implementation or supervision of such Contract unless the conflicts coming from such relationship has been resolved in a manner acceptable to the Procuring Entity throughout the tendering process and execution of the Contract.

**3.4** A tenderer shall not be involved in corrupt, coercive, obstructive or fraudulent practice. A tenderer that is proven to have been involved in any of these practices shall be automatically disqualified

**3.5** A Tenderer (either individually or as a JV member) shall not participate in more than one Tender, except for permitted alternative tenders. This includes participation as a subcontractor in other Tenders. Such participation shall result in the disqualification of all Tenders in which the firm is involved. Members of a joint venture may not also make an individual tender, be a sub-contractor in a separate tender or be part of another joint venture for the purposes of the same Tender. A firm that is not a tenderer or a JV member may participate as a subcontractor in more than one tender.

**3.6** A Tenderer may have the nationality of any country, subject to the restrictions pursuant to ITT3.9. A Tenderer shall be deemed to have the nationality of a country if the Tenderer is constituted, incorporated or registered in and operates in conformity with the provisions of

the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion also shall apply to the determination of the nationality of proposed sub-contractors or sub-consultants for any part of the Contract including related Services.

**3.7** A Tenderer that has been debarred from participating in public procurement shall be ineligible to tender or be awarded a contract. The list of debarred firms and individuals is available from the website of PPRA www.ppra.go.ke.

**3.8** A Tenderer that is a state-owned enterprise or a public institution in Kenya may be eligible to tender and be awarded Contract(s) only if it is determined by the Procuring Entity to meet the following conditions, i.e. if it is:

i) A legal public entity of Government and/or public administration,

ii) financially autonomous and not receiving any significant subsidies or budget support from any public entity or Government, and;

(iii) operating under commercial law and vested with legal rights and liabilities similar to any commercial enterprisetoenableitcompetewithfirmsintheprivatesectoronanequalbasis.

**3.9** Firms and individuals shall be ineligible if their countries of origin are:

(a) As a matter of law or official regulations, Kenya prohibits commercial relations with that country;

(b) By an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, Kenya prohibits any import of goods or contracting of works or services from that country, or any payments to any country, person, or entity in that country.

A tenderer shall provide such documentary evidence of eligibility satisfactory to the Procuring Entity, as the Procuring Entity shall reasonably request.

**3.10** Foreign tenderers are required to source at least forty (40%) percent of their contract inputs (in supplies, local sub-contracts and labor) from citizen suppliers and contractors. To this end, a foreign tenderer shall provide in its tender documentary evidence that this requirement is met. Foreign tenderers not meeting this criterion will be automatically disqualified. Information required to enable the Procuring Entity determine if this condition is met shall be provided for this purpose in "*SECTIONI II - EVALUATION AND QUALIFICATION CRITERIA, Item 9*".

**3.11** Pursuant to the eligibility requirements of ITT 3.10, a tender is considered a foreign tenderer, If it is registered in Kenya and has less than 51 percent ownership by nationals of Kenya and if it does not subcontract to foreign firms or individuals more than 10 percent of the contract price, excluding provisional sums. JVs are considered as foreign tenderers if the individual member firms registered in Kenya have less 51 percent ownership by nationals of Kenya. The JV shall not subcontract to foreign firms more than 10 percent of the contract price, excluding provisional sums.

**3.12** The National Construction Authority Act of Kenya requires that all local and foreign contractors be registered with the National Construction Authority and be issued with a Registration Certificate before they can undertake any construction works in Kenya. Registration shall not be a condition for tender, but it shall be a condition of contract award and signature. A selected tenderer shall be given opportunity to register before such award and signature of contract. Application for registration with National Construction Authority may be accessed from the website www.nca.go.ke.

**3.13** The Competition Act of Kenya requires that firms wishing to tender as Joint Venture

undertakings which may prevent, distort or lessen competition in provision of services are prohibited unless they are exempt in accordance with the provisions of Section 25 of the Competition Act, 2010. JVs will be required to seek for exemption from the Competition Authority. Exemption shall not be a condition for tender, but it shall be a condition of contract award and signature. A JV tenderer shall be given opportunity to seek such exemption as a condition of award and signature of contract. Application for exemption from the Competition Authority of Kenya may be accessed from the website www.cak.go.ke.

**3.14** A kenyan tenderer shall be eligible to tender if it provides evidence of having fulfilled his/her tax obligations by producing valid tax compliance certificate or tax exemption certificate issued by the Kenya Revenue Authority.

**4.0 Eligible goods, equipment, and services**

**4.1** Goods, equipment and services to be supplied under the Contract may have their origin in any country that is not ineligible under ITT 3.9. At the Procuring Entity's request, Tenderers may be required to provide evidence of the origin of Goods, equipment and services.

**4.2** Any goods, works and production processes with characteristics that have been declared by the relevant national environmental protection agency or by other competent authority as harmful to human beings and to the environment shall not be eligible for procurement.

**5.0 Tenderer's responsibilities**

**5.1** The tenderer shall bear all costs associated with the preparation and submission of his/her tender, and the Procuring Entity will in no case be responsible or liable for those costs.

**5.2** The tenderer, at the tenderer's own responsibility and risk, is encouraged to visit and examine and inspect the Site of the Works and its surroundings and obtain all information that may be necessary for preparing the tender and entering into a contract for construction of the Works. The costs of visiting the Site shall beat the tenderer's own expense.

**5.3** The Tenderer and any of its personnel or agents will be granted permission by the Procuring Entity to enter upon its premises and lands for the purpose of such visit. The Tenderer shall indemnify the Procuring Entity again stall liability arising from death or personal injury, loss of or damage to property, and any other losses and expenses incurred as a result of the examination and inspection.

**5.4** The tenderer shall provide in the Form of Tender and Qualification Information, a preliminary description of the proposed work method and schedule, including charts, as necessary or required.

## B. CONTENTS OF TENDER DOCUMENTS

**6.0 Sections of Tender Document**

**6.1** The tender document consists of Parts 1, 2, and 3, which includes all the sections specified below, and which should be read in conjunction with any Addenda issued in accordance with ITT 10.

**PART 1: Tendering Procedures**
Section I – Instructions to Tenderers
Section II – Tender Data Sheet (**TDS** )
Section III- Evaluation and Qualification
Criteria Section IV – Tendering Forms

**PART 2: Works'**

**Requirements** Section V -
Bills of Quantities Section VI
- Specifications Section VII -
Drawings

**PART 3: Conditions of Contract and Contract Forms**
Section VIII - General Conditions (GCC)
Section IX - Special Conditions of Contract
Section X- Contract Forms

**6.2** The Invitation to Tender Notice issued by the Procuring Entity is not part of the Contract documents. Unless obtained directly from the Procuring Entity, the Procuring Entity is not responsible for the completeness of the Tender document, responses to requests for clarification, the minutes of a pre-arranged site visit and those of the pre-Tender meeting (if any), or Addenda to the Tender document in accordance with ITT 10. Incase of any contradiction, documents obtained directly from the Procuring Entity shall prevail.

**6.3** The Tenderer is expected to examine all instructions, forms, terms, and specifications in the Tender Document and to furnish with its Tender all information and documentation as is required by the Tender document.

**7.0 Clarification of Tender Document, Site Visit, Pre-tender Meeting**

**7.1** A Tenderer requiring any clarification of the Tender Document shall contact the Procuring Entity in writing at the Procuring Entity's address specified in the **TDS** or raise its enquiries during the pre-Tender meeting if provided for in accordance with ITT 7.2. The Procuring Entity will respond in writing to any request for clarification, provided that such request is received no later than the period specified in the **TDS p**rior to the deadline for submission of tenders. The Procuring Entity shall forward copies of its response to all tenderers who have acquired the Tender documents in accordance with ITT 7.4, including a description of the inquiry but without identifying its source. If so specified in the **TDS** , the Procuring Entity shall also promptly publish its response at the web page identified in the **TDS** . Should the clarification result in changes to the essential elements of the Tender Documents, the Procuring Entity shall amend the Tender Documents following the procedure under ITT 8 and ITT 22.2.

**7.2** The Tenderer, at the Tenderer's own responsibility and risk, is encouraged to visit and examine and inspect the site(s) of the required contracts and obtain all information that may be necessary for preparing a tender. The costs of visiting the Site shall be at the Tenderer's own expense. The Procuring Entity shall specify in the **TDS** if a pre-arranged Site visit and or a pre-tender meeting will be held, when and where. The Tenderer's designated representative is invited to attend a pre-arranged site visit and a pre-tender meeting, as the case may be. The purpose of the site visit and the pre-tender meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

**7.3** The Tenderer is requested to submit any questions in writing, to reach the Procuring Entity not later than the period specified in the **TDS** before the meeting.

**7.4** Minutes of a pre-arranged site visit and those of the pre-tender meeting, if applicable, including the text of the questions asked by Tenderers and the responses given, together

with any responses prepared after the meeting, will be transmitted promptly to all Tenderers who have acquired the Tender Documents. Minutes shall not identify the source of the questions asked.

**7.5** The Procuring Entity shall also promptly publish anonymized (*no names*) Minutes of the pre-arranged site visit and those of the pre-tender meeting at the web page identified in the **TDS** . Any modification to the Tender Documents that may become necessary as a result of the pre-arranged site visit and those of the pre-tender meeting shall be made by the Procuring Entity exclusively through the issue of an Addendum pursuant to ITT 8 and not through the minutes of the pre-Tender meeting. Non-attendance at the pre-arranged site visit and the pre-tender meeting will not be a cause for disqualification of a Tenderer.

### 8.0 Amendment of Tender Documents

**8.1** At any time prior to the deadline for submission of Tenders, the Procuring Entity may amend the Tender Documents by issuing addenda.

**8.2** Any addendum issued shall be part of the Tender Documents and shall be communicated in writing to all who have obtained the Tender Documents from the Procuring Entity. The Procuring Entity shall also promptly publish the addendum on the Procuring Entity's website in accordance with ITT 7.5.

**8.3** To give Tenderers reasonable time in which to take an addendum into account in preparing their Tenders, the Procuring Entity should extend the dead line for the submission of Tenders, pursuant to ITT 22.2.

## C. PREPARATION OF TENDERS

### 9.0 . Cost of Tendering

The Tenderer shall bear all costs associated with the preparation and submission of its Tender, and the Procuring Entity shall not be responsible or liable for those costs, regardless of the conduct or outcome of the tendering process.

### 10.0 Language of Tender

The Tender, as well as all correspondence and documents relating to the tender exchanged by the tenderer and the Procuring Entity, shall be written in the English Language. Supporting documents and printed literature that are part of the Tender may be in another language provided they are accompanied by an accurate and notarized translation of the relevant passages into the English Language, in which case, for purposes of interpretation of the Tender, such translation shall govern.

### 11.0 Documents Comprising the Tender

**11.1** The Tender shall comprise the following:

a) Form of Tender prepared in accordance with ITT 12;

b) Schedules including priced Bill of Quantities, completed in accordance with ITT 12 and ITT 14;

c) Tender Security or Tender-Securing Declaration, in accordance with ITT 19.1;

d) Alternative Tender, if permissible, in accordance with ITT 13;

e) ***Authorization***: written confirmation authorizing the signatory of the Tender to commit the Tenderer, in accordancewithITT20.3;

f) *Qualifications:* documentary evidence in accordance with ITT 17 establishing the

Tenderer's qualifications to per form the Contract if its Tender is accepted;

g) *Conformity:* a technical proposal in accordance with ITT 16;

h) Any other document required in the **TDS .**

**11.2** In addition to the requirements under ITT 11.1, Tenders submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful Tender shall be signed by all members and submitted with the Tender, together with a copy of the proposed JV Agreement. Change of membership and conditions of the JV prior to contract signature will render the tender liable for disqualification.

### 12.0 Form of Tender and Schedules

**12.1** The Form of Tender and Schedules, including the Bill of Quantities, shall be prepared using the relevant forms furnished in Section IV, Tendering Forms. The forms must be completed with out any alterations to the text, and no substitutes shall be accepted except as provided under ITT 20.3. All blank spaces shall be filled in with the information requested. The Tenderer shall chronologically serialize all pages of the tender documents submitted.

**12.2** The Tenderer shall furnish in the Form of Tender information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Tender.

### 13.0 Alternative Tenders

**13.1** Unless otherwise specified in the **TDS** , alternative Tenders shall not be considered.

**13.2** When alternative times for completion are explicitly invited, a statement to that effect will be included in the **TDS** , and the method of evaluating different alternative times for completion will be described in Section III, Evaluation and Qualification Criteria.

**13.3** Except as provided under ITT 13.4 below, Tenderers wishing to offer technical alternatives to the requirements of the Tender Documents must first price the Procuring Entity's design as described in the Tender Documents and shall further provide all information necessary for a complete evaluation of the alternative by the Procuring Entity, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the Tenderer with the Winning Tender conforming to the basic technical requirements shall be considered by the Procuring Entity.

**13.4** When specified in the **TDS** , Tenderers are permitted to submit alternative technical solutions for specified parts of the Works, and such parts will be identified in the **TDS** , as will the method for their evaluating, and described in Section VII, Works' Requirements.

### 14.0 Tender Prices and Discounts

**14.1** The prices and discounts (including any price reduction) quoted by the Tenderer in the Form of Tender and in the Billof Quantities shall conform to the requirements specified below.

**14.2** The Tenderer shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Tenderer shall be deemed covered by the rates for other items in the Bill of Quantities and will not be paid for separately by the Procuring Entity. An item not listed in the priced Bill of Quantities shall be assumed to be not included in the Tender, and provided that the Tender is determined substantially responsive notwithstanding this omission, the average price of the item quoted by substantially responsive Tenderers will be added to the Tender price and the

equivalent total cost of the Tender so determined will be used for price comparison.

**14.3** The price to be quoted in the Form of Tender, in accordance with ITT 12.1, shall be the total price of the Tender, including any discounts offered.

**14.4** The Tenderer shall quote any discounts and the methodology for their application in the Form of Tender, in accordance with ITT 12.1.

**14.5** It will be specified in the **TDS** if the rates and prices quoted by the Tenderer are or are not subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract, except incases where the contract is subject to fluctuations and adjustments, not fixed price. In such a case, the Tenderer shall furnish the indices and weightings for the price adjustment formulae in the Schedule of Adjustment Data and the Procuring Entity may require the Tenderer to justify its proposed indices and weightings.

**14.6** Where tenders are being invited for individual lots (contracts)or for any combination of lots (packages), tenderers wishing to offer discounts for the award of more than one Contract shall specify in their Tender the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Discounts shall be submitted in accordance with ITT 14.4, provided the Tenders for all lots (contracts) are opened at the sametime.

**14.7** All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 30 days prior to the deadline for submission of Tenders, shall be included in the rates and prices and the total Tender Price submitted by the Tenderer.

### 15.0 Currencies of Tender and Payment

**15.1** The currency(ies) of the Tender and the currency(ies) of payments shall be the same**.**

**15.2** Tenderers shall quote entirely in Kenya Shillings. The unit rates and the prices shall be quoted by the Tenderer in the Bill of Quantities, entirely in Kenya shillings.

a) A Tenderer expecting to incur expenditures in other currencies for inputs to the Works supplied from outside Kenya (referred to as "the foreign currency requirements") shall (if so allowed in the **TDS** ) indicate in the Appendix to Tender the percentage(s) of the Tender Price (excluding Provisional Sums), needed by the Tenderer for the payment of such foreign currency requirements, limited to no more than two foreign currencies.

b) The rates of exchange to be used by the Tenderer in arriving at the local currency equivalent and the percentage(s) mentioned in (a) above shall be specified by the Tenderer in the Appendix to Tender and shall be based on the exchange rate provided by the Central Bank of Kenya on the date 30 days prior to the actual date of tender opening. Such exchange rate shall apply for all foreign payments under the Contract.

**15.3** Tenderers may be required by the Procuring Entity to justify, to the Procuring Entity's satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the unit rates and prices and shown in the Schedule of Adjustment Data in the Appendix to Tender are reasonable, in which case a detailed break down of the foreign currency requirements shall be provided by Tenderers.

## 16.0 Documents Comprising the Technical Proposal

The Tenderer shall furnish a technical proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section IV, Tender Forms, insufficient detail to demonstrate the adequacy of the Tenderer's proposal to meet the work's requirements and the completion time.

## 17.0 Documents Establishing the Eligibility and Qualifications of the Tenderer

**17.1** Tenderers shall complete the Form of Tender, included in Section IV, Tender Forms, to establish Tenderer's eligibility in accordance with ITT 4.

**17.2** In accordance with Section III, Evaluation and Qualification Criteria, to establish its qualifications to perform the Contract the Tenderer shall provide the information requested in the corresponding information sheets included in Section IV, Tender Forms.

**17.3** If a margin of preference applies as specified in accordance with ITT 33.1, nation al tenderers, individually or in joint ventures, applying for eligibility for national preference shall supply all information required to satisfy the criteria for eligibility specified in accordance with ITT 33.1.

**17.4** Tenderers shall be asked to provide, as part of the data for qualification, such information, including details of ownership, as shall be required to determine whether, according to the classification established by the Procuring Entity, a particular contractor or group of contractors qualifies for a margin of preference. Further the information will enable the Procuring Entity identify any actual or potential conflict of interest in relation to the procurement and/or contract management processes, or a possibility of collusion between tenderers, and thereby help to prevent any corrupt influence in relation to the procurement process or contract management.

**17.5** The purpose of the information described in ITT 17.4 above overrides any claims to confidentiality which a tenderer may have. There can be no circumstances in which it would be justified for a tenderer to keep information relating to its ownership and control confidential where it is tendering to undertake public sector work and receive public sector funds. Thus, confidentiality will not be accepted by the Procuring Entity as a justification for a Tenderer's failure to disclose, or failure to provide required information on its ownership and control.

**17.6** The Tenderer shall provide further documentary proof, information or authorizations that the Procuring Entity may request in relation to owner ship and control which in formation on any changes to the information which was provided by the tenderer under ITT 6.4. The obligations to require this information shall continue for the duration of the procurement process and contract performance and after completion of the contract, if any change to the information previously provided may reveal a conflict of interest in relation to the award or management of the contract.

**17.7** All information provided by the tenderer pursuant to these requirements must be complete, current and accurate as at the date of provision to the Procuring Entity. In submitting the information required pursuant to these requirements, the Tenderer shall warrant that the information submitted is complete, current and accurate as at the date of submission to the Procuring Entity.

**17.8** If a tenderer fails to submit the information required by these requirements, its tender will be rejected. Similarly, if the Procuring Entity is unable, after taking reasonable steps, to verify to a reasonable degree the information submitted by a tenderer pursuant to these requirements, then the tender will be rejected.

**17.9** If information submitted by a tenderer pursuant to these requirements, or obtained by the Procuring Entity (whether through its own enquiries, through notification by the public or otherwise), shows any conflict of interest which could materially and improperly benefit the tenderer in relation to the procurement or contract management process, then:

a) If the procurement process is still ongoing, the tenderer will bed is qualified from the procurement process,

b) if the contract has been awarded to that tenderer, the contract award will be set aside pending the outcome of (iii),

c) the tenderer will be referred to the relevant law enforcement authorities for investigation of whether the tenderer or any other person shave committed any criminal offence.

**17.10** If a tenderer submits information pursuant to these requirements that is in complete, in accurate or out-of-date, or attempts to obstruct the verification process, then the consequences ITT 17.8 will ensue unless the tenderer can show to the reasonable satisfaction of the Procuring Entity that any such act was not material, or was due to genuine error which was not attributable to the intentional act, negligence or recklessness of the tender.

### 18.0 Period of Validity of Tenders

**18.1** Tenders shall remain valid for the Tender Validity period specified in the **TDS** . The Tender Validity period starts from the date fixed for the Tender submission deadline (as prescribed by the Procuring Entity in accordance with ITT 22). At ender valid for a shorter period shall be rejected by the Procuring Entity as non-responsive.

**18.2** In exceptional circumstances, prior to the expiration of the Tender validity period, the Procuring Entity may requestTendererstoextendtheperiodofvalidityoftheirTenders.Therequestandtheresponsessh allbemadein writing. If a Tender Security is requested in accordance with ITT 19, it shall also be extended for thirty (30) days beyond the deadline of the extended validity period. A Tenderer may refuse the request without forfeiting its Tendersecurity.ATenderergrantingtherequestshallnotberequiredorpermittedtomodifyitsTen der.

### 19.0 Tender Security

**19.1** The Tenderer shall furnish as part of its Tender, either a Tender-Securing Declaration or a Tender Security as specified in the **TDS** , in original form and, in the case of a Tender Security, in the amount and currency specified in the **TDS** . A Tender-Securing Declaration shall use the form included in Section IV, Tender Forms.

**19.2** If a Tender Security is specified pursuant to ITT 19.1, the Tender Security shall be a demand guarantee in any of the following forms at the Tenderer's option:

a) cash;

b) a bank guarantee;

c) a guarantee by an insurance company registered and licensed by the Insurance Regulatory Authority listed by the Authority;

d) a guarantee issued by a financial institution approved and licensed by the Central Bank of Kenya, from a reputable source, and an eligible country.

**19.3** If an unconditional bank guarantee is issued by a bank located outside Kenya, the issuing bank shall have a correspondent bank located in Kenya to make it enforceable. The Tender Security shall be valid for thirty (30) days beyond the original validity period of the Tender, or beyond any period of extension if requested under ITT 18.2.

**19.4** If a Tender Security or Tender-Securing Declaration is specified pursuant to ITT 19.1, any Tender not accompanied by a substantially responsive Tender Security or Tender-Securing Declaration shall be rejected by the Procuring Entity as non-responsive.

**19.5** If a Tender Security is specified pursuant to ITT 19.1, the Tender Security of unsuccessful Tenderers shall be returned as promptly as possible upon the successful Tenderer's signing

the Contract and furnishing the Performance Security and any other documents required in the **TDS** . The Procuring Entity shall also promptly return the tender security to the tenderers where the procurement proceedings are terminated, all tenders were determined non-responsive or a bidder declines to extend tender validity period.

**19.6** The Tender Security of the successful Tenderer shall be returned as promptly as possible once the successful Tenderer has signed the Contract and furnished the required Performance Security, and any other documents required in the **TDS** .

**19.7** The Tender Security may be forfeited or the Tender-Securing Declaration executed:

a) if a Tenderer withdraws its Tender during the period of Tender validity specified by the Tenderer on the Form of Tender, or any extension there to provided by the Tenderer; or

b) if the successful Tenderer fails to: -

i) sign the Contract in accordance with ITT47; or

ii) furnish a Performance Security and if required in the **TDS** , and any other documents required in the **TDS** .

**19.8** Where tender securing declaration is executed, the Procuring Entity shall recommend to the PPRA to debars the Tenderer from participating in public procurement as provided in the law.

**19.9** The Tender Security or the Tender-Securing Declaration of a JV shall be in the name of the JV that submits the Tender. If the JV has not been legally constituted into a legally enforceable JV at the time of tendering, the Tender Security or the Tender-Securing Declaration shall be in the names of all future members as named in the letter of intent referred to in ITT 4.1 and ITT 11.2.

**19.10** A tenderer shall not issue a tender security to guarantee itself.

### 20.0 Format and Signing of Tender

**20.1** The Tenderer shall prepare one original of the documents comprising the Tender as described in ITT 11 and clearly mark it "ORIGINAL." Alternative Tenders, if permitted in accordance with ITT 13, shall be clearly marked "ALTERNATIVE." In addition, the Tenderer shall submit copies of the Tender, in the number specified in the **TDS** and clearly mark them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.

**20.2** Tenderers shall mark as "CONFIDENTIAL" all information in their Tenders which is confidential to their business. This may include proprietary information, trade secrets, or commercial or financially sensitive information.

**20.3** The original and all copies of the Tender shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Tenderer. This authorization shall consist of a written confirmation as specified in the **TDS** and shall be attached to the Tender. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Tender where entries or amendments have been made shall be signed or initialed by the person signing the Tender.

**20.4** Incase the Tenderer is a JV, the Tender shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.

**20.5** Any inter-lineation, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Tender.

## D. D. SUBMISSION AND OPENING OF TENDERS

### 21.0 Sealing and Marking of Tenders

**21.1** The Tenderer shall deliver the Tender in a single sealed envelope, or in a single sealed package, or in a single sealed container bearing the name and Reference number of the Tender, addressed to the Procuring Entity and a warning not to open before the time and date for Tender opening date. Within the single envelope, package or container, the Tenderer shall place the following separate, sealed envelopes:

a) in an envelope or package or container marked "ORIGINAL", all documents comprising the Tender, as described in ITT 11; and

b) in an envelope or package or container marked "COPIES", all required copies of the Tender; and

c) if alternative Tenders are permitted in accordance with ITT 13, and if relevant:

i) in an envelope or package or container marked "ORIGINAL –ALTERNATIVE TENDER", the alternative Tender; and

ii) in the envelope or package or container marked "COPIES- ALTERNATIVE TENDER", all required copies of the alternative Tender.

The inner envelopes or packages or containers shall:

a) bear the name and address of the Procuring Entity,

b) bear the name and address of the Tenderer; and

c) bear the name and Reference number of the Tender.

**21.2** If an envelope or package or container is not sealed and marked as required, the Procuring Entity will assume no responsibility for the misplacement or premature opening of the Tender. Tenders misplaced or opened prematurely will not be accepted.

### 22.0 Deadline for Submission of Tenders

**22.1** Tenders must be received by the Procuring Entity at the address specified in the **TDS** and no later than the date and time also specified in the **TDS** . When so specified in the **TDS** , tenderers shall have the option of submitting their Tenders electronically. Tenderers submitting Tenders electronically shall follow the electronic Tender submission procedures specified in the **TDS** .

**22.2** The Procuring Entity may, at its discretion, extend the deadline for the submission of Tenders by amending the Tender Documents in accordance with ITT 8, in which case all rights and obligations of the Procuring Entity and Tenderers previously subject to the deadline shall there after be subject to the deadline as extended.

### 23.0 Late Tenders

The Procuring Entity shall not consider any Tender that arrives after the deadline for submission of tenders, in accordance with ITT 22. Any Tender received by the Procuring Entity after the deadline for submission of Tenders shall be declared late, rejected, and returned unopened to the Tenderer.

### 24.0 Withdrawal, Substitution, and Modification of Tenders

**24.1** A Tenderer may withdraw, substitute, or modify its Tender after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITT 20.3, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Tender must accompany the respective written notice. All notices must be:

a) prepared and submitted in accordance with ITT 20 and ITT 21 (except that withdrawals notices

do not require copies), and in addition, the respective envelopes shall be clearly marked "WITHDRAWAL," "SUBSTITUTION," "MODIFICATION;" and

b) received by the Procuring Entity prior to the deadline prescribed for submission of Tenders, in accordance with ITT 22.

**24.2** Tenders requested to be withdrawn in accordance with ITT 24.1 shall be returned unopened to the Tenderers.

**24.3** No Tender may be withdrawn, substituted, or modified in the interval between the deadline for submission of Tenders and the expiration of the period of Tender validity specified by the Tenderer on the Form of Tender or any extension thereof.

### 25.0 Tender Opening

**25.1** Except in the cases specified in ITT 23 and ITT 24.2, the Procuring Entity shall publicly open and read out all Tenders received by the deadline, at the date, time and place specified **in the TDS** , in the presence of Tenderers' designated representatives who chooses to attend. Any specific electronic Tender opening procedures required if electronic Tendering is permitted in accordance with ITT 22.1, shall be as specified in the **TDS** .

**25.2** First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelopes with the corresponding Tender shall not be opened but returned to the Tenderer. No Tender withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at Tender opening.

**25.3** Next, envelopes marked "SUBSTITUTION" shall be opened and read out and exchanged with the corresponding Tender being substituted, and the substituted Tender shall not be opened, but returned to the Tenderer. No Tender substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at Tender opening.

**25.4** Next, envelopes marked "MODIFICATION" shall be opened and read out with the corresponding Tender. No Tender modification shall be permitted unless the corresponding modification notice contains a valid authorizationtorequestthemodificationandisreadoutatTenderopening.

**25.5** Next, all remaining envelopes shall be opened one at a time, reading out: the name of the Tenderer and whether there is a modification; the total Tender Price, per lot (contract) if applicable, including any discounts and alternative Tenders; the presence or absence of a Tender Security or Tender-Securing Declaration, if required; and any other details as the Procuring Entity may consider appropriate.

**25.6** Only Tenders, alternative Tenders and discounts that are opened and read out at Tender opening shall be considered further for evaluation. The Form of Tender and pages of the Bill of Quantities (to be decided on by the tender opening committee) are to be initialed by the members of the tender opening committee attending the opening.

**25.7** At the Tender Opening, the Procuring Entity shall neither discuss the merits of any Tender nor reject any Tender (except for late Tenders, in accordance with ITT 23.1).

**25.8** The Procuring Entity shall prepare minutes of the Tender Opening that shall include, as a minimum: -

a) the name of the Tenderer and whether there is a withdrawal, substitution, or modification;

b) the Tender Price, per lot (contract) if applicable, including any discounts;

c) any alternative Tenders;

d) the presence or absence of a Tender Security, if new as required;

e) number of pages of each tender document submitted.

**25.9** The Tenderers' representatives who are present shall be requested to sign the minutes. The omission of a Tenderer's signature on the minutes shall not invalidate the contents and

effect of the minutes. A copy of the tender opening register shall be distributed to all Tenderers.

## E. EVALUATION AND COMPARISON OF TENDERS

### 26.0 Confidentiality

**26.1** Information relating to the evaluation of Tenders and recommendation of contract award shall not be disclosed to Tenderers or any other persons not officially concerned with the Tender process until information on Intention to Award the Contract is transmitted to all Tenderers in accordance with ITT 43.

**26.2** Any effort by a Tenderer to influence the Procuring Entity in the evaluation of the Tenders or Contract award decisions may result in the rejection of its tender.

**26.3** Not withstanding ITT 26.2, from the time of tender opening to the time of contract award, if a tenderer wishes to contact the Procuring Entity on any matter related to the tendering process, it shall do so in writing.

### 27.0 Clarification of Tenders

**27.1** To assist in the examination, evaluation, and comparison of the tenders, and qualification of the tenderers, the Procuring Entity may, at its discretion, ask any tenderer for a clarification of its tender, given a reasonable time for a response. Any clarification submitted by a tenderer that is not in response to a request by the Procuring Entity shall not be considered. The Procuring Entity's request for clarification and the response shall be in writing. No change, including any voluntary increase or decrease, in the prices or substance of the tender shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Procuring Entity in the evaluation of the tenders, in accordance with ITT 31.

**27.2** If a tenderer does not provide clarifications of its tender by the date and time set in the Procuring Entity's request for clarification, its Tender may be rejected.

### 28.0 Deviations, Reservations, and Omissions

**28.1** During the evaluation of tenders, the following definitions apply: -

a) "Deviation" is a departure from the requirements specified in the tender document;

b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the tender document; and

c) "Omission" is the failure to submit part or all of the information or documentation required in the Tender document.

### 29.0 Determination of Responsiveness

**29.1** The Procuring Entity's determination of a Tender's responsiveness is to be based on the contents of the tender itself, as defined in ITT 11.

**29.2** A substantially responsive Tender is one that meets the requirements of the Tender document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that, if accepted, would:

a) Affect in any substantial way the scope, quality, or performance of the Works specified in the Contract;

b) limit in any substantial way, inconsistent with the tender document, the Procuring Entity's rights or the tenderer's obligations under the proposed contract;

c) if rectified, would unfairly affect the competitive position of other tenderers presenting substantially responsive tenders.

**29.3** The Procuring Entity shall examine the technical aspects of the tender submitted in

accordance with ITT 16, to confirm that all requirements of Section VII, Works' Requirements have been met without any material deviation, reservation or omission.

**29.4** If a tender is not substantially responsive to the requirements of the tender document, it shall be rejected by the Procuring Entity and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

### 30.0 Non-material Non-conformities

**30.1** Provided that a tender is substantially responsive, the Procuring Entity may waive any non-conformities in the tender.

**30.2** Provided that a Tender is substantially responsive, the Procuring Entity may request that the tenderer submit the necessary information or documentation, within a reasonable period of time, to rectify non-material non- conformities in the tender related to documentation requirements. Requesting information or documentation on such non-conformities shall not be related to any aspect of the price of the tender. Failure of the tenderer to comply with the request may result in the rejection of its tender.

**30.3** Provided that a tender is substantially responsive, the Procuring Entity shall rectify quantifiable non-material non-conformities related to the Tender Price. To this effect, the Tender Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component in the manner specified **in the TDS**.

### 31.0 Arithmetical Errors

**31.1** The tender sum as submitted and read out during the tender opening shall be absolute and final and shall not be the subject of correction, adjustment or amendment in any way by any person or entity.

**31.2** Provided that the Tender is substantially responsive, the Procuring Entity shall handle errors on the following basis: -

a) Any error detected if considered a major deviation that affects the substance of the tender, shall lead to disqualification of the tender as non-responsive.

b) Any errors in the submitted tender arising from a miscalculation of unit price, quantity, subtotal and total bid price shall be considered as a major deviation that affects the substance of the tender and shall lead to disqualification of the tender as non-responsive. and

c) if there is a discrepancy between words and figures, the amount in words shall prevail

**31.3** Tenderers shall be notified of any error detected in their bid during the notification of award.

### 32.0 Conversion to Single Currency

For evaluation and comparison purposes, the currency(ies) of the Tender shall be converted in to a single currency as specified in the **TDS** .

### 33.0 Margin of Preference and Reservations

**33.1** A margin of preference may be allowed only when the contract is open to international competitive tendering where foreign contractors are expected to participate in the tendering process and where the contract exceeds the value/threshold specified in the Regulations.

**33.2** A margin of preference shall not be allowed unless it is specified so in the TDS .

**33.3** Contracts procured on basis of international competitive tendering shall not be subject to reservations exclusive to specific groups as provided in ITT 33.4.

**33.4** Where it is intended to reserve a contract to as pecific group of businesses (these groups are Small and Medium Enterprises, Women Enterprises, Youth Enterprises and Enterprises of persons living with disability, as the case may be), and who are appropriately registered as such by the authority to be specified in the TDS , a procuring entity shall ensure that the invitation to tender specifically indicates that only businesses or firms belonging to the specified group are eligible to tender. No tender shall be reserved to more than one group. If not so stated in the Invitation to Tender and in the Tender documents, the

invitation to tender will be open to all interested tenderers.

### 34.0 Nominated Subcontractors

**34.1** Unless otherwise stated in the **TDS** , the Procuring Entity does not intend to execute any specific elements of the Works by subcontractors selected/nominated by the Procuring Entity. Incase the Procuring Entity nominates a subcontractor, the subcontract agreement shall be signed by the Subcontractor and the Procuring Entity. The main contract shall specify the working arrangements between the main contractor and the nominated subcontractor.

**34.2** Tenderers may propose sub-contracting up to the percentage of total value of contracts or the volume of works as specified in the **TDS** . Subcontractors proposed by the Tenderer shall be fully qualified for their parts of the Works.

**34.3** Domestic subcontractor's qualifications shall not be used by the Tenderer to qualify for the Works unless their specialized parts of the Works were previously designated so by the Procuring Entity in the **TDS** a scan be met by subcontractors referred to hereafter as 'Specialized Subcontractors', in which case, the qualifications of the Specialized Subcontractors proposed by the Tenderer may be added to the qualifications of the Tenderer.

### 35.0 Evaluation of Tenders

**35.1** The Procuring Entity shall use the criteria and methodologies listed in this ITT and Section III, Evaluation and Qualification Criteria No other evaluation criteria or methodologies shall be permitted. By applying the criteria and methodologies the Procuring Entity shall determine the Lowest Evaluated Tender in accordance with ITT 40.

**35.2** To evaluate a Tender, the Procuring Entity shall consider the following:

a) Price adjustment in accordance with ITT 31.1 (iii); excluding provisional sums and contingencies, if any, but including Daywork items, where priced competitively;

b) price adjustment due to discounts offered in accordance with ITT 14.4;

c) converting the amount resulting from applying (a) and (b) above, if relevant, to a single currency in accordance with ITT 32;

d) price adjustment due to quantifiable non material non-conformities in accordance with ITT 30.3; and

e) any additional evaluation factors specified in the TDS and Section III, Evaluation and Qualification Criteria.

**35.3** The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be considered in Tender evaluation.

**35.4** Where the tender involves multiple lots or contracts, the tenderer will be allowed to tender for one or more lots (contracts). Each lot or contract will be evaluated in accordance with ITT 35.2. The methodology to determine the lowest evaluated tenderer or tenderers base done lot (contract) or based on a combination of lots (contracts), will be specified in Section III, Evaluation and Qualification Criteria. In the case of multiple lots or contracts, tenderer will be will be required to prepare the Eligibility and Qualification Criteria Form for each Lot.

### 36.0 Comparison of tenders

The Procuring Entity shall compare the evaluated costs of all substantially responsive Tenders established in accordance with ITT 35.2 to determine the Tender that has the lowest evaluated cost.

## 37.0 Abnormally low tenders and abnormally high tenders

### Abnormally Low Tenders

**37.1** An Abnormally Low Tender is one where the Tender price, in combination with other elements of the Tender, appears so low that it raises material concerns as to the capability of the Tenderer in regards to the Tenderer's ability to perform the Contract for the offered Tender Price or that genuine competition between Tenderers is compromised.

**37.2** In the event of identification of a potentially Abnormally Low Tender, the Procuring Entity shall seek written clarifications from the Tenderer, including detailed price analyses of its Tender price in relation to the subject matter of the contract, scope, proposed methodology, schedule, allocation of risks and responsibilities and any other requirements of the Tender document.

**37.3** After evaluation of the price analyses, in the event that the Procuring Entity determines that the Tenderer has failed to demonstrate its capability to perform the Contract for the offered Tender Price, the Procuring Entity shall reject the Tender.

### Abnormally high tenders

**37.4** An abnormally high tender price is one where the tender price, in combination with other constituent elements of the Tender, appears unreasonably too high to the extent that the Procuring Entity is concerned that it (the Procuring Entity) may not be getting value for money or it may be paying too high a price for the contract compared with market prices or that genuine competition between Tenderers is compromised.

**37.5** Incase of a nab normally high price, the Procuring Entity shall make a survey of the market prices, check if the estimated cost of the contract is correct and review the Tender Documents to check if the specifications, scope of work and conditions of contract are contributory to the abnormally high tenders. The Procuring Entity may also seek written clarification from the tenderer on the reason for the high tender price. The Procuring Entity shall proceed as follows:

i) If the tender price is abnormally high based on wrong estimated cost of the contract, the Procuring Entity may accept or not accept the tender depending on the Procuring Entity's budget considerations.

ii) If specifications, scope of work and/or conditions of contract are contributory to the abnormally high tender prices, the Procuring Entity shall reject all tenders and may retender for the contract based on revised estimates, specifications, scope of work and conditions of contract, as the case may be.

**37.6** If the Procuring Entity determines that the Tender Price is abnormally too high because genuine competition between tenderers is compromised (often due to collusion, corruption or other manipulations), the Procuring Entity shall reject all Tenders and shall institute or cause competent Government Agencies to institute an investigation on the cause of the compromise, before retendering.

## 38.0 Unbalanced and/ or front-loaded tenders

**38.1** If in the Procuring Entity's opinion, the Tender that is evaluated as the lowest evaluated price is seriously unbalanced and/or frontloaded, the Procuring Entity may require the Tenderer to provide written clarifications. Clarifications may include detailed price analyses to demonstrate the consistency of the tender prices with the scope of works, proposed methodology, schedule and any other requirements of the Tender document.

**38.2** After the evaluation of the information and detailed price analyses presented by the Tenderer, the Procuring Entity may as appropriate:

a) accept the Tender;

b) require that the total amount of the Performance Security be increased at the expense of the

Tenderer to a level not exceeding a 30% of the Contract Price;

c) agree on a payment mode that eliminates the inherent risk of the Procuring Entity paying too much for undelivered works;

d) reject the Tender,

### 39.0 Qualifications of the tenderer

**39.1** The Procuring Entity shall determine to its satisfaction whether the eligible Tenderer that is selected as having submitted the lowest evaluated cost and substantially responsive Tender, meets the qualifying criteria specified in Section III, Evaluation and Qualification Criteria.

**39.2** The determination shall be based upon an examination of the documentary evidence of the Tenderer's qualifications submitted by the Tenderer, pursuant to ITT 17. The determination shall not take into consideration the qualifications of other firms such as the Tenderer's subsidiaries, parent entities, affiliates, subcontractors (other than Specialized Sub-contractors if permitted in the Tender document), or any other firm(s) different from the Tenderer.

**39.3** An affirmative determination shall be a prerequisite for award of the Contract to the Tenderer. A negative determination shall result in disqualification of the Tender, in which event the Procuring Entity shall proceed to the Tenderer who offers a substantially responsive Tender with the next lowest evaluated price to make a similar determination of that Tenderer's qualifications to perform satisfactorily.

### 40.0 Lowest evaluated tender

Having compared the evaluated prices of Tenders, the Procuring Entity shall determine the Lowest Evaluated Tender. The Lowest Evaluated Tender is the Tender of the Tenderer that meets the Qualification Criteria and whose Tender has been determined to be:

a) Most responsive to the Tender document; and

b) the lowest evaluated price.

### 41.0 Procuring entity's right to accept any tender, and to reject any or all tenders.

The Procuring Entity reserves the right to accept or reject any Tender and to annul the Tender process and reject all Tenders at any time prior to Contract Award, without there by incurring any liability to Tenderers. Incase of annulment, all Tenders submitted and specifically, Tender securities, shall be promptly returned to the Tenderers.

## F. AWARD OF CONTRACT

### 42.0 Award criteria

The Procuring Entity shall award the Contract to the successful tenderer whose tender has been determined to be the Lowest Evaluated Tender.

### 43.0 Notice of Intention to Enter into a Contract/Notification of Award

Upon award of the contract and Prior to the expiry of the Tender Validity Period the Procuring Entity shall issue a Notification of Intention to Enter into a Contract/Notification of award to all tenderers which shall contain, at a minimum, the following information:

a) the name and address of the Tenderer submitting the successful tender;

b) the Contract price of the successful tender;

c) a statement of the reason(s) the tender of the unsuccessful tenderer to whom the letter is addressed was unsuccessful, unless the price information in (c) above already reveals the reason;

d) the expiry date of the Standstill Period; and

e) instruction son how to request a debriefing and/ or submit a complaint during the stand still period;

### 44.0 Stand still Period

**44.1** The Contract shall not be signed earlier than the expiry of a Standstill Period of 14 days to allow any dissatisfied tender to launch a complaint. Where only one Tender is submitted, the Standstill Period shall not apply.

**44.2** Where a Standstill Period applies, it shall commence when the Procuring Entity has transmitted to each Tenderer the Notification of Intention to Enter into a Contract with the successful Tenderer.

### 45.0 Debriefing by The Procuring Entity

**45.1** On receipt of the Procuring Entity's Notification of Intention to Enter into a Contract referred to in ITT 43, an unsuccessful tenderer may make a written request to the Procuring Entity for a debriefing on specific issues or concerns regarding their tender. The Procuring Entity shall provide the debriefing within five days of receipt of the request.

**45.2** Debriefings of unsuccessful Tenderers may be done in writing or verbally. The Tenderer shall bear its own costs of attending such a debriefing meeting.

### 46.0 Letter of Award

Prior to the expiry of the Tender Validity Period and upon expiry of the Standstill Period specified in ITT 42.1, upon addressing a complaint that has been filed with in the Standstill Period, the Procuring Entity shall transmit the Letter of Award to the successful Tenderer. The letter of award shall request the successful tenderer to furnish the Performance Security within 21 days of the date of the letter.

### 47.0 Signing of Contract

**47.1** Upon the expiry of the fourteen days of the Notification of Intention to enter in to contract and upon the parties meeting their respective statutory requirements, the Procuring Entity shall send the successful Tenderer the Contract Agreement.

**47.2** Within fourteen (14) days of receipt of the Contract Agreement, the successful Tenderer shall sign, date, and return it to the Procuring Entity.

**47.3** The written contract shall be entered into within the period specified in the notification of award and before expiry of the tender validity period.

### 48.0 Performance Security

**48.1** Within twenty-one (21) days of the receipt of the Letter of Award from the Procuring Entity, the successful Tenderer shall furnish the Performance Security and, any other documents required in the TDS , in accordance with the General Conditions of Contract, subject to ITT 38.2 (b), using the Performance Security and other Forms included in Section X, Contract Forms, or another form acceptable to the Procuring Entity. A foreign institution providing a bank guarantee shall have a correspondent financial institution located in Kenya, unless the Procuring Entity has agreed in writing that a correspondent bank is not required.

**48.2** Failure of the successful Tenderer to submit the above-mentioned Performance Security and other documents required in the TDS or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the Tender Security. In that event

the Procuring Entity may award the Contract to the Tenderer offering the next Best Evaluated Tender.

**48.3** Performance security shall not be required for contracts estimated to cost less than the amount specified in the Regulations.

### 49.0 Publication of Procurement Contract

Within fourteen days after signing the contract, the Procuring Entity shall publish the awarded contract at its notice boards and websites; and on the Website of the Authority. At the minimum, the notice shall contain the following information:

a) name and address of the Procuring Entity;

b) name and reference number of the contract being awarded, a summary of its scope and the selection method used;

c) the name of the successful Tenderer, the final total contract price, the contract duration;

d) dates of signature, commencement and completion of contract;

e) names of all Tenderers that submitted Tenders, and their Tender prices as readout at Tender opening.

### 50.0 Procurement related Complaints and Administrative Review

**50.1** The procedures for making Procurement-related Complaints are as specified in the TDS .

**50.2** A request for administrative review shall be made in the form provided under contract forms.

## Section II - Tender Data Sheet (TDS )

The following specific data shall complement, supplement, or amend the provisions in the Instructions to Tenderers (ITT). Whenever there is a conflict, the provisions herein shall prevail over those in ITT.

| Reference to ITC Clause | PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS |
|---|---|
| **A. General** | |
| **ITT 1.1** | The name of the contract is P**roposed Enhancements and Improvement of Electrical Power Systems and Associated Data Centre Works at Kisumu Branch for Central Bank of Kenya**<br><br>The reference number of the Contract is **Tender No. CBK/056/2026-2027**<br><br>The number and identification of lots (contracts) comprising this Tender are N/A |
| **ITT 2.4** | The Information made available on competing firms is as follows: N/A |
| **ITT 2.4** | The firms that provided consulting services for the contract being tendered for are: |
| | |
| **ITT 3.1** | Maximum number of members in the Joint Venture (JV) shall be ***two.*** |
| **B. Contents of Tender Document** | |
| **ITT 7.1** | (i) The Tenderer will submit any request for clarifications in writing at the Address Deputy Director, General Services Department, P. O. Box 600000 – 00200, Nairobi<br><br>to reach the Procuring Entity not later than **four days** before the tender closing date<br><br>(ii) The Procuring Entity shall publish its response at the website PPIP website: **www.tenders.go.ke OR Central Bank of Kenya website: www.centralbank.go.ke** |
| **ITT 7.2** | (A) A pre-arranged pretender site visit *"shall"* take place at the following date, time and place:<br><br>**on 28th October 2026 at 11:00am at CBK- Kisumu Branch**.<br><br>(B) Pre-Tender meeting *"shall"* take place at the following date, time and place: **on 29th October 2026 at 11:00am at CBK-Kisumu Branch**. |
| **ITT 7.3** | The Tenderer will submit any questions in writing, to reach the Procuring Entity not later than **29th October 2026**. |

| Reference to ITC Clause | PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS |
|---|---|
| | |
| **ITT 7.5** | The Procuring Entity's website where Minutes of the pre-Tender meeting and the pre-arranged pretender will be published is **www.tenders.go.ke OR Central Bank of Kenya website: www.centralbank.go.ke** |
| **ITT 9.1** | For Clarification of Tender purposes, for obtaining further information and for purchasing tender documents, the Procuring Entity's address is:<br><br>(1) Name of Procuring Entity **Central Bank of Kenya**<br><br>(2) Physical address for hand Courier Delivery is **Central Bank of Kenya,** Head Office in Nairobi, Ground Floor, Haile Selassie Avenue, P. O. Box 60000 – 00200, Nairobi<br><br>(3) Postal Address: P. O. Box 60000 – 00200, Nairobi<br><br>(4) Insert name, telephone number and e-mail address of the officer to be contacted: **Deputy Director, General Services Department** |
| **C. Preparation of Tenders** | |
| ITT 11.1 (h) | The Tenderer shall submit the following additional documents in its Tender: *As detailed in the evaluation criteria* |
| **ITT 13.1** | Alternative Tenders *"shall not be"* considered. |
| ITT 13.2 | Alternative times for completion *shall be* permitted only with prior approval of the Procuring Entity. |
| ITT 13.4 | Alternative technical solutions shall be permitted for the following parts of the Works: N/A |
| **ITT 14.5** | The prices quoted by the Tenderer shall be *fixed and* should include all associated costs and taxes including **Capacity Building Levy.**<br><br>Tenderers are notified of PPRA circular No. 01/2024 dated 30th August 2024 and Legal notice No. 206 of 6th November 2023 which introduces Capacity Building Levy to be paid/borne by a supplier on all procurement contracts signed between the supplier and the procuring entity at a rate **of 0.03% of the value of contract exclusive of applicable taxes**. The procuring entity shall deduct and remit the levy to PPRA |
| **ITT 15.2 (a)** | Foreign currency requirements **not allowed.** |
| **ITT 18.1** | The Tender validity period shall be **210 days**. |
| **ITT 18.3** | (a) The Number of days beyond the expiry of the initial tender validity period will be 30 days. |

| Reference to ITC Clause | PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS |
|---|---|
| | (b) The Tender price shall be adjusted by the following percentages of the tender price:<br><br>(i) By ____N/A_____% of *the local currency portion of the Contract price adjusted to reflect local inflation during the period of extension,*<br>*and*<br><br>*(ii) By____N/A_____% the foreign currency portion of the Contract price adjusted to reflect the international inflation during the period of extension.* |
| **ITT 19.1** | Tender shall provide **a Tender Security**<br>The type of Tender security shall be in form of bank guarantee in the amount of **Kenya shillings 100,000.00** ***in the format provided in this tender document*** **issued by a Commercial Bank or Microfinance Institution licensed and regulated by CBK or Insurance Company authorized by PPRA** |
| **ITT 20.1** | In addition to the original of the Tender, the number of copies is: one.<br><br>**Note:** The Bidder shall submit, together with the bid, a USB flash drive containing a scanned electronic copy of all documents comprising the bid. The electronic copy shall be a true and complete replica of the submitted hard-copy bid. |
| **ITT 20.3** | The written confirmation of authorization to sign on behalf of the Tenderer shall consist of **Power of Attorney.** |
| **D. Submission and Opening of Tenders** | |
| **ITT 22.1** | For Tender submission purposes only, the Procuring Entity's address is:<br>**Central *Bank of Kenya,*** Head Office in Nairobi,<br>Haile Selassie Avenue, Senior Staff Canteen on 6th Floor<br>***Attention:*** Deputy Director, Head of Procurement<br>***Physical Address,*** for hand Courier Delivery to an office or Tender Box (City, Street, Building, Floor Number and Room) is Green Tender Box No. 3 located on Ground Floor, Central Bank of Kenya, Head Office, Nairobi, Haile Selassie Avenue**,**<br>**The deadline for Tender submission is:** Refer to the Invitation to tender<br>Tenderers ***shall not*** have the option of submitting their Tenders electronically.<br>The electronic Tendering submission procedures shall be: ***N/A*** |
| **ITT 25.1** | The Tender opening shall take place at the time and the address for Opening of Tenders provided below:<br><br>**Central Bank of Kenya,** Central Bank of Kenya, Head Office in Nairobi on Haile Selassie Avenue 5th Floor, P. O. Box 60000 – 00200, Nairobi |

| Reference to ITC Clause | PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS |
|---|---|
| | Attention: Deputy Director, Head of Procurement<br><br>**Physical Address,** for hand Courier Delivery to an office or Tender Box (City, Street, Building, Floor Number and Room) is Green Tender Box No. 3 located on Ground Floor, Central Bank of Kenya, Head Office, Nairobi, Haile Selassie Avenue,<br><br>**Tender Opening date : 18th November, 2026 at 10:30am** |
| **ITT 25.1** | If Tenderers are allowed to submit Tenders electronically, they shall follow the electronic tender submission procedures **specified: N/A** |
| **E. Evaluation, and Comparison of Tenders** | |
| **ITT 30.3** | The adjustment shall be based on the a*verage* price of the item or component as quoted in other substantially responsive Tenders. If the price of the item or component cannot be derived from the price of other substantially responsive Tenders, the Procuring Entity shall use its best estimate. |
| **TT 32.1** | The currency that shall be used for Tender evaluation and comparison purposes only to convert at the selling exchange rate all Tender prices expressed in various currencies into a single currency is: Kenya Shillings<br><br>The source of exchange rate shall be: **The Central bank of Kenya** (Selling rate)<br><br>The date for the exchange rate shall be*:* **the deadline date for Submission of the Tenders.** |
| **ITT 33.2** | A margin of preference **shall be** applied in line with the provision of Public Procurement and Asset Disposal Act, 2015 and attendant regulation 2020. |
| **ITT 33.4** | The invitation to tender is extended to the following group that qualify for Reservations: N/A |
| **ITT 34.1** | At this time, the Procuring Entity *does not intend* to execute certain specific parts of the Works by subcontractors selected in advance. |
| **ITT 34.2** | Contractor's may propose subcontracting: Maximum percentage of subcontracting permitted is: *25% of the total contract amount.* Tenderers planning to subcontract more than 10% of total volume of work shall specify, in the Form of Tender, the activity (ies) or parts of the Works to be subcontracted along with complete details of the subcontractors and their qualification and experience. |

| Reference to ITC Clause | PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS |
|---|---|
| **ITT 34.3** | The parts of the Works for which the Procuring Entity permits Tenderers to propose Specialized Subcontractors are designated as follows:<br>i) Builders Works Domestic Sub-Contractor<br>ii) LV Switchgear Fabricator Domestic Sub-Contractor<br>iii) Security Services Domestic Sub-Contractor<br>iv) White Space Goods Domestic Sub-Contractor<br>v) Fire Detection and Protection Domestic Sub-Contractor<br>vi) Air-Conditioning Domestic Sub-Contractor |
| **ITT 35.2 (e)** | Additional requirements apply. These are detailed in the evaluation criteria in Section III, Evaluation and Qualification Criteria. |
| **ITT 48.1** | Other documents required in addition to the Performance Security are insurance covers |
| **ITT 50.1** | The procedures for making a Procurement-related Complaint are detailed in the "Notice of Intention to Award the Contract" herein and are also available from the PPRA Website www.ppra.go.ke or email complaints@ppra.go.ke.<br><br>If a Tenderer wishes to make a Procurement-related Complaint, the Tenderer should submit its complaint following these procedures, in writing (by the quickest means available, that is either by hand delivery or email to:<br><br>**The address to request for debriefing will be as follows:**<br>**For the attention**: Deputy *Director, Head of procurement*<br>**Title/position**: Deputy *Director, Head of Procurement*<br>**Procuring Entity**: *Central Bank of Kenya*<br>**Email address***: supplies@centralbank.go.ke*<br>In summary, a Procurement-related Complaint may challenge any of the following:<br>**1.** the terms of the Tendering Documents; and<br>the Procuring Entity's decision to award the contract.<br>In summary, a Procurement-related Complaint may challenge any of the following (among others):<br><br>(i) the terms of the Tender Documents; and<br><br>(ii) the Procuring Entity's decision to award the contract. |

## SECTION III - EVALUATION AND QUALIFICATION CRITERIA

### 1.0 GENERAL PROVISIONS

**1.1** This section contains the criteria that the Employer shall use to evaluate tender and qualify tenderers. No other factors, methods or criteria shall be used other than specified in this tender document. The Tenderer shall provide all the information requested in the forms included in Section IV, Tendering Forms.

**1.2** Wherever a Tenderer is required to state a monetary amount, Tenderers should indicate the Kenya Shilling equivalent using the rate of exchange determined as follows:

a) For construction turnover or financial data required for each year - Exchange rate prevailing on the last day of the respective calendar year (in which the amounts for that year is to be converted) was originally established.

b) Value of single contract - Exchange rate prevailing on the date of the contract signature.

c) Exchange rates shall be taken from the publicly available source identified in the ITT 14.3. Any error in determining the exchange rates in the Tender may be corrected by the Procuring Entity.

**1.3** EVALUATION AND CONTRACT AWARD CRITERIA

The Procuring Entity shall use the criteria and methodologies listed in this Section to evaluate tenders and arrive at the Lowest Evaluated Tender. The tender that(i) meets the qualification criteria, (ii) has been determined to be substantially responsive to the Tender Documents, and (iii) is determined to have the Lowest Evaluated Tender price shall be selected for award of contract.

### 2.0 PRELIMINARY EXAMINATION FOR DETERMINATION OF RESPONSIVENESS

The Procuring Entity will start by examining all tenders to ensure they meet in all respects the eligibility criteria and other mandatory requirements in the ITT, and that the tender is complete in all aspects in meeting the requirements provided for in the preliminary evaluation criteria outlined below. Tenders that do not pass the Preliminary Examination will be considered non- responsive and will not be considered further.

**Preliminary Examination and Mandatory Requirements Parameters – Stage 1 of the Evaluation**

**A. Main Contractor**

| S/N | Mandatory Eligibility criteria | Documents to be provided | Compliance (YES or NO) |
|---|---|---|---|
| MR 1 | Provide documentary evidence of the company's Certificate of Incorporation (Legal structure) | Copy of Valid Certificate | |
| MR 2 | Provide copy of current CR 12 for Incorporated Firms to confirm that the firm is a citizen contractor | Copy of C12 | |
| MR 3 | Provide copy of the company's **current** Certificate of Tax Compliance issued by Kenya Revenue Authority (KRA) valid at least up to the date of tender opening. | Copy of Tax Compliance Certificate | |
| MR 4 | Submit a duly filled Form of Tender with a validity period of at least **210 days**. | Duly filled Form of Tender | |
| MR 5 | Submit a completed company's profile using the business questionnaire attached. | Duly filled in Business Questionnaire | |
| MR 6 | Provide documentary evidence of liquid assets and/or availability of credit facilities of a value of at least **Kshs.400 million (Kenya Shillings Four Hundred Million)**. (Attach copies of certified bank statements for the last six months **OR** letter of credit line from a financial institution registered by Central Bank of Kenya. The documents so provided may be verified for authenticity). | Copy of Letter of Credit or Bank Statements | |
| MR 7 | Provide documentary evidence of the Company's valid registration by National Construction Authority as an Electrical Works Contractor Category NCA 1 | Copy of NCA Registration Certificate | |
| MR 8 | Provide documentary evidence of the Company's valid annual practicing license from the National Construction Authority as a Electrical Works Contractor Category NCA 1 | Copy of NCA Practicing Lincense | |

| | | | |
|---|---|---|---|
| MR 9 | Provide documentary evidence of the Company's valid annual practising license from the Energy and Petroleum Regulatory Authority Class A 1 | Copy of EPRA License | |
| MR 10 | Provide documentary evidence in form of Audited Accounts for the Company for at least three (3) consecutive years 2023, 2024 and 2025 showing average minimum turnover of **Kenya Shillings 800,000,000.00** (**In words Eight Hundred Million)** (In The audited accounts MUST be signed by the auditor preparing the audited accounts and the candidate's Company Director(s). A copy of Valid Practicing License to be attached for each Audited Year. | Copy of Audited of Audited Accounts | |
| MR 11 | Provide Manufacturer letter of Authority specifically addressed to Central Bank of Kenya and quoting the tender name and number for the following affirming compliance to specifications described in the bills of quantities:<br>Power Conditioning Equipment<br>Transformers<br>Busbars<br>Earthing, lightning and surge protection | Relevant MAF Letter | |

**B. Builders Works Domestic Sub-Contractor**

| S/N | Mandatory Eligibility criteria | Documents to be provided | Compliance (YES or NO) |
|---|---|---|---|
| MR 1 | Agreement with the Sub-Contractor | Signed agreement by both parties | |
| MR2 | Documentary evidence of the company's Certificate of Incorporation or registration certificate (Legal structure) | Certificate of Incorporation | |
| MR 3 | Submit copy of the company's valid Tax Compliance Certificate OR exemption certificate valid at least up to the date of tender opening. | Tax Compliance certificate valid up-to at least the date of tender opening | |
| MR 4 | Current National Construction Authority Practicing Licenses for the following categories: Builder's Works – Minimum NCA 4 | Current Valid Practicing License for the National Construction Authority | |
| MR 5 | Manufacturer letter of Authority specifically addressed to Central Bank of Kenya and quoting the tender name and number for the following affirming compliance to specifications described in the bills of quantities: NOC/Conference Room Furniture | Relevant MAF Letters | |
| MR 6 | Submit a completed company's profile using the business questionnaire attached. | Company's profile using the business questionnaire attached. | |
| **Determination of Responsiveness (R/NR)** | | | |

**B) LV Switchgear Fabricator Domestic -Sub-Contractor**

| S/N | Mandatory Eligibility criteria | Documents to be provided | Compliance (YES or NO) |
|---|---|---|---|
| MR 1 | Agreement with the Sub-Contractor | Signed agreement by both parties | |
| MR 2 | Documentary evidence of the company's Certificate of Incorporation or registration certificate (Legal structure) | Certificate of Incorporation | |
| MR 3 | Submit copy of the company's valid Tax Compliance Certificate OR exemption certificate valid at least up to the date of tender opening. | Tax Compliance certificate valid up-to at least the date of tender opening | |
| MR 4 | Submit a completed company's profile using the business questionnaire attached. | Company's profile using the business questionnaire attached. | |
| MR 5 | a) Manufacturer Letter of Authority specifically addressed to Central Bank of Kenya quoting tender name and number affirming that LV Switchgear compliance to IEC 61439 Standards Full Type Tested Assembly<br>b) Current Original Equipment Manufacturer License to manufacture/assemble the above Switchgear brand (**Issued to the LV Switchgear Fabricator**) | Relevant MAF Letters | |
| **Determination of Responsiveness (R/NR)** | | | |

**C. UPS Equipment Domestic -Sub-Contractor**

| S/N | Mandatory Eligibility criteria | Documents to be provided | Compliance (YES or NO) |
|---|---|---|---|
| MR 1 | Agreement with the Sub-Contractor | Signed agreement by both parties | |
| MR 2 | Documentary evidence of the company's Certificate of Incorporation or registration certificate (Legal structure) | Certificate of Incorporation | |
| MR 3 | Submit copy of the company's valid Tax Compliance Certificate OR exemption certificate valid at least up to the date of tender opening. | Tax Compliance certificate valid up-to at least the date of tender opening | |
| MR 4 | Provide documentary evidence of the Company's valid annual practicing license from the National Construction Authority as a Electrical Works Contractor Category NCA 1 | Current Valid Practicing License for the National Construction Authority | |
| MR 5 | Provide documentary evidence of the Company's valid annual practising license from the Energy and Petroleum Regulatory Authority Class A 1 | Current Valid Practicing License for the Energy Regulatory Authority | |
| MR 6 | Submit a completed company's profile using the business questionnaire attached. | Company's profile using the business questionnaire attached. | |

| | | | |
|---|---|---|---|
| MR 7 | c) Manufacturer Letter of Authority specifically addressed to Central Bank of Kenya quoting tender name and number affirming that the New UPS 400 & 200 KW Units comply to specifications<br>d) UPS Equipment Manufacturer Letter of Authority specifically addressed to Central Bank of Kenya quoting tender name and number for 50 KW module compatible to existing 'Vertiv APM 500' Series | Relevant MAF Letters | |
| **Determination of Responsiveness (R/NR)** | | | |

**D. Security Services Domestic Sub-Contractor**

| S/N | Mandatory Eligibility criteria | Documents to be provided | Compliance (YES or NO) |
|---|---|---|---|
| MR 1 | Agreement with the Sub-Contractor | Signed agreement by both parties | |
| MR 2 | Documentary evidence of the company's Certificate of Incorporation or registration certificate (Legal structure) | Certificate of Incorporation | |
| MR 3 | Submit copy of the company's valid Tax Compliance Certificate OR exemption certificate valid at least up to the date of tender opening. | Tax Compliance certificate valid up- to at least the date of tender opening | |
| MR 4 | Submit a completed company's profile using the business questionnaire attached. | Company's profile using the business questionnaire attached. | |
| MR 5 | Manufacturer letter of Authority specifically addressed to Central Bank of Kenya and quoting the tender name and number for the following affirming compliance to specifications described in the bills of quantities:<br>a) Integrated CCTV and Access Control System<br>**(Backend software to unified system)** | Relevant MAF Letters | |
| **Determination of Responsiveness (R/NR)** | | | |

**E. Thermal Containment Domestic Sub-Contractor**

| S/N | Mandatory Eligibility criteria | Documents to be provided | Compliance (YES or NO) |
|---|---|---|---|
| MR 1 | Agreement with the Sub-Contractor | Signed agreement by both parties | |
| MR 2 | Documentary evidence of the company's Certificate of Incorporation or registration certificate (Legal structure) | Certificate of Incorporation | |
| MR 3 | Submit copy of the company's valid Tax Compliance Certificate OR exemption certificate valid at least up to the date of tender opening. | Tax Compliance certificate valid up-to at least the date of tender opening | |
| MR 4 | Submit a completed company's profile using the business questionnaire attached. | Company's profile using the business questionnaire attached. | |
| MR 5 | Manufacturer letter of Authority specifically addressed to Central Bank of Kenya and quoting the tender name and number for the following affirming compliance to specifications described in the bills of quantities:<br>• Thermal Containment<br>• Data Center Infrastructure Management | Relevant MAF Letters | |
| **Determination of Responsiveness (R/NR)** | | | |

**F. Fire Detection and Protection Sub-Contractor**

| S/N | Mandatory Eligibility criteria | Documents to be provided | Compliance (YES or NO) |
|---|---|---|---|
| MR 1 | Agreement with the Sub-Contractor | Signed agreement by both parties | |
| MR2 | Documentary evidence of the company's Certificate of Incorporation or registration certificate (Legal structure) | Certificate of Incorporation | |
| MR3 | Submit copy of the company's valid Tax Compliance Certificate OR exemption certificate valid at least up to the date of tender opening. | Tax Compliance certificate valid up-to at least the date of tender opening | |
| MR4 | Current National Construction Authority Practicing Licenses for the following categories:<br>Fire Fighting Installations – Minimum NCA 2 | Current Valid Practicing License for the National Construction Authority | |
| MR5 | Submit a completed company's profile using the business questionnaire attached. | Company's profile using the business questionnaire<br>attached. | |
| MR6 | Manufacturer letter of Authority specifically addressed to Central Bank of Kenya and quoting the tender name and number for the following affirming compliance to specifications described in the bills of quantities:<br>a) Fire Detection and High Smoke Sensitivity System<br>b) Gas Fire Suppression System<br>c) Water Mist Suppression System | Relevant MAF Letters | |

| Determination of Responsiveness (R/NR) | |
|---|---|

**G. Air-Conditioning Domestic Sub-Contractor**

| S/N | Mandatory Eligibility criteria | Documents to be provided | Compliance (YES or NO) |
|---|---|---|---|
| MR 1 | Agreement with the Sub-Contractor | Signed agreement by both parties | |
| MR 2 | Documentary evidence of the company's Certificate of Incorporation or registration certificate (Legal structure) | Certificate of Incorporation | |
| MR 3 | Submit copy of the company's valid Tax Compliance Certificate OR exemption certificate valid at least up to the date of tender opening. | Tax Compliance certificate valid up- to at least the date of tender opening | |
| MR 4 | Current National Construction Authority Practicing Licenses for the following categories:<br>Mechanical – Minimum NCA 1 | Current Valid Practicing License for the National Construction Authority | |
| MR 5 | Submit a completed company's profile using the business questionnaire attached. | Company's profile using the business questionnaire attached. | |
| MR 6 | Manufacturer letter of Authority specifically addressed to Central Bank of Kenya and quoting the tender name and number for the following affirming compliance to specifications described in the bills of quantities:<br>• UPS Room Precision Air-conditioning Equipment<br>• White Space Precision Airconditioning capable of working in a Master /Slave Configuration with the Existing 'Stulz CRL 361 AS' Series. **For bidders offering alternate brands other than the stated compatible 'Stulz' Model a clear Methodology to be included in the MAF letter (Proof of Concept will be required as part of Due Delligence)** | Relevant MAF Letters | |
| **Determination of Responsiveness (R/NR)** | | | |

**H. Copper and Fiber Domestic Sub-Contractor**

| S/N | Mandatory Eligibility criteria | Documents to be provided | Compliance (YES or NO) |
|---|---|---|---|
| MR 1 | Agreement with the Sub-Contractor | Signed agreement by both parties | |
| MR 2 | Documentary evidence of the company's Certificate of Incorporation or registration certificate (Legal structure) | Certificate of Incorporation | |
| MR 3 | Submit copy of the company's valid Tax Compliance Certificate OR exemption certificate valid at least up to the date of tender opening. | Tax Compliance certificate valid up-to at least the date of tender opening | |
| MR 4 | Submit a completed company's profile using the business questionnaire attached. | Company's profile using the business questionnaire attached. | |
| MR 5 | Provide documentary evidence of the Company's valid Registration with ICT Authority minimum ICTA 2 -Data Center | Valid Certificate Issued by ICTA | |
| MR 6 | Provide documentary evidence of the Company's valid Registration with ICT Authority minimum ICTA 2-ICT Networks | Valid Certificate Issued by ICTA | |
| MR 7 | Provide Documentary evidence of Company valid Registration with CAK as a Telecommunication Contractor | Valid Certifcate issued by CAK | |
| MR 8 | Provide documentary evidence of the Company's valid Registration with ICT Authority minimum ICTA 2 -Information Networks | Valid Certificate Issued by ICTA | |
| MR 9 | Manufacturer letter of Authority specifically addressed to Central Bank of Kenya and quoting the tender name and number for the following affirming compliance to specifications described in the bills of quantities:<br>• Intelligent Copper and Fiber Installations | Relevant MAF Letters | |
| **Determination of Responsiveness (R/NR)** | | | |

**I. Generator Domestic Sub-Contractor**

| S/N | Mandatory Eligibility criteria | Documents to be provided | Compliance (YES or NO) |
|---|---|---|---|
| MR 1 | Agreement with the Sub-Contractor | Signed agreement by both parties | |
| MR 2 | Documentary evidence of the company's Certificate of Incorporation or registration certificate (Legal structure) | Certificate of Incorporation | |
| MR 3 | Submit copy of the company's valid Tax Compliance Certificate OR exemption certificate valid at least up to the date of tender opening. | Tax Compliance certificate valid up-to at least the date of tender opening | |
| MR 4 | Submit a completed company's profile using the business questionnaire attached. | Company's profile using the business questionnaire attached. | |
| MR 5 | Manufacturer letter of Authority specifically addressed to Central Bank of Kenya and quoting the tender name and number for the following affirming compliance to specifications described in the bills of quantities:<br>• Generator Equipment<br>• Master Control Panel | Relevant MAF Letters | |
| **Determination of Responsiveness (R/NR)** | | | |

**Note: All Mandatory documents submitted by the bidders may be authenticated**

Bidders shall be required to meet all the Mandatory Requirements to progress to stage 2 of the evaluation on Technical Evaluation on specification.

**Stage 2: Technical Evaluation on Specifications - Stage 2 of the Evaluation**

Bidders meeting the pass mark on qualification will be subjected to technical evaluation on specification. Bids will be analyzed, using the information provided in the technical brochures or technical schedules or written responses, to determine compliance with technical specifications for the equipment as indicated in Section VI and as detailed in the technical specifications attached to this tender document. Bidders will be required to meet the minimum technical specification of each equipment to proceed to technical evaluation on qualification

**In addition, bidders will be required to attain a complete technical Compliance without any deviation to the requirements to qualify to the next stage on technical evaluation on qualification.**

| SN | ITEM | Manufacturer | Model | Datasheet (Make reference to the specific pages ) | Comply with specs | Not comply with specs | Bidder remarks |
|---|---|---|---|---|---|---|---|
| **1** | **Builder works** | | | | | | |
| 1.1 | Two Hour Fire Rated Steel Door | | | | | | |
| 1.2 | Two Hour Fire Rated Fire Escape Door | | | | | | |
| 1.3 | 4mm thick polyurethane PU floor finish | | | | | | |
| 1.4 | V-Concept Console multiple linear configuration for 5 operators, rounded design | | | | | | |
| 1.5 | RDI meeting room solutions type C+ boardroom table | | | | | | |
| **2** | **Generator and Fuel Storage System** | | | | | | |
| 2.1 | 400 KW Engine, standard containerized Data Centre Continuous Running rated Generator Including | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | GCP,Internal Fuel Tank and Split Board | | | | | | |
| 2.2 | Bunded Fuel Tanks as Manufactured by 'ORCA' or equivalent 15,000 liters capacity complete with Fuel filtration System | | | | | | |
| 2.3 | Indoor, IP54, Critical Power Master Control Panel (NOT Engine Mounted Deep Sea Controller) | | | | | | |
| 3 | **PV Solar Ststem** | | | | | | |
| 3.1 | Phtovoltaic Array System | | | | | | |
| 3.2 | Inverter | | | | | | |
| **4** | **Electrical and Associated Works** | | | | | | |
| **4.1** | 11KV Ring Main Unit Indoor type - 2 way | | | | | | |
| **4.2** | 1600 kVA, 11/0.415 kV, Cu/Cu, Dry Type Distribution Transformer | | | | | | |
| **4.3** | Automatic voltage conditioner 1000kVA | | | | | | |
| **4.3** | Busbar Riser Complete with Accessories | | | | | | |
| 4.5 | Sample Fully Type Tested Electrical Panel | | | | | | |
| 4.6 | 400 KVA UPS with 10 Mins Back up Time (VRLA Batteries) | | | | | | |
| 4.7 | 200 KVA UPS with 10 mins Back up Time (VRLA Batteries) | | | | | | |
| 4.8 | Vertiv 50KVA APM 500 UPS Module | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4.9 | 12way distribution board complete with Earth stud heavy duty enclosure with removable gland plate and blanking plates | | | | | | |
| 4.1 | Sample Single Pole MCB | | | | | | |
| 4.11 | Low Voltage XLPE/PVC/AWS/PVC Cables-LSZH | | | | | | |
| 5 | **Earthing and Lightening Protection** | | | | | | |
| 5.1 | Lighting Protection Air-Terminal | | | | | | |
| 5.2 | Smart Lightning Logger | | | | | | |
| 5.3 | Smart Centralized Earthing System | | | | | | |
| **6** | **Lighting Automation** | | | | | | |
| 6.1 | Lighting Control Panel | | | | | | |
| 3.2 | Power supply with emergency power input | | | | | | |
| 6.2 | KNX - Dali Gateway or equivalent | | | | | | |
| 6.3 | KNX IP Interface or equivalent | | | | | | |
| 6.4 | switching actuator | | | | | | |
| 6.5 | Push-button with 2,4,6 & 8 operating buttons | | | | | | |
| 6.6 | Smart Touch Control Screen | | | | | | |
| 6.7 | Certified EIB/KNX Bus Cable LSZH single pair building management cable. | | | | | | |
| 6.8 | Presence sensor | | | | | | |
| **7** | **Local Area Network** | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7.1 | Wireless Access Point | | | | | | |
| 7.2 | Core Layer Switch | | | | | | |
| 7.3 | Access Layer Switch | | | | | | |
| 7.4 | Distribution Network Switch (48-Port PoE+) | | | | | | |
| 7.5 | KVM Switch (1U, 8-port, with flip-up 19" LCD console) | | | | | | |
| **8** | **Containment** | | | | | | |
| 8.1 | Wall Trunking Steel Powder coated | | | | | | |
| 8.2 | Power way cable ladder 3mm thick | | | | | | |
| **9** | **White Space Containment** | | | | | | |
| 9.1 | Server Rack | | | | | | |
| 9.2 | Network Rack | | | | | | |
| 9.3 | Rack PDU | | | | | | |
| 9.4 | Aisle Containment | | | | | | |
| 9.5 | Aisle Access Control | | | | | | |
| 9.6 | Containment Monitoring | | | | | | |
| 9.7 | Containment Cooling | | | | | | |
| **10** | **Copper and Fiber Installations** | | | | | | |
| 10.1 | Central Patching Zone Racks | | | | | | |
| 10.2 | Standard Copper Patching Equipment | | | | | | |
| 10.3 | Standard Copper Patch Cords | | | | | | |
| 10.4 | Intelligent Copper Patching Equipment | | | | | | |
| 10.5 | Intelligent Copper Patch Cords | | | | | | |
| 10.6 | Standard Fiber Patching Equipment | | | | | | |
| 10.7 | Standard Fiber Patch Cords | | | | | | |
| 10.8 | Intelligent Fiber Patching Equipment | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10.9 | Intelligent Fiber Patch Cords | | | | | | |
| 10.10 | Management Software | | | | | | |
| 10.11 | Management Server | | | | | | |
| 10.13 | Data Acquisition Panel | | | | | | |
| 10.13 | Data Acquisition Bus | | | | | | |
| 10.14 | Plug and Play Pre-terminated Copper Trunk | | | | | | |
| 10.15 | Plug and Play Pre-terminated Fiber Trunk | | | | | | |
| **11** | **Telco Room Racks** | | | | | | |
| 11.1 | Integrated Single-Rack System complete with power distribution panel, UPS and battery, rack PDU , power management unit, LCD touch screen panel and environmental sensors in a fully enclosed rack with factory pre-assembled, | | | | | | |
| **12** | **Data Center Infrastructure Management System** | | | | | | |
| 12.1 | Data Center Infrastructure Management system | | | | | | |
| **13** | **Security Services** | | | | | | |
| 13.1 | Unified Security Management Software | | | | | | |
| 13.2 | 4MP Dome Camera | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 13.3 | 4MP Bullet Camera | | | | | | |
| 13.4 | 4 MP ptz Camera | | | | | | |
| 13.5 | 10 MP PTZ Camera | | | | | | |
| 13.6 | 48tb Network Video Recorder | | | | | | |
| 13.7 | CCTV System Workstation | | | | | | |
| 13.8 | IP Finger Print and Card Reader | | | | | | |
| **14** | **Air-conditioning System** | | | | | | |
| 14.1 | Telcom Room Precision Split Air-conditioning unit | | | | | | |
| 14.2 | UPS Room Precision Airconditioning unit | | | | | | |
| **15** | **Fire System** | | | | | | |
| 15.1 | Integrated Fire Alarm & Emergency Control Panel | | | | | | |
| 15.2 | Central Smoke Damper Panel | | | | | | |
| 15.3 | Motorized Fire Damper | | | | | | |
| 15.4 | High Smoke Sensitivity Sysem Panel | | | | | | |
| 15.5 | Fire Protection Cylinder and Gas | | | | | | |
| 15.6 | Fire Protection Actuation Mechanism for Gas Suppression System | | | | | | |
| | High Pressure Water Mist System Pump and Accessories | | | | | | |
| **16** | **Audio Visual Installations** | | | | | | |
| 16.1 | Video wall NOC Room | | | | | | |
| 16.2 | Video Wall War Room | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 16.3 | 75 inch smart TV | | | | | | |
| 16.4 | Modular Video Wall Controller | | | | | | |
| 16.5 | Video Conferencing Equipment | | | | | | |
| 16.6 | Audio Conferencing Equipment | | | | | | |
| 16.7 | Wireless Presentation System | | | | | | |
| I6.8 | IP Based Voice Evacuation System | | | | | | |

**Note:** Bidders shall be required to meet all the technical Compliance without any deviation to the requirements to qualify to the next stage on technical evaluation on qualification.

**Stage 3: Technical Evaluation on Qualification – Stage 3 of the Evaluation**
Tenderers fully complying with specification will be subjected to technical evaluation on qualification based on the technical parameters given below:

| | Evaluation Attribute | Weighting Score | Max Score |
|---|---|---|---|
| **T1** | **a) General Experience - General Electrical Installations- Applicable to Electrical Contractor Only**<br>Provide a list of at least Three (3) **clients with references (names and telephone of contact persons)** to which the company has undertaken either all or part of the following General Electrical Installation Works valued at a minimum of **Kshs. 300,000,000.00** and above in the last 8 **years.**<br>a) Electrical Installations<br>**Note**: Bidder to provide copies of contracts and completion certificates/letter from client clearly stating the nature of the contract, amount and completion date as proof of having undertaken the works. | Each reference client will earn 5 **marks** | **15** |
| **T2** | **General Experience – Data Center (Applicable to Main or Thermal and Copper/Fiber Sub-Contractors Only)**<br>Provide a list of at Two **(2**) **project with references (names and telephone of contact persons)** to which the company has undertaken the following Data Center Installation Works valued at a minimum of **KShs. 200,000,000.00** and above in the last 8 **years. The following combined scope MUST be sighted as a** | Each reference client will earn 10 **marks** | **20** |

| | Evaluation Attribute | Weighting Score | Max Score |
|---|---|---|---|
| | **Minimum. Stand Alone Scope will NOT be considered**<br>a). Electrical Installations<br>b). Air-conditioning Installations<br>c). Pre-terminated Copper and Fiber Installation<br>d). UPS Equipment Installations<br>e). Builders Works<br>f). Data Center Infrastructure Management System<br>**Note**: Bidder to provide copies of contracts and/or completion certificates/letter from client clearly stating the nature of the contract, amount and completion date as proof of having undertaken the works. | | |
| **T3** | **Specific Experience – Intelligent Pre-Terminated Copper and Fiber Installations- Minimum 900 terminations complete with central monitoring – Applicable Only to Intelligent Copper and Fiber Cabling**<br>Provide a list of at least one **(1**) **project with references (names and telephone of contact persons)** to which the company Intelligent Pre-Terminated Copper and Fiber Installations in the last 8 **years.**<br>**Note:** Bidder to provide copies of contracts and or completion certificates/letter from Client clearly stating the nature of contract and completion date as proof of having undertaken the works | Each reference client will earn 10 **marks** | **10** |
| **T4** | **Specific Experience – Data Thermal Containment (Minimum 30 Racks) -Applicable to Thermal Sub-Contractor Only**<br>Provide at least One (1) **Projects with references (names and telephone of contact persons)** to which the company has undertaken as Data Centre Thermal Containment Installation in the last 8 **years.**<br>**Note**: Bidder to provide copies of **Note**: Bidder to provide copies of contracts, layout drawing of white space and completion certificates/letter from client clearly stating the nature of the contract, amount completion date as proof of having undertaken the works. | Each reference client will earn **10 marks** | **10** |

| | Evaluation Attribute | Weighting Score | Max Score |
|---|---|---|---|
| **T5** | **Original Equipment Manufacturers Partnership- Thermal Containment -Applicable to Thermal Sub-Contractor Only**<br>a) Proof of Company/Organization recognized by Manufacturer as a Business Partner capable of Implementation of Project using OEM Products –-5 Marks<br>b) Not Proof …0Marks | Maximum<br>**5 marks** | 5 |
| **T6** | **Original Equipment Manufacturers Partnership- Copper and Fiber Installations -Applicable to Copper and Fiber Sub-Contractor**<br>c) Proof of Company/Organization recognized by Manufacturer as a Business Partner capable of Implementation of Project using OEM Products – 5 Marks<br>**d)** Not Proof …0Marks | Maximum<br>**5 marks** | 5 |
| **T7** | **Original Equipment Manufacturers Partnership- UPS Equipment Installations -Applicable to UPS Sub-Contractor**<br>e) Proof of Company/Organization recognized by Manufacturer as a Business Partner capable of Implementation of Project using OEM Products – 5 Marks<br>Not Proof …0Marks | Maximum<br>**5 marks** | 5 |
| **T7** | Provide a list of at least Six (6) Qualified Technical Staff in the company relevant to the Data Center Industry<br>For any of the personnel provided to qualify, the following requirements MUST be met:<br>**A.** All technical staff provided MUST have as a minimum five years' post college experience in construction/Data Center Installation industry. Each personnel MUST indicate the firms he/she has worked in since graduation.<br>**B. Detailed Curriculum Vitae (CV's) of each staff MUST be attached.** The Curriculum Vitae MUST state qualification, experience, and duration with the firm and active contacts of the staff. The contacts given in the Curriculum Vitae MUST be active email addresses.<br>**C. Copies of academic certificates MUST be provided.**<br>**D.** The role of each technical staff should be indicated<br>Where personnel provide certificates of degrees from foreign institutions, a letter of recognition of the institution from the | | **30** |

| | Evaluation Attribute | Weighting Score | Max Score |
|---|---|---|---|
| | Commissioner of University Education of Kenya MUST be provided for the certificate to qualify | | |
| **T7.1** | **Project Manager Qualification**<br>a) Holder of Project Management certification – Minimum prince 2 or equivalent – 3 Marks<br>b) No Project Management certification – 0 marks<br>**Relevant Experience**<br>**a)** Similar works undertaken – 2 Marks<br>No similar works undertaken – 1 mark | Each criterium will earn maximum 5**marks** | |
| **T7.2** | **Electrical Supervisor Academic Qualification**<br>**a)** Holder of Degree in Electrical Engineering – 3 Marks<br>**b)** Holder of Diploma in Electrical Engineering – 1 mark<br>**Relevant Experience**<br>**a)** Similar works undertaken – 2 Marks<br>No similar works undertaken – 1 mark | Each criterium will earn maximum 5**marks** | |
| **T7.3** | **Building Works Supervisor Academic Qualification**<br>**a)** Holder of Degree in Architecture/Civil Engineering – 3 Marks<br>**b)** Holder of Diploma in Architecture/Civil Engineering – 1 mark<br>**Relevant Experience**<br>**a)** Similar works undertaken – 2 Marks<br>No similar works undertaken – 1 mark | Each criterium will earn maximum 5**marks** | |
| **T7.4** | **Air-conditioning Supervisor Academic Qualification**<br>**a)** Holder of Degree in Mechanical Engineering – 2 Marks<br>**b)** Holder of Diploma in Mechanical Engineering – 1 mark<br>**Professional Experience**<br>a) Manufacturer Certification for Precision Airconditioning Installation – 2 marks<br>b) No Manufacturer Certification – 0 Marks<br>**Relevant Experience**<br>**a)** Similar works undertaken – 1 Marks | Each criterium will earn maximum 5**marks** | |

| | Evaluation Attribute | Weighting Score | Max Score |
|---|---|---|---|
| | **b)** No similar works undertaken – 0 mark | | |
| **T7.5** | **Thermal Containment Supervisor**<br>**Academic Qualification**<br>**a)** Holder of Degree in Engineering/ Technology Field – 2 Marks<br>**b)** Holder of Diploma in Engineering/Technology – 1 marks<br>**Professional Experience**<br>**a)** Manufacturer certification for Thermal Containment – 2Marks<br>**b)** No Manufacturer Certification – 0 marks<br>**Relevant Experience**<br>**a)** Minimum 5 years of similar works experience – 2 Marks<br>**b)** No similar works experience of less than 5 years if any – 0 marks | Maximum 5 **marks** | |
| **T 7.6** | **Structured Cabling Supervisor Academic Qualification**<br>**Academic Qualification**<br>**c)** Holder of Degree in Engineering/ Technology Field – 2 Marks<br>**d)** Holder of Diploma in Engineering/Technology – 1 mark<br>**Professional Experience**<br>**c)** Manufacturer certified installer of copper and fiber installations– 2Marks<br>**d)** No Manufacturer Certification – 0 marks<br>**Relevant Experience**<br>**c)** Minimum 5 years of similar works experience – 2 Marks<br>**d)** No similar works experience of less than 5 years if any – 0 marks | Maximum 5 **marks** | |
| | **Total** | | **100** |

Tenderers will be required to score 75 % and above on the above Technical Evaluation on Qualification to qualify for financial evaluation.

**Stage 4: Financial Evaluation - Stage 4 of the Evaluation**

Tenderers scoring 75% and above will have their bids subjected to financial evaluation. Financial Evaluation will involve checking for completeness of the bill of quantities and ranking to determine

the lowest evaluated bidder. The lowest evaluated bidder will be recommended for award.

**Stage 5: Due Diligence**

The lowest evaluated bidder will be subjected to Due Diligence on specific experience quoted as part of the submission

**Recommendation of Award**

The lowest evaluated bidder will be recommended for consideration of award of the tender.

**MULTIPLE CONTRACTS: N/A**

Multiple contracts will not be permitted in accordance with ITT 35.4. Tenderers are evaluated on basis of the entire works and a lowest evaluated tenderer identified. The Procuring Entity will select one Option of the two Options listed below for award of Contracts.

**ALTERNATIVE TENDERS (ITT 13.1): N/A**

**MARGIN OF PREFERENCE**

If the **TDS** so specifies, the Procuring Entity will grant a margin of preference of fifteen percent (15%) to be loaded on evaluated prices of the foreign tenderers, where the percentage of share holding of Kenyan citizens is less than fifty- one percent (51%).

After Tenders have been received and reviewed by the Procuring Entity, responsive Tenders shall be assessed to ascertain their percentage of shareholding of Kenyan citizens. Responsive tenders shall be classified into the following groups:

a) Group A: tenders offered by Kenyan Contractors and other Tenderers where Kenyan citizens hold shares of over fifty one percent (51%).
b) Group B: tenders offered by foreign Contractors and other Tenderers where Kenyan citizens hold shares of less than fifty one percent (51%).

All evaluated tenders in each group shall, as a first evaluation step, be compared to determine the lowest tender, and the lowest evaluated tender in each group shall be further compared with each other. If, as a result of this comparison, a tender from Group A is the lowest, it shall be selected for the award of contract. If a tender from Group B is the lowest, an amount equal to the percentage indicated in Item 6.1 of the respective tender price, including unconditional discounts and excluding provisional sums and the cost of day works, if any, shall be added to the evaluated price offered in each tender from Group B. All tenders shall then be compared using new prices with added prices to Group B and the lowest evaluated tender from Group A. If the tender from Group A is still the lowest tender, it shall be selected for award. If not, the lowest evaluated tender from Group B based on the first evaluation price shall be selected.

**Post qualification and Contract ward (ITT 39), more specifically,**

**A.** In case the tender was subject to post-qualification, the contract shall be awarded to the lowest evaluated tenderer, subject to confirmation of pre-qualification data, if so required.

**B.** Incase the tender was not subject to post-qualification, the tender that has been determined to be the lowest evaluated tenderer shall be considered for contract award, subject to meeting each of the following conditions.

- The Tenderer shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means (independent of any contractual advance payment) sufficient to meet the

construction cash flow of Kenya Shillings **100Million**

- Minimum average annual construction turnover of Kenya Shillings **400Million**, equivalent calculated as total certified payments received for contracts in progress and/or completed within the last 3 years
- At least two of contract(s) of a similar nature executed within Kenya, that have been satisfactorily and substantially completed as a prime contractor, or joint venture member or sub-contractor each of minimum value Kenya shillings **100Million** equivalent.
- Contractor's Representative and Key Personnel, which are specified as_____
- Contractors key equipment listed on the table "Contractor's Equipment" below and more specifically listed as_____

**C.** Other conditions depending on their seriousness.

**i. History of non-performing contracts:**

Tenderer and each member of JV in case the Tenderer is a JV, shall demonstrate that Non- performance of a contract did not occur because of the default of the Tenderer, or the member of a JV in the last five years. The required information shall be furnished in the appropriate form.

**Pending Litigation**

Financial position and prospective long-term profit ability of the Single Tenderer, and in the case the Tenderer is a JV, of each member of the JV, shall remain sound according to criteria established with respect to Financial Capability under Paragraph (i) above if all pending litigation will be resolved against the Tenderer. Tenderer shall provide information on pending litigations in the appropriate form.

**ii. Litigation History**

There shall be no consistent history of court/arbitral award decisions against the Tenderer, in the last five. All parties to the contract shall furnish the information in the appropriate form about any litigation or arbitration resulting from contracts completed or on going unde rits execution over the years specified. A consistent history of awards against the Tenderer or any member of a JV may result in rejection of the tender.

**QUALIFICATION FORM***

| 1 | 2 | 3 | *4* | *5* |
|---|---|---|---|---|
| **Item No.** | **Qualification Subject** | **Qualification Requirement** | ***Document To be Completed by Tenderer*** | ***For Procuring Entity's Use (Qualification met or Not Met)*** |
| 1 | Nationality | Nationality in accordance with ITT 3.6 | Forms ELI – 1.1 and 1.2, with attachments | |
| 2 | Tax Obligations for Kenyan Tenderers | Has produced a current tax clearance certificate or tax exemption certificate issued by Kenya Revenue Authority in accordance with ITT 3.14. | Attachment | |
| 3 | Conflict of Interest | No conflicts of interest in accordance with ITT 3.3 | Form of Tender | |
| 4 | PPRA Eligibility | Not having been declared ineligible by the PPRA as described in ITT 3.7 | Form of Tender | |
| 5 | State- owned Enterprise | Meets conditions of ITT 3.8 | Forms ELI – 1.1 and 1.2, with attachments | |
| 6 | Goods, equipment and services to be supplied under the contract | To have their origin in any country that is not determined ineligible under ITT 4.1 | Forms ELI – 1.1 and 1.2, with attachments | |
| 7 | History of Non-Performing Contracts | Non-performance of a contract did not occur as a result of contractor default since 1st January [*…….]*. | Form CON-2 | |
| 8 | Suspension Based on Execution of Tender/Proposal Securing Declaration by the Procuring Entity | Not under suspension based on-execution of a Tender/Proposal Securing Declaration pursuant to ITT 19.9 | Form of Tender | |
| 9 | Pending Litigation | Tender's financial position and prospective long-term profitability still sound according to criteria established in 3.1 and assuming that all pending litigation will NOT be resolved against the Tenderer. | Form CON – 2 | |

| 1 | 2 | 3 | *4* | *5* |
|---|---|---|---|---|
| **Item No.** | **Qualification Subject** | **Qualification Requirement** | ***Document To be Completed by Tenderer*** | ***For Procuring Entity's Use (Qualification met or Not Met)*** |
| 10 | Litigation History | No consistent history of court/arbitral award decisions against the Tenderer since 1st January *2018*. | Form CON – 2 | |
| 11 | Financial Capabilities | (i) The Tenderer shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means (independent of any contractual advance payment) sufficient to meet the construction cash flow requirements estimated as Kenya Shillings 100million equivalent for the subject contract(s) net of the Tenderer's other commitments.<br><br>(ii) The Tenderers shall also demonstrate, to the satisfaction of the Procuring Entity, that it has adequate sources of finance to meet the cash flow requirements on works currently in progress and for future contract commitments.<br><br>(iii) The audited balance sheets or, if not required by the laws of the Tenderer's country, other financial statements acceptable to the Procuring Entity, for the last three years shall be submitted and must demonstrate the current soundness of the Tenderer's financial position and indicate its prospective long-term profitability. | Form FIN – 3.1, with attachments | |

| 1 | 2 | 3 | *4* | *5* |
|---|---|---|---|---|
| **Item No.** | **Qualification Subject** | **Qualification Requirement** | ***Document To be Completed by Tenderer*** | ***For Procuring Entity's Use (Qualification met or Not Met)*** |
| 12 | Average Annual Construction Turnover | Minimum average annual construction turnover of Kenya Shillings *400 Million*, equivalent calculated as total certified payments received for contracts in progress and/or completed within the last *three* years, divided by *three* | Form FIN – 3.2 | |
| 13 | General Construction Experience | Experience under construction contracts in the role of prime contractor, JV member, sub-contractor, or management contractor for at least the last *seven years* starting 1st January *2018*. | Form EXP – 4.1 | |
| 14 | Specific Construction & Contract Management Experience | A minimum number of *two* similar contracts specified below that have been satisfactorily and substantially completed as a prime contractor, joint venture member, management contractor or sub-contractor between 1st January, 2018 and tender submission deadline i.e. …. (number) contracts, each of minimum value Kenya shillings 100Million equivalent. | Form EXP 4.2(a) | |

## SECTION IV - TENDERING FORMS

### QUALIFICATION FORMS

### 1. FOREIGN TENDERERS 40%RULE: Not Applicable (N/A)

Pursuant to ITT 3.9, a foreign tenderer must complete this form to demonstrate that the tender fulfils this condition.

| ITEM | Description of Work Item | Describe location of Source | COST in K. shillings | Comments, if any |
|---|---|---|---|---|
| A | Local Labor | | | |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| B | Sub contracts from Local sources | | | |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| C | Local materials | | | |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| D | Use of Local Plant and Equipment | | | |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| E | Add any other items | | | |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| | TOTAL COST LOCAL CONTENT | | XXXXX | |
| | PERCENTAGE OF CONTRACT PRICE | | | |

## 2. FORMEQU: EQUIPMENT

The Tenderer shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section III, Evaluation and Qualification Criteria. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Tenderer.

| Item of equipment | | |
|---|---|---|
| Equipment information | Name of manufacturer | Model and power rating |
| | Capacity | Year of manufacture |
| Current status | Current location | |
| | Details of current commitments | |
| Source | Indicate source of the equipment<br>☐ Owned ☐ Rented ☐ Leased ☐ Specially manufactured | |

Omit the following information for equipment owned by the Tenderer.

| Owner | Name of owner | |
|---|---|---|
| | Address of owner | |
| | Telephone | Contact name and title |
| | Fax | Telex |
| Agreements | Details of rental / lease / manufacture agreements specific to the project | |
| | | |
| | | |

**3. FORM PER -1**

**Contractor's Representative and Key Personnel Schedule**

Tenderers should provide the names and details of the suitably qualified Contractor's Re presentative and Key Personnel to perform the Contract. The data on their experience should be supplied using the Form PER-2 below for each candidate.

**Contractor' Representative and Key Personnel**

| | | |
|---|---|---|
| **1.** | **Title of position:** Contractor's Representative | |
| | **Name of candidate:** | |
| | **Duration of appointment:** | [*insert the whole period (start and end dates) for which this position will be engaged*] |
| | **Time commitment: for this position:** | [*insert the number of days/week/months/ that has been scheduled for this position*] |
| | **Expected time schedule for this position:** | [*insert the expected time schedule for this position (e.g. attach high level Gantt chart*] |
| **2.** | **Title of position:** *[_____]* | |
| | **Name of candidate:** | |
| | **Duration of appointment:** | [*insert the whole period (start and end dates) for which this position will be engaged*] |
| | **Time commitment: for this position:** | [*insert the number of days/week/months/ that has been scheduled for this position*] |
| | **Expected time schedule for this position:** | [*insert the expected time schedule for this position (e.g. attach high level Gantt chart*] |
| **3.** | **Title of position:** *[_____]* | |
| | **Name of candidate:** | |
| | **Duration of appointment:** | [*insert the whole period (start and end dates) for which this position will be engaged*] |
| | **Time commitment: for this position:** | [*insert the number of days/week/months/ that has been scheduled for this position*] |
| | **Expected time schedule for this position:** | [*insert the expected time schedule for this position (e.g. attach high level Gantt chart*] |
| **4.** | **Title of position:** *[_____]* | |
| | **Name of candidate:** | |
| | **Duration of appointment:** | [*insert the whole period (start and end dates) for which this position will be engaged*] |
| | **Time commitment: for this position:** | [*insert the number of days/week/months/ that has been scheduled for this position*] |

| | | |
|---|---|---|
| | **Expected time schedule for this position:** | [*insert the expected time schedule for this position (e.g. attach high level Gantt chart*] |
| **5.** | **Title of position:** *[insert title]* | |
| | **Name of candidate** | |
| | **Duration of appointment:** | [*insert the whole period (start and end dates) for which this position will be engaged*] |
| | **Time commitment: for this position:** | [*insert the number of days/week/months/ that has been scheduled for this position*] |
| | **Expected time schedule for this position:** | [*insert the expected time schedule for this position (e.g. attach high level Gantt chart*] |

**4. FORM PER - 2:**

Resume and Declaration - Contractor's Representative and Key Personnel.

| Name of Tenderer |
|---|

| Position [*#1*]: [*title of position from Form PER-1*] | | |
|---|---|---|
| Personnel information | Name: | Date of birth: |
| | Address: | E-mail: |
| | | |
| | Professional qualifications: | |
| | Academic qualifications: | |
| | Language proficiency: *[language and levels of speaking, reading and writing skills]* | |
| Details | | |
| | Address of Procuring Entity: | |
| | Telephone: | Contact (manager / personnel officer): |
| | Fax: | |
| | Job title: | Years with present Procuring Entity: |

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

| Project | Role | Duration of involvement | Relevant experience |
|---|---|---|---|
| *[main project details]* | *[role and responsibilities on the project]* | *[time in role]* | *[describe the experience relevant to this position]* |
| | | | |
| | | | |
| | | | |

**Declaration**

I, the undersigned *[insert either "Contractor's Representative" or "Key Personnel" as applicable]*, certify that to the best of my knowledge and belief, the information contained in this Form PER-2 correctly describes myself, my qualifications and my experience.

I confirm that I am available as certified in the following table and throughout the expected time schedule for this position as provided in the Tender:

| **Commitment** | **Details** |
|---|---|
| Commitment to duration of contract: | *[insert period (start and end dates) for which this Contractor's Representative or Key Personnel is available to work on this contract]* |
| Time commitment: | *[insert period (start and end dates) for which this Contractor's Representative or Key Personnel is available to work on this contract]* |

I understand that any misrepresentation or omission in this Form may:

(a) be taken into consideration during Tender evaluation;
(b) result in my disqualification from participating in the Tender;
(c) result in my dismissal from the contract.

Name of Contractor's Representative or Key Personnel: [*insert name*]

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Tenderer:

Signature: _____

Date: (day month year): _____

## 5. TENDERERS QUALIFICATION WITHOUT PREQUALIFICATION

To establish its qualifications to perform the contract in accordance with Section III, Evaluation and Qualification Criteria the Tenderer shall provide the information requested in the corresponding Information Sheets included hereunder.

### 5.1 FORM ELI -1.1 Tenderer Information Form

Date:_____

ITT No. and title:_____

| |
|---|
| Tenderer's name |
| In case of Joint Venture (JV), name of each member: |
| Tenderer's actual or intended country of registration:<br>*[indicate country of Constitution]* |
| Tenderer's actual or intended year of incorporation: |
| Tenderer's legal address [in country of registration]: |
| Tenderer's authorized representative information<br>Name: _____<br>Address: _____<br>Telephone/Fax numbers: _____<br>E-mail address: _____ |
| 1. Attached are copies of original documents of<br>☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITT 3.6<br>☐ In case of JV, letter of intent to form JV or JV agreement, in accordance with ITT 3.5<br>☐In case of state-owned enterprise or institution, in accordance with ITT 3.8, documents establishing:<br>• Legal and financial autonomy<br>• Operation under commercial law<br>1. Establishing that the Tenderer is not under the supervision of the Procuring Entity<br>2. Included are the organizational chart and a list of Board of Directors |

**5.2 FORM ELI -1.2**
**Tenderer's JV Information Form**
**(to be completed for each member of Tenderer's JV)**

Date:_____

ITT No. and title:_____

| |
|---|
| Tenderer's JV name: |
| JV member's name: |
| JV member's country of registration: |
| JV member's year of constitution: |
| JV member's legal address in country of constitution: |
| JV member's authorized representative information<br>Name: _____<br>Address: _____<br>Telephone/Fax numbers: _____<br>E-mail address: _____ |
| 1. Attached are copies of original documents of<br>☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITT 3.6.<br>☐ In case of a state-owned enterprise or institution, documents establishing legal and financial autonomy, operation in accordance with commercial law, and that they are not under the supervision of the Procuring Entity, in accordance with ITT 3.5.<br><br>2. Included are the organizational chart and a list of Board of Directors. |

**5.3 FORM CON –2**

**Historical Contract Non-Performance, Pending Litigation and Litigation History**

Tenderer's Name: _____

Date: _____

JV Member's Name_____

ITT No. and title: _____

| Non-Performed Contracts in accordance with Section III, Evaluation and Qualification Criteria | | | |
|---|---|---|---|
| ☐ Contract non-performance did not occur since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, Sub-Factor 2.1.<br><br>☐ Contract(s) not performed since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, requirement 2.1<br><br>☐ Contract(s) withdrawn since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, requirement 2.1 | | | |
| **Year** | **Non-performed portion of contract** | **Contract Identification** | **Total Contract Amount (current value, currency, exchange rate and Kenya Shilling equivalent)** |
| *[insert year]* | *[insert amount and percentage]* | Contract Identification: *[indicate complete contract name/ number, and any other identification]*<br>Name of Procuring Entity: *[insert full name]*<br>Address of Procuring Entity: *[insert street/city/country]*<br>Reason(s) for nonperformance: *[indicate main reason(s)]* | *[insert amount]* |
| Pending Litigation, in accordance with Section III, Evaluation and Qualification Criteria | | | |
| ☐ No pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3.<br>☐ Pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3 as indicated below. | | | |

| Year of dispute | Amount in dispute (currency) | Contract Identification | Total Contract Amount (currency), Kenya Shilling Equivalent (exchange rate) |
|---|---|---|---|
| | | Contract Identification: _____<br>Name of Procuring Entity: _____<br>Address of Procuring Entity: _____<br>Matter in dispute: _____<br>Party who initiated the dispute: ____<br>Status of dispute: _____ | |
| | | Contract Identification:<br>Name of Procuring Entity:<br>Address of Procuring Entity:<br>Matter in dispute:<br>Party who initiated the dispute:<br>Status of dispute: | |
| Litigation History in accordance with Section III, Evaluation and Qualification Criteria | | | |
| ☐ No Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4.<br>☐ Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4 as indicated below. | | | |
| *[insert year]* | *[insert percentage]* | Contract Identification: [indicate complete contract name, number, and any other identification]<br>Name of Procuring Entity: *[insert full name]*<br>Address of Procuring Entity: *[insert street/city/country]*<br>Matter in dispute: *[indicate main issues in dispute]*<br>Party who initiated the dispute: *[indicate "Procuring Entity" or "Contractor"]*<br>Reason(s) for Litigation and award decision *[indicate main reason(s)]* | *[insert amount]* |

Include details relating to potential bid-rigging practices such as previous occasions where tenders were withdrawn, joint bids with competitors, subcontracting work to unsuccessful tenderers, etc.

**5.4 FORM FIN – 3.1:**

**Financial Situation and Performance**

Tenderer's Name: _____
Date: _____
JV Member's Name_____
ITT No. and title: _____

**5.4.1 Financial Data**

| **Type of Financial information in_____ (currency)** | **Historic information for previous _____*years,*** _____ **(amount in currency, currency, exchange rate*, USD equivalent)** | | | | |
|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| Statement of Financial Position (Information from Balance Sheet) | | | | | |
| Total Assets (TA) | | | | | |
| Total Liabilities (TL) | | | | | |
| Total Equity/Net Worth (NW) | | | | | |
| Current Assets (CA) | | | | | |
| Current Liabilities (CL) | | | | | |
| Working Capital (WC) | | | | | |
| Information from Income Statement | | | | | |
| Total Revenue (TR) | | | | | |
| Profits Before Taxes (PBT) | | | | | |
| Cash Flow Information | | | | | |
| Cash Flow from Operating Activities | | | | | |

*Refer to ITT 15 for the exchange rate

### 5.4.2 Sources of Finance

Specify sources of finance to meet the cash flow requirements on works currently in progress and for future contract commitments.

| No. | Source of finance | Amount (Kenya Shilling equivalent) |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |

### 5.4.3 Financial documents

The Tenderer and its parties shall provide copies of financial statements for _____years pursuant Section III, Evaluation and Qualifications Criteria, Sub-factor 3.1. The financial statements shall:

(a) reflect the financial situation of the Tenderer or in case of JV member, and not an affiliated entity (such as parent company or group member).

(b) be independently audited or certified in accordance with local legislation.

(c) be complete, including all notes to the financial statements.

(d) correspond to accounting periods already completed and audited.

☐ Attached are copies of financial statements[1] for the _____ years required above; and complying with the requirements

### 5.5 FORM FIN – 3.2:

**Average Annual Construction Turnover**

Tenderer's Name: _____

Date: _____

JV Member's Name_____

ITT No. and title: _____

| | Annual turnover data (construction only) | | |
|---|---|---|---|
| **Year** | **Amount Currency** | **Exchange rate** | **Kenya Shilling equivalent** |
| *[indicate year]* | *[insert amount and indicate currency]* | | |

[1] If the most recent set of financial statements is for a period earlier than 12 months from the date of Tender, the reason for this should be justified.

| | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| Average Annual Construction Turnover * | | | |

* See Section III, Evaluation and Qualification Criteria, Sub-Factor 3.2.

**5.6 FORM FIN – 3.3:**

**Financial Resources**

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract or contracts as specified in Section III, Evaluation and Qualification Criteria

| **Financial Resources** | | |
|---|---|---|
| **No.** | **Source of financing** | **Amount (Kenya Shilling equivalent)** |
| 1 | | |
| 2 | | |
| 3 | | |
| | | |

**5.7 FORM FIN – 3.4:**

**Current Contract Commitments / Works in Progress**

Tenderers and each member to a JV should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

**Current Contract Commitments**

| No. | Name of Contract | Procuring Entity's Contact Address, Tel, | Value of Outstanding Work [Current Kenya Shilling /month Equivalent] | Estimated Completion Date | Average Monthly Invoicing Over Last Six Months [Kenya Shilling /month)] |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| | | | | | |

**5.8 FORM EXP - 4.1**

**General Construction Experience**

Tenderer's Name: _____
Date: _____
JV Member's Name_____
ITT No. and title: _____

Page _____of _____pages

| Starting Year | Ending Year | Contract Identification | Role of Tenderer |
|---|---|---|---|
| | | Contract name: _____<br>Brief Description of the Works performed by the Tenderer: _____<br>Amount of contract: _____<br>Name of Procuring Entity: _____<br>Address: _____ | |
| | | Contract name: _____<br>Brief Description of the Works performed by the Tenderer: _____<br>Amount of contract: _____<br>Name of Procuring Entity: _____<br>Address: _____ | |
| | | Contract name: _____<br>Brief Description of the Works performed by the Tenderer: _____<br>Amount of contract: _____<br>Name of Procuring Entity: _____<br>Address: _____ | |

## 5.9 FORM EXP - 4.2(a)

**Specific Construction and Contract Management Experience**

Tenderer's Name: _____
Date: _____
JV Member's Name_____
ITT No. and title: _____

| **Similar Contract No.** | **Information** | | | |
|---|---|---|---|---|
| Contract Identification | | | | |
| Award date | | | | |
| Completion date | | | | |
| Role in Contract | Prime Contractor ☐ | Member in JV ☐ | Management Contractor ☐ | Sub-contractor ☐ |
| Total Contract Amount | | | **Kenya Shilling** | |
| If member in a JV or sub-contractor, specify participation in total Contract amount | | | | |
| Procuring Entity's Name: | | | | |
| Address:<br>Telephone/fax number<br>E-mail: | | | | |

## 5.10 FORM EXP - 4.2(a)

**Specific Construction and Contract Management Experience**

Tenderer's Name: _____
Date: _____
JV Member's Name_____
ITT No. and title: _____

| **Similar Contract No.** | **Information** | | | |
|---|---|---|---|---|
| Contract Identification | | | | |
| Award date | | | | |
| Completion date | | | | |
| Role in Contract | Prime Contractor ☐ | Member in JV ☐ | Management Contractor ☐ | Sub-contractor ☐ |
| Total Contract Amount | | | **Kenya Shilling** | |
| If member in a JV or sub-contractor, specify participation in total Contract amount | | | | |
| Procuring Entity's Name: | | | | |
| Address:<br>Telephone/fax number<br>E-mail: | | | | |

## 5.11 FORM EXP - 4.2 (a) (cont.)

**Specific Construction and Contract Management Experience (cont.)**

| **Similar Contract No.** | **Information** |
|---|---|
| Description of the similarity in accordance with Sub-Factor 4.2(a) of Section III: | |
| 1. Amount | |
| 2. Physical size of required works items | |
| 3. Complexity | |
| 4. Methods/Technology | |
| 5. Construction rate for key activities | |
| 6. Other Characteristics | |

## 5.12 FORM EXP - 4.2(b)

**Construction Experience in Key Activities**

Tenderer's Name: _____
Date: _____
Tenderer's JV Member Name: _____
Sub-contractor's Name[2] (as per ITT 34): _____
ITT No. and title: _____

All Sub-contractors for key activities must complete the information in this form as per ITT 34 and Section III, Evaluation and Qualification Criteria, Sub-Factor 4.2.

1. Key Activity No One: _ _____

| | **Information** | | | |
|---|---|---|---|---|
| Contract Identification | | | | |
| Award date | | | | |
| Completion date | | | | |
| Role in Contract | Prime Contractor ☐ | Member in JV ☐ | Management Contractor ☐ | Sub-contractor ☐ |
| Total Contract Amount | | | **Kenya Shilling** | |
| Quantity (Volume, number or rate of production, as applicable) performed under the contract per year or part of the year | Total quantity in the contract (i) | Percentage participation (ii) | | Actual Quantity Performed (i) x (ii) |
| Year 1 | | | | |
| Year 2 | | | | |
| Year 3 | | | | |
| Year 4 | | | | |
| Procuring Entity's Name: | | | | |
| Address:<br>Telephone/fax number<br>E-mail: | | | | |

[2] If applicable

| | **Information** |
|---|---|
| Description of the key activities in accordance with Sub-Factor 4.2(b) of Section III: | |
| | |
| | |
| | |
| | |
| | |

2. Activity No. Two
3. ……

**OTHER FORMS**

## 1. FORM OF TENDER

***INSTRUCTIONS TO TENDERERS***

*i) All italicized text i t help the Tenderer in preparing this form.*

*ii) The Tenderer must prepare this Form of Tender on stationery with its letterhead clearly showing the Tenderer's complete name and business address. Tenderers are reminded that this is a mandatory requirement.*

*iii) Tenderer must complete and sign CERTIFICATE OF INDEPENDENT TENDER DETERMINATION and the SELF DECLARATION FORMS OF THE TENDERER as listed under (xxii) below.*

**Date of this Tender submission**:.....*[insert date (as day, month and year) of Tender submission]* **Tender Name and Identification**:.....*[insert identification]*

**Alternative No.**:.....*[insert identification No if this is a Tender for an alternative]*

To: ..... *[Insert complete name of Procuring Entity]*

**Date of this Tender submission**: *[insert date (as day, month and year) of Tender submission]* **Request for Tender No.:** *[insert identification]* **Name and description of Tender** *[Insert as per ITT)* **Alternative No.:** *[insert identification No if this is a Tender for an alternative]*

**To:** *[insert complete name of Procuring Entity]*

Dear Sirs,

1. In accordance with the Conditions of Contract, Specifications, Drawings and Bills of Quantities for the execution of the above named Works, we, the undersigned offer to construct and complete the Works and remedy any defects therein for the sum[3] of Kenya Shillings [*[Amount in figures]* _____Kenya Shillings *[amount in words]*_____

   The above amount includes foreign currency[4] amount (s) of [*state figure or a percentage and currency*] [figures]_____[words] _____
   _____

2. We undertake, if our tender is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Architect notice to commence, and to complete the whole of the Works comprised in the Contract within _____ calendar weeks being within the time

[3] *This sum should be carried forward from the Summary of the Bills of Quantities.*

[4] *The percentage quoted above should not include provisional sums, and not more than two foreign currencies are allowed.*

stated in the Special Conditions of Contract.

3. We agree to adhere by this tender until_____*[Insert date],* and it shall remain binding upon us and may be accepted at any time before that date.

4. We understand that you are not bound to accept the lowest or any tender you may receive.

5. We, the under signed, further declare that:

   i) No reservations: We have examined and have no reservations to the tender document, including Addenda issued in accordance with ITT 28;

   ii) Eligibility: We meet the eligibility requirements and have no conflict of interest in accordance with ITT 3 and 4;

   iii) Tender - Securing Declaration: We have not been suspended nor declared ineligible by the Procuring Entity based on execution of a Tender-Securing or Proposal-Securing Declaration in the Procuring Entity's Country in accordance with ITT 19.8;

   *iv)* Conformity: We offer to execute in conformity with the tendering documents and in accordance with the implementation and completion specified in the construction schedule, the following Works: *[insert a brief description of the Works];*

   *v)* Tender Price: The total price of our Tender, excluding any discounts offered in item 1 above is: *[Insert one of the options below as appropriate]*

   vi Option 1, incase of one lot: Total price is: *[insert the total price of the Tender in words and figures, indicating the various amounts and the respective currencies*]; or

   Option2, in case of multiple lots:

   (a) Total price of each lot [*insert the total price of each lot in words and figures, indicating the various amounts and the respective currencies*]; and

   (b) Total price of all lots (sum of all lots) [*insert the total price of all lots in words and figures, indicating the various amounts and the respective currencies*];

   vii) Discounts: The discounts offered and the methodology for their application are:

   viii) The discounts offered are: [*Specify in detail each discount offered.*]

   ix) The exact method of calculations to determine the net price after application of discounts is shown below: [*Specify in detail the method that shall be used to apply the discounts*];

   x) Tender Validity Period: Our Tender shall be valid for the period **140 Days** from the date fixed for the Tender submission deadline specified in **TDS** 22.1 (as amended, if applicable), and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

   xi) Performance Security: If our Tender is accepted, we commit to obtain a Performance Security in accordance with the Tendering document;

   xii) One Tender Per Tender: Weare not submitting any other Tender(s) as an individual Tender, and we are not participating in any other Tender(s) as a Joint Venture member or as a sub-contractor, and meet the requirements of ITT 3.4, other than alternative Tenders submitted in accordance with ITT 13.3;

xiii) Suspension and Debarment: We, along with any of our subcontractors, suppliers, Engineer, manufacturers, or service providers for any part of the contract, are not subject to, and not controlled by any entity or individual that is subject to, a temporary suspension or a debarment imposed by the Public Procurement Regulatory Authority or any other entity of the Government of Kenya, or any international organization.

xiv) State-owned enterprise or institution: [*select the appropriate option and delete the other*] [*We are not a state- owned enterprise or institution*]/[*We are a state-owned enterprise or institution but meet the requirements of ITT3.8*];

xv*)* Commissions, gratuities, fees: We have paid, or will pay the following commissions, gratuities, or fees with respect to the tender process or execution of the Contract: *[insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount and currency of each such commission or gratuity]*.

| Name of Recipient | Address | Reason | Amount |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

*(If none has been paid or is to be paid, indicate "none.")*

xvi) Binding Contract: We understand that this Tender, together with your written acceptance there of included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;

xvii) Not Bound to Accept: We understand that you are not bound to accept the lowest evaluated cost Tender, the Most Advantageous Tender or any other Tender that you may receive;

xviii) Fraud and Corruption: We here by certify that we have taken steps to ensure that no person acting for us or on our behalf engages in any type of Fraud and Corruption; and

xix) Collusive practices: We hereby certify and confirm that the tender is genuine, non-collusive and made with the intention of accepting the contract if awarded. To this effect we have signed the "Certificate of Independent Tender Determination" attached below.

xx) We undertake to adhere by the Code of Ethics for Persons Participating in Public Procurement and Asset Disposal, copy available from___(*specify website*) during the procurement process and the execution of any resulting contract.

xxi) **Beneficial Ownership Information:** We commit to provide to the procuring entity the Beneficial Ownership Information in conformity with the Beneficial Ownership Disclosure Form upon receipt of notification of intention to enter into a contract in the event we are the successful tenderer in this subject procurement proceeding.

xxii) We, the Tenderer, have duly completed, signed and stamped the following Forms as part of our Tender:

a) Tenderer's Eligibility; Confidential Business Questionnaire - to establish we are no tin any conflict to interest.

(b) Certificate of Independent Tender Determination - to declare that we completed the

tender without colluding with other tenderers.

(a) Self-Declaration of the Tenderer - to declare that we will, if awarded a contract, not engage in any form of fraud and corruption.

(d) Declaration and commitment to the Code of Ethics for Persons Participating in Public Procurement and Asset Disposal.

Further, we confirm that we have read and understood the full content and scope of fraud and corruption as informed in **"Appendix 1 - Fraud and Corruption**" attached to the Form of Tender.

**Name of the Tenderer:** *[*insert complete name of person signing the Tender*]

**Name of the person duly authorized to sign the Tender on behalf of the Tenderer:** **[*insert complete name of person duly authorized to sign the Tender*]

**Title of the person signing the Tender**: [*insert complete title of the person signing the Tender*]

**Signature of the person named above**: [*insert signature of person whose name and capacity are shown above*]

**Date signed** [*insert date of signing*] day of [*insert month*], [*insert year*]

Date signed_____day of_____,_____

Notes
** In the case of the Tender submitted by joint venture specify the name of the Joint Venture as Tenderer.*
***Person signing the Tender shall have the power of attorney given by the Tenderer to be attached with the Tender.*

## a. TENDERER'S ELIGIBILITY-CONFIDENTIAL BUSINESS QUESTIONNAIRE

**Instruction to Tenderer**

Tender is in structed to complete the particulars required in this Form, *one form for each entity if Tender is a JV*. Tenderer isfurtherreminded that it is an offence to give false information on this Form.

### a) Tenderer's details

| | ITEM | DESCRIPTION |
|---|---|---|
| 1 | Name of the Procuring Entity | |
| 2 | Reference Number of the Tender | |
| 3 | Date and Time of Tender Opening | |
| 4 | Name of the Tenderer | |
| 5 | Full Address and Contact Details of the Tenderer. | 1. Country<br>2. City<br>3. Location<br>4. Building<br>5. Floor<br>6. Postal Address<br>7. Name and email of contact person. |
| 6 | Current Trade License Registration Number and Expiring date | |
| 7 | Name, country and full address (*postal and physical addresses, email, and telephone number*) of Registering Body/Agency | |
| 8 | Description of Nature of Business | |
| 9 | Maximum value of business which the Tenderer handles. | |
| 10 | State if Tenders Company is listed in stock exchange, give name and full address (*postal and physical addresses, email, and telephone number*) of<br>state which stock exchange | |

## General and Specific Details

**(a) Sole Proprietor,** provide the following details.

Name in full_____Age_____
Nationality_____Country of Origin_____
Citizenship_____

**(b) Partnership,** provide the following details.

| | Names of Partners | Nationality | Citizenship | % Shares owned |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |

**(c) Registered Company,** provide the following details.

I) Private or public Company _____
ii) State the nominal and issued capital of the Company_____

Nominal Kenya Shillings (Equivalent).....
Issued Kenya Shillings (Equivalent).....

iii) Give details of Directors as follows.

| | Names of Director | Nationality | Citizenship | % Shares owned |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |

**(d) DISCLOSURE OF INTEREST - Interest of the Firm in the Procuring Entity.**

i) Are there any person/persons in…… (*Name of Procuring Entity)* who has/have an interest or relationship in this firm? Yes/No……

If yes, provide details as follows.

| | Names of Person | Designation in the Procuring Entity | Interest or Relationship with Tenderer |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

**(i) Conflict of interest disclosure**

| | Type of Conflict | Disclosure YES OR NO | If YES provide details of the relationship with Tenderer |
|---|---|---|---|
| 1 | Tenderer is directly or indirectly controls, is controlled by or is under common control with another tenderer. | | |
| 2 | Tenderer receives or has received any direct or indirect subsidy from another tenderer. | | |
| 3 | Tenderer has the same legal representative as another tenderer | | |

| | Type of Conflict | Disclosure YES OR NO | If YES provide details of the relationship with Tenderer |
|---|---|---|---|
| 4 | Tender has a relationship with another tenderer, directly or through common third parties, that puts it in a position to influence the tender of another tenderer, or influence the decisions of the Procuring Entity regarding this tendering process. | | |
| 5 | Any of the Tenderer's affiliates participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the tender. | | |
| 6 | Tenderer would be providing goods, works, non-consulting services or consulting services during implementation of the contract specified in this Tender Document. | | |
| 7 | Tenderer has a close business or family relationship with a professional staff of the Procuring Entity who are directly or indirectly involved in the preparation of the Tender document or specifications of the Contract, and/or the Tender evaluation process of such contract. | | |
| 8 | Tenderer has a close business or family relationship with a professional staff of the Procuring Entity who would be involved in the implementation or supervision of the such Contract. | | |
| 9 | Has the conflict stemming from such relationship stated in item 7 and 8 above been resolved in a manner acceptable to the Procuring Entity throughout the tendering process and execution of the Contract. | | |

**Certification**

On behalf of the Tenderer, I certify that the information given above is complete, current and accurate as at the date of submission.

Full Name_____

Title or Designation_____

_____ _____

*(Signature)* *(Date)*

**b. CERTIFICATE OF INDEPENDENT TENDER DETERMINATION**

I, the undersigned, in submitting the accompanying Letter of Tender to the_____
_____*[Name of Procuring Entity]*
for:_____*[Name and number of tender]*
in response to the request for tenders made by:_____*[Name of Tenderer]* do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of_____*[Name of Tenderer]* that:

1. I have read and I understand the contents of this Certificate;

2. I understand that the Tender will be disqualified if this Certificate is found not to be true and complete in every respect;

3. I am the authorized representative of the Tenderer with authority to sign this Certificate, and to submit the Tender on behalf of the Tenderer;

4. For the purposes of this Certificate and the Tender, I understand that the word "competitor" shall include any individual or organization, other than the Tenderer, whether or not affiliated with the Tenderer, who:

   a) Has been requested to submit a Tender in response to this request for tenders;
   b) could potentially submit a tender in response to this request for tenders, based on their qualifications, abilities or experience;

5. The Tenderer discloses that [check one of the following, as applicable]:

   a) The Tenderer has arrived at the Tender independently from, and without consultation, communication, agreement or arrangement with, any competitor;

   b) theTenderer has entered into consultations, communications, agreements or arrangements with one or more competitors regarding this request for tenders, and the Tenderer discloses, in the attached document(s), complete details thereof, including the names of the competitors and the nature of, and reasons for, such consultations, communications, agreements or arrangements;

6. In particular, without limiting the generality of paragraphs (5)(a) or(5)(b) above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:

   a) prices;

   b) methods, factors or formulas used to calculate prices;

   c) the intention or decision to submit, or not to submit, a tender; or

   d) the submission of a tender which does not meet the specifications of the request for Tenders; except as specifically disclosed pursuan tto paragraph (5)(b) above;

7. In addition, there has been no consultation, communication, agreement or arrangement with any competitor regarding the quality, quantity, specifications or delivery particulars of the works or services to which this request for tenders relates, except as specifically authorized by the procuring authority or as specifically disclosed pursuant to paragraph(5)(b) above;

8. The terms of the Tender have not been, and will not be, knowingly disclosed by the Tenderer, directly or indirectly, to any competitor, prior to the date and time of the official tender opening, or of the awarding of the Contract, whichever comes first, unless otherwise required

byl aw or as specifically disclosed pursuant to paragraph (5)(b) above.

Name_____

Title_____

Date _____

*[Name, title and signature of authorized agent of Tenderer and Date]*

**c. SELF- DECLARATION FORMS**

## FORM SD1

**SELF DECLARATION THAT THE PERSON/TENDERER IS NOT DEBARRED IN THE MATTER OF THE PUBLIC PROCUREMENT AND ASSET DISPOSAL ACT 2015.**

I, ……., of Post Office Box ……..…… being a resident of…….. in the Republic of ……. do hereby make a statement as follows: -

1. THAT I am the Company Secretary/ Chief Executive/Managing Director/Principal Officer/Director of
   ……..…….. *(insert name of the Company)* who is a Bidder in respect of **Tender No.**
   **……..** for ……. *(insert tender title/description)* for ……. *(insert name of the Procuring entity)* and duly authorized and competent to make this statement.

2. THAT the aforesaid Bidder, its Directors and subcontractors have not been debarred from participating in procurement proceeding under Part IV of the Act.

3. THAT what is deponed to here in above is true to the best of my knowledge, information and belief.

| …… | …… | …… |
|---|---|---|
| (Title) | (Signature) | (Date) |

Bidder Official Stamp

## FORM SD2

**SELF DECLARATION THAT THE PERSON/TENDERER WILL NOT ENGAGE IN ANY CORRUPT OR FRAUDULENT PRACTICE.**

I, ……of P.O. Box ……..…… being a resident of …….. in the Republic of …… do hereby make a statement as follows: -

1. THAT I am the Chief Executive/Managing Director/Principal Officer/Director of ……..... (insert name of the Company) who is a Bidder in respect of **Tender No.**…… for …… *(insert tender title/description)* for …… *(insert name of the Procuring entity)* and duly authorized and competent to make this statement.

2. THAT the aforesaid Bidder, its servants and/or agents/subcontractors will not engage in any corrupt or fraudulent practice and has not been requested to pay any inducement to any member of the Board, Management, Staff and/or employees and/or agents of …… *(insert name of the Procuring entity)* which is the procuring entity.

3. THAT the aforesaid Bidder, its servants and/or agents /subcontractors have not offered any inducement to any member of the Board, Management, Staff and/or employees and/or agents of …… *(name of the procuring entity)*.

4. THAT the aforesaid Bidder will not engage /has not engaged in any corrosive practice with other bidders participating in the subject tender

5. THAT what is deponed to here in above is true to the best of my knowledge information and belief.

…… ……
……..…… (Title) (Signature)
(Date)

Bidder's Official Stamp

**DECLARATION AND COMMITMENT TO THE CODE OF ETHICS**

I …… (person) on behalf of ***(Name of the Business/ Company/Firm***)
.....
…….. declare that I have read and fully understood the contents of the Public Procurement & Asset Disposal Act, 2015, Regulations and the Code of Ethics for persons participating in Public Procurement and Asset Disposal and my responsibilities under the Code.

I do here by commit to abide by the provisions of the Code of Ethics for persons participating in Public Procurement and Asset Disposal.

Name of Authorized
signatory.....

Sign…….....

Position.....
..

Office address.....

Telephone..... E-

mail…….....

.....

Name of the
Firm/Company…….....

Date…….....

**(Company Seal/ Rubber Stamp where applicable)**

Witness

Name…….....

.....

Sign…….....

Date…….....

## d. APPENDIX 1 - FRAUD AND CORRUPTION

*(Appendix 1 shall not be modified)*

### 1. Purpose

1.1 The Government of Kenya's Anti-Corruption and Economic Crime laws and their sanction's policies and procedures, Public Procurement and Asset Disposal Act *(no. 33 of 2015)* and its Regulation, and any other Kenya's Acts or Regulations related to Fraud and Corruption, and similar offences, shall apply with respect to Public Procurement Processes and Contracts that are governed by the laws of Kenya.

### 2. Requirements

2.1 The Government of Kenya requires that all parties including Procuring Entities, Tenderers, (applicants/proposers), Consultants, Contractors and Suppliers; any Sub-contractors, Sub-consultants, Service providers or Suppliers; any Agents (whether declared or not); and any of their Personnel, involved and engaged in procurement under Kenya's Laws and Regulation, observe the highest standard of ethics during the procurement process, selection and contract execution of all contracts, and refrain from Fraud and Corruption and fully comply with Kenya's laws and Regulations as per paragraphs 1.1 above.

2.2 Kenya's public procurement and asset disposal act *(no. 33 of 2015)* under Section 66 describes rules to be followed and actions to be taken in dealing with Corrupt, Coercive, Obstructive, Collusive or Fraudulent practices, and Conflicts of Interest in procurement including consequences for offences committed. A few of the provisions noted below highlight Kenya's policy of no tolerance for such practices and behavior:

1) A person to whom this Act applies shall not be involved in any corrupt, coercive, obstructive, collusive or fraudulent practice; or conflicts of interest in any procurement or as set disposal proceeding;

2) A person referred to under subsection (1) who contravenes the provisions of that sub-section commits an offence;

3) Without limiting the generality of the subsection (1) and (2), the person shall be: -

   a) disqualified from entering into a contract for a procurement or asset disposal proceeding; or

   b) if a contract has already been entered into with the person, the contract shall be voidable;

4) The voiding of a contract by the procuring entity under subsection (7) does not limit any legal remedy the procuring entity may have;

5) An employee or agent of the procuring entity or a member of the Board or committee of the procuring entity who has a conflict of interest with respect to a procurement: -

   a) Shall not take part in the procurement proceedings;
   b) shall not, after a procurement contract has been entered in to, take part in any decision relating to the procurement or contract; and
   c) shall not be a subcontract or for the tender to whom was awarded contract, or a member of the group of tenderers to whom the contract was awarded, but the subcontractor appointed shall meet all the requirements of this Act.

6) An employee, agent or member described in subsection (1) who refrains from doing

anything prohibited under that subsection, but for that subsection, would have been within his or her duties shall disclose the conflict of interest to the procuring entity;

7) If a person contravenes subsection (1) with respect to a conflict of interest described in subsection (5)(a) and the contract is awarded to the person or his relative or to another person in whom one of them had a direct or indirect pecuniary interest, the contract shall be terminated and all costs incurred by the public entity shall be made good by the awarding officer. Etc.

3. In compliance with Kenya's laws, regulations and policies mentioned above, the Procuring Entity:

a) Defines broadly, for the purposes of the above provisions, the terms set forth below as follows:

i) "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
ii) "fraudulent practice" is any act or omission, including is representation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;
iii) "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party; "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
iv) "obstructive practice" is:

- Deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede investigation by Public Procurement Regulatory Authority (PPRA) or any other appropriate authority appointed by Government of Kenya into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

- acts intended to materially impede the exercise of the PPRA's or the appointed authority's inspection and audit rights provided for under paragraph 2.3 e. below.

b) Defines more specifically, in accordance with the above procurement Act provisions set forth for fraudulent and collusive practices as follows:

"fraudulent practice" includes a misrepresentation of fact in order to influence a procurement or disposal process or the exercise of a contract to the detriment of the procuring entity or the tenderer or the contractor, and includes collusive practices amongst tenderers prior to or after tender submission designed to establish tender prices at artificial non-competitive levels and to deprive the procuring entity of the benefits of free and open competition.

c) Rejects a proposal for award[1] of a contract if PPRA determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

d) Pursuant to the Kenya's above stated Acts and Regulations, may recommend to appropriate authority(ies) for sanctioning and debarment of a firm or individual, as applicable under the Acts and Regulations;

e) Requires that a clause be included in Tender documents and Request for Proposal documents requiring(i) Tenderers (applicants/proposers), Consultants, Contractors, and Suppliers, and their Sub-contractors, Sub-consultants, Service providers, Suppliers, Agents personnel, permit the PPRA or any other appropriate authority appointed by Government of Kenya to inspect[2] all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the PPRA or any other appropriate authority appointed by Government of Kenya; and

f) Pursuant to Section 62 of the above Act, requires Applicants/Tenderers to submit along with their Applications/Tenders/Proposals a "Self-Declaration Form" as included in the procurement document declaring that they and all parties involved in the procurement process and contract execution have not engaged/will not engage in any corrupt or fraudulent practices.

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[1] *For the avoidance of doubt, a party's in eligibility to be awarded a contract shall include, without limitation, (i) applying for pre-qualification, expressing interest in a consultancy, and tendering, either directly or as a nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider, in respect of such contract, and (ii) entering into an addendum or amendment introducing a material modification to any existing contract.*

[2] *Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Investigating Authority or persons appointed by the Procuring Entity to address specific matters related to investigations/audits, suc has evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for th investigation/audit, and making copies there of as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information.*

**FORM OF TENDER SECURITY-[Option 1–Demand Bank Guarantee]**

**Beneficiary:**_____

**Request for Tenders No:**_____

**Date:**_____

**TENDER GUARANTEE No.:**_____

**Guarantor:** _____

1. We have been informed that_____(here in after called "the Applicant") has submitted or will submit to the Beneficiary its Tender (here in after called" the Tender") for the execution of_____ under Request for Tenders No. ("the ITT").

2. Furthermore, we understand that, according to the Beneficiary's conditions, Tenders must be supported by a Tender guarantee.

3. At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of____(_____) upon receipt by us of the Beneficiary's complying demand, supported by the Beneficiary's statement, whether in the demand itself or a separate signed document accompanying or identifying the demand, stating that either the Applicant:

(a) has withdrawn its Tender during the period of Tender validity set forth in the Applicant's Letter of Tender ("the Tender Validity Period"), or any extension thereto provided by the Applicant; or

b) having been notified of the acceptance of its Tender by the Beneficiary during the Tender Validity Period or any extension there to provided by the Applicant, (i) has failed to execute the contract agreement, or (ii) has failed to furnish the Performance.

4. This guarantee will expire: (a) if the Applicant is the successful Tenderer, upon our receipt of copies of the contract agreement signed by the Applicant and the Performance Security and, or (b) if the Applicant is not the successful Tenderer, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the Tendering process; or (ii) thirty days after the end of the Tender Validity Period.

5. Consequently, any demand for payment under this guarantee must be received by us at the office indicated above onor before that date.

_____

*[signature(s)]*

***Note: All italicized text is for use in preparing this form and shall be deleted from the final product.***

**FORMAT OF TENDER SECURITY [Option 2–Insurance Guarantee]**

**TENDER GUARANTEE No.: _____**

1. Whereas ..... [*Name of the tenderer]* (hereinafter called "the tenderer") has submitted its tender dated ..... [*Date of submission of tender]* for the ..... *[Name and/or description of the tender]* (hereinafter called "the Tender") for the execution of under Request for Tenders No._____("the ITT").

2. KNOW ALL PEOPLE by these presents that WE ..... of ..... [**Name of Insurance Company**] having our registered office at ..... (hereinafter called "the Guarantor"), are bound unto ..... [*Name of Procuring Entity*] (hereinafter called "the Procuring Entity") in the sum of ..... (Currency and guarantee amount) for which payment well and truly to be made to the said Procuring Entity, the Guarantor binds itself, its successors and assigns, jointly and severally, firmly by these presents.

   Sealed with the Common Seal of the said Guarantor this ___day of _____ 20 __.

3. NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Applicant:

   a) has withdrawn its Tender during the period of Tender validity set forth in the Principal's Letter of Tender ("the Tender Validity Period"), or any extension thereto provided by the Principal; or

   b) having been notified of the acceptance of its Tender by the Procuring Entity during the Tender Validity Period or any extension thereto provided by the Principal; (i) failed to execute the Contract agreement; or (ii) has failed to furnish the Performance Security, in accordance with the Instructions to tenderers ("ITT") of the Procuring Entity's Tendering document.

   then the guarantee undertakes to immediately pay to the Procuring Entity up to the above amount upon receipt of the Procuring Entity's first written demand, without the Procuring Entity having to substantiate its demand, provided that in its demand the Procuring Entity shall state that the demand arises from the occurrence of any of the above events, specifying which event(s) has occurred.

4. This guarantee will expire: (a) if the Applicant is the successful Tenderer, upon our receipt of copies of the contract agreement signed by the Applicant and the Performance Security and, or (b) if the Applicant is not the successful Tenderer, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the Tendering process; or (ii)twenty-eight days after the end of the Tender Validity Period.

5. Consequently, any demand for payment under this guarantee must be received by us at the office indicated above on or before that date.

| | |
|---|---|
| _____ | _____ |
| *[Date ]* | *[Signature of the Guarantor]* |
| _____ | _____ |
| *[Witness]* | *[Seal]* |

***Note: All italicized text is for use in preparing this form and shall be deleted from the final product.***

**FORM OF TENDER - SECURING DECLARATION**

*[The Bidder shall complete this Form in accordance with the instructions indicated]*

Date: ..... *[insert date (as day, month and year) of Tender Submission]*

Tender No.: ..... *[insert number of tendering process]*

To: ..... *[insert complete name of Purchaser]* I/We, the

undersigned, declare that:

1. I/We understand that, according to your conditions, bids must be supported by a Tender-Securing Declaration.

2. I/We accept that I/we will automatically be suspended from being eligible for tendering in any contract with the Purchaser for the period of time of [insert number of months or years] starting on [insert date], if we are in breach of our obligation(s) under the bid conditions, because we–(a) have withdrawn our tender during the period of tender validity specified by us in the Tendering Data Sheet; or (b) having been notified of the acceptance of our Bid by the Purchaser during the period of bid validity, (i) fail or refuse to execute the Contract, if required, or (ii) fail or refuse to furnish the Performance Security, in accordance with the instructions to tenders.

3. I/We understand that this Tender Securing Declaration shall expire if we are not the successful Tenderer(s), upon the earlier of:
   a) Our receipt of a copy of your notification of the name of the successful Tenderer; or
   b) thirty days after the expiration of our Tender.

4. I/We understand that if I am /we are/ in a Joint Venture, the Tender Securing Declaration must be in the name of the Joint Venture that submits the bid, and the Joint Venture has not been legally constituted at the time of bidding, the Tender Securing Declaration shall be in the names of all future partners as named in the letter of intent.

Signed:…….…….. Capacity/title (director or

partner or sole proprietor, etc.) ……..……

Name:…….. Duly authorized to

sign the bid for and on behalf of: *[insert complete name of Tenderer]*

Dated on …… day of ……., ……. *[Insert date of signing]* Seal or stamp

**Appendix to Tender**

**Schedule of Currency requirements**

Summary of currencies of the Tender for_____*[insert name of Section of the Works]*

| *Name of currency* | *Amounts payable* |
|---|---|
| Local currency: _____ | |
| Foreign currency #1: _____ | |
| Foreign currency #2: _____ | |
| Foreign currency #3: _____ | |
| Provisional sums expressed in local currency _____ | [*To be entered by the Procuring Entity*] |

# PART II - WORKS REQUIREMENTS

## SECTION V - BILLS OF QUANTITIES

### A. Notes and Sample Items for Preparing a Bill of Quantities

1. These Notes for Preparing a Bill of Quantities are intended only as information for the Procuring Entity or the person drafting the Tender Documents. Priced Bills of Quantities shall be part and parcel of the Contract Documents.

2. The objectives and purpose of the Bills of Quantities are to provide sufficient information on the specifications, descriptions and quantities of Works to be performed to enable tenders to be prepared efficiently and accurately and when a contract has been entered into, to provide a priced Bill of Quantities for use in the periodic valuation of Works executed. In order to attain these objectives, Works should be itemized in the Bill of Quantities insufficient detail to distinguish between the different classes of Works, or between Works of the same nature carried out in different locations or in other circumstances which may give rise to different considerations of cost. Consistent with these requirements, the layout and content of the Bill of Quantities should be as simple and clear as possible.

3. The Bills of Quantities should be divided generally into the following sections:

   a) **Preambles**
   b) **Preliminary items**
   c) Work Items
   c) Daywork Schedule; and
   d) Provisional items
   e) Summary.

### 4. NOTES TO PREPARING PREAMBLES

4.1 The Preambles should include only those items that constitute the cost of the works but would not be priced separately as they are expected to be included in the unit prices. Care should be taken to ensure that these items are not are petition of the conditions of contract. The Preambles should indicate the inclusiveness of the unit prices and should state the methods of measurement that have been adopted in the preparation of the Bill of Quantities, that are to be used for the measurement of any part of the Works. The units of measurement and abbreviations should be defined and any mandatory national units defined and described. The methods of and procedure for re- measurement should be described in the Preambles.

4.2 Units of Measurement - The following units of measurement and abbreviations shall be used, unless other national units are mandatory in Kenya.

| Unit | Abbreviation | Unit | Abbreviation |
|---|---|---|---|
| cubic meter | $m^3$ *or* cu m | millimetre | mm |
| hectare | ha | month | mon |
| hour | h | number | nr |
| kilogram | kg | square meter | $m^2$ *or* sq m |
| lump sum | ls | square millimeter | $mm^2$ *or* sq mm |
| meter | m | week | wk |

| | | | |
|---|---|---|---|
| metric ton | t | | |

4.3 The Bills of Quantities shall be read in conjunction with the Instructions to Tenders, General and Special Conditions of Contract, Technical Specifications, and Drawings.

4.4 The quantities given in the Bills of Quantities are estimated and partly provisional and are given to provide a common basis for tendering. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Architect and valued at the rates and prices tender in the priced Bills of Quantities, where applicable, and otherwise at such rates and prices as the Architect may fix within the terms of the Contract.

4.5 The rates and prices tender in the priced Bills of Quantities shall, except in so far as it is otherwise provided under the Contract, include all Constructional Plant, labour, supervision, materials, erection, maintenance, insurance, profit, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.

4.6 A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of Items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.

4.7 The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bills of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.

4.8 General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bills of Quantities. References to the relevant sections of the Contract documents shall be made before entering prices against each item in the priced Bills of Quantities.

4.9 Provisional Sums and contingency sums included and so designated in the Bills of Quantities shall be expended in whole or in part at the direction and discretion of the Architect in accordance with Sub-Clause13.5 and Clause 13.6 of the General Conditions of contract.

4.10 In preparing the Bills of Quantities, notes should be removed as they are intended to guide the person preparing the Tender Documents. The Contractor must allow in his rates for any costs associated with and complying with the requirements in the Preambles.

4.11 Should a tenderer/contractor not price any item in any section of the Bills of Quantities including Preliminary items, it will be assumed that he/she has spread its cost in other areas that he/she will have priced. Therefore, the item or items will be executed without any additional costs or without being treated like variations.

## 5. NOTES ON PREPARING BILLS OF QUANTITIES

5.1 The Preliminary Items should be limited to tangible items that should be priced by the tenderer, are identifiable and can be priced separately and included in the interim valuations precisely. Such items may include such items as site office, notice boards, and other temporary works, otherwise items such as security for the Works which are primarily part of the Contractor's obligations should be included in the Contractor's rates.

5.2 The work items in the Bills of Quantities should be grouped into sections to distinguish between those parts of the Works which by nature, location, access, timing, or any other special characteristics may give rise to different methods of construction, or phasing of the Works, or considerations of cost. Such groups could be ground excavations, structures, external works, services, etc. General items common to all parts of the Works may be grouped as a separate section in the Bill of Quantities.

5.3 Quantities should be computed net from the Drawings, unless directed otherwise in the Contract, and no allowance should be made for bulking, shrinkage or waste. Quantities should be rounded up where appropriate.

5.4 Where the measured items a redeemed not to be exact because of the likelihood that the scope can change during the execution of the works, such items could be subject to re-measurement, the word **"provisional"** should be used to identify such cases. Where whole sections of the work items fall in this class, for example foundations, they should be labelled "Provisional Quantities" or "Provisional Items" so that the Tenderer/Contractor is advised up front that such items are subject to re-measurement to done before such work is cover-up.

5.5 All items that have not been measured and therefore not subject tot enders pricing should be listed in the Bills of Quantities as **Provisional Sums** for particular item or class of Work, which may be subject to a nominated subcontract or separate measurements at a later date during the execution of the works. For example, if it is deemed not possible to measure electrical works before going to tender because detail designs are not ready, a provisional sum can be allowed in the Bills of Quantities for "Installation of Electrical Works" to be executed later when actual design details are completed. To the extent not covered above, there should be in the Bills of Quantities a general provision for physical and financial contingencies made as a "Provisional Sum for Contingencies" and "Provisional Sum for Fluctuations". The inclusion of such provisional sums often facilitates budgetary approval by avoiding the need to request periodic supplementary approvals as the future need arises.

5.6 Provisional sums to cover specialized works normally carried out by Nominated Sub Contractors should be avoided and instead Bills of Quantities of the specialized Works should be included as a section of the main Bills of Quantities to be priced by the Main Contractor. The Main Contractor should be required to indicate the name(s) of the specialized firms he proposes to engage to carry out the specialized Works as his approved domestic sub-contractors. Only provisional sums to cover specialized Works by statutory authorities should be included in the Bills of Quantities.

5.7 A Daywork Schedule should be included if the probability of unforeseen work, outside the items included in the Bill of Quantities, is relatively high. To facilitate checking by the Procuring Entity of the realism of rates quoted by the tenderers, the Daywork Schedule should normally comprise:

i) A list of the various classes of labor, and materials for which basic.

ii) Daywork rates and prices for various categories of labor are to be inserted by the tenderer, together with a statement of the conditions under which the Contractor will be paid for Work executed on a Daywork basis.

iii) A percent a get o be entered by the tenderer against each basic Day work item.

iv) Subtotal amount for labor, materials and plant representing the Contractor's profit, overheads, supervision and other charges.

5.2 The Summary should contain a tabulation of the separate parts of the Bills of Quantities carried forward, with provisional sums for Daywork, Provisional sums and Contingencies, and provision for Total Costing. The last line should allow for tenderer to indicate any discounts before arriving at a total cost carried forward to the Form of Tender.

**BILLS OF QUANTITIES**

**a. Preambles**

1. The method of measurement of completed work for payment shall be in accordance with [insert the name of a standard reference guide, or full details of the methods to be used].

2. The Site is situated in Nairobi – CBK-IMS in Nairobi It is approximately ten(10) Kilometers from Nairobi. Access to the site shall be through Nairobi - Thika. Which is an existing public road. Any damage caused to the surfaces of this road shall be made good at the Contractor's expense. The Contractor shall visit the site and acquaint itself with its nature and position, the nature of the ground, substrata and other local conditions, positions of existing power, water and other services, access roads or any other limitations that might affect his cost or progress. No claim for extras shall be considered on account of lack of knowledge in this respect.

3. The Contractor shall obtain the Architect's approval on the siting of all temporary buildings, spoil heaps, temporary access path, and storage of materials. The Contractor shall also obtain the Architect approval and direction regarding the use of any materials found on the Site.

4. The drawings used in the preparation of these Bills of Quantities can be inspected at the offices of the Procuring Entity or Procuring Entity's Representative during normal working hours. Two sets of the Working Drawings shall be provided to the contractor but additional copies shall be provided at a cost to be determined by the Engineer.

5. The Contractor shall allow for the payment of all bank charges in connection with the procurement of Bank Guarantees and stamp charges in connection with this contract Agreement.

6. The Contractor shall carry out the various sections of the Works in such an order as the Architect May direct. The Procuring Entity reserves the right to occupy the Works by sections on completion provided that such occupation is considered to be both practical and reasonable and will not interfere with the Works. The Contractor shall allow any costs associated with such occupation.

7. The main Contractor will be fully responsible for paying his Sub-Contractor but the Procuring Entity reserves the right in very exceptional circumstances to make such payments direct in the interests of the project where the completion thereof might be jeopardized by any dispute or vicariousness between the Contractor and the Sub- Contractor involve.

8. The Contractor shall complete and deliver the Works in the period inserted in the Form of Tender as his time for completion of the Works from the date for , to be agreed with the

Engineer. The Contract Period is presumed to have been calculated making due allowance for seasonal inclement weather conditions. No claimfor extension of time due to the normal in clement weather for this area shall be entertained.

9. The Contractor shall, upon receiving instructions to proceed with the Works, draw up a Programme and Progress Chart setting out the order in which the Works are to be carried out, with the appropriate dates there of. This Chart shall be agreed with the Architect and no deviation from the order set out in it will be permitted without the written consent of the Engineer. The Contractor will be responsible for arranging the above programme with all his sub-Contractors and Specialties. The Contractor shall allow in his rates for carrying out this exercise, and for updating it as required.

10. The Contractor shall submit to the Architect on the first day of each week or such longer period as the Architect from time to time direct, a Progress Report and any information for the proceeding period, showing the progress during the period and the up-to-date cumulative progress on all important items of each section or portion of the Works.

11. The Contractor shall arrange for photographs of the Site to be taken by a professional photographer approved by the Engineer. The Photographs shall provide a record of the Site and adjacent are as prior to the commencement of the Works and shall cover such portion of the works in progress and completion as the Architect shall direct. All prints shall be full plate size, unmounted, and marked on the reverse side with the date of exposure, identification reference and brief description. The copyright of all photographs shall be vested in the Procuring Entity. The negatives and four prints from each negative shall be delivered to the Architect within two weeks of exposure.

12. Figured dimensions are to be followed in preference to dimensions scaled from the Drawings, but whenever possible dimensions are to be taken on the Site or from the buildings. Before any work is commenced by Sub- Contractors or Specialist Firms, dimensions must be checked on the site comparable dimensions shown on the drawings. The Contractor shall be responsible for the accuracy of such dimensions.

13. Prior to commencement of any work the Contractor is to ascertain from the relevant Authorities the exact position, depth and level of all existing electric cables, waterpipes or other services in the area and he shall make whatever provisions may be required by the Authorities concerned for the support and protection of such services. Any damage or disturbance caused to any services shall be reported immediately to the Architect and the relevant Authority and shall be made good to their satisfaction at the Contractor's expense. Where appropriate the Contractor shall open up the ground in advance of the main work by hand digging if necessary, to locate precisely the position and details of the services which are likely to affect his operations.

14. The Contractor shall include in his prices for the transport of materials, workmen, etc./, to and from the site of the proposed works, at such hours and by such route as are permitted by the Authorities.

15. The Contractor will be required to make good, at his own expense and damage he may

cause to the present road surface and pavements within or beyond the boundary of the Site, during the period of the works. All existing paths, storm water channels, etc., that may be destroyed or damaged during the progress of the Works shall be reinstated by the Contractor to the satisfaction of the Engineer.

16. The Contractor is to allow for complying with all instructions and regulations of the Police Authorities.

17. All water shall be fresh, clean and pure, free from earthly, vegetable or organic matter, acid or alkaline substance in solution. The Contractor shall provide at his own risk and cost all water for use in connection with the Works, (including works of sub–contractors). If need be, he shall make arrangements with the Local Water Authority for the installation of a separate meter for all water used by him throughout the Contract and pay all cost and fees in connection therewith. He shall also provide temporary storage tanks and tubing, etc., as may be necessary, and clear away at completion.

18. The Contractor shall provide all artificial lighting and power for his own use on the Works, (including Sub – Contractor's) including all temporary connections, wiring, fittings, etc., and clearing away on completion. The Contractor shall pay all fees and obtain all permits in connection there with.

19. The Contractor shall constantly keep on the Works a Literate English-speaking Agent or Representative, competent and experienced in the kind of work involved, who shall giveh is whole time to the superintendence of the works. (Including works of sub – contractors). Such Agent or Representative shall receive on behalf of the Contractor directions and instruction from the Engineer, and such directions and instructions shall be deemed to be given to the contractor in accordance with the Conditions of Contract. The Agent shall not be replaced without the specific approval of the Engineer.

20. The Contractor shall ensure that the safety of his work people and all authorized visitors to the site are protected at all times. In particular, there shall be the proper provision of guard–rails to scaffolding, protection against falling materials, tools on site, dust, nail and other sharp objects. The site shall be kept tidy and clear of dangerous rubbish. The Architect shall be empowered to suspend work on site should it be considered this condition is not being observed and no claim arising from such suspension will be allowed.

21. The are as available to the Contractor for work yards, offices and other facilities shall be directed by the Architect and any existing features to remain shall be protected from damage throughout the Contract Period and handed back in good condition when they are vacated at the end of the Contract. If additional areas are required, the contractor shall source them at own cost.

22. The Contractor shall give the Architect reasonable notice of the intention to set out or take levels for any part of the Works so that arrangements may be made for checking the work. The accuracy of setting out and leveling shall be within the tolerances specified in the Specifications or on the Drawings. The checking of setting out or leveling by the Architect shall not relieve the Contractor of his duties or responsibilities under the Contract.

23. The Contractor must take steps necessary to safe guard and shall beheld fully responsible for any damage caused to existing and adjacent property, including buildings that are not a

subject of demolition. He shall make good at his own cost damage to persons and property caused there on, and he shall indemnify the Procuring Entity against any loss or claim that may arise.

24. The Contractor shall take such steps and exercise such care and diligence as to minimize nuisance arising from dust, noise or any other cause to the occupiers of the existing and adjacent property. He must provide such temporary and special screens and tarpaulins or gummy bags, hoarding, barriers, warning signs etc. as he considers necessary and sufficient for the protection of the existing and adjacent property and or prevention of nuisance etc. as directed by Engineer.

25. The Contractors attention is drawn to the standards levy order which was amended on 15thOctober 1998.Legal notice No.154 of 1998. The Contractor is required to pay a monthly level of 0.2% of his factory price of construction works with effect from January 1999. Tenderer shall allow for this in the build-up of his rates.

26. The Contractor shall provide temporary sheds, offices mesh rooms, sanitary, accommodation and other temporary buildings for the use of the contractor and sub-contractors, including lighting furniture equipment and attendance.

27. Contractor shall provide/build labor camp sat areas to be agreed with the Engineer. Labor camps shall be complete with sanitary accommodation and fencing gates.

28. The Contractor must provide the necessary toilet facilities to the requirement and satisfaction of the Health Authorities and maintain the same in a thoroughly clean and sanitary condition and pay all conservancy fees during the period of the Works and remove when no longer required.

29. The Contractor shall provide at his own risk and cost all watching and lighting as necessary to safeguard the Works, Plant and materials against damage and theft.

30. The Contractor shall provide all necessary hoists, tackle, plant, equipment, vehicles, tools and appliances of every description for the due and satisfactory completion of the Works and shall remove the same on completion. All such plant, tools and equipment shall comply with all regulations in force throughout the period of the Contract and shall be altered or adopted during the Contract period as may be necessary to comply with any amendments in or additions to such regulations.

31. Provide, erect and maintain all necessary scaffolding, sufficiently strong and efficient for the due performance of the works, including Sub-Contract Works, provide special scaffolding as required by Sub-Contractors, alter and adopt all scaffolding as and when required during the Works, and remove on completion. No scaffolding is measured here in after and the Contractor must allow in his rates for this.

32. The Contractor shall take all necessary precautions such as temporary fencing, hoarding fans, planked footways, guard–rails gantries screen, etc., for the safe custody of the Works, materials and public protection and adjacent properties.

33. Cover up all and protect from damage, including damage from in clement weather, all finished work and unfixed materials, including that of Sub-Contractors, etc., to the satisfaction of the Architect until the completion of the Contract.

34. The Contractor shall, after completion of the works, at his own expense, remove and clear away all surplus excavated demolition materials, plant, rubbish and unused materials and shall leave the whole of the Site and Works in a clean and tidy state to the satisfaction of the Engineer, sheds, camps, etc. Particular care shall be taken to leave clean all floors and windows and tore move all paint and cement all rubbish and dirt as it accumulates. The Contractor is to find his own dump and shall pay all charges in connection there with.

35. Concrete test cubes shall be prepared in a set of three, as described including testing fees, labor and materials, making molds, transport, handling, etc. Allow in your rates for making at least four cubes on each occasion, from different batches; the concrete being taken from the point of deposit.

36. The Contractors hall furnish at the earliest possible opportunity before work commences, and at his own cost, any samples of materials and workmanship that may be called for by the Architect for the approval or rejection, and any further samples in the case of rejection, until such samples are approved by the Engineer. Such samples, when approved, shall be the minimum standard for the work to which they apply. The procedure for submitting samples of materials for testing or approval and the method of marking for identification shall be as laid down by the Engineer. The Contractor shall allow in his Tender for such samples and tests, including those in connection with his Sub-Contractors work.

37. The Contractors attention is drawn to the Finance Bill of the year 2000/2001 on withholding tax on contractual payment section 35(7)(i)(ii) which became effective on 1st July 2000. A 3% withholding tax will be applicable to all interim payments exceeding Kshs……..…… for work done in respect of building or civil works. The contractor shall allow for any costs arising resulting there from in the build-up of rates.

38. Blasting will only be allowed with the express permission of the Architect in writing. All blasting operations shall be carried out at the Contractor's sole risk and cost, in accordance with any Government regulations in force for the time being, and any special regulations laid down by the Architect governing the use and storage of explosives.

39. The National Construction Authority is a state corporation established under the national construction authority Act No.14 of 2011. The broad Mandate of the Authority is to over see the construction industry and coordinate its development. The National Construction Authority Regulations 2014 with an effective date of 6thJune 2014, regulation 25, - Allow 0.5% of the tender sum/contract sum for construction levy.

40. The Contractor attention is drawn to Finance Bill of 1993 where VAT was introduced in all contracts for construction services. The tenderer is also drawn to VAT Act Cap 476 clause 19(9). The tenderer must allow for VAT 1.19 as instructed else where.

41. The contractor shall allow and pay for all insurance to cover risks and indemnities required Items 17 and 18 of the Conditions of contract and also specified in the Special Conditions of Contract.

**DETAILED BILLS OF QUANTITIES**

## Attached as Appendix 1 of this tender document

**SUMMARY PAGE OF BILLS OF QUANTITES**

**Detailed Bill of Quantities Attached as Appendix 1 of this tender document**

**Summary of Costs**

CENTRAL BANK OF KENYA
PROPOSED BUILDING POWER AND DATA CENTER UPGRADE KISUMU BRANCH
BILLS OF QUANTITIES -MAIN SUMMARY PAGE

| | **FINAL SUMMARY** | | **Amount** | |
|---|---|---|---|---|
| 1 | TOTAL B/F FROM DATA CENTER UPGRADE | | | |
| 2 | TOTAL B/F FROM INCOMING POWER | | | |
| 3 | GRAND TOTAL CARRIED FORWARD TO FORM OF TENDER | KES | | |

**Note: Award of the tender will be to the lowest evaluated bidder for the entire scope of the works.**

We submit our tender for the above specified equipment amounting to KShs_____

in words: Kenya Shillings_____

_____

_____

1. Completion period shall be_____ weeks.

3. Our tender will remain valid for _____ (Not less than 140 days) from the date of tender opening)

Signature of tenderer _____

## SECTION VI - SPECIFICATIONS

**Attached as Appendix 2 of this tender document**

## SECTION VII - DRAWINGS

**Drawings are available and interested bidders are advised to contact Central bank of Kenya, General Services Department, Project Office on 6th Floor through the address given in this tender document.**

# PART III - THE CONDITIONS OF CONTRACT AND CONTRACT

## SECTION VIII - GENERAL CONDITIONS OF CONTRACT (GCC)

Name of Procuring Entity: **Central Bank of Kenya**

Name of Contract: **Proposed Enhancements and Improvements of Electrical Power Systems and Associated Data Centre Works at Kisumu Branch for Central Bank of Kenya**

Architect Name and Address: To be stated in the contract

**General Conditions of Contract**

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### 1. GENERALPROVISIONS

#### 1.1 Definitions

In this Contract, except where context otherwise requires, the following terms shall be interpreted as indicated below. Words indicating persons or parties include corporations and other legal entities, except where the context requires otherwise.

**"Accepted Contract Amount"** means the amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects.

**"Base Date"** means a date 30 day prior to the submission of tenders.

**"Bill of Quantities"** means the priced and completed Bill of Quantities forming part of the

tender. **"Completion Date"** means the date of completion of the Works as certified by

the Engineer.

**"Contract Price"** means the price defined in the contract and there after as adjusted in accordance with the provisions of the Contract.

**"Contract"** means the agreement entered into between the Procuring Entity and the Contractor as recorded in the Agreement Form and signed by the parties including all attachments and appendices thereto and all documents incorporated by reference therein to execute, complete, and maintain the Works.

**"Contractor's Documents"** means the calculations, computer programs and other software, progress reports, drawings, manuals, models and other documents of a technical nature (if any) supplied by the Contractor under the Contract.

**"Contractor's Equipment"** means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works and the remedying of any defects. However, Contractor's Equipment excludes Temporary Works, Procuring Entity's Equipment (if any), Plant, Materials and any other things intended to form or forming part of the Permanent Works.

**"Contractor's Personnel"** means the Contractor's Representative and all personnel whom the Contractor utilizes on Site, who may include the staff, labor and other employees of the Contractor and of each Subcontractor; and any other personnel assisting the Contractor in the execution of the Works.

**"Contractor's Representative"** means the person named by the Contractor in the Contractor appointed from time to time by the Contractor who acts on behalf of the Contractor.

**"Contractor"** means the person(s) named as contractor in the Form of Tender accepted by the Procuring Entity.

**"Cost"** means expenditure reasonably incurred (or to be incurred) by the Contractor, whether on or off the Site, including overhead and similar charges, but does not include profit.

**"Day"** means a calendar day and **"year"** means 365 days.

**"Dayworks"** means Work inputs subject to payment on a time basis for labour and the associated materials and plant.

**"Defect"** means any part of the Works not completed in accordance with the Contract.

**"Defects Liability Certificate"** means the certificate issued by Architect upon correction of defects by the Contractor.

**"Defects Liability Period"** means the period named in the Special Conditions of Contract and calculated from the Completion Date, within which the contractor is liable for any defects that may develop in the handed over works.

**"Defects Notification Period"** means the period for notifying defects in the Works or a Section (as the case may be) under Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects], which extend over the days stated in the Special Conditions of Contract.

**"Drawings"** means the drawings of the Works, as included in the Contract, and any additional and modified drawings issued by (or on behalf of) the Procuring Entity in accordance with the Contract.

**"Final Payment Certificate"** means the payment certificate issued under Sub-Clause 14.13 [Issue of Final Payment Certificate].

**"Final Statement"** means the statement defined in Sub-Clause 14.11 [Application for Final

Payment Certificate]. **"Force Majeure"** is defined in Clause19 [Force Majeure].

**"Foreign Currency"** means a currency of another country (not Kenya) in which part (or all) of the Contract Price is payable, but not the Local Currency.

**"Goods"** means Contractor's Equipment, Materials, Plant and Temporary Works, or any of them as appropriate.

**"Interim Payment Certificate"** means a payment certificate issued under Clause 14 [Contract Price and Payment], other than the Final Payment Certificate.

**"Laws"** means all national legislation, statutes, ordinances, and regulations and by-laws of any legally constituted public authority.

**"Letter of Acceptance"** means the letter of formal acceptance of a tender, signed by Procuring Entity, including any annexed memoranda comprising agreements between and signed by both Parties.

**"Local Currency"** means the currency of Kenya.

**"Materials"** means things of all kinds (other than Plant) intended to form or forming part of the Permanent Works, including the supply-only materials (if any) to be supplied by the Contractor under the Contract.

**"Notice of Dissatisfaction"** means the notice given by either Party to the other under Sub-Clause 20.3 indicating its dissatisfaction and intention to commence arbitration.

**"Special Conditions of Contract"** means the pages completed by the Procuring Entity entitled Special Conditions of Contract which constitute Part A of the Special Conditions.

**"Party"** means the Procuring Entity or the Contractor, as the context requires.

**"Payment Certificate"** means a payment certificate issued under Clause 14 [Contract Price and Payment]. **"Performance Certificate"** means the certificate issued under Sub-Clause 11.9 [Performance Certificate]. **"Performance Security"** means the security (or securities, if any) under Sub-Clause 4.2 [Performance Security]. **"Permanent Works"** means the permanent works to be executed by the Contractor under the Contract.

**"Plant"** means the apparatus, machinery and other equipment intended to form or forming part of the Permanent Works, including vehicles purchased for the Procuring Entity and relating to the construction or operation of the Works.

**"Procuring Entity's Equipment"** means the apparatus, machinery and vehicles (if any) made available by the Procuring Entity for the use of the Contract or in the execution of the Works, as stated in the Specification; but does not include Plant which has not been taken over by the Procuring Entity.

**"Procuring Entity's Personnel"** means the Engineer, the Engineer, the assistants and all other staff, labor and other employees of the Architect and of the Procuring Entity; and any other personnel notified to the Contractor, by the Procuring Entity or the Engineer, as Procuring Entity's Personnel.

**"Procuring Entity"** means the Entity named in the Special Conditions of Contract.

**"Engineer"** is the person named in the Appendix to Conditions of Contract (or any other competent person appointed by the Procuring Entity and notified to the Contractor, to act in replacement of the Engineer) who is responsible for supervising the execution of the Works and administering the Contract and shall be an "Architect" or a "Quantity Surveyor" registered under the Architects and Quantity Surveyors Act Cap 525 or an "Engineer" registered under Engineers Registration Act Cap 530.

**"Engineer"** means the person appointed by the Procuring Entity to act as the Architect for the purposes of the Contract and named in the Special Conditions of Contract, or other person appointed from time to time by the Procuring Entity and notified to the Contractor

**"Provisional Sum"** means a sum (if any) which is specified in the Contract as a provisional sum, for the execution of any part of the Works or for the supply of Plant, Materials or services under Sub-Clause 13.5 [Provisional Sums].

**"Retention Money"** means the accumulated retention moneys which the Procuring Entity retains under Sub-Clause
14.3 [Application for Interim Payment Certificates] and pays under Sub-Clause 14.9 [Payment of Retention Money].

**"Schedules"** means the document(s) entitled schedules, completed by the Contractor and submitted with the Form of Tender, as included in the Contract.

**"Section"** means a part of the Works specified in the Special Conditions of Contract as a Section (if any)

**"Site Investigation Reports"** are those reports that may be included in the tendering documents which a ref actual and interpretative about the surface and sub-surface condition sat the Site.

**"Site"** means the places where the Permanent Works are to be executed, including storage and working areas, and to which Plant and Materials are to be delivered, and any other places as may be specified in the Contract as forming part of the Site.

**"Specification"** means the document entitled specification, as included in the Contract, and any additions and modifications to the specification in accordance with the Contract. Such document specifies the Works.

**"Start Date" or "Commencement Date"** is the latest date when the Contractor shall commence execution of the Works. It does not necessarily coincide with the Site possession date(s).

**"Statement"** means a statement submitted by the Contractor as part of an application, under Clause 14 [Contract Price and Payment], for a payment certificate.

**"Subcontractor"** means any person named in the Contract as a subcontractor, or any person appointed as a subcontractor, for a part of the Works.

**"Taking-Over Certificate"** means a certificate issued under Clause 10 [Procuring Entity's Taking Over].

**"Temporary Works"** means all temporary works of every kind (other than Contractor's Equipment) required on Site for the execution and completion of the Permanent Works and the remedying of any defects.

**"Temporary works"** means works designed, constructed, installed, and removed by the Contractor which are needed for construction or installation of the Works.

**"Tender"** means the Form of Tender and all other documents which the Contractor submitted with the Form of Tender, as included in the Contract.

**"Tests after Completion"** means the tests (if any) which are specified in the Contract and which are carried out in accordance with the Specification after the Works or a Section (as the case may be) are taken over by the Procuring Entity.

**"Tests on Completion"** means the tests which are specified in the Contractor agreed by both Parties or instructed as a Variation, and which are carried out under Clause 9 [Tests on Completion] before the Works or a Section (as the case may be) are taken over by the Procuring Entity.

**"Time for Completion"** means the time for completing the Works or a Section (as the case may be) as stated in the Special Conditions of Contract (with any extension calculated from the Commencement Date.

**"Unforeseeable"** means not reasonably foreseeable by an experienced contractor by the Base Date.

**"Variation"** means any change to the Works, which is instructed or approved as a variation under Clause 13 [Variations and Adjustments].

**"Works"** means the items the Procuring Entity requires the Contractor to undertake as defined in the Appendix to Conditions of Contract. **"Works" may** also mean the Permanent Works and the Temporary Works, or either of them as appropriate.

### 1.2 Interpretation

In the Contract, except where the context requires otherwise:

a) Words indicating one gender include all genders;

b) words indicating the singular also include the plural and words indicating the plural also include the singular;
c) provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing;
d) "written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record; and

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

**1.3 Communications**

1.3.1 Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests and discharges, these communications shall be:

a) In writing and delivered by hand (against receipt), sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission as stated in the Special Conditions of Contract; and
b) delivered, sent or transmitted to the addressf or the recipient's communications as stated in the Special Conditions of Contract. However:

i) if the recipient gives notice of another address, communications shall thereafter be delivered accordingly; and
ii) if the recipient has not stated otherwise when requesting an approval or consent, it may be sent to the address from which the request was issued.

1.3.2 Approvals, certificates, consents and determinations shall not be unreasonably withheld or delayed. When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Engineer, a copy shall be sent to the Architect or the other Party, as the case may be.

**1.4 Law and Language**

1.4.1 The Contract shall be governed by the laws of **Kenya.**

1.4.2 The ruling language of the Contract shall be **English.**

**1.5 Priority of Documents**

The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence:

a) The Contract Agreement,
b) The Letter of Acceptance,
c) The Special Conditions – Part A,
d) the Special Conditions – Part B
e) the General Conditions of Contract
f) the Form of Tender,
g) the Specifications and Bills of Quantities
h) the Drawings, and
i) the Schedules and any other documents forming part of the Contract.

If an ambiguity or discrepancy is found in the documents, the Architect shall issue any necessary clarification or instruction.

**1.6 Contract Agreement**

The Parties shall enter into a Contract Agreement within 14 days after the Contractor

receives the Contract Agreement, unless the Special Conditions establish otherwise. The Contract Agreement shall be based upon the form annexed to the Special Conditions. The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the Contract Agreement shall be borne by the Procuring Entity.

**1.7 Assignment**

The Contractor shall not assign the whole or any part of the Contract or any benefit or interest in or under the Contract. However, the contractor:

a) May as sign the whole or any part with the prior consent of the Procuring Entity, and
b) may, as security in favor of a bank or financial institution, assign its right to moneys due, or to become due, under the Contract.

**1.8 Care and Supply of Documents**

1.8.1 The Specifications and Drawings shall be in the custody and care of the Procuring Entity. Unless otherwise stated in the Contract, two copies of the Contract and of each subsequent Drawings and Bills of Quantities shall be supplied to the Contractor, who may make or request further copies at the cost of the Contractor.

1.8.2 Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until taken over bythe Procuring Entity. Unless otherwise stated in the Contract, the Contractor shall supply to the Architect two copies of each of the Contractor's Documents.

1.8.3 The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Specification, the Contractor's Documents (if any), the Drawings and Variations and other communications given under the Contract. The Procuring Entity's Personnel shall have the right of access to all these documents at all reasonable times.

1.8.4 If a Party becomes aware of an error or defect in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.

**1.9 Timely provision of Drawings or Instructions**

1.9.1 The Contractor shall give notice to the Architect whenever the Works are likely to be delayed or disrupted if any necessary drawing or instruction is not issued to the Contractor within a particular time, which shall be reasonable. The notice shall include details of the necessary drawing or instruction, details of why and by when it should be issued, and the nature and amount of the delay or disruption likely to be suffered if it is late.

1.9.2 If the Contractor suffers delay and/or incurs Cost as a result of a failure of the Architect to issue the notified drawing or instruction within a time which is reasonable and is specified in the notice with supporting details, the Contractor shall give a further notice to the Architect and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

b) payment of any other associated costs accrued, which shall be included in the Contract Price.

1.9.3 After receiving this further notice, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

1.9.4 However, if and to the extent that the Architect failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, or costs accrued.

**1.10 Procuring Entity's Use of Contractor's Documents**

1.10.1 As agreed between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor.

1.10.2 The Contractor shall be deemed (by signing the Contract) to give to the Procuring Entity a non-terminable transferable non-exclusive royalty-free license to copy, use and communicate the Contractor's Documents, including making and using modifications of them. This license shall:

a) apply throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works,
b) entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and
c) in the case of Contractor's Documents which are in the form of computer programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor.

1.10.3 The Contractor's Documents and other design documents made by (or on behalf of) the Contractor shall not, without the Contractor's consent, be used, copied or communicated to a third party by (or on behalf of) the Procuring Entity for purposes other than those permitted under Sub-Clause 1.10.2.

**1.11 Contractor's Use of Procuring Entity's Documents**

As agreed between the Parties, the Procuring Entity shall retain the copyright and other intellectual property rights in the Specification, the Drawings and other documents made by (or on behalf of) the Procuring Entity. The Contractor may, at his cost, copy, use, and obtain communication of these documents for the purposes of the Contract. They shall not, without the Procuring Entity's consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the Contract.

**1.12 Confidential Details**

1.12.1 The Contractor's and the Procuring Entity's Personnel shall ensure confidentiality at all times. The confidentiality shall survive termination or completion of the contract. They shall disclose all such confidential and other information as may be reasonably required in order to verify compliance with the Contract and allow its proper implementation.

1.12.2 The Contractor's and the Procuring Entity's Personnel shall also treat the details of the Contract as private and confidential, except to the extent necessary to carry out their respective obligations under the Contract or to comply with applicable Laws. Each of them shall not publish or disclose any particulars of the Works prepared by the other Party without the previous agreement of the other Party. However, the Contractor shall be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects.

**1.13 Compliance with Laws**

The Contractor shall, in performing the Contract, comply with applicable Laws. Unless otherwise stated in the Special Conditions of Contract:

a) The Procuring Entity shall have obtained (or shall obtain) the planning, zoning, building permitor similar permission for the Permanent Works, and any other permissions described in the Specifications as having been (or to be) obtained by the Procuring Entity; and the Procuring Entity shall indemnify and hold the Contractor harmless against and from the consequences of any failure to do so; and

b) the Contractor shall give all notices, pay all taxes, duties and fees, and obtain all permits, licenses and approvals, as required by the Laws in relation to the execution and completion of the Works and the remedying of any defects; and the Contractor shall indemnify and hold the Procuring Entity harmless against and from the consequences of any failure to do so, unless the Contractor is impeded to accomplish these actions and shows evidence of its diligence.

### 1.14 Joint and Several Liability

If the Contractor constitutes (under applicable Laws) a joint venture, consortium or other unincorporated grouping of two or more persons:

a) These persons shall be deemed to be jointly and severally liable to the Procuring Entity for the performance of the Contract;
b) these persons shall notify the Procuring Entity of their leader who shall have authority to bind the Contractor and each of these persons; and
c) the Contractor shall not alter its composition or legal status without the prior consent of the Procuring Entity.

### 1.15 Inspections and Audit by the Procuring Entity

Pursuant to paragraph 2.2(e). of Appendix B to the General Conditions, the Contractor shall permit and shall cause its subcontractors and sub-consultants to permit, the Public Procurement Regulatory Authority, Procuring Entity and/or persons appointed or designated by the Government of Kenya to inspect the Site and/or the accounts and records relating to the procurement process, selection and/or contract execution, and to have such accounts and records audited by auditors appointed by the Procuring Entity if requested by the Procuring Entity. The Contractor's and its Subcontractors' and sub-consultants' attention is drawn to Sub-Clause 15.6 (Fraud and Corruption) which provides, inter alia, that acts intended to materially impede the exercise of the Procuring Entity's inspection and audit rights constitute a prohibited practice subject to contract termination (as well as to a determination of in eligibility pursuant to the Procuring Entity's prevailing sanctions procedures).

## 2. THE PROCURING ENTITY

### 2.1 Right of Access to the Site

2.1.1 The Procuring Entity shall give the Contractor right of access to, and possession of, all parts of the Site within the time (or times) stated in the **Special Conditions of Contract.** The right and possession may not be exclusive to the Contractor. If, under the Contract, the Procuring Entity is required to give (to the Contractor) possession of any foundation, structure, plant or means of access, the Procuring Entity shall do so in the time and manner stated in the Specification. However, the Procuring Entity may withhold any such right or possession until the Performance Security has been received.

2.1.2 If no such time is stated in the Special Conditions of Contract, the Procuring Entity shall give the Contractor right of access to, and possession of, the Site within such times as required to enable the Contractor to proceed without disruption in accordance with the

programme submitted under Sub-Clause 8.3 [Programme].

2.1.3 If the Contractor suffers delay and/or incurs Cost as a result of a failure by the Procuring Entity to give any such right or possession within such time, the Contractor shall give notice to the Architect and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:
a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
b) payment of any such Cost-plus profit, which shall be included in the Contract Price.

2.1.4 After receiving this notice, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

2.1.5 However, if and to the extent that the Procuring Entity's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit.

**2.2 Permits, Licenses or Approvals**

2.2.1 The Procuring Entity shall provide, at the request of the Contractor, such reasonable assistance as to allow the Contractor to obtain properly:

a) Copies of the Laws of Kenya which are relevant to the Contract but are not readily available, and
b) any permits, licenses or approvals required by the Laws of Kenya:

i) which the Contractor is required to obtain under Sub-Clause 1.13 [Compliance with Laws],
ii) for the delivery of Goods, including clearance through customs, and
iii) for the export of Contractor's Equipment when it is removed from the Site.

**2.3 Procuring Entity's Personnel**

The Procuring Entity shall be responsible for ensuring that the Procuring Entity's Personnel and the Procuring Entity's other contractor son the Site:

a) co-operate with the Contractor's efforts under Sub-Clause 4.6 [Co-operation], and

b) take actions similar to those which the Contractor is required to take under sub-paragraphs (a), (b) and (c) of Sub-Clause 4.8 [Safety Procedures] and under Sub-Clause 4.18 [Protection of the Environment].

**2.4 Procuring Entity's Financial Arrangements**

The Procuring Entity shall make and maintain all necessary financial arrangements which will enable the Procuring Entity to pay the Contract Price punctually (as estimated at that time) in accordance with Clause14 [Contract Price and Payment].

**3. THE ENGINEER**

**3.1 Architect Duties and Authority**

3.1.1 The Procuring Entity shall appoint the Architect who shall carry out the duties as signed to him in the Contract. The Architect staff shall include suitably qualified Assistants and other professionals who are competent to carry out these duties. The Architect Name and Address shall be provided in the **Special Conditions of Contract.**

3.1.2 The Architect shall have no authority to amend the Contract.

3.1.3 The Architect May exercise the authority attributable to the Architect as specified in or necessarily to be implied from the Contract. If the Architect is required to obtain the approval of the Procuring Entity before exercising a specified authority, the requirements shall be as stated in the S**pecial Conditions of Contract**. The Procuring Entity shall promptly inform the Contractor of any change to the authority attributed to the Engineer.

3.1.4 However, whenever the Architect exercises a specified authority for which the Procuring Entity's approval is required, then (for the purposes of the Contract) the contractor shall require the Architect to provide evidence of such approval before complying with the instruction.

3.1.5 Except as otherwise stated in these Conditions:

a) Whenever carrying out duties or exercising authority, specified in or implied by the Contract, the Architect shall be deemed to act for the Procuring Entity;

b) the Architect has no authority to relieve either Party of any duties, obligations or responsibilities under the Contract;

c) any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Architect (including absence of disapproval) shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances; and

d) any act by the Architect in response to a Contractor's request shall be notified in writing to the Contractor within 14 days of receipt.

3.1.6 The following provisions shall apply:

The Architect shall obtain the specific approval of the Procuring Entity before taking action under the-following Sub-Clauses of these Conditions:

a) Sub-Clause 4.12: agreeing or determining an extension of time and/or additional cost.

b) Sub-Clause 13.1: instructing a Variation, except;

i) In an emergency situation as determined by the Engineer, or

ii) If such a Variation would increase the Accepted Contract Amount by less than the percentage specified in the **Special Conditions of Contract.**

c) Sub-Clause 13.3: Approving a proposal for Variation submitted by the Contractor in accordance with Sub Clause 13.1 or 13.2.

d) Sub-Clause13.4: Specifying the amount payable in each of the applicable three currencies.

3.1.7 Not withstanding the obligation, as set out above, to obtain approval, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he may, without relieving the Contractor of any of his duties and responsibility under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forth with comply, despite the absence of approval of the Procuring Entity, with any such instruction of the Engineer. The Architect shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Clause 13 and shall notify the Contractor accordingly, with a copy to the Procuring Entity.

**3.2 Delegation by the Engineer**

3.2.1 The Architect may from time to time assign duties and delegate authority to assistants and

may also revoke such assignment or delegation. These assistants may include a resident Engineer, and/or independent inspectors appointed to inspect and/ or test items of Plant and/or Materials. The assignment, delegation or revocation shall be in writing and shall not take effect until copies have been received by both Parties. However, unless otherwise agreed by both Parties, the Architect shall not delegate the authority to determine any matter in accordance with Sub-Clause 3.5 [Determinations].

3.2.2 Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorized to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by an assistant, in accordance with the delegation, shall have the same effect as though the act had been an act of the Engineer. However:

a) Any failure to disapprove any work, Plant or Materials shall not constitute approval, and shall therefore not prejudice the right of the Architect to reject the work, Plant or Materials;

b) If the Contractor questions any determination or instruction of an assistant, the Contractor may refer the matter to the Engineer, who shall promptly confirm, reverse or vary the determination or instruction.

### 3.3 Instructions of the Engineer

3.3.1 The Architect may issue to the Contractor (at anytime) instructions and additional or modified Drawings which may be necessary for the execution of the Works and the remedying of any defects, all in accordance with the Contract. The Contractor shall only take instructions from the Engineer, or from an assistant to whom the appropriate authority has been delegated under Clause 3.2.1.

3.3.2 The Contractor shall comply with the instructions given by the Architect or delegated assistant, on any matter related to the Contract. Whenever practicable, their instructions shall be given in writing. If the Architec tor a delegated assistant:

a) Gives an oral instruction,

b) receives a written confirmation of the instruction, from (or on behalf of) the Contractor, within two working days after giving the instruction, and

c) does not reply by issuing a written rejection and/or instruction within two working days after receiving the confirmation,

Then the confirmation shall constitute the written instruction of the Architect or delegated assistant (as the case may be).

### 3.4 Replacement of the Engineer

If the Procuring Entity intends to replace the Engineer, the Procuring Entity shall, in not less than 21 days before the intended date of replacement, give notice to the Contractor of the name, address and relevant experience of the intended person to replace the Engineer.

### 3.5 Determinations

3.5.1 Whenever these Conditions provide that the Architect shall proceed in accordance with this Sub-Clause3.5 to agree or determine any matter, the Architect shall consult with each Party in an endeavor to reach agreement. If agreement is not achieved, the Architect shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.

3.5.2 The Architect shall give notice to both Parties of each agreement or determination, with supporting particulars, within 30 days from the receipt of the corresponding claim or request except when otherwise specified. Each Party shall give effect to each agreement or determination unless and until revised under Clause 20 [Claims, Disputes and Arbitration].

## 4. THE CONTRACTOR

### 4.1 Contractor's General Obligations

4.1.1 The Contractor shall design (to the extent specified in the Contract), execute and complete the Works in accordance with the Contract and with the Architect instructions, ands hall remedy any defects in the Works.

4.1.2 The Contractor shall provide the Plant and Contractor's Documents specified in the Contract, and all Contractor's Personnel, Goods, consumables and other things and services, whether of a temporary or permanent nature, required in and for this design, execution, completion and remedying of defects.

4.1.3 All equipment, material, and services to be incorporated in or required for the Works shall have their origin in any eligible source country.

4.1.4 The Contractor shall be responsible for the adequacy, stability and safety of all Site operations and of all methods of construction. Except to the extent specified in the Contract, the Contractor (i) shall be responsible for all Contractor's Documents, Temporary Works, and such design of each item of Plant and Materials as is required for the item to be in accordance with the Contract, and (ii) shall not otherwise be responsible for the design or specification of the Permanent Works.

4.1.5 The Contractor shall, whenever required by the Engineer, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. No significant alteration to these arrangements and methods shall be made without this having previously been notified to the Engineer.

4.1.6 If the Contract specifies that the Contractor shall design any part of the Permanent Works, then unless otherwise stated in the Special Conditions:

a) The Contractor shall submit to the Architect the Contractor's Documents for this part in accordance with the procedures specified in the Contract;

b) these Contractor's Documents shall be in accordance with the Specification and Drawings, shall be written in the language for communications defined in Sub-Clause 1.4 [Law and Language], and shall include additional information required by the Architect to add to the Drawings for co-ordination of each Party's designs;

c) the Contractor shall be responsible for this part and it shall, when the Works are completed, befit for such purposes for which the part is intended as are specified in the Contract; and

d) prior to the commencement of the Tests on Completion, the Contractor shall submit to the Architect the "as-built" documents and, if applicable, operation and maintenance manuals in accordance with the Specification and in sufficient detail for the Procuring Entity to operate, maintain, dismantle, reassemble, adjust and repair this part of the Works. Such part shall not be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections] until these documents and manuals have been submitted to the Engineer.

### 4.2 Performance Security

4.2.1 The Contractor shall obtain (at his cost) a Performance Security for proper performance, in the amount stated in the **Special Conditions of Contract** and denominated in the currency (ies) of the Contract or in a freely convertible currency acceptable to the Procuring Entity. If an amount is not stated in the Special Conditions of Contract, this Sub-Clause shall not

apply.

4.2.2 The Contractor shall deliver the Performance Security to the Procuring Entity within 30 days after receiving the Notification of Award and shall send a copy to the Engineer. The Performance Security shall be issued by a reputable bank selected by the Contractor and shall be in the form annexed to the Special Conditions, as stipulated by the Procuring Entity in the Special Conditions of Contract, or in another form approved by the Procuring Entity.

4.2.3 The Contractor shall ensure that the Performance Security is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects. If the terms of the Performance Security specify its expiry date, and the Contractor has not become entitled to receive the Performance Certificate by the date 30 days prior to the expiry date, the Contractor shall extend the validity of the Performance Security until the Works have been completed and any defects have been remedied.

4.2.4 The Procuring Entity shall not make a claim under the Performance Security, except for amounts to which the Procuring Entity is entitled under the Contract.

4.2.5 The Procuring Entity shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which the Procuring Entity was not entitled to make the claim.

4.2.6 The Procuring Entity shall return the Performance Security to the Contractor within 14 days after receiving a copy of the Taking-Over Certificate.

4.2.7 Without limitation to the provisions of the rest of this Sub-Clause, whenever the Architect determines an addition or a reduction to the Contract Price as a result of a change in cost and/ or legislation, or as a result of a Variation, amounting to more than 25 percent of the portion of the Contract Price payable in a specific currency, the Contractor shall at the Architect request promptly increase, or may decrease, as the case may be, the value of the Performance Security in that currency by an equal percentage.

**4.3 Contractor's Representative**

4.3.1 The Contractor shall appoint the Contractor's Representative and shall give him all authority necessary to act on the Contractor's behalf under the Contract. The Contractor's Representative's Name and Address shall be provided in the **Special Conditions of Contract.**

4.3.2 Unless the Contractor's Representative **is named in the Contract**, the Contractor shall, prior to the Commencement Date, submit to the Architect for consent the name and particulars of the person the Contractor proposes to appoint as Contractor's Representative. If consent is with held or subsequently revoked in terms of Sub-Clause 6.9 [Contractor's Personnel], or if the appointed person fails to act as Contractor's Representative, the Contractor shall similarly submit the name and particulars of an other suitable person for such appointment.

4.3.3 The Contractor shall not, without the prior consent of the Engineer, revoke the appointment of the Contractor's Representative or appoint are placement.

4.3.4 The whole time of the Contractor's Representative shall be given to directing the Contractor's performance of the Contract. If the Contractor's Representative is to be temporarily absent from the Site during the execution of the Works, a suitable replacement person shall be appointed, subject to the Architect prior consent, and the Architect shall be notified accordingly.

4.3.5 The Contractor's Representative shall, on behalf of the Contractor, receive instructions under Sub-Clause 3.3 [Instructions of the Engineer].

4.3.6 The Contractor's Representative may delegate any powers, functions and authority to any competent person, and may at any time revoke the delegation. Any delegation or revocation shall not take effect until the Architect has received prior notice signed by the Contractor's Representative, naming the person and specifying the powers, functions and authority being delegated or revoked.

4.3.7 The Contractor's Representative shall be fluent in the language for communications defined in Sub-Clause1.4 [Law and Language]. If the Contractor's Representative's delegates are not fluent in the said language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer.

**4.4 Sub-contractors**

4.4.1 The Contractor shall not subcontract the whole of the Works. The contractor may however subcontract the works as provided in Clause 34.2.

4.4.2 The Contractor shall be responsible for the acts or defaults of any Subcontractor, his agents or employees, as if they were the acts or defaults of the Contractor. Unless otherwise stated in the Special Conditions:

a) The Contractor shall not be required to obtain consent to suppliers solely of Materials, or to a subcontract for which the Subcontractor is named in the Contract;
b) The prior consent of the Procuring Entity shall be obtained to other proposed Subcontractors;
c) the Contractor shall give the Procuring Entity not less than 14 days' notice of the intended date of the commencement of each Subcontractor's work, and of the commencement of such work on the Site; and
d) each subcontract shall include provisions which would entitle the Procuring Entity to require the subcontract to be assigned to the Procuring Entity under Sub-Clause 4.5 [Assignment of Benefit of Subcontract] (if or when applicable) or in the event of termination under Sub-Clause 15.2 [Termination by Procuring Entity].

4.4.3 The Contractor shall ensure that the requirements imposed on the Contractor by Sub-Clause 1.12 [Confidential Details] apply equally to each Subcontractor.

4.4.4 Where practicable, the Contractor shall give fair and reasonable opportunity for contractors from Kenya to be appointed as Subcontractors.

**4.5 Assignment of Benefit of Subcontract**

If a Subcontractor's obligations extend beyond the expiry date of the relevant Defects Notification Period and the Engineer, prior to this date, instructs the Contractor to assign the benefit of such obligations to the Procuring Entity, then the Contractor shall do so. Unless otherwise stated in the assignment, the Contractor shall have no liability to the Procuring Entity for the work carried out by the Subcontractor after the assignment takes effect.

**4.6 Co-operation**

4.6.1 The Contractor shall, as specified in the Contract or as instructed by the Engineer, allow appropriate opportunities for carrying out work to:

a) The Procuring Entity's Personnel,
b) Any other contractors employed by the Procuring Entity, and
c) The personnel of any legally constituted public authorities, who may be employed in the execution on or near the Site of any work not included in the Contract.

4.6.2 Any such instruction shall constitute a Variation if and to the extent that it causes the Contractor to suffer delays and/or toincur Unforeseeable Cost. Services for these personnel and other contractors may include the use of Contractor's Equipment, Temporary Works or access arrangements which are the responsibility of the Contractor.

4.6.3 If, under the Contract, the Procuring Entity is required to give to the Contractor possession of any foundation, structure, plant or means of access in accordance with Contractor's Documents, the Contractor shall submit such documents to the Architect in the time and manner stated in the Specification.

**4.7 Setting Out of the Works**

4.7.1 The Contractor shall set out the Works in relation to original points, lines and levels of reference specified in the Contractor notified by the Engineer. The Contractor shall be responsible for the correct positioning of all parts of the Works, and shall rectify any error in the positions, levels, dimensions or alignment of the Works.

4.7.2 The Procuring Entity shall be responsible for any errors in these specified or notified items of reference, but the Contractor shall use reasonable efforts to verify their accuracy before they are used.

4.73 If the Contractor suffers delay and/or incurs Cost from executing work which was necessitated by an error in these items of reference, and an experienced contractor could not reasonably have discovered such error and avoided this delay and/ or Cost, the Contractor shall give notice to the Architect and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
b) payment of any such costs accrued, which shall be included in the Contract Price.

4.7.4 After receiving this notice, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent the error could not reasonably have been discovered, and (ii) the matters described in sub-paragraphs (a) and (b) above related to these.

**4.8 Safety Procedures**

The Contractor shall:

a) Comply with all applicable safety regulations,
b) Take care for the safety of all persons entitled to be on the Site,
c) Use reasonable efforts to keep the Site and Works clear of unnecessary obstruction so as to avoid danger to these persons,
d) provide fencing, lighting, guarding and watching of the Works until completion and taking over under Clause 10 [Procuring Entity's Taking Over], and
e) provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land.

**4.9 Quality Assurance**

4.9.1 The Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. The system shall be in accordance with the details stated in the Contract. The Architect shall be entitled to audit any aspect of the system.

4.9.2 Details of all procedures and compliance documents shall be submitted to the Architect for information before each design and execution stage is commenced. When any document of a technical nature is issued to the Engineer, evidence of the prior approval

by the Contractor itself shall be apparent on the document itself.

Compliance with the quality assurance system shall not relieve the Contractor of any of his duties, obligations or responsibilities under the Contract.

**4.10 Site Data**

4.10.1 The Procuring Entity shall have made available to the Contractor for his information, prior to the Base Date, all relevant data in the Procuring Entity's possession on sub-surface and hydrological conditions at the Site, including environmental aspects. The Procuring Entity shall similarly make available to the Contractor all such data which come into the Procuring Entity's possession after the Base Date. The Contractor shall be responsible for interpreting all such data.

4.10.2 To the extent which was practicable (taking account of cost and time), the Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Tender or Works. To the same extent, the Contractor shall be deemed to have inspected and examined the Site, its surroundings, the above data and other available information, and to have been satisfied before submitting the Tender as to all relevant matters, including (without limitation):

a) The form and nature of the Site, including sub-surface conditions,

b) the hydrological and climatic conditions,

c) the extent and nature of the work and Goods necessary for the execution and completion of the Works and the remedying of any defects,

d) the Laws, procedures and labour practices of Kenya, and

e) the Contractor's requirements for access, accommodation, facilities, personnel, power, transport, water and other services.

**4.11 Sufficiency of the Accepted Contract Amount**

4.11.1 The Contractor shall be deemed to:

a) Have satisfied itself as to the correctness and sufficiency of the Accepted Contract Amount, and

b) have based the Accepted Contract Amount on the data, interpretations, necessary information, inspections, examinations and satisfaction as to all relevant matters referred to in Sub-Clause 4.10 [Site Data].

4.11.2 Unless otherwise stated in the Contract, the Accepted Contract Amount covers all the Contractor's obligations under the Contract (including those under Provisional Sums, if any) and all things necessary for the proper execution and completion of the Works and the remedying of any defects.

**4.12 Unforeseeable Physical Conditions**

4.12.1 In this Sub-Clause, "physical conditions" means natural physical conditions and man-made and other physical obstructions and pollutants, which the Contractor encounters at the Site when executing the Works, including sub-surface and hydrological conditions but excluding climatic conditions.

4.12.2 If the Contractor encounters adverse physical conditions which he considers to have been Unforeseeable, the Contractor shall give notice to the Architect as soon as practicable.

4.12.3 This notice shall describe the physical conditions, so that they can be inspected by the Architect and shall set out the reasons why the Contractor considers them to be Unforeseeable. The Contractor shall continue executing the Works, using such proper and reasonable measures as are appropriate for the physical conditions, and shall comply with any instructions which the Architect may give. If an instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

4.12.4 If and to the extent that the Contractor encounters physical conditions which are Unforeseeable, gives such a notice, and suffers delay and/or incurs Cost due to these conditions, the Contractor shall be entitled subject to notice under Sub-Clause 20.1 [Contractor's Claims] to:

a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

b) payment of any such Cost, which shall be included in the Contract Price.

4.12.5 Upon receiving such notice and inspecting and/or investigating these physical conditions, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent these physical conditions were Unforeseeable, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extent.

4.12.6 However, before additional Cost is finally agreed or determined under sub-paragraph (ii), the Architect may also review whether other physical conditions in similar parts of the Works (if any) were more favorable than could reasonably have been foreseen when the Contractor submitted the Tender. If and to the extent that these more favorable conditions were encountered, the Architect may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the reductions in Cost which were due to these conditions, which may be included (as deductions) in the Contract Price and Payment Certificates. However, the net effect of all adjustments under sub-paragraph (b) and all these reductions, for all the physical conditions encountered in similar parts of the Works, shall not result in a net reduction in the Contract Price.

4.12.7 The Architect shall take account of any evidence of the physical conditions foreseen by the Contract or when submitting the Tender, which shall be made available by the Contractor, but shall not be bound by the Contractor's interpretation of any such evidence.

### 4.13 Rights of Way and Facilities

Unless otherwise specified in the Contract the Procuring Entity shall provide effective access to and possession of the Site including special and/or temporary rights-of-way which are necessary for the Works. The Contractor shall obtain, at his risk and cost, any additional rights of way or facilities out side the Site which he may require for the purposes of the Works.

### 4.14 Avoidance of Interference

4.14.1 The Contractor shall not interfere unnecessarily or improperly with:

a) The convenience of the public, or

b) The access to and use and occupation of all roads and foot paths, irrespective of whether they are public or in the possession of the Procuring Entity or of others.

4.14.2 The Contractor shall indemnify and hold the Procuring Entity harmless against and from all

damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference.

### 4.15 Access Route

4.15.1 The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site at Base Date. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes.

4.15.2 Except as otherwise stated in these Conditions:

a) The Contractor shall (as between the Parties) be responsible for any maintenance which may be required for his use of access routes;

b) the Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permission which may be required from the relevant authorities for his use of routes, signs and directions;

c) the Procuring Entity shall not be responsible for any claims which may arise from the use or otherwise of any access route;

d) the Procuring Entity does not guarantee the suitability or availability of particular access routes; and

e) Costs due to non-suitability or non-availability, for the use required by the Contractor, of access routes shall be borne by the Contractor.

### 4.16 Transport of Goods

Unless otherwise stated in the Special Conditions:

a) the Contractor shall give the Architect not less than 21 days' notice of the date on which any Plant or a major item of other Goods will be delivered to the Site;

b) the Contractor shall be responsible for packing, loading, transporting, receiving, unloading, storing and protecting all Goods and other things required for the Works; and

c) the Contractor shall indemnify and hold the Procuring Entity harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from the transport of Goods and shall negotiate and pay all claims arising from their transport.

### 4.17 Contractor's Equipment

The Contractor shall be responsible for all Contractor's Equipment. When brought on to the Site, Contractor's Equipment shall be deemed to be exclusively intended for the execution of the Works. The Contractor shall not remove from the Site any major items of Contractor's Equipment without the consent of the Engineer. However, consent shall not be required for vehicles transporting Goods or Contractor's Personnel off Site.

### 4.18 Protection of the Environment

4.18.1 The contractor shall comply with the applicable environmental laws, regulations and policies.

4.18.2 The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from

pollution, noise and other results of his operations.

4.18.3 The Contractor shall ensure that emissions, surfaced is charges and effluent from the Contractor's activities shall not exceed the values stated in the Specification or prescribed by applicable Laws.

### 4.19 Electricity, Water and Gas

4.19.1 The Contractor shall, except as stated below, be responsible for the provision of all power, water and other services he may require for his construction activities and to the extent defined in the Specifications, for the tests.

4.19.2 The Contractor shall be entitled to use for the purposes of the Works such supplies of electricity, water, gas and other services as may be available on the Site and of which details and prices are given in the Specifications. The Contractor shall, at his risk and cost, provide any apparatus necessary for his use of these services and for measuring the quantities consumed.

4.19.3 The quantities consumed and the amounts due (at these prices) for such services shall be agreed or determined by the Architect in accordance with Sub-Clause 2.5 [Procuring Entity's Claims] and Sub-Clause 3.5 [Determinations]. The Contractor shall pay these amounts to the Procuring Entity.

### 4.20 Procuring Entity's Equipment and Free-Issue Materials

4.20.1 The Procuring Entity shall make the Procuring Entity's Equipment (if any) available for the use of the Contractor in the execution of the Works in accordance with the details, arrangements and prices stated in the Specification. Unless otherwise stated in the Specification:

a) The Procuring Entity's hall be responsible for the Procuring Entity's Equipment, except that

b) the Contractor shall be responsible for each item of Procuring Entity's Equipment whilst any of the Contractor's Personnel is operating it, driving it, directing it or in possession or control of it.

4.20.1 The appropriate quantities and the amounts due (at such stated prices) for the use of Procuring Entity's Equipment shall be agreed or determined by the Architect in accordance with Sub-Clause 2.5 [Procuring Entity's Claims] and Sub-Clause3.5 [Determinations]. The Contractor shall pay these amounts to the Procuring Entity.

4.20.2 The Procuring Entity shall supply, free of charge, the "free-issue materials" (if any) in accordance with the details stated in the Specification. The Procuring Entity shall, at his risk and cost, provide these materials at the time and place specified in the Contract. The Contractor shall then visually inspect them and shall promptly give notice to the Architect of any shortage, defect or default in these materials. Unless otherwise agreed by both Parties, the Procuring Entity shall immediately rectify the notified shortage, defector default.

4.20.3 After this visual inspection, the free-issue materials shall come under the care, custody and control of the Contractor. The Contractor's obligations of inspection, care, custody and control shall not relieve the Procuring Entity of liability for any shortage, defect or default not apparent from a visual inspection.

### 4.21 Progress Reports

4.21.1 Unless otherwise stated in the Special Conditions, monthly progress reports shall be

prepared by the Contractor and submitted to the Architect in six copies. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the period to which it relates.

4.21.2 Reporting shall continue until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works. Each report shall include:

a) charts and detailed descriptions of progress, including each stage of design (if any), Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection and testing; and including these stages for work by each nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]),

b) photographs showing the status of manufacture and of progress on the Site;

c) for the manufacture of each main item of Plant and Materials, the name of the manufacturer, manufacture location, percentage progress, and the actual or expected dates of:

i) commencement of manufacture,

ii) Contractor's inspections,

iii) tests, and

iv) shipment and arrival at the Site;

d) the details described in Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment];

e) copies of quality assurance documents, test results and certificates of Materials;

f) list of notices given under Sub-Clause 2.5 [Procuring Entity's Claims] and notices given under Sub- Clause 20.1 [Contractor's Claims];

g) safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and

h) comparisons of actual and planned progress, with details of any events or circumstances which may jeopardize the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

## 4.22 Security of the Site

Unless otherwise stated in the Special Conditions:

a) The Contractor shall be responsible for keeping unauthorized persons off the Site, and

b) authorized persons shall be limited to the Contractor's Personnel and the Procuring Entity's Personnel; and to any other personnel notified to the Contractor, by the Procuring Entity or the Engineer, as authorized personnel of the Procuring Entity's other contractors on the Site.

## 4.23 Contractor's Operations on Site

4.23.1 The Contractor shall confine his operations to the Site, and to any additional areas which may be obtained by the Contractor and agreed by the Architect as additional working areas. The Contractor shall take all necessary precautions to keep Contractor's Equipment and Contractor's Personnel within the Site and these additional areas, and to keep them off adjacent land.

4.23.2 During the execution of the Works, the Contractor shall keep the Site free from all

unnecessary obstruction and shall store or dispose of any Contractor's Equipment or surplus materials. The Contractor shall clear away and remove from the Site any wreckage, rubbish and Temporary Works which are no longer required.

4.23.3 Upon the issue of a Taking-Over Certificate, the Contractor shall clear away and remove, from that part of the Site and Works to which the Taking-Over Certificate refers, all Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works. The Contractor shall leave that part of the Site and the Works in a clean and safe condition. However, the Contractor may retain on Site, during the Defects Notification Period, such Goods as are required for the Contractor to fulfil obligations under the Contract.

### 4.24 Fossils

4.24.1 All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Procuring Entity. The Contractor shall take reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings.

4.24.2 The Contractor shall, upon discovery of any such finding, promptly give notice to the Engineer, who shall issue instructions for dealing with it. If the Contractor suffers delay and/or incurs Cost from complying with the instructions, the Contractor shall give a further notice to the Architect and shall be entitled subject to Sub- Clause 20.1 [Contractor's Claims] to:

a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
b) payment of any such Cost, which shall be included in the Contract Price.
After receiving this further notice, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

## 5. NOMINATED SUBCONTRACTORS

### 5.1 Definition of "nominated Subcontractor"

In this Contract, "nominated Subcontractor" means a Subcontractor:

a) Who is nominated by the Procuring Entity, or
b) Contractor has nominated as a Subcontractor subject to Sub-Clause 5.2 [Objection to Notification].

### 5.2 Objection to Nomination

The Contractor shall not be under any obligation to employ a nominated Subcontractor against whom the Contractor raises reasonable objection by notice to the Procuring Entity as soon as practicable, with supporting particulars. An objection shall be deemed reasonable if it arises from (among other things) any of the following matters, unless the Procuring Entity agrees in writing to indemnify the Contractor against and from the consequences of the matter:

a) there are reasons to believe that the Subcontractor does not have sufficient competence, resources or financial strength;
b) the nominated Subcontractor does not accept to indemnify the Contractor against and from any negligence or misuse of Goods by the nominated Subcontractor, his agents and employees; or
c) the nominated Subcontractor does not accept to enter into a subcontract which specifies that, for the subcontracted work (including design, if any), the nominated Subcontractor shall:
    i) undertake to the Contractor such obligations and liabilities as will enable the

Contractor to discharge his obligations and liabilities under the Contract;

ii) indemnify the Contractor against and from all obligations and liabilities arising under or in connection with the Contract and from the consequences of any failure by the Subcontractor to perform these obligations or to fulfil these liabilities, and

iii) be paid only if and when the Contractor has received from the Procuring Entity payments for sums due under the Subcontract referred to under Sub-Clause 5.3 [Payment to nominated Subcontractors].

**5.3 Payments to nominated Subcontractors**

The Contractor shall pay to the nominated Subcontractor the amounts shown on the nominated Subcontractor's invoices approved by the Contractor which the Architect certifies to be due in accordance with the subcontract. These amounts plus other charges shall be included in the Contract Price in accordance with sub-paragraph (b) of Sub-Clause 13.5 [Provisional Sums], except as stated in Sub-Clause 5.4 [Evidence of Payments].

**5.4 Evidence of Payments**

5.4.1 Before issuing a Payment Certificate which includes an amount payable to a nominated Subcontractor, the Architect may request the Contractor to supply reasonable evidence that the nominated Subcontractor has received all amounts due in accordance with previous Payment Certificates, less applicable deductions for retention or otherwise. Unless the Contractor:

(a) Submits this reasonable evidence to the Engineer, or

(b) i) Satisfies the Architect in writing that the Contractor is reasonably entitled to withhold or refuse to pay these amounts, and

ii) Submits to the Architect reasonable evidence that the nominated Subcontractor has been notified of the Contractor's entitlement, then the Procuring Entity may (at his sole discretion) pay, directly to the nominated Subcontractor, part or all of such amounts previously certified (less applicable deductions) as are due to the nominated Subcontractor and for which the Contractor has failed to submit the evidence described in sub-paragraphs (a) or (b) above. The Contractor shall then repay, to the Procuring Entity, the amount which the nominated Subcontractor was directly paid by the Procuring Entity.

**6. STAFF AND LABOR**

**6.1 Engagement of Staff and Labor**

Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labor, local or otherwise, and for their payment, feeding, transport, and, when appropriate, housing. The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labor with appropriate qualifications and experience from sources within Kenya.

**6.2 Rates of Wages and Conditions of Labor**

6.2.1 The Contractor shall pay rates of wages, and observe conditions of labor, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by Procuring Entity's whose trade or industry is similar to that of the Contractor.

6.2.2 The Contractor shall inform the Contractor's Personnel about their liability to pay personal income taxes in Kenya in respect of such of their salaries, wages, allowances and any benefits as are subject to tax under the Laws of Kenya for the time being in force, and the Contractor shall perform such duties in regard to such deductions there of as may be imposed on him by such Laws.

### 6.3 Persons in the Service of Procuring Entity

The Contractor shall not recruit, or attempt to recruit, staff and labour from amongst the Procuring Entity's Personnel.

### 6.4 Labor Laws

The Contractor shall comply with all the relevant labour Laws applicable to the Contractor's Personnel, including Laws relating to their employment, employment of children, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights. The Contractor shall require his employees to obey all applicable Laws, including those concerning safety at work.

### 6.5 Working Hours

No work shall be carried out on the Site on locally recognized days of rest, or outside the normal working hours stated in the **Special Conditions of Contract**, unless:

a) Otherwise stated in the Contract,
b) The Architect gives consent, or
c) The work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer, provided that work done outside the normal working hours shall be considered and paid for as overtime.

### 6.6 Facilities for Staff and Labor

Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities on site for the Contractor's Personnel. The Contractor shall also provide facilities for the Procuring Entity's Personnel as stated in the Specifications. The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.

### 6.7 Health and Safety

6.7.1 The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Procuring Entity's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

6.7.2 The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide what ever is required by this person to exercise this responsibility and authority.

6.7.3 The Contractor shall send, to the Engineer, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Architect may reasonably require.

6.7.4 The Contractor shall conduct an awareness programme on HIV and other sexually transmitted diseases via an approved service provider and shall undertake such other measures taken to reduce the risk of the transfer of these diseases between and among the Contractor's Personnel and the local community, to promote early diagnosis and to assist affected individuals.

**6.8 Contractor's Superintendence**

6.8.1 Throughout the execution of the Works, and as long thereafter as is necessary to fulfil the Contractor's obligations, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect and test the work.

6.8.2 Superintendence shall be given by a sufficient number of persons having adequate knowledge of the language for communications (defined in Sub-Clause 1.4 [Law and Language]) and of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents), for the satisfactory and safe execution of the Works.

**6.9 Contractor's Personnel**

6.9.1 The Contractor's Personnel shall be appropriately qualified, skilled and experienced in their respective trades or occupations. The Contractors Key personnel shall be named in the Special Conditions of Contract. The Architect may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative if applicable, who:

a) Persists in any misconduct or lack of care,

b) Carries out duties in competently or negligently,

c) fails to conform with any provisions of the Contract,

d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment, or

e) based on reasonable evidence, is determined to have engaged in Fraud and Corruption during the execution ofthe Works.

6.9.2 If appropriate, the Contractor shall then appoint (or cause to be appointed) a suitable replacement person.

**6.10 Records of Contractor's Personnel and Equipment**

The Contractor shall submit, to the Engineer, details showing the number of each class of Contractor's Personnel and of each type of Contractor's Equipment on the Site. Details shall be submitted each calendar month, in a form approved by the Engineer, until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

**6.11 Disorderly Conduct**

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.

**6.12 Foreign Personnel**

6.12.1 The Contractor shall not employ foreign personnel unless the contractor demonstrates that there are no Kenyans with the required skills.

6.12.2 The Contractor shall be responsible for the return of any foreign personnel to the place where they were recruited or to their domicile. In the event of the death in Kenya of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.

### 6.13 Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.

### 6.14 Measures against Insect and Pest Nuisance

The Contractor shall a tall times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce the danger to their health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.

### 6.15 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Laws of Kenya, onsite, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift, barter or disposal there of by Contractor's Personnel.

### 6.16 Prohibition of Forced or Compulsory Labour

The Contractor shall not employ forced labor, which consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labor, such as indentured labor, bonded labor or similar labor-contracting arrangements.

### 6.17 Prohibition of Harmful Child Labor

The Contractor shall not employ children in a manner that is economically exploitative, or is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Where the relevant labour laws of Kenya have provisions for employment of minors, the Contractor shall follow those laws applicable to the Contractor. Children below the age of 18 years shall not be employed in dangerous work.

### 6.18 Employment Records of Workers

The Contractor shall keep complete and accurate records of the employment of labour at the Site. The records shall include the names, ages, genders, hours worked and wages paid to all workers. These records shall be summarized on a monthly basis and submitted to the Engineer. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment].

### 6.19 Workers' Organizations

The Contractor shall comply with the relevant labor laws that recognize workers' rights to form and to join workers' organizations of their choosing without interference.

### 6.20 Non-Discrimination and Equal Opportunity

The Contractor shall base the labour employment on the principle of equal opportunity and fair treatment and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion,

termination of employ mentor retirement, and discipline.

## 7. PLANT, MATERIALS AND WORKMANSHIP

### 7.1 Manner of Execution

The Contractor shall carry out the manufacture/assemble of plant, the production and manufacture of Materials, and all other execution of the Works:

a) In the manner (if any) specified in the Contract,

b) in a proper workman like and careful manner, in accordance with recognized good practice, and

c) with properly equipped facilities and non-hazardous Materials, except as otherwise specified in the Contract.

### 7.2 Samples

The Contractor shall submit the following samples of Materials, and relevant information, to the Architect for consent prior to using the Material sin or for the Works:

a) manufacturer's standard samples of Materials and samples specified in the Contract, all at the Contractor's cost, and

b) additional samples instructed by the Architect as a Variation.

Each sample shall be labeled as to origin and intended use in the Works.

### 7.3 Inspection

7.3.1 The Procuring Entity's Personnel shall at all reasonable times:

a) Have full access to all parts of the Site and to all places from which natural Materials are being obtained, and

b) during production, manufacture and construction (at the Site and elsewhere), be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of manufacture of Plant and production and manufacture of Materials.

7.3.2 The Contractor shall give the Procuring Entity's Personnel full opportunity to carry out these activities, including providing access, facilities, permissions and safety equipment. No such activity shall relieve the Contractor from any obligation or responsibility.

7.3.3 The Contractor shall give notice to the Architect whenever any work is ready and before it is covered up, put out of sight, or packaged for storage or transport. The Architect shall then either carry out the examination, inspection, measurement or testing without unreasonable delay, or promptly give notice to the Contractor that the Architect does not require to do so. If the Contractor fails to give the notice, he shall, if and when required by the Engineer, uncover the work and there after reinstate and make good, all at the Contractor's cost.

### 7.4 Testing

7.4.1 This Sub-Clause shall apply to all tests specified in the Contract.

7.4.2 Except as otherwise specified in the Contract, the Contractor shall provide all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables, instruments, labor, materials, and suitably qualified and experienced staff, as are necessary

to carry out the specified tests efficiently. The Contractor shall agree, with the Engineer, the time and placef ort he specified testing of any Plant, Materials and other parts of the Works.

7.4.3 The Architect may, under Clause 13 [Variations and Adjustments], vary the location or details of specified tests, or instruct the Contractor to carry out additional tests. If these varied or additional tests show that the tested Plant, Materials or workmanship is not in accordance with the Contract, the cost of carrying out this Variation shall be borne by the Contractor, not withstanding other provisions of the Contract.

7.4.4 The Architect shall give the Contractor not less than 24 hours' notice of the Architect intention to attend the tests. If the Architect does not attend at the time and place agreed, the Contractor may proceed with the tests, unless otherwise instructed by the Engineer, and the tests shall then be deemed to have been made in the Architect presence.

7.4.5 If the Contractor suffers delay and/ or incurs Cost from complying with these instructions or as a result of a delay for which the Procuring Entity is responsible, the Contractor shall give notice to the Architect and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

b) payment of any such Cost-plus profit, which shall be included in the Contract Price.

7.4.6 After receiving this notice, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

7.4.7 The Contractor shall promptly forward to the Architect duly certified reports of the tests. When the specified tests have been passed, the Architect shall endorse the Contractor's test certificate, or issue a certificate to him, to that effect. If the Architect has not attended the tests, he shall be deemed to have accepted the readings as accurate.

### 7.5 Rejection

7.5.1 If, as a result of an examination, inspection, measurement or testing, any Plant, Materials or workmanship is found to be defective or otherwise not in accordance with the Contract, the Architect may reject the Plant, Materials or workmanship by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the Contract.

7.5.2 If the Architect requires this Plant, Materials or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause the Procuring Entity to incur additional costs, the Contractor shall subject to Sub-Clause 2.5 [Procuring Entity's Claims] pay these costs to the Procuring Entity.

### 7.6 Remedial Work

7.6.1 Not withstanding any previous test or certification, the Architect may instruct the Contractor to:

a) Remove from the Site and replace any Plant or Materials which is not in accordance with the Contract,

b) remove and re-execute any other work which is not in accordance with the Contract, and

c) execute any work which is urgently required for the safety of the Works, whether because of an accident, unforeseen able event or otherwise.

7.6.2 The Contractor shall comply with the instruction within a reasonable time, which shall be the time (if any) specified in the instruction, or immediately if urgency is specified under sub-paragraph (c).

7.6.3 If the Contractor fails to comply with the instruction, the Procuring Entity shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall subject to Sub-Clause 2.5 [Procuring Entity's Claims] pay to the Procuring Entity all costs arising from this failure.

7.6.4 If the contractor repeatedly delivers defective work, the Procuring Entity may consider termination in accordance with Clause 15.

### 7.7 Ownership of Plant and Materials

Except as otherwise provided in the Contract, each item of Plant and Materials shall become the property of the Procuring Entity at whichever is the earlier of the following times, free from liens and other encumbrances:

a) When it is incorporated in the Works;

b) when the Contractor is paid the corresponding value of the Plant and Materials under Sub-Clause 8.10 [Payment for Plant and Materials in Event of Suspension].

### 7.8 Royalties

Unless otherwise stated in the Specification, the Contractor shall pay all royalties, rents and other payments for:

a) Natural materials obtained from outside the Site, and

b) The disposal of material from demolitions and excavations and of other surplus material (whether natural or man-made), except to the extent that disposal are as within the Site are specified in the Contract.

## 8. COMMENCEMENT, DELAYS AND SUSPENSION

### 8.1 Commencement of Works

8.1.1 Except as otherwise specified in the Special Conditions of Contract, the Commencement Date shall be the date at which the following precedent conditions have all been fulfilled and the Architect notification recording the agreement of both Parties on such fulfilment and instructing to commence the Work is received by the Contractor:

a) Signature of the Contract Agreement by both Parties, and if required, approval of the Contract by relevant authorities of Kenya;

b) except if otherwise specified in the Special Conditions of Contract, effective access to and possession of the Site given to the Contractor together with such permission(s) under (a) of Sub-Clause 1.13 [Compliance with Laws] as required for the commencement of the Works.

c) Receipt by the Contractor of the Advance Payment under Sub-Clause 14.2 [Advance Payment] provided that the corresponding bank guarantee has been delivered by the Contractor.

8.1.2 If the said Architect instruction is not received by the Contractor within 180 days from his receipt of the Letter of Acceptance, the Contractor shall be entitled to terminate the Contract under Sub-Clause1 6.2 [Termination by Contractor].

8.1.3 The Contractor shall commence the execution of the Works as soon as is reasonably practicable after the Commencement Date and shall then proceed with the Works with due expedition and without delay.

### 8.2 Time for Completion

The Contractor shall complete the whole of the Works, and each Section (if any), within the Time for Completion for the Works or Section (as the case may be), including:

a) Achieving the passing of the Tests on Completion, and

b) completing all work which is stated in the Contract as being required for the Works or Section to be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections].

**8.3 Programme**

8.3.1 The Contractor shall submit a detailed time programme to the Architect within 14 days after receiving the notice under Sub-Clause 8.1 [Commencement of Works]. The Contractor shall also submit a revised programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations. Each programme shall include:

a) The order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design (if any), Contractor's Documents, procurement, manufacture of Plant, delivery to Site, construction, erection and testing,

b) each of these stages for work by each nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]),

c) the sequence and timing of inspections and tests specified in the Contract, and

d) a supporting report which includes:

)

i. a general description of the methods which the Contractor intends to adopt, and of the major stages, in the execution of the Works, and

ii. details showing the Contractor's reasonable estimate of the number of each class of Contractor's Personnel and of each type of Contractor's Equipment, required on the Site for each major stage.

8.3.2 Unless the Engineer, within 14 days after receiving a programme, gives notice to the Contractor stating the extent to which it does not comply with the Contract, the Contractor shall proceed in accordance with the programme, subject to his other obligations under the Contract. The Procuring Entity's Personnel shall be entitled to rely upon the programme when planning their activities.

8.3.3 The Contractor shall promptly give notice to the Architect of specific probable future events or circumstances which may adversely affect the work, increase the Contract Price or delay the execution of the Works.

8.3.4 If, at anytime, the Architect gives notice to the Contractor that a programme fails (to the extent stated) to comply with the Contractor to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised programme to the Architect in accordance with this Sub-Clause.

**8.4 Extension of Time for Completion**

8.4.1 The Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of the Time for Completion if and to the extent that completion for the purposes of Sub-Clause 10.1 [Taking Over of the Works and Sections] is or will be delayed by any of the following causes:

a) a Variation (unless an adjustment to the Time for Completion has been agreed under Sub-Clause 13.3 [Variation Procedure]) or other substantial change in the quantity of an item of work included in the Contract,

b) a cause of delay giving an entitlement to extension of time under a Sub-Clause of these Conditions,

c) exceptionally adverse climatic conditions,

d) Unforeseeable shortages in the availability of personnel or Goods caused by epidemic or governmental actions, or

e) any delay, impediment or prevention caused by or attributable to the Procuring Entity, the Procuring Entity's Personnel, or the Procuring Entity's other contractors.

8.4.2 If the Contractor considers itself to be entitled to an extension of the Time for Completion, the Contractor shall give notice to the Architect in accordance with Sub-Clause 20.1 [Contractor's Claims]. When determining each extension of time under Sub-Clause 20.1, the Architect shall review previous determinations and may increase, but shall not decrease, the total extension of time.

**8.5 Delays Caused by Authorities**

If the following conditions apply, namely:

a) The Contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities in Kenya,

b) These authorities delay or disrupt the Contractor's work, and

c) the delay or disruption was Unforeseeable, then this delay or disruption will be considered as a cause of delay under sub-paragraph (b) of Sub-Clause 8.4 [Extension of Time for Completion].

**8.6 Rate of Progress**

8.6.1 If, at anytime:

a) Actual progress is too slow to complete within the Time for Completion, and/or

b) Progress has fallen (or will fall) behind the current programme under Sub-Clause 8.3 [Programme], other than as a result of a cause listed in Sub-Clause 8.4 [Extension of Time for Completion], then the Architect may instruct the Contractor to submit, under Sub-Clause 8.3 [Programme], a revised programme and supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete within the Time for Completion.

8.6.2 Unless the Architect notifies otherwise, the Contractor shall adopt these revised methods, which may require increases in the working hours and/or in the numbers of Contractor's Personnel and/or Goods, at the risk and cost of the Contractor. If these revised methods cause the Procuring Entity to incur additional costs, the Contractor shall subject to notice under Sub-Clause 2.5 [Procuring Entity's Claims] pay these costs to the Procuring Entity, in addition to delay damages (if any) under Sub-Clause 8.7 below.

8.6.3 Additional costs of revised methods including acceleration measures, instructed by the Architect to reduce delays resulting from causes listed under Sub-Clause 8.4 [Extension of Time for Completion] shall be paid by the Procuring Entity, without generating, however, any other additional payment benefit to the Contractor.

**8.7 Delay Damages**

8.7.1 If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Contractor shall subject to notice under Sub-Clause 2.5 [Procuring Entity's Claims] pay delay damages to the Procuring Entity for this default. These delay damages shall be the sum stated in the **Special Conditions of Contract**, which shall be paid for everyday which shall elapse between the relevant Time for Completion and the date stated in the taking-Over

Certificate. However, the total amount due under this Sub-Clause shall not exceed the maximum amount of delay damages (if any) stated in the Special Conditions of Contract.

8.7.2 These delay damages shall be the only damages due from the Contractor for such default, other than in the event of termination under Sub-Clause 15.2 [Termination by Procuring Entity] prior to completion of the Works. These damages shall not relieve the Contractor from his obligation to complete the Works, or from any other duties, obligations or responsibilities which he may have under the Contract.

**8.8 Suspension of Work**

8.8.1 The Architect may at anytime instruct the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.

8.8.2 The Architect may also notify the cause for the suspension. If and to the extent that the cause is notified and is the responsibility of the Contractor, the following Sub-Clauses 8.9, 8.10 and 8.11 shall not apply.

**8.9 Consequences of Suspension**

8.9.1 If the Contractor suffers delay and/or incurs Cost from complying with the Architect instructions under Sub- Clause 8.8 [Suspension of Work] and/or from resuming the work, the Contractor shall give notice to the Architect and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

b) Payment of any such Cost, which shall be included in the Contract Price.

8.9.2 After receiving this notice, the Architect shall proceed in accordance with Sub-Clause3.5 [Determinations] to agree or determine these matters.

8.9.3 The Contractor shall not be entitled to an extension of time for, or to payment of the Cost incurred in, making good the consequences of the Contractor's faulty design, workmanship or materials, or of the Contractor's failure to protect, store or secure in accordance with Sub-Clause 8.8 [Suspension of Work].

**8.10 Payment for Plant and Materials in Event of Suspension**

The Contractor shall be entitled to payment of the value (as at the date of suspension) of Plant and/ or Materials which have not been delivered to Site, if:

a) The work on Plant or delivery of Plant and/ or Materials has been suspended for more than 30 days, and

b) the Contractor has marked the Plant and/or Materials as the Procuring Entity's property in accordance with the Architect instructions.

**8.11 Prolonged Suspension**

If the suspension under Sub-Clause 8.8 [Suspension of Work] has continued for more than 84 days, the Contractor may request the Architect permission to proceed. If the Architect does not give permission within 30 days after being requested to do so, the Contractor may, by giving notice to the Engineer, treat the suspension as an omission under Clause 13 [Variations and Adjustments] of the affected part of the Works. If the suspension affects the whole of the Works, the Contractor may give notice of termination under Sub-Clause 16.2 [Termination by Contractor].

### 8.12 Resumption of Work

After the permission or instruction to proceed is given, the Contractor and the Architect shall jointly examine the Works and the Plant and Materials affected by the suspension. The Contractor shall make good any deterioration or defect in or loss of the Works or Plant or Materials, which has occurred during the suspension after receiving from the Architect an instruction to this effect under Clause 13 [Variations and Adjustments].

## 9. TESTS ON COMPLETION

### 9.1 Contractor's Obligations

9.1.1 The Contractor shall carry out the Tests on Completion in accordance with this Clause and Sub-Clause 7.4 [Testing], after providing the documents in accordance with sub-paragraph (d) of Sub-Clause 4.1 [Contractor's General Obligations].

9.1.2 The Contractor shall give to the Architect not less than 21 days' notice of the date after which the Contractor will be ready to carry out each of the Tests on Completion. Unless otherwise agreed, Tests on Completion shall be carried out within 14 days after this date, on such day or days as the Architect shall instruct.

9.1.3 In considering the results of the Tests on Completion, the Architect shall make allowances for the effect of any use of the Works by the Procuring Entity on the performance or other characteristics of the Works. As soon as the Works, or a Section, have passed any Tests on Completion, the Contractor shall submit a certified report of the results of these Tests to the Engineer.

### 9.2 Delayed Tests

9.2.1 If the Tests on Completion are being unduly delayed by the Procuring Entity, Sub-Clause 7.4 [Testing] (fifth paragraph) and/ or Sub-Clause 10.3 [Interference with Tests on Completion] shall be applicable.

9.2.2 If the Tests on Completion are being unduly delayed by the Contractor, the Architect may by notice require the Contractor to carry out the Tests within 21 days after receiving the notice. The Contractor shall carry out the Tests on such day or days within that period as the Contractor may fix and of which he shall give notice to the Engineer.

9.2.3 If the Contractor fails to carryout the Tests on Completion within the period of 21 days, the Procuring Entity's Personnel may proceed with the Test sat the risk and cost of the Contractor. The Tests on Completion shall then be deemed to have been carried out in the presence of the Contractor and the results of the Tests shall be accepted as accurate.

### 9.3 Retesting of related works

If the Works, or a Section, fail to pass the Tests on Completion, Sub-Clause 7.5 [Rejection] shall apply, and the Architect or the Contractor may require the failed Tests, and Tests on Completion on any related work, to be repeated under the same terms and conditions.

### 9.4 Failure to Pass Tests on Completion

9.4.1 If the Works, or a Section, fail to pass the Tests on Completion repeated under Sub-Clause 9.3 [Retesting], the Architect shall be entitled to:

a) Order further repetition of Tests on Completion under Sub-Clause 9.3; or

b) if the failure deprives the Procuring Entity of substantially the whole benefit of the Works or Section, reject the Works or Section (as the case may be), in which event the Procuring Entity shall have the same remedies as are provided in sub-paragraph (c) of Sub-Clause1 1.4 [Failure to Remedy Defects].

## 10. PROCURING ENTITY'S TAKING OVER

### 10.1 Taking Over of the Works and Sections

10.1.1 Except as stated in Sub-Clause 9.4 [Failure to Pass Tests on Completion], the Works shall be taken over by the Procuring Entity when (i) the Works have been completed in accordance with the Contract, including the matters described in Sub-Clause 8.2 [Time for Completion] and except as allowed in sub-paragraph (a) below, and (ii) a Taking-Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this Sub-Clause.

10.1.2 The Contractor may apply by notice to the Architect for a Taking-Over Certificate not earlier than 14 days before the Works will, in the Contractor's opinion, be complete and ready for taking over. If the Works are divided into Sections, the Contract or may similarly apply for a Taking-Over Certificate for each Section.

10.1.3 The Architect shall, within 30 days after receiving the Contractor's application:

a) Issue the Taking-Over Certificate to the Contract or, stating the date on which the Works or Section were completed in accordance with the Contract, except for any minor out standing work and defects which will not substantially affect the use of the Works or Section for their intended purpose (either until or whilst this work is completed and these defects are remedied); or

b) reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued. The Contractor shall then complete this work before issuing a further notice undert his Sub-Clause.

10.1.4 If the Architect fails either to issue the Taking-Over Certificate or to reject the Contractor's application within the period of 30 days, and if the Works or Section (as the case may be) are substantially in accordance with the Contract, the Taking-Over Certificate shall be deemed to have been issued on thel ast day of that period.

### 10.2 Taking Over of Parts of the Works

10.2.1 The Architect may, at the sole discretion of the Procuring Entity, issue a Taking-Over Certificate for any part of the Permanent Works.

10.2.2 The Procuring Entity shall not use any part of the Works (other than as a temporary measure which is either specified in the Contract or agreed by both Parties) unless and until the Architect has issued a Taking-Over Certificate for this part. However, if the Procuring Entity does use any part of the Works before the Taking-Over Certificate is issued:

a) The part which is used shall be deemed to have been taken over as from the date on which it is used,

b) the Contractor shall cease to be liable for the care of such part as from this date, when responsibility shall pass to the Procuring Entity, and

c) if requested by the Contractor, the Architect shall issue a Taking-Over Certificate for this part.

10.2.3 After the Architect has issued a Taking-Over Certificate for a part of the Works, the Contractor shall be given the earliest opportunity to take such steps as may be necessary to carry out any outstanding Tests on Completion. The Contractor shall carry out these Tests on Completion as soon as practicable before the expiry date of the relevant Defects Notification Period.

10.2.4 If the Contractor incurs Cost as a result of the Procuring Entity taking over and/or using a part of the Works, other than such use as is specified in the Contractor agreed by the Contractor, the Contractor shall (i) give notice to the Architect and (ii) be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to payment of any such accrued costs, which shall be included in the Contract Price. After receiving this notice, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this accrued cost.

10.2.5 If a Taking-Over Certificate has been issued for a part of the Works (other than a Section), the delay damages there after for completion of the remainder of the Works shall be reduced. Similarly, the delay damages for the remainder of the Section (if any) in which this part is included shall also be reduced. For any period of delay after the date stated in this Taking-Over Certificate, the proportional reduction in these delay damages shall be calculated as the proportion which the value of the part so certified bears to the value of the Works or Section (as the case may be) as a whole. The Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these proportions. The provisions of this paragraph shall only apply to the daily rate of delay damages under Sub-Clause 8.7 [Delay Damages] and shall not affect the maximum amount of these damages.

### 10.3 Interference with Tests on Completion

10.3.1 If the Contractor is prevented, for more than 14 days, from carrying out the Tests on Completion by a cause for which the Procuring Entity is responsible, the Procuring Entity shall be deemed to have taken over the Works or Section (as the case may be) on the date when the Tests on Completion would otherwise have been completed.

10.3.2 The Architect shall then issue a Taking-Over Certificate accordingly, and the Contractor shall carry out the Tests on Completion as soon as practicable, before the expiry date of the Defects Notification Period. The Architect shall require the Tests on Completion to be carried out by giving 14 days' notice and in accordance with the relevant provisions of the Contract.

10.3.3 If the Contractor suffers delay and/or incurs Cost as a result of this delay in carrying out the Tests on Completion, the Contractor shall give notice to the Architect and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

b) payment of any such accrued costs, which shall be included in the Contract Price.

10.3.4 After receiving this notice, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

### 10.4 Surfaces Requiring Reinstatement

Except as otherwise stated in a Taking-Over Certificate, a certificate for a Section or part of the Works shall not be deemed to certify completion of any ground or other surfaces requiring reinstatement.

## 11. DEFECTS LIABILITY

### 11.1 Completion of Outstanding Work and Remedying Defects

11.1.1 In order that the Works and Contractor's Documents, and each Section, shall be in the

condition required by the Contract (fair wear and tear excepted) by the expiry date of the relevant Defects Notification Period or as soon as practicable there after, the Contractor shall:

a) complete any work which is outstanding on the date stated in a Taking-Over Certificate, within such reasonable time as is instructed by the Engineer, and

b) execute all work required to remedy defects or damage, as may be notified by (or on behalf of) the Procuring Entity on or before the expiry date of the Defects Notification Period for the Works or Section (as the case may be).

11.1.2 If a defect appears or damage occurs, the Contractor shall be notified accordingly by the Engineer.

**11.2 Cost of Remedying Defects**

11.2.1 All work referred to in sub-paragraph (b) of Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:

a) Any design for which the Contractor is responsible,

b) Plant, Materials or workmanship not being in accordance with the Contract, or

c) Failure by the Contractor to comply with any other obligation.

11.2.2 If and to the extent that such work is attributable to any other cause, the Contractor shall be notified promptly by (or on behalf of) the Procuring Entity, and Sub-Clause 13.3 [Variation Procedure] shall apply.

**11.3 Extension of Defects Notification Period**

11.3.1 The Procuring Entity shall be entitled subject to Sub-Clause 2.5 [Procuring Entity's Claims] to an extension of the Defects Notification Period for the Works or a Section if and to the extent that the Works, Section or a major item of Plant (as the case may be, and after taking over) cannot be used for the purposes for which they are intended by reason of a defect or by reason of damage attributable to the Contractor. However, a Defects Notification Period shall not be extended by more than two years.

11.3.2 If delivery and/ or erection of Plant and/ or Materials was suspended under Sub-Clause 8.8 [Suspension of Work] or Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work], the Contractor's obligations under this Clause shall not apply to any defects or damage occurring more than two years after the Defects Notification Period for the Plant and/ or Materials would otherwise have expired.

**11.4 Failure to Remedy Defects**

11.4.1 If the Contractor fails to remedy any defect or damage within a reasonable time, a date may be fixed by the Engineer, on or by which the defect or damage is to be remedied. The Contractor shall be given reasonable notice of this date.

11.4.2 If the Contractor fails to remedy the defect or damage by this notified date and this remedial work was to be executed at the cost of the Contractor under Sub-Clause 11.2[ Costo f Remedying Defects], the Procuring Entity may (at his option):

(a) Carry out the work itself or by others, in a reasonable manner and at the Contractor's cost, but the Contractor shall have no responsibility for this work; and the Contractor shall subject to Sub-Clause 2.5 [Procuring Entity's Claims] pay to the Procuring Entity the costs reasonably incurred by the Procuring Entity in remedying the defect or damage;

(b) Require the Architect to agree or determine a reasonable reduction in the Contract Price in accordance with Sub-Clause 3.5 [Determinations]; or

(c) if the defect or damage deprives the Procuring Entity of substantially the whole

benefit of the Works or any major part of the Works, terminate the Contract as a whole, or in respect of such major part which cannot be put to the intended use. Without prejudice to any other rights, under the Contractor otherwise, the Procuring Entity shall then be entitled to recover all sums paid for the Works or for such part (as the case may be), plus financing costs and the cost of dismantling the same, clearing the Site and returning Plant and Materials to the Contractor.

**11.5 Removal of Defective Work**

If the defect or damage cannot be remedied expeditiously on the Site and the Procuring Entity gives consent, the Contractor may remove from the Site for the purposes of repair such items of Plant as are defective or damaged. This consent may require the Contractor to increase the amount of the Performance Security by the full replacement cost of these items, or to provide other appropriate security.

**11.6 Further Tests**

11.6.1 If the work of remedying of any defect or damage may affect the performance of the Works, the Architect may require the repetition of any of the tests described in the Contract. The requirement shall be made by notice within 14 days after the defect or damage is remedied.

11.6.2 These tests shall be carried out in accordance with the terms applicable to the previous tests, except that they shall be carried out at the risk and cost of the Party liable, under Sub-Clause 11.2 [Cost of Remedying Defects], for the cost of the remedial work.

**11.7 Right of Access**

Until the Completion Certificate has been issued, the Contractor shall have such right of access to the Works as is reasonably required in order to comply with this Clause, except as may be inconsistent with the Procuring Entity's reasonable security restrictions.

**11.8 Contractor to Search**

The Contractor shall, if required by the Engineer, search for the cause of any defect on parts of the works that have already accepted, under the direction of the Engineer. Unless the defect is to be remedied at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Cost of the search plus profit shall be agreed or determined by the Architect in accordance with Sub-Clause 3.5 [Determinations] and shall be included in the Contract Price.

**11.9 Completion Certificate**

11.9.1 Performance of the Contractor's obligations shall not be considered to have been completed until the Architect has issued the Completion Certificate to the Contractor, stating the date on which the Contractor completed his obligations under the Contract.

11.9.2 The Architect shall issue the Completion Certificate within 30days after the latest of the expiry dates of the Defects Liability Period, or as soon there after as the Contractor has supplied all the Contractor's Documents and completed and tested all the Works, including remedying any defects. A copy of the Completion Certificate shall be issued to the Procuring Entity.

11.9.3 Only the Completion Certificate shall be deemed to constitute acceptance of the Works.

### 11.10 Unfulfilled Obligations

After the Completion Certificate has been issued, each Party shall remain liable for the fulfilment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of unperformed obligations, the Contract shall be deemed to remain in force.

### 11.11 Clearance of Site

11.11.1 Upon receiving the Completion Certificate, the Contractor shall remove any remaining Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works from the Site.

11.11.2 If all these items have not been removed within 30 days after receipt by the Contractor of the Completion Certificate, the Procuring Entity may sell or otherwise dispose of any remaining items. The Procuring Entity shall be entitled to be paid the costs incurred in connection with, or attributable to, such sale or disposal and restoring the Site.

11.11.3 Any balance of the moneys from the sale shall be paid to the Contractor. If these moneys are less than the Procuring Entity's costs, the Contractor shall pay the outstanding balance to the Procuring Entity.

## 12. MEASUREMENT AN DEVALUATION

### 12.1 Works to be Measured

12.1.1 The Works shall be measured, and valued for payment, in accordance with this Clause. The Contractor shall show in each application under Sub-Clauses 14.3 [Application for Interim Payment Certificates], 14.10 [Statement on Completion] and 14.11 [Application for Final Payment Certificate] the quantities and other particulars detailing the amounts which he considers to be entitled under the Contract.

12.1.2 Whenever the Architect requires any part of the Works to be measured, reasonable notice shall be given to the Contractor's Representative, who shall:

a) promptly either attend or send another qualified representative to assist the Architect in making the measurement, and
b) supply any particulars requested by the Engineer.

12.1.3 If the Contractor fails to attend or send a representative, the measurement made by the Architect shall be accepted as accurate.

12.1.4 Except as otherwise stated in the Contract, wherever any Permanent Works are to be measured from records, these shall be prepared by the Engineer. The Contractor shall, as and when requested, attend to examine and agree on the records with the Engineer, and shall sign the same when agreed. If the Contractor does not attend, the records shall be accepted as accurate.

12.1.5 If the Contractor examines and disagrees the records, and/ or does not sign them as agreed, then the Contractor shall give notice to the Architect of the respects in which the records are asserted to be inaccurate. After receiving this notice, the Architect shall review the records and either confirm or vary them and certify the payment of the undisputed part. If the Contractor does not so give notice to the Architect within 14 days after being requested to examine the records, they shall be accepted as accurate.

### 12.2 Method of Measurement

Except as otherwise stated in the Contract:

a) Measurement shall be made of the net actual quantity of each item of the Permanent

Works, and

b) the method of measurement shall be in accordance with the Bill of Quantities or other applicable Schedules.

**12.3 Evaluation**

12.3.1 Except as otherwise stated in the Contract, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the value of work done by evaluating each item of work, applying the measurement agreed or determined in accordance with the above Sub-Clauses 12.1 and 12.2 and the appropriate rate or price for the item.

12.3.2 For each item of work, the appropriate rate or price for the item shall be the rate or price specified for such item in the Contractor, if there is no such item, specified for similar work.

12.3.3 Any item of work included in the Bill of Quantities for which no rate or price was specified shall be considered as included in other rates and prices in the Bill of Quantities and will not be paid for separately.

12.3.4 However, for a new item of work, a new rate or price shall be appropriate for such item of work if:

a) The work is instructed under Clause13 [Variations and Adjustments],

b) no rate or price is specified in the Contract for this item, and

c) no specified rate or price is appropriate because the item of work is not of similar character, or is not executed under similar conditions, as any item in the Contract.

12.3.5 Each new rate or price shall be derived from any relevant rates or prices in the Contract. If no rates or prices are relevant for the new item of work, it shall be derived from the reasonable Cost of executing such work, prevailing market rates, together with profit, taking account of any other relevant matters.

12.3.6 Until such time as an appropriate rate or price is agreed or determined, the Architect shall determine a provisional rate or price for the purposes of Interim Payment Certificates as soon as the concerned work commences.

12.3.7 Where the contract price is different from the corrected tender price, in order to ensure the contractor is not paid less or more relative to the contract price (*which would be the tender price*), payment valuation certificates and variation orders on omissions and additions valued based on rates in the Bill of Quantities or schedule of rates in the Tender, will be adjusted by a plus or minus percentage. The percentage already worked out during tender evaluation is worked out as follows: *(corrected tender price– tender price)/ tender price X 100*.

**12.4 Omissions**

Whenever the omission of any work forms part (or all) of a Variation, the value of which has not been agreed, if:

a) The Contractor will incur (or has incurred) cost which, if the work had not been omitted, would have been deemed to be covered by a sum forming part of the Accepted Contract Amount;

b) The omission of the work will result (or has resulted) in this sum not forming part of the Contract Price; and

c) this cost is not deemed to be included in the evaluation of any substituted work; then the Contractor shall give notice to the Architect accordingly, with supporting particulars. Upon receiving this notice, the Architect shall proceed in accordance with

Sub-Clause 3.5 [Determinations] to agree or determine this cost, which shall be included in the Contract Price.

## 13. VARIATIONS AND ADJUSTMENTS

### 13.1 Right to Vary

13.1.1 Variations may be initiated by the Architect at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal. No Variation instructed by the Architect under this Clause shall in any way vitiate or in validate the Contract.

13.1.2 The Contractor shall execute and be bound by each Variation, unless the Contractor promptly gives notice to the Architect stating (with supporting particulars) that (i) the Contractor cannot readily obtain the Goods required for the Variation, or (ii) such Variation triggers a substantial change in the sequence or progress of the Works. Upon receiving this notice, the Architect shall cancel, confirm or vary the instruction.

13.1.3 Each Variation may include:

a) changes to the quantities of any item of work included in the Contract (however, such changes do not necessarily constitute a Variation),

b) changes to the quality and other characteristics of any item of work,

c) changes to the levels, positions and/ or dimensions of any part of the Works,

d) omission of any work unless it is to be carried out by others,

e) any additional work, Plant, Materials or services necessary for the Permanent Works, including any associated Tests on Completion, boreholes and other testing and exploratory work, or

f) changes to the sequence or timing of the execution of the Works.

13.1.4 The Contractor shall not make any alteration and/or modification of the Permanent Works, unless and until the Architect instructs after obtaining approval of the Procuring Entity.

### 13.2 Variation Order Procedure

13.2.1 Prior to any Variation Order under Sub-Clause 13.1.4 the Architect shall notify the Contractor of the nature and form of such variation. As soon as possible after having received such notice, the Contractor shall submit to the Engineer:

a) A description of work, if any, to be performed and a programme for its execution, and

b) the Contractor's proposals for any necessary modifications to the Programme according to Sub-Clause 8.3 or to any of the Contractor's obligations under the Contract, and

c) the Contractor's proposals for adjustment to the Contract Price.

Following the receipt of the Contractor's submission the Architect shall, after due consultation with the Employer and the Contractor, decide as soon as possible whether or not the variation shall be carried out. If the Architect decides that the variation shall be carried out, he shall issue a Variation Order clearly identified as such in accordance with the Contractor's submission or as modified by agreement.

If the Architect and the Contractor are unable to agree the adjustment of the Contract Price, the provisions of Sub-Clause 13.2.2 shall apply.

### 13.3 Disagreement on Adjustment of the Contract Price

If the Contractor and the Architecture unable to agree on the adjustment of the Contract Price, the adjustment shall be determined in accordance with the rates specified in the Bills

of Quantities or Schedule of Daywork Prices. If the rates contained in the Bills of Quantities or Dayworks Prices are not directly applicable to the specific work in question, suitable rates shall be established by the Architect reflecting the level of pricing in the Dayworks Prices. Where rates are not contained in the said Prices, the amount shall be such as is in all the circumstances reasonable, reflecting a market price. Due account shall be taken of any over-or under-recovery of overheads by the Contractor in consequence of the variation. The Contractor shall also be entitled to be paid:

a) The cost of any partial execution of the Works rendered useless by any such variation,
b) The cost of making necessary alterations to Plant already manufactured or in the course of manufacture or of any work done that has to be altered in consequence of such a variation,
c) any additional costs incurred by the Contractor by the disruption of the progress of the Works as detailed in the Programme, and
d) the net effect of the Contractor's finance costs, including interest, caused by the variation.

The Architect shall on this basis determine the rates or prices to enable on-account payment to be included in certificates of payment.

**13.4 Contractor to Proceed**

On receipt of a Variation Order, the Contractor shall forth with proceed to carry out the variation and be bound to these Conditions in so doing as if such variation was stated in the Contract. The work shall not be delayed pending the granting of an extension of the Time for Completion or an adjustment to the Contract Price under Sub-Clause31.3.

**13.5 Value Engineering**

13.5.1 The Contractor may, at anytime, submit to the Architect written proposal which (in the Contractor's opinion) will, if adopted, (i) accelerate completion, (ii) reduce the cost to the Procuring Entity of executing, maintaining or operating the Works, (iii) improve the efficiency or value to the Procuring Entity of the completed Works, or (iv) otherwise be of benefit to the Procuring Entity.

13.5.2 The proposal shall be prepared at the cost of the Contractor and shall include the items listed in Sub-Clause 13.3 [Variation Procedure].

13.5.3 If a proposal, which is approved by the Engineer, includes a change in the design of part of the Permanent Works, then unless otherwise agreed by both Parties:

a) The Contractor shall design this part,
b) sub-paragraphs (a) to (d) of Sub-Clause 4.1 [Contractor's General Obligations] shall apply, and
c) if this change results in a reduction in the contract value of this part, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine a fee, which shall be included in the Contract Price. This fee shall behalf (50%) of the difference between the following amounts:
    i) such reduction in contract value, resulting from the change, excluding adjustments under Sub-Clause
    13.8 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost], and
    ii) the reduction (if any) in the value to the Procuring Entity of the varied works, taking account of any improvement in quality, anticipated life or operational efficiencies.

13.5.4 However, if the amount established in item 13.2.3 (c) (i) is less than amount established in item 13.2.3 (c (ii), there shall not be a fee. However, if the if the amount established in item

13.2.3 (c) (i) is more than amount established in item 13.2.3 (c (ii), it shall result in a price variation to the Procuring Entity.

**13.6 Variation Procedure for Value Engineering proposal**

13.6.1 If the Architect requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why he cannot comply (if this is the case) or by submitting:

a) A description of the proposed work to be performed and a programme for its execution,

b) the Contractor's proposal for any necessary modifications to the programme according to Sub-Clause 8.3 [Programme] and to the Time for Completion, and

c) the Contractor's proposal for evaluation of the Variation.

13.6.2 The Architect shall, as soon as practicable after receiving such proposal (under Sub-Clause 13.2 [Value Project Engineering] or otherwise), respond with approval, disapproval or comments. The Contractor shall not delay any work whilst a waiting a response.

13.6.3 Each instruction to execute a Variation, with any requirements for the recording of Costs, shall be issued by the Architect to the Contractor, who shall acknowledge receipt.

13.6.4 Each Variation shall be evaluated in accordance with Clause 12 [Measurement and Evaluation], unless the Architect instructs or approves otherwise in accordance with this Clause.

**13.7 Payment in Applicable Currencies**

If the Contract provides for payment of the Contract Price in more than one currency, then whenever an adjustment is agreed, approved or determined as stated above, the amount payable in each of the applicable currencies shall be specified. For this purpose, reference shall be made to the actual or expected currency proportions of the Cost of the varied work, and to the proportions of various currencies specified for payment of the Contract Price.

**13.8 Provisional Sums**

13.8.1 Each Provisional Sum shall only be used, in whole or in part, in accordance with the Architect instructions, and the Contract Price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Architect shall have instructed. For each Provisional Sum, the Architect May instruct:

a) Work to be executed (including Plant, Materials or services to be supplied) by the Contractor and valued under Sub-Clause 13.3 [Variation Procedure]; and/or

b) Plant, Materials or services to be purchased by the Contractor, from a nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]) or otherwise; and for which there shall be included in the Contract Price:

i) The actual amounts paid (or due to be paid) by the Contractor, and

ii) a sum for overhead charges and profit, calculated as a percentage of these actual amounts by applying the relevant percentage rate (if any) stated in the appropriate Schedule. If there is no such rate, the percentage rate stated in **the Special Conditions of Contract** shall be applied.

13.8.2 The Contractor shall, when required by the Engineer, produce quotations, invoices, vouchers and accounts or receipts in substantiation.

**13.9 Dayworks**

13.9.1 For work of a minor or incidental nature, the Architect may instruct that a Variation shall be

executed on a daywork basis. The work shall then be valued in accordance with the Daywork Schedule included in the Contract, and the following procedure shall apply. If a Daywork Schedule is not included in the Contract, this Sub-Clause shall not apply.

13.9.2 Before ordering Goods for the work, the Contractor shall submit quotations to the Engineer. When applying for payment, the Contractor shall submit invoices, vouchers and accounts or receipts for any Goods.

13.9.3 Except for any items for which the Daywork Schedule specifies that payment is not due, the Contractor shall deliver each day to the Architect accurate statements induplicate which shall include the following details of the resources used in executing the previous day's work:

a) The names, occupations and time of Contractor's Personnel,
b) the identification, type and time of Contractor's Equipment and Temporary Works, and
c) the quantities and types of Plant and Materials used.

13.9.4 One copy of each statement will, if correct, or when agreed, be signed by the Architect and returned to the Contractor. The Contractor shall then submit priced statements of these resources to the Engineer, prior to their inclusion in the next Statement under Sub-Clause 14.3 [Application for Interim Payment Certificates].

**13.10 Adjustments for Changes in Legislation**

13.10.1 The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of Kenya (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws, made after the Base Date, which affect the Contractor in the performance of obligations under the Contract.

13.10.2 If the Contractor suffers (or will suffer) delay and/or incurs (or will incur) additional Cost as a result of these changes in the Laws or in such interpretations, made after the Base Date, the Contractor shall give notice to the Architect and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
b) payment of any such Cost, which shall be included in the Contract Price.

13.10.3 After receiving this notice, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

13.10.4 Not withstanding the foregoing, the Contractor shall not be entitled to an extension of time if the relevant delay has already been taken into account in the determination of a previous extension of time and such Cost shall not be separately paid if the same shall already have been taken into account in the indexing of any inputs to the table of adjustment data in accordance with the provisions of Sub-Clause 13.8 [Adjustments for Changes in Cost].

**13.11 Adjustments for Changes in Cost**

13.11.1 In this Sub-Clause, "table of adjustment data" means the completed table of adjustment data for local and foreign currencies included in the Schedules. If there is no such table of adjustment data, this Sub-Clause shall not apply.

13.11.2 If this Sub-Clause applies, the amounts payable to the Contractor shall be adjusted for rises or falls in the cost of labor, Goods and other inputs to the Works, by the addition or deduction of the amounts determined by the formulae prescribed in this Sub-Clause. To the extent that full compensation for any rise or fall in Costs is not covered by the provisions

of this or other Clauses, the Accepted Contract Amount shall be deemed to have included a mounts to cover the contingency of other rises and falls in costs.

13.11.3 The adjustment to be applied to the amount otherwise payable to the Contractor, as valued in accordance with the appropriate Schedule and certified in Payment Certificates, shall be determined from formulae for each of the currencies in which the Contract Price is payable. No adjustment is to be applied to work valued on the basis of Cost or current prices. The formulae shall be of the following general type:

**Price Adjustment Formula**

Prices shall be adjusted for fluctuations in the cost of inputs only if **provided for in the SCC.** If so provided, the amounts certified in each payment certificate, before deducting for Advance Payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due in each currency. A separate formula of the type specified below applies:

**P = A + B Im/Io**
where:
**P** is the adjustment factor for the portion of the Contract Price payable.
**A** and **B** a re-coefficients **specified in the SCC,** representing then on adjustable and adjustable portions, respectively, of the Contract Price payable and
**I m** is the index prevailing at the end of the month being invoiced and **Io**c is the index prevailing 30 days before Bid opening for inputs payable.

**NOTE:** The sum of the two coefficients A and B should be 1 (one) in the formula for each currency. Normally, both coefficients shall be the same in the formulae for all currencies, since coefficient A, for the non adjustable

13.11.4 The cost indices or reference prices stated in the table of adjustment data shall be used. If their source is in doubt, itshall be determined by the Engineer. Forth is purpose, reference shall be made to the values of the indices at stated dates (quoted in the fourth and fifth columns respectively of the table) for the purposes of clarification of the source; although these dates (and thus these values) may not correspond to the base cost indices.

13.11.5 Incases where the "currency of index" is not the relevant currency of payment, each index shall be converted into the relevant currency of payment at the selling rate, established by the Central Bank of Kenya, of this relevant currency on the above date for which the index is required to be applicable.

13.11.6 Until such time as each current cost index is available, the Architect shall determine a provisional index for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.

13.11.7 If the Contractor fails to complete the Works within the Time for Completion, adjustment of prices there after shall be made using either (i) each index or price applicable on the date 49 days prior to the expiry of the Time for Completion of the Works, or (ii) the current index or price, whichever is more favorable to the Procuring Entity.

13.11.8 The weightings (coefficients) for each of the factors of cost stated in the table(s) of adjustment data shall only be adjusted if they have been rendered unreasonable, unbalanced or in applicable, as a result of Variations.

## 14. CONTRACT PRICE AND PAYMENT

### 14.1 The Contract Price

14.1.1 Unless otherwise stated in the Special Conditions:

a) The value of the payment certificate shall be agreed or determined under Sub-Clause 12.3 [Evaluation] and be subject to adjustments in accordance with the Contract;

b) the Contractor shall pay all taxes, duties and fees required to be paid by him under the Contract, and the Contract Price shall not be adjusted for any of these costs except as stated in Sub-Clause 13.7 [Adjustments for Changes in Legislation];

c) any quantities which may be set out in the Bill of Quantities or other Schedule are estimated quantities and are not to be taken as the actual and correct quantities:

i) of the Works which the Contractor is required to execute, or

ii) for the purposes of Clause12 [Measurement and Evaluation]; and

d) the Contractor shall submit to the Engineer, within 30 days after the Commencement Date, a proposed breakdown of each lump sum price in the Schedules. The Architect may take account of the break down when preparing Payment Certificates but shall not be bound by it.

14.1.2 Notwithstanding the provisions of subparagraph (b), Contractor's Equipment, including essential spare parts there for, imported by the Contractor for the sole purpose of executing the Contract shall not be exempt from the payment of import duties and taxes upon importation.

### 14.2 Advance Payment

14.2.1 The Procuring Entity shall make an advance payment, as an interest-free loan for mobilization and cashflow support, when the Contractor submits a guarantee in accordance with this Clause. The total advance payment, the number and timing of instalments (if more than one), and the applicable currencies and proportions, shall be as stated in the **Special Conditions of Contract.**

14.2.2 Unless and until the Procuring Entity receives this guarantee, or if the total advance payment is not stated in the Special Conditions of Contract, this Sub-Clause shall not apply.

14.2.3 The Architect shall deliver to the Procuring Entity and to the Contractor an Interim Payment Certificate for the advance payment or its first instalment after receiving a Statement (under Sub-Clause 14.3 [Application for Interim Payment Certificates]) and after the Procuring Entity receives (i) the Performance Security in accordance with Sub-Clause 4.2 [Performance Security] and (ii) a guarantee in amounts and currencies equal to the advance payment. This guarantee shall be issued by a reputable bank or financial institutions elected by the Contractor and shall be in the form annexed to the Special Conditions or in another form approved by the Procuring Entity.

14.2.4 The Contractor shall ensure that the guarantee is valid and enforceable until the advance payment has been repaid, but its amount shall be progressively reduced by the amount repaid by the Contractor as indicated in the Payment Certificates. If the terms of the guarantee specify its expiry date, and the advance payment has not been repaid by the date 30 days prior to the expiry date, the Contractor shall extend the validity of the guarantee until the advance payment has been repaid.

14.2.5 Unless stated otherwise in **the Special Conditions of Contract**, the advance payment shall be repaid through percentage deductions from the interim payments determined by the Architect in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates], as follows:

a) Deductions shall commence in the next interim Payment Certificate following that in which the total of all certified interim payments (excluding the advance payment and deductions and repayments of retention) exceeds 30 percent (30%) of the Accepted Contract Amount less Provisional Sums; and

b) deductions shall be made at the amortization rate stated in the **Special Conditions of Contract** of the amount of each Interim Payment Certificate (excluding the advance payment and deductions for its repayments as well as deductions for retention money) in the currencies and proportions of the advance payment until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the time when 90 percent (90%) of the Accepted Contract Amount less Provisional Sums has been certified for payment.

14.2.6 If the advance payment has not been repaid prior to the issue of the Taking-Over Certificate for the Works or prior to termination under Clause 15 [Termination by Procuring Entity], Clause 16 [Suspension and Termination by Contractor] or Clause 19 [Force Majeure] (as the case may be), the whole of the balance then outstanding shall immediately become due and in case of termination under Clause 15 [Termination by Procuring Entity], except for Sub-Clause 14.2.7 [Procuring Entity's Entitlement to Termination for Convenience], payable by the Contractor to the Procuring Entity.

### 14.3 Application for Interim Payment Certificates

14.3.1 The Contractor shall submit a Statement (in number of copies indicated in the **Special Conditions of Contract**) to the Architect after the end of each month, in a form approved by the Engineer, showing in detail the amounts to which the Contractor considers itself to be entitled, together with supporting documents which shall include there portion the progress during this month in accordance with Sub-Clause4.21 [Progress Reports].

14.3.2 The Statement shall include the following items, as applicable, which shall be expressed in the various currencies in which the Contract Price is payable, in the sequence listed:

a) the estimated contract value of the Works executed and the Contractor's Documents produced up to the end of the month (including Variations but excluding items described in sub-paragraphs (b) to (g) below);

b) any amounts to be added and deducted for changes in legislation and changes in cost, in accordance with Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost];

c) any amount to be deducted for retention, calculated by applying the percentage of retention stated in **the Special Conditions of Contract** to the total of the above amounts, until the amount so retained by the Procuring Entity reaches the limit of Retention Money (if any) stated **in the Special Conditions of Contract**;

d) any amounts to be added for the advance payment and (if more than one instalment) and to be deducted for its repayments in accordance with Sub-Clause 14.2 [Advance Payment];

e) any amounts to be added and deducted for Plant and Materials in accordance with Sub-Clause 14.5 [Plant and Materials intended for the Works];

f) any other additions or deductions which may have become due under the Contractor otherwise, including those under Clause 20 [Claims, Disputes and Arbitration]; and

g) the deduction of amounts certified in all previous Payment Certificates.

**14.4 Schedule of Payments**

14.4.1 If the Contract includes a schedule of payments specifying the instalments in which the Contract Price will be paid, then unless otherwise stated in this schedule:

a) The instalments quoted in this schedule of payments shall be the estimated contract values for the purposes of sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates];

b) Sub-Clause 14.5 [Plant and Materials intended for the Works] shall not apply; and

c) If these instalments are not defined by reference to the actual progress achieved in executing the Works, and if actual progress is found to be less or more than that on which this schedule of payments was based, then the Architect may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine revised instalments, which shall take account of the extent to which progress is less or more than that on which the instalments were previously based.

14.4.2 If the Contract does not include a schedule of payments, the Contractor shall submit non-binding estimates of the payments which he expects to become due during each quarterly period. The first estimate shall be submitted within 42 days after the Commencement Date. Revised estimates shall be submitted at quarterly intervals, until the Taking-Over Certificate has been issued for the Works.

**14.5 Plant and Materials intended for the Works**

14.5.1 If this Sub-Clause applies, Interim Payment Certificates shall include, under sub-paragraph (e) of Sub-Clause 14.3, (i) an amount for Plant and Materials which have been sent to the Site for incorporation in the Permanent Works, and (ii) a reduction when the contract value of such Plant and Materials is included as part of the Permanent Works under sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates].

14.5.2 If the lists referred to in sub-paragraphs (b)(i) or (c)(i) below are not included in the Schedules, this Sub-Clause shall not apply.

14.5.3 The Architect shall determine and certify each addition if the following conditions a resatisfied:

a) The Contractor has:
   i) kept satisfactory records (including the orders, receipts, Costs and use of Plant and Materials) which are available for inspection, and
   (ii) submitted statement of the Cost of acquiring and delivering the Plant and Materials to the Site, supported by satisfactory evidence;

   and either:

b) the relevant Plant and Materials:
   i) are those listed in the Schedules for payment when shipped,
   ii) have been shipped to Kenya, enroute to the Site, in accordance with the Contract; and
   iii) are described in a clean shipped bill of lading or other evidence of shipment, which has been submitted to the Architect together with evidence of payment of freight and insurance, any other documents reasonably required, and a bank guarantee in a form and issued by an entity approved by the Procuring Entity in amounts and currencies equal to the amount due under this Sub-Clause: this

guarantee may be in a similar form to the form referred to in Sub-Clause14.2 [Advance Payment] and shall be valid until the Plant and Materials are properly stored on Site and protected against loss, damage or deterioration; or

c) the relevant Plant and Materials:

i) are those listed in the Schedules for payment when delivered to the Site, and

ii) have been delivered to and are properly stored on the Site, are protected against loss, damage or deterioration and appear to be in accordance with the Contract.

14.5.4 The additional amount to be certified shall be the equivalent of eighty percent (80%) of the Architect determination of the cost of the Plant and Materials (including delivery to Site), taking account of the documents mentioned in this Sub-Clause and of the contract value of the Plant and Materials.

14.5.5 The currencies for this additional amount shall be the same as those in which payment will become due when the contract value is included under sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates]. At that time, the Payment Certificate shall include the applicable reduction which shall be equivalent to, and in the same currencies and proportions as, this additional amount for the relevant Plant and Materials.

**14.6 Issue of Interim Payment Certificates**

14.6.1 No amount will be certified or paid until the Procuring Entity has received and approved the Performance Security. Thereafter, the Architect shall, within 30 days after receiving a Statement and supporting documents, deliver to the Procuring Entity and to the Contractor an Interim Payment Certificate which shall state the amount which the Architect fairly determines to be due, with all supporting particulars for any reduction or withholding made by the Architect on the Statemen tif any.

14.6.2 However, prior to issuing the Taking-Over Certificate for the Works, the Architect shall not be bound to issue an Interim Payment Certificate in an amount which would (after retention and other deductions) be less than the minimum amount of Interim Payment Certificates (if any) stated **in the Special Conditions of Contract**. In this event, the Architect shall give notice to the Contractor accordingly.

14.6.3 An Interim Payment Certificate shall not be withheld for any other reason, although:

a) if anything supplied or work done by the Contractor is not in accordance with the Contract, the cost of rectification or replacement may be withheld until rectification or replacement has been completed; and/or

b) if the Contractor was or is failing to perform any work or obligation in accordance with the Contract, and had been so notified by the Engineer, the value of this work or obligation may be withheld until the work or obligation has been performed.

4.6.4 The Architect may in any Payment Certificate make any correction or modification that should properly be made to any previous Payment Certificate. A Payment Certificate shall not be deemed to indicate the Architect acceptance, approval, consent or satisfaction.

**14.7 Payment**

14.7.1 The Procuring Entity shall pay to the Contractor:

a) The advance payment shall be paid within 60 days after signing of the contract by both parties or within 60 days after receiving the documents in accordance with Sub-Clause 4.2 [Performance Security] and Sub- Clause 14.2 [Advance Payment], which ever is later;

b) The amount certified in each Interim Payment Certificate within 60 days after the

Architect Issues Interim Payment Certificate; and

c) the amount certified in the Final Payment Certificate within 60 days after the Procuring Entity Issues Interim Payment Certificate; or after determination of any disputed amount shown in the Final Statement in accordance with Sub-Clause 16.2 [Termination by Contractor].

14.7.2 Payment of the amount due in each currency shall be made into the bank account, nominated by the Contractor, in the payment country (forth is currency) specified in the Contract.

**14.8 Delayed Payment**

14.8.1 If the Contractor does not receive payment in accordance with Sub-Clause 14.7 [Payment], the Contractor shall be entitled to receive financing charges (simple interest) monthly on the amount unpaid during the period of delay. This period shall be deemed to commence on the date for payment specified in Sub-Clause 14.7 [Payment], irrespective (in the case of its sub-paragraph (b) of the date on which any Interim Payment Certificate is issued.

14.8.2 These financing charges shall be calculated at the annual rate of three percentage points above the mean rate of the Central Bank in Kenya of the currency of payment, or if not available, the inter bank offered rate, and shall be paid in such currency.

14.8.3 The Contractor shall be entitled to this payment without formal notice and certification, and without prejudice to any other right or remedy.

**14.9 Payment of Retention Money**

14.9.1 When the Taking-Over Certificate has been issued for the Works, the first half of the Retention Money shall be certified by the Architect for payment to the Contractor. If a Taking-Over Certificate is issued for a Section or part of the Works, a proportion of the Retention Money shall be certified and paid. This proportion shall behalf (50%) of the proportion calculated by dividing the estimated contract value of the Section or part, by the estimated final Contract Price.

14.9.2 Promptly after the latest of the expiry dates of the Defects Liability Periods, the outstanding balance of the Retention Money shall be certified by the Architect for payment to the Contractor. If a Taking-Over Certificate was issued for a Section, a proportion of the second half of the Retention Money shall be certified and paid promptly after the expiry date of the Defects Notification Period for the Section. This proportion shall behalf (50%) of the proportion calculated by dividing the estimated contract value of the Section by the estimated final Contract Price.

14.9.3 However, if any work remains to be executed under Clause 11 [Defects Liability], the Architects hall be entitled to withhold certification of the estimated cost of this work until it has been executed.

14.9.4 When calculating these proportions, no account shall be taken of any adjustments under Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause13.8 [Adjustments for Changes in Cost].

14.9.5 Unless otherwise stated in the Special Conditions, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment by the Engineer, the Contractor shall be entitled to substitute a Retention Money

Security guarantee, in the form annexed to the Special Conditions or in another form approved by the Procuring Entity and issued by a reputable bank or financial institution selected by the Contractor, for the second half of the Retention Money.

14.9.6 The Procuring Entity shall return the Retention Money Security guarantee to the Contractor within 14 days after receiving a copy of the Completion Certificate.

**14.10 Statement at Completion**

14.10.1 Within 84 days after receiving the Taking-Over Certificate for the Works, the Contractor shall submit to the Architect three copies of a Statement at completion with supporting documents, in accordance with Sub- Clause 14.3 [Application for Interim Payment Certificates], showing:

a) the value of all work done in accordance with the Contract up to the date stated in the Taking-Over Certificate for the Works,
b) any further sums which the Contractor considers to be due, and
c) an estimate of any other amounts which the Contractor considers will become due to him under the Contract. Estimated amounts shall be shown separately in this Statement at completion.

14.10.2 The Architect shall then certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates].

**14.11 Application for Final Payment Certificate**

14.11.1 Within 60 days after receiving the Completion Certificate, the Contractor shall submit, to the Engineer, six copies of a draft final statement with supporting documents showing in detail in a form approved by the Engineer:

a) The value of all work done in accordance with the Contract, and
b) Any further sums which the Contractor considers to be due to him under the Contractor otherwise.

14.11.2 If the Architect disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Architect may reasonably require within 30 days from receipt of said draft and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Architect the final statement as agreed. This agreed statement is referred to in these Conditions as the "Final Statement".

14.11.3 However, if, following discussions between the Architect and the Contractor and any changes to the draft final statement which are agreed, it be comes evident that a dispute exists, the Architect shall deliver to the Procuring Entity (with a copy to the Contractor) an Interim Payment Certificate for the agreed parts of the draft final statement. Thereafter, if the dispute is finally resolved under Sub-Clause 20.4 [Obtaining Dispute Board's Decision] or Sub-Clause 20.5 [Amicable Settlement], the Contractor shall then prepare and submit to the Procuring Entity (with a copy to the Engineer) a Final Statement.

**14.12 Discharge**

When submitting the Final Statement, the Contractor shall submit a discharge which confirms that the total of the Final Statement represents full and final settlement of all moneys due to the Contractor under or in connection with the Contract. This discharge may state that it becomes effective when the Contractor has received the Performance Security and the out standing balance of this total, in which event the discharge shall be effective on such date.

### 14.13 Issue of Final Payment Certificate

14.13.1 Within 30days after receiving the Final Statement and discharge in accordance with Sub-Clause 14.11 [Application for Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Architect shall deliver, to the Procuring Entity and to the Contractor, the Final Payment Certificate which shall state:

a) The amount which he fairly determines is finally due, and
b) After giving credit to the Procuring Entity for all amounts previously paid by the Procuring Entity and for all sums to which the Procuring Entity is entitled, the balance (if any) due from the Procuring Entity to the Contractor or from the Contractor to the Procuring Entity, as the case may be.

14.13.2 If the Contractor has not applied for a Final Payment Certificate in accordance with Sub-Clause 14.11 [Application for Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Architect shall request the Contractor to do so. If the Contractor fails to submit an application within a period of 30 days, the Architect shall issue the Final Payment Certificate for such amount as he fairly determines to be due.

### 14.14 Cessation of Procuring Entity's Liability

14.14.1 The Procuring Entity shall not be liable to the Contractor for any matter or thing under or in connection with the Contract or execution of the Works, except to the extent that the Contractor shall have included an amount expressly for it:

a) in the Final Statement and also,
b) (except for matters or things arising after the issue of the Taking-Over Certificate for the Works) in the Statement at completion described in Sub-Clause 14.10 [Statement at Completion].

14.14.2 However, this Sub-Clause shall not limit the Procuring Entity's liability under his indemnification obligations, or the Procuring Entity's liability in any case of fraud, deliberate default or reckless misconduct by the Procuring Entity.

### 14.15 Currencies of Payment

The Contract Price shall be paid in the currency or currencies named in the Schedule of Payment Currencies. If more than one currency is so named, payments shall be made as follows:

a) If the Accepted Contract Amount was expressed in Local Currency only:
   i) the proportions or amounts of the Local and Foreign Currencies, and the fixed rates of exchange to be used for calculating the payments, shall be as stated in the Schedule of Payment Currencies, except as otherwise agreed by both Parties;
   ii) payments and deductions under Sub-Clause 13.5 [Provisional Sums] and Sub-Clause 13.7 [Adjustments for Changes in Legislation] shall be made in the applicable currencies and proportions; and
   iii) other payments and deductions under sub-paragraphs (a) to (d) of Sub-Clause 14.3 [Application for Interim Payment Certificates] shall be made in the currencies and proportions specified in sub- paragraph (a) (i) above;
b) payment of the damages specified in the Special Conditions of Contract, shall be made in the currencies and proportions specified in the Schedule of Payment Currencies;

c) other payments to the Procuring Entity by the Contractor shall be made in the currency in which the sum was expended by the Procuring Entity, or in such currency as may be agreed by both Parties;

d) if any amount payable by the Contractor to the Procuring Entity in a particular currency exceeds the sum payable by the Procuring Entity to the Contractor in that currency, the Procuring Entity may recover the balance of this amount from the sums otherwise payable to the Contractor in other currencies; and

e) if no rates of exchange are stated in the Schedule of Payment Currencies, they shall be those prevailing on the Base Date and determined by the Central Bank of Kenya.

## 15. TERMINATION BY PROCURING ENTITY

### 15.1 Notice to correct any defects or failures

If the Contractor fails to carry out any obligation under the Contract, the Architect may by notice require the Contractor to make good the failure and to remedy it within 30 days.

### 15.2 Termination by Procuring Entity

15.2.1 The Procuring Entity shall be entitled to terminate the Contract if the Contractor breaches the contract based on following circumstances which shall include but not limited to:

a) fails to comply with Sub-Clause 4.2 [Performance Security] or with a notice under Sub-Clause 15.1 [Notice to Correct],

b) abandons the Works or otherwise plainly demonstrates the intention not to continue performance of his obligations under the Contract,

c) without reasonable excuse fails:

i) to proceed with the Works in accordance with Clause 8 [Commencement, Delays and Suspension], or

ii) to comply with a notice issued under Sub-Clause 7.5 [Rejection] or Sub-Clause 7.6 [Remedial Work], within 30 days after receiving it,

d) subcontracts the major part or whole of the Works or assigns the Contract without the consent of the Procuring Entity,

e) becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events, or

f) gives or offers to give (directly or indirectly) to any person any bribe, gift, gratuity, commission or other thing of value, as an induce mentor reward:

i) for doing or for bearing to do any action in relation to the Contract, or

ii) for showing or for bearing to show favor or disfavor to any person in relation to the Contract, or

iii) if any of the Contractor's Personnel, agents or Subcontractors gives or offers to give (directly or indirectly) to any person any such inducement or reward as is described in this sub-paragraph (f). However, lawful inducements and rewards to Contractor's Personnel shall not entitle termination, or

g) If the contract or repeatedly fails to remedy delivers defective work,

h) based on reasonable evidence, has engaged in Fraud and Corruption as defined in paragraph 2.2 of the Appendix B to these General Conditions, in competing for or in executing the Contract.

15.2.2 In any of these events or circumstances, the Procuring Entity may, upon giving 14 days'

notice to the Contractor, terminate the Contract and expel the Contractor from the Site. However, in the case of sub- paragraph (e) or (f) or (g) or (h), the Procuring Entity may by notice terminate the Contract immediately.

15.2.3 The Procuring Entity's election to terminate the Contract shall not prejudice any other rights of the Procuring Entity, under the Contractor otherwise.

15.2.4 The Contractor shall then leave the Site and deliver any required Goods, all Contractor's Documents, and other design documents made by or for him, to the Engineer. However, the Contractor shall use his best efforts to comply immediately with any reasonable instructions included in the notice (i) for the assignment of any subcontract, and (ii) for the protection of life or property or for the safety of the Works.

15.2.5 After termination, the Procuring Entity may complete the Works and/ or arrange for any other entities to do so. The Procuring Entity and these entities may then use any Goods, Contractor's Documents and other design documents made by or on behalf of the Contractor.

15.2.6 The Procuring Entity shall then give notice that the Contractor's Equipment and Temporary Works will be released to the Contractor at or near the Site. The Contractor shall promptly arrange their removal, at the risk and cost of the Contractor. However, if by this time the Contractor has failed to make a payment due to the Procuring Entity, these items may be sold by the Procuring Entity in order to recover this payment. Any balance of the proceeds shall then be paid to the Contractor.

### 15.3 Valuation at Date of Termination

As soon as practicable after a notice of termination under Sub-Clause 15.2 [Termination by Procuring Entity] has taken effect, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the value of the Works, Goods and Contractor's Documents, and any other sums due to the Contractor for work executed in accordance with the Contract.

### 15.4 Payment after Termination

After a notice of termination under Sub-Clause 15.2 [Termination by Procuring Entity] has taken effect, the Procuring Entity may:

a) Proceed in accordance with Sub-Clause 2.5 [Procuring Entity's Claims],
b) withhold further payments to the Contractor until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any), and all other costs incurred by the Procuring Entity, have been established, and/ or

c) recover from the Contractor any losses and damages incurred by the Procuring Entity and any extra costs of completing the Works, after allowing for any sum due to the Contractor under Sub-Clause 15.3 [Valuation at Date of Termination]. After recovering any such losses, damages and extra costs, the Procuring Entity shall pay any balance to the Contractor.

### 15.5 Procuring Entity's Entitlement to Termination for Convenience

The Procuring Entity shall be entitled to terminate the Contract, at any time at the Procuring Entity's convenience, by giving notice of such termination to the Contractor. The termination shall take effect 30 days after the later of the dates on which the Contractor receives this notice or the Procuring Entity returns the Performance Security. The Procuring Entity shall not terminate the Contract under this Sub-Clause in order to execute the Works itself or to arrange for the Works to be executed by another contractor or to avoid a termination of the Contract by the Contractor under Clause 16.2 [Termination by

Contractor]. After this termination, the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's Equipment] and shall be paid in accordance with Sub-Clause 16.4 [Payment on Termination].

### 15.6 Fraud and Corruption

The Contractor shall ensure compliance with the Kenya Government's Anti-Corruption Laws and its prevailing sanctions.

### 15.7 Corrupt gifts and payments of commission

15.7.1 The Contractor shall not;

a) Offer or give or agree to give to any person in the service of the Procuring Entity any gift or consideration of any kind as an inducement or reward for doing or for bearing to door for having done or for borne to do any act in relation to the obtaining or execution of this or any other Contract for the Procuring Entity or for showing or for bearing to show favor or disfavor to any person in relation to this or any other contract for the Procuring Entity.

b) Enter into this or any other contract with the Procuring Entity in connection with which commission has been paid or agreed to be paid by him or on his behalf or to his knowledge, unless before the Contract is made particulars of any such commission and of the terms and conditions of any agreement for the payment there of have been disclosed in writing to the Procuring Entity.

15.7.2 Any breach of this Condition by the Contractor or by anyone employed by him or acting on his behalf (whether with or without the knowledge of the Contractor) shall be an offence under the provisions of the Public Procurement and Asset Disposal Act (2015) and the Anti-Corruption and Economic Crimes Act (2003) of the Laws of Kenya.

## 16. SUSPENSION AND TERMINATION BY CONTRACTOR

### 16.1 Contractor's Entitlement to Suspend Work

16.1.1 If the Architect fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or Sub-Clause 14.7 [Payment],or not receiving instructions that would enable the contractor to proceed with the works in accordance with the program, the Contractor may, after giving not less than 30 days' notice to the Procuring Entity, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment Certificate, reasonable evidence or payment, as the case may be and as described in the notice.

16.1.2 The Contractor's action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2 [Termination by Contractor].

16.1.3 If the Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before giving a notice of termination, the Contractor shall resume normal working as soon as is reasonably practicable.

16.1.4 If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall give notice to the Architect and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
b) payment of any such Cost-plus profit, which shall be included in the Contract Price.

**16.2** After receiving this notice, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

### 16.3 Termination by Contractor

16.3.1 The Contractor shall be entitled to terminate the Contract if:

a) the Architect fails, within 60 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate,
b) the Contractor does not receive the amount due under an Interim Payment Certificate within 90 days after the expiry of the time stated in Sub-Clause1 4.7 [Payment] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [Procuring Entity's Claims]),
c) the Procuring Entity substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract,
d) a prolonged suspension affects the whole of the Works as described in Sub-Clause 8.11 [Prolonged Suspension], or
e) the Procuring Entity becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events.
f) the Contractor does not receive the Architect instruction recording the agreement of both Parties on the fulfilment of the conditions for the Commencement of Works under Sub-Clause 8.1 [Commencement of Works].

16.3.2 In any of these events or circumstances, the Contractor may, upon giving 14 days' notice to the Procuring Entity, terminate the Contract. However, in the case of sub-paragraph (f) or (g), the Contractor may by notice terminate the Contract immediately.

16.3.3 The Contractor's election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contractor otherwise.

### 16.4 Cessation of Work and Removal of Contractor's Equipment

After a notice of termination under Sub-Clause 15.5 [Procuring Entity's Entitlement to Termination for Convenience], Sub-Clause 16.2 [Termination by Contractor] or Sub-Clause 19.6 [Optional Termination, Payment and Release] has taken effect, the Contractor shall promptly:

a) cease all further work, except for such work as may have been instructed by the Architect for the protection of life or property or for the safety of the Works,
b) hand over Contractor's Documents, Plant, Materials and other work, for which the Contractor has received payment, and
c) remove all other Goods from the Site, except as necessary for safety, and leave the Site.

### 16.5 Payment on Termination

After a notice of termination under Sub-Clause 16.2 [Termination by Contractor] has taken effect, the Procuring Entity shall promptly:

a) Return the Performance Security to the Contractor,

b) pay the Contractor in accordance with Sub-Clause 19.6 [Optional Termination, Payment and Release], and

c) pay to the Contractor the amount of any loss or damage sustained by the Contractor as a result of this termination.

## 17. RISK AND RESPONSIBILITY

### 17.1 Indemnities

17.1.1 The Contractor shall indemnify and hold harmless the Procuring Entity, the Procuring Entity's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of:

a) Bodily injury, sickness, disease or death, of any person what so ever arising outo for in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless attributable to any negligence, willful actor breach of the Contract by the Procuring Entity, the Procuring Entity's Personnel, or any of their respective agents, and

b) damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss arises out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless and to the extent that any such damage or loss is attributable to any negligence, willful act or breach of the Contract by the Procuring Entity, the Procuring Entity's Personnel, their respective agents, or anyone directly or indirectly employed by any of them.

17.1.2 The Procuring Entity shall indemnify and hold harmless the Contractor, the Contractor's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of (1) bodily injury, sickness, disease or death, which is attributable to any negligence, willful act or breach of the Contract by the Procuring Entity, the Procuring Entity's Personnel, or any of their respective agents, and (2) the matters for which liability may be excluded from insurance cover, as described in sub-paragraphs (d)(i), (ii) and (iii) of Sub-Clause 18.3 [Insurance Against Injury to Persons and Damage to Property], unless and to the extent that any such damage or loss is attributable to any negligence, willful actor breach of the Contract by the contractor, the contractor's Personnel, their respective agents, or anyone directly or indirectly employed by any of them.

### 17.2 Contractor's Care of the Works

17.2.1 The Contractor shall take full responsibility for the care of the Works and Goods from the Commencement Date until the Taking-Over Certificate is issued (or is deemed to be issued under Sub-Clause 10.1 [Taking Over of the Works and Sections]) for the Works, when responsibility for the care of the Works shall pass to the Procuring Entity. If a Taking-Over Certificate is issued (or is so deemed to be issued) for any Section or part of the Works, responsibility for the care of the Section or part shall then pass to the Procuring Entity.

17.2.2 After responsibility has accordingly passed to the Procuring Entity, the Contractor shall take responsibility for the care of any work which is outstanding on the date stated in a Taking-Over Certificate, until this outstanding work has been completed.

17.2.3 If any loss or damage happens to the Works, Goods or Contractor's Documents during the period when the Contractor is responsible for their care, from any cause not listed in Sub-Clause 17.3 [Procuring Entity's Risks], the Contractor shall rectify the loss or damage at the Contractor's risk and cost, so that the Works, Goods and Contractor's Documents conform with the Contract.

17.2.4 The Contractor shall be liable for any loss or damage caused by any actions performed by the Contractor after a Taking-Over Certificate has been issued. The Contractor shall

also be liable for any loss or damage which occurs after a Taking-Over Certificate has been issued and which arose from a previous event for which the Contractor was liable.

**17.3 Procuring Entity's Risks**

The risks referred to in Sub-Clause 17.4 [Consequences of Procuring Entity's Risks] below, in so far as they directly affect the execution of the Works in Kenya, are:

a) War hostilities (whether war be declared or not),
b) rebellion, riot, commotion or disorder, terrorism, sabotage by persons other than the Contractor's Personnel,
c) explosive materials, ionizing gradiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such explosives, radiation or radio-activity,
d) pressure waves caused by aircraft or other aerial devices traveling at sonic or supersonic speeds,
e) use or occupation by the Procuring Entity of any part of the Permanent Works, except as may be specified in the Contract,
f) design of any part of the Works by the Procuring Entity's Personnel or by others for whom the Procuring Entity is responsible, and
g) any operation of the forces of nature which is Unforeseeable or against which an experienced contractor could not reasonably have been expected to have taken adequate preventive precautions.

**17.4 Consequences of Procuring Entity's Risks**

17.4.1 If and to the extent that any of the risks listed in Sub-Clause 17.3 above results in loss or damage to the Works, Goods or Contractor's Documents, the Contractor shall promptly give notice to the Architect and shall rectify this loss or damage to the extent required by the Engineer.

17.4.2 If the Contractor suffers delay and/ or incurs Cost from rectifying this loss or damage, the Contractor shall give a further notice to the Architect and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
(b) Payment of any such Cost, which shall be included in the Contract Price. In the case of sub-paragraphs (e)and (g) of Sub-Clause 17.3 [Procuring Entity's Risks], Accrued Costs shall be payable.

17.4.3 After receiving this further notice, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

**17.5 Intellectual and Industrial Property Rights**

17.5.1 In this Sub-Clause, "infringement" shall refer to an infringement (or alleged infringement) of any patent, registered design, copyright, trade mark, trade name, trade secret or other intellectual or industrial property right relating to the Works; and "claim" shall refer to a claim (or proceedings pursuing a claim) alleging an infringement.

17.5.2 Whenever a Party does not give notice to the other Party of any claim within 30 days of receiving the claim, the first Party shall be deemed to have waived any right to indemnity under this Sub-Clause.

17.5.3 The Procuring Entity shall indemnify and hold the Contractor harmless against and from any claim alleging an infringement which is or was:
a) An un avoidable result of the Contractor's compliance with the Contract, or
b) A result of any Works being used by the Procuring Entity:
i) for a purpose other than that indicated by, or reasonably to be inferred from, the Contract, or
ii) in conjunction with anything not supplied by the Contractor, unless such use was disclosed to the Contractor prior to the Base Date or is stated in the Contract.

17.5.4 The Contractor shall indemnify and hold the Procuring Entity harmless again stand from any other claim which arises out of or in relation to (i) the manufacture, use, sale or import of any Goods, or (ii) any design for which the Contractor is responsible.

17.5.5 If a Party is entitled to be indemnified under this Sub-Clause, the indemnifying Party may (at its cost) conduct negotiations for the settlement of the claim, and any litigation or arbitration which may arise from it. The other Party shall, at the request and cost of the indemnifying Party, assist in contesting the claim. This other Party (and its Personnel) shall not make any admission which might be prejudicial to the indemnifying Party, unless the indemnifying Party failed to take over the conduct of any negotiations, litigation or arbitration upon being requested to do so by such other Party.

17.5.6 For operation and maintenance of any plan to reequipment installed, the contractor shall grant a non-exclusive and non-transferable license to the Procuring Entity under the patent, utility models ,or other intellectual rights owned by the contractor or a third party from whom the contract or has received the rights to grant sub-licenses and shall also grant to the Procuring Entity a non-exclusive and non-transferable rights (without the rights to sub-license) to use the know how and other technical information disclosed to the contract or under the contract. Nothing contained here-in shall be construed as transferring ownership of any patent, utility model, trademark, design, copy right, know-how or other intellectual rights from the contractor or any other third party to the Procuring Entity.

**17.6 Limitation of Liability**

17.6.1 Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contractor for any in director consequential loss or damage which may be suffered by the other Party in connection with the Contract, other than as specifically provided in Sub-Clause 8.7 [Delay Damages]; Sub-Clause 11.2 [Cost of Remedying Defects]; Sub-Clause 15.4 [Payment after Termination]; Sub-Clause 16.4 [Payment on Termination]; Sub-Clause 17.1 [Indemnities]; Sub-Clause 17.4(b) [Consequences of Procuring Entity's Risks] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights].

17.6.2 The total liability of the Contractor to the Procuring Entity, under or in connection with the Contract other than under Sub-Clause 4.19 [Electricity, Water and Gas], Sub-Clause 4.20 [Procuring Entity's Equipment and Free- Issue Materials], Sub-Clause 17.1 [Indemnities] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights], shall not exceed the sum resulting from the application of a multiplier (less or greater than one) to the Accepted Contract Amount, as stated in **the Special Conditions of Contract**, or (if such multiplier or other sum is not so stated) the Accepted Contract Amount.

17.6.3 This Sub-Clause shall not limit liability in any case of fraud, deliberate default or reckless misconduct by the defaulting Party.

**17.7 Use of Procuring Entity's Accommodation/Facilities**

17.7.1 The Contractor shall take full responsibility for the care of the Procuring Entity provided accommodation and facilities, if any, as detailed in the Specification, from the respective dates of hand-over to the Contractor until cessation of occupation (where hand-over or cessation of occupation may take place after the date stated in the Taking-Over

Certificate for the Works).

17.7.2 If any loss or damage happens to any of the above items while the Contractor is responsible for their care arising from any cause whatsoever other than those for which the Procuring Entity is liable, the Contractor shall, at his own cost, rectify the loss or damage to the satisfaction of the Engineer.

## 18. INSURANCE

### 18.1 General Requirements for Insurances

18.1.1 In this Clause, "insuring Party" means, for each type of insurance, the Party responsible for effecting and maintaining the insurance specified in the relevant Sub-Clause.

18.1.2 Wherever the Contractor is the insuring Party, each insurance shall be effected with insurers and in terms approved by the Procuring Entity. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause.

18.1.3 Wherever the Procuring Entity is the insuring Party, each insurance shall be effected with insurers and in terms acceptable to the Contractor. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause.

18.1.4 If a policy is required to indemnify joint insured, the cover shall apply separately to each insured as though a separate policy had been issued for each of the joint insured. If a policy indemnifies additional joint insured, namely in addition to the insured specified in this Clause, (i) the Contractor shall act under the policy on behalf of these additional joint insured except that the Procuring Entity shall act for Procuring Entity's Personnel, (ii) additional joint insured shall not be entitled to receive payments directly from the insurer or to have any other direct dealings with the insurer, and (iii) the insuring Party shall require all additional joint insured to comply with the conditions stipulated in the policy.

18.1.5 Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify the loss or damage. Payments received from insurers shall be used for the rectification of the loss or damage.

18.1.6 The relevant insuring Party shall, within the respective periods stated in **the Special Conditions of Contract** (calculated from the Commencement Date), submit to the other Party:

a) Evidence that the insurances described in this Clause have been affected, and
b) copies of the policies for the insurances described in Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment] and Sub-Clause 18.3 [Insurance against Injury to Persons and Damage to Property].

18.1.7 When each premium is paid, the insuring Party shall submit evidence of payment to the other Party. Whenever evidence or policies are submitted, the insuring Party shall also give notice to the Engineer.

18.1.8 Each Party shall comply with the conditions stipulated in each of the insurance policies. The insuring Party shall keep the insurers informed of any relevant changes to the execution of the Works and ensure that insurance is maintained in accordance with this Clause.

18.1.9 Neither Party shall make any material alteration to the terms of any insurance without the

prior approval of the other Party. If an insurer makes (or at tempts to make) any alteration, the Party first notified by the insurer shall promptly give notice to the other Party.

18.1.10 If the insuring Party fails to effect and keep in force any of the insurances it is required to effect and maintain under the Contractor fails to provide satisfactory evidence and copies of policies in accordance with this Sub- Clause, the other Party may (at its option and without prejudice to any other right or remedy) effect insurance for the relevant coverage and pay the premiums due. The insuring Party shall pay the amount of these premiums to the other Party, and the Contract Price shall be adjusted accordingly.

18.1.11 Nothing in this Clause limits the obligations, liabilities or responsibilities of the Contractor or the Procuring Entity, under the other terms of the Contractor otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the Contractor and/or the Procuring Entity.

18.1.12 Procuring Entity in accordance with these obligations, liabilities or responsibilities. However, if the insuring Party fails to effect and keep in force an insurance which is available and which it is required to effect and maintain under the Contract, and the other Party neither approves the omission nor effects insurance for the coverage relevant to this default, any moneys which should have been recoverable under this insurance shall be paid by the insuring Party.

18.1.13 Payments by one Party to the other Party shall be subject to Sub-Clause 2.5 [Procuring Entity's Claims] or Sub- Clause 20.1 [Contractor's Claims], as applicable.

18.1.14 The Contractor shall be entitled to place all insurance relating to the Contract (including, but not limited to the insurance referred to Clause 18) with insurers from any eligible source country.

**18.2 Insurance for Works and Contractor's Equipment**

18.2.1 The insuring Party shall insure the Works, Plant, Material sand Contractor's Documents for not less than the full reinstatement cost including the costs of demolition, removal of debris and professional fees and profit. This insurance shall be effective from the date by which the evidence is to be submitted under sub-paragraph (a) of Sub-Clause 18.1 [General Requirements for Insurances], until the date of issue of the Taking-Over Certificate for the Works.

18.2.2 The insuring Party shall maintain this insurance to provide cover until the date of issue of the Performance Certificate, for loss or damage for which the Contractor is liable arising from a cause occurring prior to the issue of the Taking-Over Certificate, and for loss or damage caused by the Contractor in the course of any other operations (including those under Clause 11 [Defects Liability]).

18.2.3 The insuring Party shall insure the Contractor's Equipment for not less than the full replacement value, including delivery to Site. For each item of Contractor's Equipment, the insurance shall be effective while it is being transported to the Site and until it is no longer required as Contractor's Equipment.

18.2.4 Unless otherwise stated in the Special Conditions, insurances under this Sub-Clause:

a) Shall be effected and maintained by the Contractor as insuring Party,

b) shall be in the joint names of the Parties, who shall be jointly entitled to receive payments from the insurers, payments being held or allocated to the Party actually bearing the costs of rectifying the loss or damage,

c) shall cover all loss and damage from any cause not listed in Sub-Clause 17.3 [Procuring Entity's Risks],

d) shall also cover, to the extent specifically required in the tendering documents of the Contract, loss or damage to a part of the Works which is attributable to the use or

occupation by the Procuring Entity of another part of the Works, and loss or damage from the risks listed in sub-paragraphs (c), (g) and (h)of Sub-Clause 17.3 [Procuring Entity's Risks], excluding (in each case) risks which are not insurable at commercially reasonable terms, with deductibles per occurrence of not more than the amount stated **in the Special Conditions** of Contract (if an amount is not so stated,t his sub-paragraph (d) shall not apply), and

e) may however exclude loss of, damage to, and reinstatement of:
   i) a part of the Works which is in a defective condition due to a defect in its design, materials or workmanship (but cover shall include any other parts which are lost or damaged as a direct result of this defective condition and not as described in sub-paragraph (ii) below),
   ii) apart of the Works which is lost or damaged in order to reinstate any other part of the Works if this other part is in a defective condition due to a defect in its design, materials or workmanship,
   iii) apart of the Works which has been taken over by the Procuring Entity, except to the extent that the Contractor is liable for the loss or damage, and
   iv) Goods while they are not in Kenya, subject to Sub-Clause 14.5 [Plant and Materials intended for the Works].

18.2.5 If, more than one year after the Base Date, the cover described in sub-paragraph (d) above ceases to be available at commercially reasonable terms, the Contractor shall (as insuring Party) give notice to the Procuring Entity, with supporting particulars. The Procuring Entity shall then (i) be entitled subject to Sub-Clause 2.5 [Procuring Entity's Claims] to payment of an amount equivalent to such commercially reasonable terms as the Contractor should have expected to have paid for such cover, and (ii) be deemed, unless he obtains the cover at commercially reasonable terms, to have approved the omission under Sub-Clause 18.1 [General Requirements for Insurances].

**18.3 Insurance against Injury to Persons and Damage to Property**

18.3.1 The insuring Party shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property (except things insured under Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment]) or to any person (except persons insured under Sub-Clause 18.4 [Insurance for Contractor's Personnel]), which may arise out of the Contractor's performance of the Contract and occurring before the issue of the Performance Certificate.

18.3.2 This insurance shall be for a limit per occurrence of not less than the amount stated in **the Special Conditions of Contract**, with no limit on the number of occurrences. If an amount is not stated in the **Special Conditions of Contract**, this Sub-Clause shall not apply.

18.3.3 Unless otherwise stated in the Special Conditions, the insurances specified in this Sub-Clause:

a) Shall be effected and maintained by the Contractor as insuring Party,

b) shall be in the joint names of the Parties,

c) shall be extended to cover liability for all loss and damage to the Procuring Entity's property (except things insured under Sub-Clause 18.2) arising out of the Contractor's performance of the Contract, and

d) may however exclude liability to the extent that it arises from:
   i) the Procuring Entity's right to have the Permanent Works executed on, over, under, in or
   ii) through any land, and to occupy this land for the Permanent Works,
   iii) damage which is an unavoidable result of the Contractor's obligations to execute the

iv) Works and remedy any defects, and

v) a cause listed in Sub-Clause 17.3 [Procuring Entity's Risks], except to the extent that cover is available at commercially reasonable terms.

### 18.4 Insurance for Contractor's Personnel

18.4.1 The Contractor shall effect and maintain insurance against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel.

18.4.2 The insurance shall cover the Procuring Entity and the Architect against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of the Procuring Entity or of the Procuring Entity's Personnel.

18.4.3 The insurance shall be maintained in full force and effect during the whole time that these personnel are assisting in the execution of the Works. For a Subcontractor's employees, the insurance may be effected by the Subcontractor, but the Contractor shall be responsible for compliance with this Clause.

## 19. FORCE MAJEURE

### 19.1 Definition of Force Majeure

19.1.1 In this Clause, "Force Majeure" means an exceptional event or circumstance:

a) Which is beyond a Party's control,

b) Which such Party could not reasonably have provided against before entering into the Contract,

c) which, having arisen, such Party could not reasonably have avoided or over come, and

d) which is not substantially attributable to the other Party.

19.1.2 Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied:

a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,

b) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war,

c) riot, commotion, disorder, strike or lock out by persons other than the Contractor's Personnel,

d) munitions of war, explosive materials, ionizing radiation or contamination by radio-activity, except as may be attributable to the Contractor' s use of such munitions, explosives, radiation or radio-activity, and

e) natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.

### 19.2 Notice of Force Majeure

19.2.1 If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.

19.2.2 The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.

19.2.3 Not withstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.

**19.3 Duty to Minimize Delay**

Each Party shall at all times use all reasonable endeavors to minimize any delay in the performance of the Contract as a result of Force Majeure. A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.

**19.4 Consequences of Force Majeure**

19.4.1 If the Contractor is prevented from performing his substantial obligations under the Contract by Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], and suffers delay and/ or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and

b) if the event or circumstance is of the kind described in sub-paragraphs (i) to (iv) of Sub-Clause 19.1 [Definition of Force Majeure] and, in sub-paragraphs (ii) to (iv), occurs in Kenya, payment of any such Cost, including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Force Majeure, to the extent they are not indemnified through the insurance policy referred to in Sub- Clause18.2 [Insurance for Works and Contractor's Equipment].

19.4.2 After receiving this notice, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

**19.5 Force Majeure Affecting Subcontractor**

If any Subcontractor is entitled under any contract or agreement relating to the Works to relief from force majeure on terms additional to or broader than those specified in this Clause, such additional or broader force majeure events or circumstances shall not excuse the Contractor's non-performance or entitle him to relief under this Clause.

**19.6 Optional Termination, Payment and Release**

19.6.1 If the execution of substantially all the Works in progress is prevented for a continuous period of 84 days by reason of Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], or for multiple periods which total more than 140 days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's Equipment].

19.6.2 Upon such termination, the Architect shall determine the value of the work done and issue a Payment Certificate which shall include:

a) The amounts payable for any work carried out for which a price is stated in the Contract;

b) the Cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery: this Plant and Materials shall become the property of (and be at the risk of) the Procuring Entity when paid for by the Procuring Entity, and the Contractor shall place the same at the Procuring Entity's disposal;

c) other Cost or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works;
d) the Cost of removal of Temporary Works and Contractor's Equipment from the Site and the return of these items to the Contractor's works in his country (or to any other destination at no greater cost); and
e) the Cost of repatriation of the Contractor's staff and lab or employed wholly in connection with the Works at the date of termination.

### 19.7 Release from Performance

Not withstanding any other provision of this Clause, if any event or circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both Parties to fulfil its or their contractual obligations or which, under the law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance:

a) The Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract, and
b) The sum payable by the Procuring Entity to the Contractor shall be the same as would have been payable under Sub-Clause 19.6 [Optional Termination, Payment and Release] if the Contract had been terminated under Sub-Clause 19.6.

## 20. SETTLEMENT OF CLAIMS AND DISPUTES

### 20.1 Contractor's Claims

20.1.1 If the Contractor considers itself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give Notice to the Engineer, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 30 days after the Contractor became aware, or should have become aware, of the event or circumstance.

20.1.2 If the Contractor fails to give notice of a claim within such period of 30 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Procuring Entity shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Sub-Clause shall apply.

20.1.3 The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

20.1.4 The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at an other location acceptable to the Engineer. Without admitting the Procuring Entity's liability, the Architect may, after receiving any notice under this Sub-Clause, monitor the record-keeping and/ or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Architect to inspect all these records and shall (if instructed) submit copies to the Engineer.

20.1.5 Within 42days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Engineer, the Contractor shall send to the Architect fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/ or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:

a) This fully detailed claim shall be considered as interim;
b) The Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/ or amount claimed, and such further particulars as the

Architect may reasonably require; and

c) The Contractor shall send a final claim within 30 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Engineer.

20.1.6 Within 42 days after receiving a Notice of a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Architect and approved by the Contractor, the Architect shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars but shall nevertheless give his response on the principles of the claim within the above defined time period.

20.1.7 Within the above defined period of 42 days, the Architect shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with Sub-Clause 8.4 [Extension of Time for Completion], and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

20.1.8 Each Payment Certificate shall include such additional payment for any claim as has been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

20.1.9 If the Architect does not respond within the time frame defined in this Clause, either Party may consider that the claim is rejected by the Architect and any of the Parties may refer the dispute for amicable settlement in accordance with Clause 20.3.

20.1.10 The requirements of this Sub-Clause are in addition to those of any other Sub-Clause which may apply to a claim. If the Contractor fails to comply with this or another Sub-Clause in relation to any claim, any extension of time and/ or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Sub-Clause 20.3.

**20.2 Procuring Entity's Claims**

20.2.1 If the Procuring Entity considers itself to be entitled to any payment under any Clause of these Conditions or otherwise in connection with the Contract, and/or to any extension of the Defects Notification Period, the Procuring Entity or the Architect shall give notice and particulars to the Contractor. However, notice is not required for payments due under Sub-Clause 4.19 [Electricity, Water and Gas], under Sub-Clause 4.20 [Procuring Entity's Equipment and Free-Issue Materials], or for other services requested by the Contractor.

20.2.2 The notice shall be given as soon as practicable and no longer than 30 days after the Procuring Entity became aware, or should have become aware, of the event or circumstances giving rise to the claim. A notice relating to any extension of the Defects Notification Period shall be given before the expiry of such period.

20.2.3 The particulars shall specify the Clause or other basis of the claim and shall include substantiation of the amount and/or extension to which the Procuring Entity considers itself to be entitled in connection with the Contract. The Architect shall then proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the amount (if any) which the Procuring Entity is entitled to be paid by the Contractor, and/ or (ii) the extension (if any) of the Defects Notification Period in accordance with Sub-Clause 11.3 [Extension of Defects Notification Period].

20.2.4 This amount may be included as a deduction in the Contract Price and Payment Certificates. The Procuring Entity shall only be entitled to set off against or make any deduction from an amount certified in a Payment Certificate, or to otherwise claim against the Contractor, in accordance with this Sub-Clause.

**20.3 Amicable Settlement**

Where a notice of a claim has been given, both Parties shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both Parties agree otherwise, the Party giving a notice of a claim in accordance with Sub-Clause 20.1 above should move to commence arbitration after 60 days from the day on which a notice of a claim was given, even if no attempt at an amicable settlement has been made.

**20.4 Matters that may be referred to arbitration**

Notwithstanding anything stated herein the following matters may be referred to arbitration before the practical completion of the Works or abandonment of the Works or termination of the Contract by either party:

a) Whether or not the issue of an instruction by the Architect is empowered by these Conditions.
b) Whether or not a certificate has been improperly withheld or is not in accordance with these Conditions.
c) Any dispute arising in respect risks arising from matters referred to in Clause 17.3 and Clause 19.
d) All other matters shall only be referred to arbitration after the completion or alleged completion of the Works or termination or alleged termination of the Contract, unless the Procuring Entity and the Contractor agree otherwise in writing.

**20.5 Arbitration**

20.5.1 Any claim or dispute between the Parties arising out of or in connection with the Contract not settled amicably in accordance with Sub-Clause 20.3 shall be finally settled by arbitration.

20.5.2 No arbitration proceedings shall be commenced on any claim or dispute where notice of a claim or dispute has not been given by the applying party within ninety days of the occurrence or discovery of the matter or issue giving rise to the dispute.

20.5.3 Not withstanding the issue of a notice as stated above, the arbitration of such a claim or dispute shall not commence unless an attempt has in the first instance been made by the parties to settle such claim or dispute amicably with or without the assistance of third parties. Proof of such attempt shall be required.

20.5.4 The Arbitrator shall, without prejudice to the generality of his powers, have powers to direct such measurements, computations, tests or valuations as may in his opinion be desirable in order to determine the rights of the parties and assess and a ward any sums which ought to have been the subject of or included in any certificate.

20.5.5 The Arbitrator shall, without prejudice to the generality of his powers, have powers to open up, review and revise any certificate, opinion, decision, requirement or notice and to determine all matters in dispute which shall be submitted to him in the same manner as if no such certificate, opinion, decision require mentor notice had been given.

20.5.6 The arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, relevant to the dispute. Nothing shall disqualify representatives of the Parties and the Architect from being called as a witness and giving evidence before the arbitrators on any matter whatsoever relevant to the dispute.

20.5.7 Neither Party shall be limited in the proceedings before the arbitrators to the evidence, or to the reasons for dissatisfaction given in its Notice of Dissatisfaction.

20.5.7 Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, and the Architect shall not be altered by reason of any arbitration being conducted during the progress of the Works.

20.5.8 The terms of the remuneration of each or all the members of Arbitration shall be mutually agreed upon by the Parties when agreeing the terms of appointment. Each Party shall be responsible for paying one-half of this remuneration.

**20.6 Arbitration with National Contractors**

20.6.1 If the Contract is with national contractors, arbitration proceedings will be conducted in accordance with the Arbitration Laws of Kenya. In case of any claim or dispute, such claim or dispute shall be notified in writing by either party to the other with a request to submit it to arbitration and to concur in the appointment of an Arbitrator within thirty days of the notice. The dispute shall be referred to the arbitration and final decision of a person to be agreed between the parties. Failing agreement to concur in the appointment of an Arbitrator, the Arbitrator shall be appointed, on the request of the applying party, by the Chairman or Vice Chairman of any of the following professional institutions;

i) Architectural Association of Kenya
ii) Institute of Quantity Surveyors of Kenya
iii) Association of Consulting Engineers of Kenya
iv) Chartered Institute of Arbitrators (Kenya Branch)
v) Institution of Engineers of Kenya

20.6.2 The institution written to first by the aggrieved party shall take precedence over all other institutions.

**20.7 Arbitration with Foreign Contractors**

20.6.3 Arbitration with foreign contractors shall be conducted in accordance with the arbitration rules of the United Nations Commission on International Trade Law (UNCITRAL); or with proceedings administered by the International Chamber of Commerce (ICC) and conducted under the ICC Rules of Arbitration; by one or more arbitrators appointed in accordance with said arbitration rules.

20.6.4 The place of arbitration shall be a location specified in the **SCC;** and the arbitration shall be conducted in the language for communications defined in Sub-Clause1.4 [Law and Language].

**20.8 Alternative Arbitration Proceedings**

Alternatively, the Parties may refer the matter to the Nairobi Centre for International Arbitration (NCIA) which offers a neutral venue for the conduct of national and international arbitration with commitment to providing institutional support to the arbitral process.

**20.9 Failure to Comply with Arbitrator's Decision**

20.6.5 The award of such Arbitrator shall be final and binding up on the parties.

20.6.6 In the event that a Party fails to comply with a final and binding Arbitrator's decision, then the other Party may, without prejudice to any other rights it may have, refer the matter to a competent court of law.

**20.10 Contract operations to continue**

Notwithstanding any reference to arbitration herein,

20.10.1 the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree; and

20.10.2 the Procuring Entity shall pay the Contractor any monies due the Contractor.

## Section IX - Special Conditions of Contract

The following Special Conditions shall supplement the GCC. Whenever there is a conflict, the provisions here in shall prevail over those in the GCC.

| Conditions | Sub-Clause | Data |
|---|---|---|
| **Part A - Contract Data** | | |
| Procuring Entity's name and address | Heading | **Central bank of Kenya, P. O. Box 60000 – 00200, Nairobi** |
| Name and Reference No. of the Contract | Heading and 1.1 | **Proposed Enhancement and Improvement of Electrical Power Systems and Associated Data Centre Works at Kisumu Branch for Central Bank of Kenya, Tender No. CBK-056-2026-2027** |
| Engineers Name and address | Heading and 3.1.1 | Remax Consult Ltd<br>P.O. Box 3550-00506<br>Nairobi, Kenya<br>Email: info@remaxconsult.com |
| Contractor's Representative's name | 4.3.1 | *To be stated in the contract* |
| Key Personnel names | 16.9.1 | *To be stated in the contract* |
| Time for Completion | 1.1. | To be agreed based on Contractor's proposed duration in the Form of Tender but not more than two years |
| Defects Liability Period | 1.1 | 365 days |
| Defects Notification Period | 1.1 | 365 days |
| Sections | 1.1 | *If Sections are to be used, refer to Table: Summary of Sections below* |
| Communication | 1.3.1(a) | To include email and communication through the Enterprise Resource Planning (ERP) system |
| Priority Documents | 1.5 | The priority of the documents shall be in accordance with the following sequence:<br>i. Contract Agreement Form;<br>ii. Tender Form;<br>iii. Notification of intention to enter into a contract dated ….<br>iv. Acceptance letter dated ….<br>v. Notification of award dated ……<br>vi. Special Conditions – Part A<br>vii. Special Conditions Part B<br>viii. The General Conditions of Contract<br>ix. Technical Specifications/information<br>x. Price Schedule or bill of quantities submitted by Contractor<br>xi. Drawings |

| | | |
|---|---|---|
| | | xii. Any other Schedule |
| Time for the Parties entering into a Contract Agreement | 1.6 | Within 30days from the date of receipt of contract agreement provided that the contract shall be signed within the tender validity period stated in the tender document |
| Assignment | 1.7 | The assignment shall be in accordance with the terms and conditions outlined by the Central Bank of Kenya |
| Confidentiality | 1.12.3 | Add to the Clause to read:<br>i. The Bank acknowledges the confidential nature of any information which may be disclosed to or otherwise come into the possession of the Contractor, or its employees, in any manner directly or indirectly arising from the conclusion or performance of this Contract.<br><br>ii. The Supplier shall not divulge such information to any person nor permit such to be communicated among its employees, agents or sub-contractors save to the extent that is necessary for the performance of this Contract, without The Bank's prior written consent. The Supplier shall obtain from any employee, agent or sub-contractor to whom any such information is to be disclosed or who may in any manner obtain access to such information, an appropriate undertaking in terms no less binding upon such person as the terms of this clause.<br><br>iii. Confidential information means all information (whether commercial, financial, technical or otherwise) relating to the disclosing party, its sub-contractors, other customers and Suppliers disclosed to or otherwise obtained by the recipient party under or in connection with this Contract and which is designated as being confidential or which is by its nature clearly confidential.<br><br>iv. This obligation in this clause shall not apply to any Confidential Information:<br>• In the recipient's possession (with full right to disclose) before receiving it; or Which is, or becomes, public knowledge other than by breach of this clause; or<br>• Is independently developed by the recipient without access to or use of the Confidential information; or<br>• Is lawfully received from a third party with full right to disclose.<br>v. This Confidentiality clause shall continue in force notwithstanding the termination of this Contract for any |

| | | |
|---|---|---|
| | | reason. |
| Compliance with Laws | 1.13(b) | To include levies |
| Joint and Several Liability | 1.14(c) | The consent shall be in accordance with the terms and conditions outlined by the Central Bank of Kenya |
| Inspections and Audit by the Procuring Entity | 1.15 | Amend the paragraph to refer to Appendix 1 paragraph 2.2 to the general conditions instead of paragraph 2.2(e) of Appendix B |
| Inspections and Audit by the Procuring Entity | 1.15 | The impediment shall apply to officers from Public Procurement Regulatory Authority (PPRA) and or persons appointed or designated by the Government of Kenya |
| Time for access to the Site | 2.1.1 | Add the following provisions on Access to Site:<br><br>The date of possession and site access shall be agreed upon between the Employer and Contractor after Contract execution.<br>Access to the Site shall be at the Central Bank of Kenya premises, specifically the Kisumu Branch, for the Works, and shall at all times be subject to the Bank's security, safety, operational and access-control requirements. Access shall be granted only to personnel of the Contractor who have been pre-cleared by the Bank, approved subcontractors where applicable, and pre-cleared tools, equipment and materials. The Contractor shall submit in advance all required personnel details and identification documents, vehicle details and proposed work schedules. The Contractor shall comply with all screening, identification, escort, permitted working-hours, confidentiality and restricted-area requirements; coordinate all access with the Architect/ Engineer or the Bank's authorised representative; perform the Works without disrupting the Bank's operations; and promptly remove any personnel, tools, equipment or materials from the premises whenever required by the Bank. |
| Architect Duties and Authority | 3.1.6 (b) (ii) | Variations resulting in an increase of the Accepted Contract Amount over the Contract Price shall require approval of the Procuring Entity |
| The Architect Duties and Authority | 3.1.6 | Add the following paragraphs<br>e) use of Prime Cost Sums<br>f) use of Provisional Sums<br>g) Use of Contingency sums<br>h) reimbursable cost |
| Replacement of the Engineer | 3.4 | Not less than 7 days |
| Performance Security | 4.2.1 | The performance security will be in the form of a "demand guarantee" in the amount(s) of **10%** (percent) of the Accepted Contract Amount and in the same |

| | | |
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| | | currency(ies) of the Accepted Contract Amount. |
| Safety Procedures | 4.8 | Add the following paragraph<br>f) comply with safety audits conducted by the Procuring Entity from time to time to verify the Contractor's compliance with the safety requirements of the Contract. |
| Protection of the Environment | 4.18.1 | Replace Sub-Clause 4.18.1 with the following<br>The contractor shall comply with applicable climate change, environmental, social and governance laws, regulations and policies |
| Labor Laws | 6.4 | Including compliance with the prevailing minimum wage requirements. The Procuring Entity may conduct labor audits on contractors, subcontractors and related third parties, to ensure compliance |
| Normal working hours | 6.5 | Working hours shall be in shifts covering 24 hours |
| Health and Safety | 6.73 | The reporting shall comply with the provisions of Occupation Health and Safety Act |
| Foreign Personnel | 6.12.1 | The contractor shall seek prior approval in writing from the Procuring Entity prior to engaging foreign personnel |
| Commencement Date | 8.1.1 | To be stated in the contract based on agreement between the Parties. |
| Delay damages for the Works | 8.7 & 14.15(b) | 0.05% of the Contract Price per day.<br>If Sections are to be used, refer to Table: Summary of Sections below |
| Payment for Plant and Materials in the Event of Suspensions | 8.10 (a) | Replace 3o days with 60 days in the paragraph |
| Extension of Defects Notification Period | 11.3.1 | Before the expiry of the Defect Liability Period, the Procuring Entity has a right to issue a notice of extension to the contractor stating the period of extension at no cost to the Procuring Entity. |
| Contractor to Search | 11.8 | Add the following provision:<br>the Procuring Entity shall not incur the cost of search by the contractor |
| Right to Vary | 13.1.3 | To include*; to be indicated in the contact* |
| Variation procedure for value engineering proposals | 13.4.4 | the Architect shall seek the consent of the Procuring Entity before approving the value engineering proposal |
| Provisional Sums | 13.6. (b)(ii) | [If there are Provisional Sums, insert a percentage for adjustment of Provisional Sums] – 10% |
| Adjustments for Changes in Cost | 13.9 | Period "n" applicable to the adjustment multiplier "Pn":<br>_____ *[Insert the period if different from one (1) month; if period "n" is one (1) month, insert "not applicable"]* |
| The Contract Price | 14.1.1(b) | To include levies |

| | | |
|---|---|---|
| Total advance payment | 14.2.1 | 20 % Percentage of the Accepted Contract Amount payable in the currencies and proportions in which the Accepted Contract Amount is payable<br>[Insert number and timing of installments if applicable] |
| Repayment amortization rate of advance payment | 14.2.5 (b) | 35% of each interim payment |
| Application for Interim Payment Certificates | 14.3.1 | The number of copies of the statement shall be 2 (two) |
| Percentage of Retention | 14.3.2 (c) | 5% |
| Limit of Retention Money | 14.3.2 (c) | 5% of the Accepted Contract Amount |
| Plant and Materials | 14.5.3(b)(i) | If Sub-Clause 14.5 applies: N/A<br>Plant and Materials for payment Free on Board _____ *[list]*. |
| | 14.5.3(c)(i) | Plant and Materials for payment when delivered to the Site: N/A _____ *[list]*. |
| Plant and Materials Intended for Works | 14.5.4 | The percentage is 70 percent (70%) |
| Minimum Amount of Interim Payment Certificates | 14.6.2 | _____5_____ % of the Accepted Contract Amount. |
| Delayed Payment | 14.8.3 | Provided the interim or final payment certificate amount is undisputed. |
| Publishing source of commercial interest rates for financial charges in case of delayed payment | 14.8 | Prevailing Central Bank of Kenya Rate - CBR |
| Termination by Procuring Entity | 15.2.1(b) | The Architect shall give notice to the contractor to resume work within 14 days. Failure to which a termination notice shall be issued |
| Termination by Procuring Entity | 15.2.1(g) | Failure to remedy or deliver defective work after two defect notices by the Architect |
| Termination by Procuring Entity | 15.2.1(h) | Reference is to Appendix 1 and not appendix B |
| Procuring Entity's Entitlement to Terminate for Convenience | 15.5 | Amend the cross reference from Clause 16.3 where referred, to 16.4 and Clause 16.4 where referred, to 15.4 |
| Termination by Contractor | 16.3.2 | Notice of 30 days notice. Delete reference of sub-paragraph (g) |
| Payment in Termination | 16.5(c) | Not Applicable |
| Maximum total liability of the Contractor to the Procuring Entity | 17.6.2 | The Accepted Contract Amount, |
| Periods for submission of insurance: | 18.1.6 | *[Insert period for submission of evidence of insurance and policy. Period may be from 14 days to 30days.]* |

| | | |
|---|---|---|
| a. evidence of insurance.<br>b. relevant policies | | _14____days<br>__30___days |
| Maximum amount of deductibles for insurance of the Procuring Entity's risks | 18.2.4 (d) | *To be stated in the contract* |
| Minimum amount of third-party insurance | 18.3.2 | *To be stated in the contract* |
| Definition of Force Majeure | 19.1.2 | Add paragraph:<br>f) Pandemic and endemic |
| Amicable Settlement | 20.3 | Delete any reference to Arbitration |
| | 20.3 | In settling disputes amicably, the Architect will make a determination on the claim arising from errors in design under clause …in the event either party is dissatisfied with the determination by the Architect, the Procuring Entity shall request the relevant professional authority to nominate a professional to make an independent determination which is binding to the parties. The cost of the independent professional shall be shared by both parties. |
| Arbitration | 20.4 - 20.10 | Not Applicable; Deleted |
| The place of arbitration | 20.7.2 | *Not Applicable; Deleted* |
| Dispute Settlement | 21 | Notwithstanding any provision of this Contract to the contrary, all provisions requiring, permitting or relating to arbitration, including the referral of disputes to an arbitrator, arbitral tribunal, arbitral institution, dispute adjudication board, adjudicator or any similar dispute resolution mechanism, are hereby deleted and shall be of no force or effect.<br>*21.1 The parties shall negotiate in good faith with a view to settling any dispute or claim arising out of or relating to this Agreement and may not initiate any further proceedings until either party has, by written notice to the other, declared that such negotiations have failed.*<br>*21.2 Any disputes between the parties arising out of or in connection with this Agreement, which cannot be settled amicably shall proceed to the Courts of Law in Kenya. The Courts of Law in Kenya shall have exclusive jurisdiction to resolve all disputes arising herein.*<br>*21.3 Pending the final determination of any dispute, the Parties shall continue to perform their respective obligations under the Contract, to the extent reasonably practicable, unless otherwise agreed in writing by the Parties or directed by the Court* |

| | | |
|---|---|---|
| Data Protection | 22 | *22.1 Both parties undertake to comply with Data Protection policies of the Procuring Entity relating to the processing of personal data or privacy or any amendments and re-enactments thereof, and shall procure that its employees, agents and sub-contractors shall observe the provisions of the same.*<br><br>*22.2 Both parties agree to comply with their respective obligations under all applicable Data Protection Laws. The Service Provider will safeguard any personal data provided by the Procuring Entity against unauthorized access, accidental loss, improper use and unlawful disclosure, as required by the applicable Data Protection Act.* |

## SECTION X - CONTRACT FORMS

FORM No. 1 - NOTIFICATION OF INTENTION TO AWARD

FORM NO. 2 – REQUEST FOR REVIEW

FORM No. 3-LETTER OF AWARD

FORM No. 4 - CONTRACT AGREEMENT

FORM No. 5 - PERFORMANCE SECURITY [Option 1 - Unconditional Demand Bank Guarantee]

FORM No. 6- PERFORMANCE SECURITY [Option 2– Performance Bond]

FORM No. 7 - ADVANCE PAYMENT SECURITY

FORM No. 8 - RETENTION MONEY SECURITY

**FORM No 1: NOTIFICATION OF INTENTION TO AWARD OF CONTRACT**

This Notification of Award shall be sent to each Tenderer that submitted a Tender and was not successful. Send this Notification to the Tenderer's Authorized Representative named in the Tender Information Form on the format below.

**FORMAT**

1. For the attention of Tenderer's Authorized Representative

   *i)* Name: *[insert Authorized Representative's name]*

   *ii)* Address: *[insert Authorized Representative's Address]*

   *iii)* Telephone: *[insert Authorized Representative's telephone/fax numbers]*

   *iv)* Email Address: *[insert Authorized Representative's email address]*

   *[IMPORTANT: insert the date that this Notification is transmitted to Tenderers. The Notification must be sent to all Tenderers simultaneously. This means on the same date and as close to the same time as possible.]*

2. Date of transmission: [*email*] on [*date*] (local time)

   This Notification is sent by (*Name and designation*) _____

3. Notification of Award

   *i)* Procuring Entity: *[insert the name of the Procuring Entity]*

   *ii)* Project: *[insert name of project]*

   *iii)* Contract title: *[insert the name of the contract]*

   *iv)* ITT No: *[insert ITT reference number from Procurement Plan]*

   This Notification of Intention to Award (Notification) notifies you of our decision to award the above contract. The transmission of this Notification begins the Standstill Period. During the Standstill Period, you may:

4. Request a debriefing in relation to the evaluation of your tender by submitting a Procurement-related Complaint in relation to the decision to award the contracts.

   a) The successful tenderers

   i) Name of successful Tender_____

   ii) Address of the successful Tender _____

   _____

   iii) Contract price of the successful Tender Kenya Shillings _____

   (in words_____)

   b) The reasons for your tender being unsuccessful are as follows:

   c) Other Tenderers

Names of all Tenderers that submitted a Tender. If the Tender's price was evaluated include the evaluated price as well as the Tender price as read out.

| SNo | Name of Tender | Tender Price as read out | Tender's evaluated price (Note a) | One Reason Why Not Evaluated |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| | | | | |

*(Note a) State NE if not evaluated*

5. How to request a debriefing

a) DEADLINE: The dead line to request a debriefing expires at midnight on [*insert date*] (*local time*).

b) You may request a debriefing in relation to the results of the evaluation of your Tender. If you decide to request a debriefing your written request must be made within three (5) Business Days of receipt of this Notification of Intention to Award.

c) Provide the contract name, reference number, name of the Tenderer, contact details; and address the request for debriefing as follows:

i) Attention: [*insert full name of person, if applicable*]

ii) Title/position: [*insert title/position*]

iii) Agency: [*insert name of Procuring Entity*]

iv) Email address: [*insert email address*]

d) If your request for a debriefing is received within the 3 Days deadline, we will provide the debriefing within five (3) Business Days of receipt of your request. If we are unable to provide the debriefing within this period, the Standstill Period shall be extended by five (3) Days after the date that the debriefing is provided. If this happens, we will notify you and confirm the date that the extended Standstill Period will end.

e) The debriefing may be in writing, by phone, video conference call or in person. We shall promptly advise you in writing how the debriefing will take place and confirm the date and time.

f) If the deadline to request a debriefing has expired, you may still request a debriefing. In this case, we will provide the debriefing as soon as practicable, and normally no later than fifteen (15) Days from the date of publication of the Contract Award Notice.

6. How to make a complaint

a) Period: Procurement-related Complaint challenging the decision to award shall be submitted by midnight, [*insert date*] (local time).

b) Provide the contract name, reference number, name of the Tenderer, contact details; and address the Procurement-related Complaint as follows:

i) Attention: [*insert full name of person, if applicable*]

ii) Title/position: [*insert title/ position*]

iii) Agency: [*insert name of Procuring Entity*]

iv) Email address: [*insert email address*]

c) At this point in the procurement process, you may submit a Procurement-related Complaint challenging the decision to award the contract. You do not need to have requested, or received, a debriefing before making this complaint. Your complaint must be submitted within the Standstill Period and received by us before the Standstill Period ends.

d) Further information: For more information refer to the Public Procurement and Disposals Act 2015 and its Regulations available from the Website www.ppra.go.ke.

You should read these documents before preparing and submitting your complaint.

e) There are four essential requirements:

i) You must be an 'interested party'. In this case, that means a Tenderer who submitted a Tender in this tendering process and is the recipient of a Notification of Intention to Award.

ii) The complaint can only challenge the decision to award the contract.

iii) You must submit the complaint within the period stated above.

iv) You must include, in your complaint, all of the information required to support your complaint.

7. Standstill Period

i) DEADLINE: The Standstill Period is due to end at midnight on [*insert date*] (local time).

ii) The Standstill Period lasts ten (14) Days after the date of transmission of this Notification of Intention to Award.

iii) The Standstill Period may be extended as stated in paragraph Section 5(d) above.

If you have any questions regarding this Notification please do not hesitate to contact us. On behalf of the Procuring Entity:

**Signature:**_____

**Name:**_____

**Title/position:** _____

**Telephone:** _____

**Email: :**_____

**FORM NO. 2- REQUEST FOR REVIEW**

**FORM FOR REVIEW (r.203(1))**

**PUBLIC PROCUREMENT ADMINISTRATIVE REVIEW BOARD**

**APPLICATION NO……OF……..…20……...**

**BETWEEN**

**……...……APPLICANT**

**AND**

**……RESPONDENT (Procuring Entity)**

Request for review of the decision of the…… (Name of the Procuring Entity of ……dated the…day of ……20…….in the matter of Tender No……..…of ……..20….. for ..... (Tender description).

**REQUEST FOR REVIEW**

I/We……,the above named Applicant(s), of address: Physical address…….P. O. Box No……. Tel. No……..Email ……, hereby request the Public Procurement Administrative Review Board to review the whole/part of the above mentioned decision on the following grounds , namely:

1.

2.

By this memorandum, the Applicant requests the Board for an order/orders that:

1.

2.

SIGNED ……(Applicant) Dated on……day of ……/…20……

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FOR OFFICIAL USE ONLY Lodged with the Secretary Public Procurement Administrative Review Board on……day of ……...20……

**SIGNED**

**Board Secretary**

**FORM NO 3: LETTER OF AWARD**

*letterhead paper of the Procuring Entity]*

*[date]*

To: *[name and address of the Contractor]*

This is to notify you that your Tender dated *[date]* for execution of the *[name of the Contract and identification number, as given in the Contract Data]* for the Accepted Contract Amount *[amount in numbers and words] [name of currency]*, as corrected and modified in accordance with the Instructions to Tenderers, is here by accepted by…… *(name of Procuring Entity)*.

You are requested to furnish the Performance Security within in accordance with the Conditions of Contract, using, for that purpose, one of the Performance Security Forms included in Section VIII, Contract Forms, of the Tender Document.

Authorized Signature: .....

Name and Title of Signatory: .....

Name of Procuring Entity: .....

Attachment: *Contract Agreement:* .....

**FORM NO 4: CONTRACT AGREEMENT**

THIS AGREEMENT made the day of…… 20……., between…… ……..of…… (hereinafter "the Procuring Entity"), of the one part, and_____of _____(hereinafter "the Contractor"), of the other part:

WHEREAS the Procuring Entity desires that the Works known as_____should be executed by the Contractor, and has accepted a Tender by the Contractor for the execution and completion of these Works and the remedying of any defects there in,

The Procuring Entity and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.

   a) The Notification of Award
   b) the Form of Tender
   c) the addenda Nos_____(if any)
   d) the Special Conditions of Contract
   e) the General Conditions of Contract;
   f) the Specifications
   g) the Drawings; and
   h) the completed Schedules and any other documents forming part of the contract.

3. In consideration of the payments to be made by the Procuring Entity to the Contractor as specified in this Agreement, the Contractor here by covenants with the Procuring Entity to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Procuring Entity here by covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects there in, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

   INWITNESS where of the parties here to have caused this Agreement to be executed in accordance with the Laws of Kenya on the day, month and year specified above.

   Signed and sealed by_____(for the Procuring Entity)

   Signed and sealed by_____(for the Contractor).

**FORM NO. 5 - PERFORMANCE SECURITY**

**[Option 1 - Unconditional Demand Bank Guarantee]**

*[Guarantor letterhead]*

**Beneficiary:** *[insert name and Address of Procuring Entity]*

**Date:** _____*[Insert date of issue]*

**Guarantor:** *[Insert name and address of place of issue, unless indicated in the letterhead]*

1. We have been informed that_____(hereinafter called "the Contractor") has entered into Contract No._____dated___with (*name of Procuring Entity*)_____(the Procuring Entity as the Beneficiary), for the execution of _____(hereinafter called "the Contract").

2. Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

3. At the request of the Contractor, we as Guarantor, here by irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of____(*in words* ),[1] such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand it self or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

4. This guarantee shall expire, no later than the……..Day of……,2.....[2], and any demand for payment under it must be received by us at the office indicated above on or before that date.

5. The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed *[six months] [one year],* in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee." .....

*[Name of Authorized Official, signature(s) and seals/stamps*]

***Note:*** *All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.*

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[1]*The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance, less provisional sums, if any, and denominated either in the currency of the Contract or a freely convertible currency acceptable to the Beneficiary.*

[2]*Insert the date twenty-eight days after the expected completion date as described in GC Clause 11.9. The Procuring Entity should note that in the event of an extension of this date for completion of the Contract, the Procuring Entity would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee.*

**FORM No. 6- PERFORMANCE SECURITY**

**[Option 2– Performance Bond]**

*[**Note:** Procuring Entities are advised to use Performance Security – Unconditional Demand Bank Guarantee in stead of Performance Bond due to difficulties involved in calling Bond holder to action]*

*[Guarantor letterhead or SWIFT identifier code]* **Beneficiary:**

*[insert name and Address of* Procuring Entity*]* **Date:**

_____*[Insert date of issue]* **PERFORMANCE BOND No.:**

_____

**Guarantor:** *[Insert name and address of place of issue, unless indicated in the letterhead]*

1. By this Bond_____ as Principal (hereinafter called "the Contractor") and_____] as Surety (hereinafter called "the Surety"),are held and firmly bound unto_____] as Oblige (hereinafter called "the Procuring Entity") in the amount of_____for the payment of which sum well and truly to be made in the types and proportions of currencies in which the Contract Price is payable, the Contractor and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

2. WHEREAS the Contractor has entered into a written Agreement with the Procuring Entity dated the_____day of____,20_____, for_____in accordance with the documents, plans, specifications, and amendments there to, which to the extent here in provided for, are by reference made part here of and are here in after referred to as the Contract.

3. NOW, THEREFORE, the Condition of this Obligation is such that, if the Contractor shall promptly and faithfully perform the said Contract (including any amendments thereto), then this obligation shall be null and void; otherwise, it shall remain in full force and effect. Whenever the Contractor shall be, and declared by the Procuring Entity to be, in default under the Contract, the Procuring Entity having performed the Procuring Entity's obligations there under, the Surety may promptly remedy the default, or shall promptly:

   a) Complete the Contract in accordance with its terms and conditions; or

   b) Obtain a tender or tenders from qualified tenderers for submission to the Procuring Entity for completing the Contract in accordance with its terms and conditions, and upon determination by the Procuring Entity and the Surety of the lowest responsive Tenderers, arrange for a Contract between such Tenderer, and Procuring Entity and make available as work progresses (even though there should be a default or a succession of defaults under the Contract or Contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the Balance of the Contract Price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "Balance of the Contract Price," as used in this paragraph, shall mean the total amount payable by Procuring Entity to Contractor under the Contract, less the amount properly paid by Procuring Entity to Contractor; or

   c) Pay the Procuring Entity the amount required by Procuring Entity to complete the Contract in accordance with its terms and conditions up to a total not exceeding the amount of this Bond.

4. The Surety shall not be liable for a greater sum than the specified penalty of this Bond.

5. Any suit under this Bond must be instituted before the expiration of one year from the date of the issuing of the Taking-Over Certificate. No right of action shall accrue on this Bond to or for the use of any person or corporation other than the Procuring Entity named here in or the heirs, executors, administrators, successors, and assigns of the Procuring Entity.

6. In testimony whereof, the Contractor has here unto set his hand and affixed his seal, and the Surety has caused these presents to be sealed with his corporate seal duly at tested by the signature of his legal representative, this day ____of_____20____.

SIGNED ON_____on behalf of_____

By_____in the capacity of_____

In the presence of_____

SIGNED ON_____on behalf of_____

By_____in the capacity of_____

In the presence of_____

**FORM NO. 7 - ADVANCE PAYMENT SECURITY**

**[Demand Bank Guarantee]**

*[Guarantor letterhead]*

**Beneficiary:** *[Insert name and Address of* Procuring Entity*]* **Date:** *[Insert date of issue]*

**ADVANCE PAYMENT GUARANTEE No.:** *[Insert guarantee reference number]*

**Guarantor: [***Insert name and address of place of issue, unless indicated in the letterhead]*

1. We have been informed that (hereinafter called "the Contractor") has entered into Contract No. *dated* with the Beneficiary, for the execution of (hereinafter called" the Contract").

2. Furthermore, we understand that, according to the conditions of the Contract, an advance payment in the sum (*in words* ) is to be made against an advance payment guarantee.

3. At the request of the Contractor, we as Guarantor, here by irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of (*in words* )[1] upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating either that the Applicant:
   a) Has used the advance payment for purposes other than the costs of mobilization in respect of the Works; or
   b) Has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

4. A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the advance payment referred to above has been credited to the Contractor on its account number at .

5. The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as specified in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that ninety (90) percent of the Accepted Contract Amount, less provisional sums, has been certified for payment, or on the day of ,2 ,[2] whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

6. The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed *[six months] [one year],* in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.

*[Name of Authorized Official, signature(s) and seals/stamps*]

***Note:*** *All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.*

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[1]*The Guarantor shall insert an amount representing the amount of the advance payment and denominated either in the currency of the advance paymen tas specified in the Contract.*

[2]*Insert the expected expiration date of the Time for Completion. The Procuring Entity should note that in the event of an extension of the time for completion of the Contract, the Procuring Entity would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee.*

**FORM NO. 8 – RETENTION MONEY SECURITY**

**[Demand Bank Guarantee]**

*[Guarantor letterhead]*

**Beneficiary:** *[Insert name and Address of* Procuring Entity*]*

**Date:** *[Insert date of issue]*

**Advance payment guarantee no.** *[Insert guarantee reference number]*

**Guarantor:** *[Insert name and address of place of issue, unless indicated in the letterhead]*

1. We have been informed that *[insert name of Contractor, which in the case of a joint venture shall be the name of the joint venture]* (hereinafter called "the Contractor") has entered into Contract No. *[insert reference number of the contract]* dated with the Beneficiary, for the execution of *[insert name of contract and brief description of* Works*]* (hereinafter called "the Contract").

2. Furthermore, we understand that, according to the conditions of the Contract, the Beneficiary retains moneys up to the limit set forth in the Contract ("the Retention Money"), and that when the Taking-Over Certificate has been issued under the Contract and the first half of the Retention Money has been certified for payment, and payment of *[*insert the second half of the Retention Money] is to be made against a Retention Money guarantee.

3. At the request of the Contractor, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* ( *[insert amount in words ])*[1] upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or showgrounds for your demand or the sum specified there in.

4. A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the second half of the Retention Money as referred to above has been credited to the Contractor on its account number at *[insert name and address of Applicant's bank]*.

5. This guarantee shall expire no later than the.....Day of.....2.....[2], and any demand for payment under it must be received by us at the office indicated above on or before that date.

6. The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed *[six months] [one year],* in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.

_____

*[Name of Authorized Official, signature(s) and seals/stamps]*

***Note:*** *All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.*

[1]*The Guarantor shall insert an amount representing the amount of the second half of the Retention Money.*

[2]*Insert a date that is twenty-eight days after the expiry of retention period after the actual completion date of the contract. The Procuring Entity should note that in the event of an extension of this date for completion of the Contract, the Procuring Entity would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee.*

**FORM NO. 9 BENEFICIAL OWNERSHIP DISCLOSURE FORM**

**(Amended and issued pursuant to PPRA CIRCULAR No. 02/2022)**

***INSTRUCTIONS TO TENDERERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE FORM***

*This Beneficial Ownership Disclosure Form ("Form") is to be completed by the successful tenderer pursuant to Regulation 13 (2A) and 13 (6) of the Companies (Beneficial Ownership Information) Regulations, 2020. In case of joint venture, the tenderer must submit a separate Form for each member. The beneficial ownership information to be submitted in this Form shall be current as of the date of its submission.*

*For the purposes of this Form, a Beneficial Owner of a Tenderer is any natural person who ultimately owns or controls the legal person (tenderer) or arrangements or a natural person on whose behalf a transaction is conducted, and includes those persons who exercise ultimate effective control over a legal person (Tenderer) or arrangement.*

Tender Reference No.:_____[*insert identification no*] Name of the Tender Title/Description:_____*[insert name of the assignment]* to:____*[insert complete name of Procuring Entity]*

In response to the requirement in your notification of award dated__*[insert date of notification of award]* to furnish additional information on beneficial ownership:__*[select one option as applicable and delete the options that are not applicable]*

I) We here by provide the following beneficial ownership information.

**Details of Beneficial ownership**

| | **Details of all Beneficial Owners** | | **% of shares a person holds in the company Directly or indirectly** | **% of voting rights a person holds in the company** | **Whether a person directly or indirectly holds a right to appoint or remove a member of the board of directors of the company or an equivalent governing body of the Tenderer** (Yes / No) | **Whether a person directly or indirectly exercises significant influence or control over the Company (tenderer) (Yes / No)** |
|---|---|---|---|---|---|---|
| **1.** | Full Name | | Directly---------- % of shares<br><br>Indirectly---------- % of shares | Directly…….%% of voting rights<br><br>Indirectly----------% of voting rights | 1. Having the right to appoint a majority of the board of the directors or an equivalent governing body of the Tenderer: Yes -----No----<br>2. Is this right held directly or indirectly?:<br><br>Direct……<br><br>Indirect…… | 1. Exercises significant influence or control over the Company body of the Company (tenderer**)**<br><br>Yes -----No----<br><br>2. Is this influence or control exercised directly or indirectly?<br><br>Direct……<br><br>Indirect…… |
| | National identity card number or Passport number | | | | | |
| | Personal Identification Number (where applicable) | | | | | |
| | Nationality | | | | | |
| | Date of birth *[dd/mm/yyyy ]* | | | | | |
| | Postal address | | | | | |
| | Residential address | | | | | |
| | Telephone number | | | | | |

| | **Details of all Beneficial Owners** | | **% of shares a person holds in the company Directly or indirectly** | **% of voting rights a person holds in the company** | **Whether a person directly or indirectly holds a right to appoint or remove a member of the board of directors of the company or an equivalent governing body of the Tenderer** (Yes / No) | **Whether a person directly or indirectly exercises significant influence or control over the Company (tenderer) (Yes / No)** |
|---|---|---|---|---|---|---|
| | Email address | | | | | … |
| | Occupation or profession | | | | | |
| | | | | | | |
| **2.** | Full Name | | Directly---------- % of shares<br><br>Indirectly---------- % of shares | Directly…… ……..% of voting rights<br><br>Indirectly---------% of voting rights | 1. Having the right to appoint a majority of the board of the directors or an equivalent governing body of the Tenderer: Yes -----No----<br>2. Is this right held directly or indirectly?:<br><br>Direct…… …… | 1. Exercises significant influence or control over the Company body of the Company (tenderer**)** Yes -----No----<br><br>2. Is this influence or control exercised directly or indirectly? |
| | National identity card number or Passport number | | | | | |
| | Personal Identification Number (where applicable) | | | | | |
| | Nationality(ies) | | | | | |
| | Date of birth *[dd/mm/yyyy]* | | | | | |

| | **Details of all Beneficial Owners** | | **% of shares a person holds in the company Directly or indirectly** | **% of voting rights a person holds in the company** | **Whether a person directly or indirectly holds a right to appoint or remove a member of the board of directors of the company or an equivalent governing body of the Tenderer** (Yes / No) | **Whether a person directly or indirectly exercises significant influence or control over the Company (tenderer) (Yes / No)** |
|---|---|---|---|---|---|---|
| | Postal address | | | | Indirect…… | Direct…… |
| | Residential address | | | | …….. | |
| | Telephone number | | | | | Indirect…… |
| | Email address | | | | | … |
| | Occupation or profession | | | | | |
| | | | | | | |
| **3.** | | | | | | |
| | | | | | | |
| **e.** | | | | | | |
| **t.** | | | | | | |
| **c** | | | | | | |

II) Am fully aware that beneficial ownership information above shall be reported to the Public Procurement Regulatory Authority together with other details in relation to contract awards and shall be maintained in the Government Portal, published and made publicly available pursuant to Regulation 13(5) of the Companies (Beneficial Ownership Information) Regulations, 2020.(Notwithstanding this paragraph Personally Identifiable Information in line with the Data Protection Act shall not be published or made public). *Note that Personally Identifiable Information (PII) is defined as any information that can be used to distinguish*

*one person from another and can be used to deanonymize previously anonymous data. This information includes National identity card number or Passport number, Personal Identification Number, Date of birth, Residential address, email address and Telephone number.*

III) In determining who meets the threshold of who a beneficial owner is, the Tenderer must consider a natural person who in relation to the company:

(a) holds at least ten percent of the issued shares in the company either directly or indirectly;

(b) exercises at least ten percent of the voting rights in the company either directly or indirectly;

(c) holds a right, directly or indirectly, to appoint or remove a director of the company; or

(d) exercises significant influence or control, directly or indirectly, over the company.

IV) What is stated to herein above is true to the best of my knowledge, information and belief.

*Name of the Tenderer: .....*[insert complete name of the Tenderer]__*

*Name of the person duly authorized to sign the Tender on behalf of the Tenderer: ** [insert complete name of person duly authorized to sign the Tender]*

*Designation of the person signing the Tender: ..... [insert complete title of the person signing the Tender]*

*Signature of the person named above: ..... [insert signature of person whose name and capacity are shown above]*

*Date this ..... [insert date of signing] day of..... [Insert month], [insert year]*

Bidder Official Stamp

# APPENDIX 1

**BILL OF QUANTITIES FOR PROPOSED ENHANCEMENTS AND IMPROVEMENT OF ELECTRICAL POWER SYSTEMS AND ASSOCIATED DATA CENTRE WORKS AT KISUMU BRANCH FOR CENTRAL BANK OF KENYA**

**DATA CENTER WORKS**

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:1** | | | | | |
| | **General Provision to be read in conjunction with Preliminaries Section in the Technical Specifications. Full compliance will be expected** | | | | | |
| 1 | Allow for full compliance of Preliminaries Items | | Item | | | |
| 2 | Cost of 10% Bank guarantee for performance Bond | | | SUM | | |
| 3 | Insurance for works and workers | | | SUM | | |
| 4 | Cleaning-up works. | | | SUM | | |
| 5 | Provisions for Data Sheets, drawings and brochures for all equipment to be supplied. | | Item | | | |
| 6 | Preliminaries Designs and Shop Drawings as outlined in the scope of works in the specification | | Item | | | |
| 7 | Warranties for Materials and Workmanship | | Item | | | |
| 8 | Materials for Testing and Commissioning | | Item | | | |
| 9 | Compliance with Site Specific Health & Safety Specification | | | SUM | | |
| 10 | Allow for MANUFACTURER RECOMMENDED SPARE PARTS | | Item | | | |
| | **Commissioning, testing, O&M Manuals,** | | | | | |
| 11 | **etc.** Commissioning, testing, O&M | | | SUM | | |
| | Manuals, etc. **Samples and Submissions** | | | | | |
| 12 | Submission of samples and/or technical submissions as may be required by the Engineer | | | SUM | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 1<br>Bill No. 1<br>CONTRACT PRELIMINARIES | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **<u>O&M documentation and certificates</u>** | | | | | |
| 13 | O+ M Technical documentation draft and final submission as specified, Including system setup on memory stick | | | SUM | | |
| 14 | Preparation and handing over of "As Built" drawings, indicating all conductor routes, exact spike positions and depths and provision of all test certificates for the entire building | | | SUM | | |
| 15 | Photo Report of Complete Installation | | | SUM | | |
| | **<u>Testing and Commissioning</u>** | | | | | |
| 16 | Testing and commissioning and Compliance Certificate for the complete Installation including Test report to local requirements | | | SUM | | |
| 17 | Commissioning Procedure as outlined by Original Equipment Manufacturer | | | SUM | | |
| | **Carried to Final Summary** | | | KES | | |
| | Section No. 1<br>Bill No. 1<br>CONTRACT PRELIMINARIES | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO : 2** | | | | | |
| | **BILL NO:1** | | | | | |
| | **DEMOLITIONS** | | | | | |
| | **DEMOLITION WORKS (ALL PROVISIONAL)** | | | | | |
| | Notes: | | | | | |
| | The contractor is to allow for all temporary protection required during the works, including ordinary and special dust screens, hoarding, barriers, warning signs etc as directed by the Architect and as necessary for the protection of the existing structure. All such devices shall be removed on completion of the works and any necessary making good consequent upon this is to be done to the satisfaction of the Architect. | | | | | |
| | **All useable materials arising from the demolitions shall remain the property of the Employer but the Contractor may take away any materials not so required by the Employer and shall allow a credit for the same in the credit column indicating value for all such materials that are reusable. All debris arising therefrom shall be carried away and dumped where directed by the Employer while all reusable materials shall be delivered where directed** | | | | | |
| | The works shall be executed in such order and sequence as the Architect may direct and as little disruption and inconvinience as possible shall be caused to the client, staff and other users of existing facilities. | | | | | |
| 1 | Carefully rub down existing decorative paint, make good surface for new interior wall finish. | m2 | 410 | | | |
| 2 | Carefully demolish existing floor finish; make good of disturbed surfaces; cart away arising debris. | m2 | 752 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 1<br>DEMOLITIONS | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 3 | Carefully scarify existing floor in preparation to receive new floor finish. | m2 | 752 | | | |
| 4 | Carefully demolish existing ceiling; make good disturbed surfaces; cart away arising debris as directed | m2 | 752 | | | |
| 5 | Provide a Sum for any other neccessary demolition works that may be required by the Architect/Engineer for smooth execution of the works.<br><br>*The above Items will be based ONLY on written instructions and shall be evaluated prior to commencement and assessed after execution by the Project Quantity Surveyor for payment consideration* | | Item | | 100,000.00 | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 1<br>DEMOLITIONS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO. 2** | | | | | |
| | **INTERNAL PARTITIONS** | | | | | |
| | **Gypsum Partitions** | | | | | |
| | Gyproc standard dry wall partition system consisting of 60mm steel drywall studs spaced at 450mm centres, clad both sides with two layers 12.5mm thick tapered edge gypsum board with staggered joints between boards, in-filled with rockwool insulation and to have an acoustic rating of 30dB; to be fitted into cavity and fixed with drywall screws spaced at 220mm centres in accordance with the manufacturer's instructions | | | | | |
| 1 | 100mm thick overall thickness (P2) | m2 | 94 | | | |
| 2 | Ditto but 75mm thick with 50mm studs (P3) | m2 | 47 | | | |
| 3 | Extra over MDF boards in gypsum partitions to receive television screens. And allow for horizontal noggin to run between studs to be secured with screws (spacing to be described by Architect) | m2 | 63 | | | |
| | **Sound Proofing/Insulation** | | | | | |
| | Supply and apply green glue soundproofing sealan t as per manufacturer's instructions;all includi ng soundproofing compound, tape and all necessary accesories. | | | | | |
| 4 | To partitions (Both sides measured) | m2 | 631 | | | |
| | **Acoustic Drywall Partition** | | | | | |
| | **Carried Forward** | | | KES | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | 110mm thick acoustic drywall comprising 2 x 12.5mm thick gypsum board on either side of 60mm steel drywall studs spaced at 450mm centres, with staggered joints between boards and with sound seal strip with fibreglass (double board to both faces and cavity lite acoustic fleece) to be sealed with mastic acoustic sealant, green glue between two joints; comprising 50 x 50mm H frame post in dry wall to support Fire Door to be fixed into floor slab and horizontal steel support above to be fitted into cavity and fixed with drywall screws spaced at 220mm centres in accordance with the manufacturer's instructions. | | | | | |
| 5 | 110mm thick overall thickness (P1) | m2 | 175 | | | |
| | **Glazed aluminium partitions** | | | | | |
| 6 | Pvdf coated aluminium framed partition as 100mm strahle partition system 2000; frame size 100 x 45mm,50 x 15 x 1.8 mm capping cover,: infilled with and including 12 mm thick clear laminated and toughened glass: 20 x 20 mm glazing beads and rubber washleather gaskets and glazing wedges (colour and size of frames to be confirmed) (G2) | m2 | 104 | | | |
| 7 | Ditto but double glazed with 2 x 8 mm thick clear laminated toughened glass infilled with PVB layer to achieve sound insulation of a minimum of 41dB (G1) | m2 | 82 | | | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 2<br>INTERNAL PARTITIONS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO. 3** | | | | | |
| | **WINDOWS** | | | | | |
| | Window Blinds | | | | | |
| 1 | Supply and fix VENETIAN Window Blinds as "Vitendi" or equal and approved complete with all accessories as per Manufacturer's printed specifications and instructions to Architect/Client's approval. | m2 | 99 | | | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 3<br>WINDOWS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO. 4** | | | | | |
| | **DOORS** | | | | | |
| | Glass Doors | | | | | |
| | Frameless Glass Doors glazed with 12 mm thick toughened clear approved glass complete with all necessary ironmongery and fixing lugs built into walling and pointing in mastic. All to Architects details | | | | | |
| 1 | Double door size 2000mm x 2400mm high | No | 19 | | | |
| 2 | Ditto but single door average size 1000mm x 2400mm high | No | 2 | | | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 4<br>DOORS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO. 5** | | | | | |
| | **FLOOR FINISHES** | | | | | |
| | **Screed** | | | | | |
| | Cement and sand (1:4) beds and backing | | | | | |
| 1 | Beds to receive flooring,etc, finished with a steel trowel , thickness - 50 mm | m2 | 752 | | | |
| | **SPC Flooring** | | | | | |
| 2 | Provide a prime cost rate of [Kshs 4,500.00/sm] for supply of SPC Wood look tiles - Mvule Wood Look (tenderer to add the cost of collection, delivery, grouting, adhesive, spaces and all other materials and laying to completion) as selected by the Architect: take delivery and fix 300 x 300 x 6mm SPC tiles to floors on prepared bed (m.s) with proprietary adhesive; jointed and pointed in matching coloured proprietary grouting: including pvc spacers and expansion joints as necessary: all to Architect's approval. (FF1) | m2 | 10 | | | |
| 3 | Ditto but Mahogany Wood look (FF2) | m2 | 12 | | | |
| | **Vinyl Floor Finish** | | | | | |
| | Supply and fix high level performance wood look vinyl floor tiles as Interface; level set collection; textured wood grain A002-04 BEECH; parquet pattern or other equal and approved locally available alternative size 25 x 1000mm x 4.5mm thick, to be fixed with approved adhesive; colour and pattern to be approved by Architect. Measured inclusive of insulating underlay as described to; | | | | | |
| 4 | Floor: fixing with approved quality adhesive complete with all associated accessories.(FF3) | m2 | 484 | | | |
| | **Carried Forward** | | | KES | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Porcelain Floor Finish** | | | | | |
| 5 | Provide a prime cost rate of [Kshs 4,500.00/sm] for supply of porcelain tiles- Ivory Colour (tenderer to add the cost of collection, delivery, grouting, adhesive, spaces and all other materials and laying to completion) as selected by the Architect: take delivery and fix 600 x 600 x 8mm porcelain tiles to floors on prepared bed (m.s) with proprietary adhesive; jointed and pointed in matching coloured proprietary grouting: including pvc spacers and expansion joints as necessary: all to Architect's approval.(FF4) | m2 | 246 | | | |
| | **Skirting** | | | | | |
| 6 | 100mm high approved mahogany skirting with rounded cove, fixed to masonry walling or partition with and including all necessary accessories. | m | 931 | | | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 5<br>FLOOR<br>FINISHES | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO. 6** | | | | | |
| | **INTERNAL WALLING FINISHES** | | | | | |
| | Prepare surfaces, skim and apply one coat ideal fenomatic emulsion primer, two coats of ideal stucco filler coat and two finishing coats of ideal fenomatic my home rich matt paint; all to approved colours and satisfaction of the Architect; All paint to be JOTUN or equal and approved. | | | | | |
| 1 | Gypsum partitions | m2 | 631 | | | |
| 2 | Rubbed faces of internal walls | m2 | 410 | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 2** | | | | | |
| | Section No. 2<br>Bill No. 6<br>INTERNAL WALL FINISHES | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO. 7**<br><br>**CEILING FINISHES**<br><br>**Gypsum Ceiling**<br><br>Notes and preambles<br><br>Supply & fixing of MR Grade Gypsum Board false ceiling including vertical drops, coves, boxings & fascias using 12.5mm Gypsum Board Sheets MR Grade from Gyproc or equivalent as per design.<br><br>The suspenders for the same is to be done using 25 x 10 x 0.5mm Gypsteel Ultra or equivalent Angle in galvanized finish 120GSM attached to 27x37x25x1.6mm Gyproc or equivalent Soffit cleat duly anchored to the slab at a distance of not more than 1220mm c/c.<br><br>The suspenders is to be located only at the ribs of the hollow pot slabs.<br><br>15x45x15x0.9mm Gypsteel Ultra Intermediate channel to be duly fastened to the suspenders using M16X12 Hex bolt and Hex nut as per EN 10083 in Zinc plating finish at a distance of not more than 1220mm c/c.<br><br>80x26x0.5mm Gypsteek Ultra or equivalent ceiling section in galvanized finish is to be duly clipped at a distance of 457mm c/c using 2.64mm diameter Gyproc or equivalent connecting clip of high carbon steel wire to the intermediate channel.<br><br>12.5mm Gyproc or equivalent Gypsum Board sheets to be screwed to the ceiling section with carbon steel Drywall screws in grewy Phosphating finish of class 48 as per EN 14566.<br><br>Along the perimeter of the room the Gypboards is duly screwed to 20x28x30x0.5mm Gypsteel Ultra Perimeter channel or equivalent.<br><br>Any additional support framework required to | | | | | |
| | **Carried Forward** | | | KES | | |

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| | **Brought Forward** | | | KES | | |
| | accommodate the various services inside the ceiling to be included in the cost/rates.<br><br>Taping the gypsum board joints using 50mm wide Gyproc paper tapes or equivalent and duly skimming the same with gypsum powder.<br><br>The holes to the gypsum screws are to be duly filled & skimmed with gypsum making it ready to receive undercoats for paint.<br><br>Cut out for lights, AC, grilles, smoke detectors, sprinklers, etc should be made as required including 10mm commercial ply template to support for lighting and speaker cut-outs, complete as per the design and details.<br><br>Black paint to be applied to framing wherever visible through the grilles, etc<br><br>Job to include cost of labour, materials, scaffolding, carting off debris from site, loading, unloading, cleaning, etc<br><br>Supply & fix MR Grade Gypsum Board false ceiling including vertical drops, coves, boxings & fascias using 12.5mm Gypsum Board Sheets MR Grade from Gyproc or equivalent as per design. complete with Aluminium suspensation Tee system and all to standard specifications in 12.5mm thick MR Boards; to<br><br>FLUSH PLASTERED CEILING - WHITE "SonaKrete" Acoustical Finish System | | | | | |
| 1 | Gypsum flush plastered ceiling 9.5mm thick with tapered edge, screwed up ceiling with drywall screws spaced at 150mm centres, with main tees at 1200mm centres and cross tees at 400mm centres. All suspended with 25 x 25mm galvanized angles and not exceeding 1200mm centres. Joints to be covered with tape fixed over joints (Double over butt joints) - C01 | m2 | 154 | | | |
| | **Suspended Acoustic Ceiling** | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 7<br>CEILING<br>FINISHES | | | | | |

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| | **Brought Forward** | | | KES | | |
| | Isover Soundlite or Tegular dune supreme accessible tile system; accoustic suspended ceilings; 600 x 600 x 15mm class A Lay In fissured mineral fibre tiles; complete with epoxy acrylic protected tee clips, pipped tabs, epoxy protected acrylic tee runners, hot dipped galvanised splice plates with edge trims; fixing with screws to backgrounds requiring plugging to ceilings | | | | | |
| 2 | Linings to form horizontal soffits generally - C02 | m2 | 59 | | | |
| | **Timber Slat Ceiling** | | | | | |
| 3 | 40mm thick x 150mm deep stained fabricated mahogany timber slats suspended at 150 mm intervals with varying lengths to the Architect's approval - C03 | m2 | 26 | | | |
| | **Exposed Soffits Finish** | | | | | |
| 4 | Prepare surfaces accordingly, apply one coat of JOTUN or equal and approved white primer and two finishing coats of col black; all in accordance with manufacturer's instructions.<br>NOTE: Contractor to ensure all services piping and accessories are neatly installed and anchored. | m2 | 513 | | | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 7<br>CEILING<br>FINISHES | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO. 8** | | | | | |
| | **JOINERY** | | | | | |
| | **FITTINGS** | | | | | |
| 1 | **LOCKERS**<br><br>Supply and fix 2900 x 500 x 2700mm high lockers in 16mm thick laminated MDF carcass with a maximum of 4no shelves size 5145 x 500 and 3no 18mm thick MDF doors size 500 x 334mm high, 6no 500 x 500mm high and 2no 500 x 1000mm high complete with all iron mongery for 11no lockers all as ASSA ABLOY or other equal and approved, bearers, plugs etc. Allow for fixing of laser cut vinyl numbering (1 to 11) with recessed skirting 100mm in 16mm thick marine plywood finished with polished aluminium kickplate and 20mm thick MDF top panel 100mm high spray painted. Exposed edges to receive solid oak edging and allow also for painting with | No | 1 | | | |
| 2 | approved JOTUN paint. All to Architect's details<br><br>Ditto but 3100mm long | No | 1 | | | |
| 3 | **OPEN SHELVES**<br><br>Supply and fix open cabinets overall size 6250 x 550 x 2400mm high in 16mm thick laminated MDF carcass; skirtings 100mm high 16mm thick marine plywood skirting finished with polished aluminium kickplate. Exposed edges to receive solid oak edging and allow also for painting with approved JOTUN paint Complete with all cabinet locks, hinges and handles, and all other necessary iron mongery. Worktops and other concrete works | No | 3 | | | |
| 4 | (m/s); All to Architect's detail and approval.<br><br>Ditto but 6800mm long | No | 1 | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 2<br>Bill No. 8<br>JOINERY<br>FITTINGS | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **LOW LEVEL CABINETS** | | | | | |
| 5 | Supply and fix low level cabinets overall size 6000 x 600 x 760mm high in 16mm thick laminated MDF carcass; and 16mm thick laminated MDF doors 4 No. cabinet doors average size 370 x 760mm high; and 4no drawers size 900x300mm high ; skirtings 100mm high 16mm thick marine plywood skirting finished with polished aluminium kickplate. Exposed edges to receive solid oak edging and allow also for painting with approved JOTUN paint Complete with all cabinet locks, hinges and handles, and all other necessary iron mongery. Worktops and other concrete works (m/s); All to Architect's detail and approval | No | 5 | | | |
| 6 | Ditto but 5000mm long | No | 1 | | | |
| | 32mm thick Approved MDF worktop reverse chamfered and finished in FENIX laminate or other equal and approved; inclusive of woodshield as JOTUN or other equal and approved. All exposed edges to receive solid oak as described to; | | | | | |
| 7 | Worktops, all to Architect's detail | m2 | 21 | | | |
| | **CENTRAL SEATING AREA** | | | | | |
| 8 | Supply and fix work seating 4100 x 1700m wide x 450mm high in 18mm thick MDF boards top board size 2050 x 500mm inclusive of supporting framework in 100 x 50mm thick treated wrot cypress frames members Inclusive of upholstered fabric 75mm thick on exposed top and side surfaces approximately 2050 x 1700 and 2050 x 350mm to Architect's detail | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 8<br>JOINERY<br>FITTINGS | | | | | |

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| | **Brought Forward** | | | KES | | |
| 9 | Ditto but backrest to bench seating 6000 x 150 x 350mm high 18mm thick MDF boards top board size 2050 x 500mm inclusive of supporting framework in 100 x 50mm thick treated wrot cypress frames members Inclusive of upholstered fabric 75mm thick on exposed side surfaces approximately 2050 x 300. Also inclusive of planters 2050 x 100 x 200mm high inclusive of 18mm thick MDF surface veneered in approved finish. All to Architect's details | No | 1 | | | |
| | 32mm thick Approved MDF worktop reverse chamfered and finished in FENIX laminate or other equal and approved; inclusive of woodshield as JOTUN or other equal and approved. All exposed edges to receive solid oak as described to; | | | | | |
| 10 | Worktops, all to Architect's detail | m2 | 7 | | | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 8<br>JOINERY<br>FITTINGS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO. 9** | | | | | |
| | **BUILDER'S WORK IN CONNECTION WITH SERVICES ( ALL PROVISIONAL)** | | | | | |
| 1 | Allow a provisional sum of Kenyan Shillings One Million Only (Kshs 1,000,000.00) for Builders Works in Connection to Services. | | Item | | 1,000,000.00 | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 9<br>BUILDERS WORKS IN CONNECTION TO SERVICES | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO. 1**<br><br>**FURNITURE, FIXTURE AND EQUIPMENT**<br><br>Loose Furiture<br><br>**Situation Room (Furniture from Room Dimension or Equal and Approved)** | | | | | |
| 1 | V-Concept Console multiple linear configuration for 5 operators, rounded design, 1300mm cable duct: Total console dimension: 10050x850x939mm<br><br>Details:<br>V-Concept Console is specially designed for the organization of emergency and crisis environments, where capable solutions are required for the integration of the communications and connectivity in the workpost. V-Concept is a solution with a strong technological profile, modular design and high-end aesthetics and ergonomics. It allows the integration of small electronic equipment inside its structure and a perfect organization and distribution of all the structured cabling, monitor supports and other equipment operators may need.<br><br>1-MAIN STRUCTURE<br>Triangular section structure with double thickness ground supports with large diameter zamak levelers on top and bottom between each operator and on the edges. The ground supports are united on the superior part via a "U" shaped cable duct (300x120mm) with capability to host the monitor supports and connectivity including power, data sockets or USB, VGA, HDMI etc.<br><br>On the inferior part, the ground supports are united via a structural trays to support electronic equipment or SFF pcs and manage cabling to pass from one point to another of the console uninterrupted. | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 10<br>FURNITURE FITTINGS AND EQUIPMENT | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 2 | 24 x 7 CXO Ergonomic chair. Mystic Black Details:<br>-Ergo-chair model CXO extreme<br>-Black color<br>-Adjustable headrests<br>-5-wheels skate base<br><br>Code (SE-CXO001) | No | 21 | | | |
| 3 | Dragonfly individual LCD monitor arm with Grommet mount type.<br>Code (BR-DRF302) | No | 21 | | | |
| | **<u>Meeting Room (Furniture from Room Dimension or Equal and Approved)</u>** | | | | | |
| 4 | 24 x 7 CXO Ergonomic chair. Mystic Black Details:<br>-Ergo-chair model CXO extreme<br>-Black color<br>-Adjustable headrests<br>-5-wheels skate base<br><br>Code (SE-CXO001) | No | 12 | | | |
| 5 | RDI meeting room solutions type C+ boardroom table, Central cover fully removable for managing the wiring.<br>• Longitudinally open to space to facilitate the entry and exit of wiring cables to the surface of the table.<br>• Desktop unit power, data and USB sockets for the operators. (4x energy data in every column.)<br>• Central space between structural feet destined to house computer equipment.<br>• Led lighting on the bottom.<br><br>Ref: MSCP-C350X145/3PC | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 10<br>FURNITURE FITTINGS AND EQUIPMENT | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **NOC Room (Furniture from Room Dimension or Equal and Approved)** | | | | | |
| 6 | 24 x 7 CXO Ergonomic chair. Mystic Black Details:<br>-Ergo-chair model CXO extreme<br>-Black color<br>-Adjustable headrests<br>-5-wheels skate base | | | | | |
| | Code (SE-CXO001) | No | 6 | | | |
| | **Service Charges** | | | | | |
| 7 | Preparation of material for international shipping in special waterproof costom-made wooden container. | | | | | |
| | Management of export detailsm preparation of original documentation, invoice and certificate of origin signed and stamped by the Barcelona Chamber of Commerce | | | | | |
| | International delivery of original documentation via fast courier DHL | | | | | |
| | Applicable taxes and Duties. | | Item | | | |
| | **Hot Desks (Furniture from Reynard Africa-Herman Miller or equal and approved)** | | | | | |
| | **Control Room** | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 10<br>FURNITURE FITTINGS AND EQUIPMENT | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| |  <br>Verus Task Chair (Herman Miller or equal and approved) | | | | | |
| 8 | Work Chair / suspension back / standard height range/self adjusting tilt limiter with 3P back lock / height adjustable arms>Seat depth: Adjustable seat depth. | No | 2 | | | |
| 9 | Approved study table; 1800 x 600mm wide. | No | 2 | | | |
| | **Room** | | | | | |
| 10 | 535mm x 540mm x 815mm x458mm (shorter height) Grace chair | No | 19 | | | |
| 11 | Approved Round table 1200mm diameter | No | 8 | | | |
| 12 | Rectangular table 3500 x 1200 x 760h | No | 1 | | | |
| | **Collaborative space** | | | | | |
| 13 | High level soft half back stools | No | 12 | | | |
| 14 | Conference table 1800 x 900 x 760h | No | 3 | | | |
| | **Security Offices** | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 10<br>FURNITURE FITTINGS AND EQUIPMENT | | | | | |

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| | **Brought Forward** | | | KES | | |
| |  <br>Verus Task Chair (Herman Miller or equal and approved) | | | | | |
| 15 | Work Chair / suspension back / standard height range/self adjusting tilt limiter with 3P back lock / height adjustable arms>Seat depth: Adjustable seat depth. | No | 1 | | | |
| 16 | Height adjustable work stations 1800mm long | No | 1 | | | |
| 17 | Work stations with pedestals 1200 x 600mm | No | 4 | | | |
| 18 | wide Desk separators/Fabric screens | No | 2 | | | |
| 19 | 535mm x 540mm x 815mm x458mm (shorter height) Grace chair | No | 9 | | | |
| | **IT Offices** | | | | | |
| |  <br>Verus Task Chair (Herman Miller or equal and approved) | | | | | |
| 20 | Work Chair / suspension back / standard height range/self adjusting tilt limiter with 3P back lock / height adjustable arms>Seat depth: Adjustable seat depth. | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 10<br>FURNITURE FITTINGS AND EQUIPMENT | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 21 | Height adjustable work stations 1800mm long | No | 1 | | | |
| 22 | Work stations with pedestals 1200 x 600mm | No | 8 | | | |
| 23 | wide Desk separators/Fabric screens | No | 4 | | | |
| 24 | 535mm x 540mm x 815mm x458mm (shorter height) Grace chair | No | 17 | | | |
| | **Command and Control Centre** | | | | | |
| |  Verus Task Chair (Herman Miller or equal and approved) | | | | | |
| 25 | Work Chair / suspension back / standard height range/self adjusting tilt limiter with 3P back lock / height adjustable arms>Seat depth: Adjustable seat depth. | No | 6 | | | |
| 26 | Approved study table; 1800 x 600mm wide. | No | 6 | | | |
| | **NOC Room** | | | | | |
| 27 | Approved study table; 1800 x 600mm wide. | No | 6 | | | |
| | **Provisional Sum** | | | | | |
| 28 | Joinery Fittings and Storage Cabinets<br>Allow a sum for provision of extra furniture at Kenyan Shillings One Million Only (Kshs. 1,000,000.000) | | | SUM | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 2** | | | | | |
| | Section No. 2<br>Bill No. 10<br>FURNITURE FITTINGS AND EQUIPMENT | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO. 2** | | | | | |
| | **FURNITURE, FIXTURE AND EQUIPMENT** | | | | | |
| | THE MAIN CONTRACTOR IS HEREBY INSTRUCTED TO **TAKE DELIVERY AND FIX ONLY** THE FOLLOWING LOOSE AND FIXED FURNITURE. | | | | | |
| | **Fix only includes all associated works (Where not measured in the Bill of Quantities), installation screwing and nailing, adhesives, surface treatment and making good to the Interior Designers and Architects Satisfaction** | | | | | |
| | **All un-anticipated extensive additional work or components must be brought to the attention of the Quantity Surveyor and Project Managers for evaluation as soon as possible for evaluation.** | | | | | |
| | Builders Work in Furniture Installations | | | | | |
| 1 | Provide a Provisional Sum of Kenya Shillings Five Hundred Thousand (Kshs. 500,000.00) Only for attendance and profit in installation of furniture | | Item | | 500,000.00 | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 11<br>BUILDERS WORKS IN RELATION TO FURNITURE INSTALLA | | | | | |

**SECTION SUMMARY - BUILDERS WORKS**

| Bill No | | Page No | | Amount | |
|---|---|---|---|---|---|
| 1 | DEMOLITIONS | 4 | | | |
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| | **Carried to Final Summary** | | KES | | |

Section No. 2

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO : 3**<br><br>**BILL NO:1**<br><br>**DATA CENTER UPS INPUT/OUTPUT BOARD**<br><br>Free standing panel, to **IP42** suitable for indoor installation, front access, compliant with standards KSIEC 61439-1 concerning the construction of Type Tested Assemblies, **Form 3B**, comprising of the following specification.<br><br>Type Tested as Schneider of approved Equivalent<br><br>Complete with: -<br><br>**Incomer Section.**<br><br>1 No. 630A 4P 36kA, MCCB, with micrologic 5.0* trip unit (LSI protection) – *Schneider.*<br><br>1 No. Motor Mechanism for the above MCCB – *Schneider.*<br><br>1 Nos. RYB Phase Presence Indicator Lamps c/w protection fuses.<br><br>1 Nos. Digital Multifunction Meter, Powerlogic PM5320 Complete with protection and CTs<br>– *Schneider*<br><br>Set of Power Logic heat detectors – Schneider<br><br>Set of<br><br>Wireless<br><br>thermal<br><br>sensors<br><br>**Carried Forward**<br><br>Section No. 3<br>Bill No. 1<br>PARTICULAR SPECIFICATIONS FOR UPS SWITCHGEAR | | | KES | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | TH110 –<br>Schneider<br>1No. Panel<br>server,<br>concentrat<br>or Modbus<br>gateway.<br>**Outgoer**<br>**Section 1.**<br>1 No. 630A 4P 36kA, Adj, MCCB, with micrologic 5.0* trip unit (LSI protection) *To 400Kva UPS – Schneider*<br>1 No. 400A 4P 36kA, Adj, MCCB, with micrologic 5.0* trip unit (LSI protection) *To 200Kva UPS – Schneider*<br>3 No. 63A 4P 25kA, MCCB with TMD* trip unit – *Schneider.*<br>**400Kva UPS Section 1.**<br>2 No. 630A 4P 36kA, MCCB with Micrologic 5.0* trip unit – *Schneider.*<br>2 Nos. Direct Rotary Handle for the above MCCBs – *Schneider*<br>1 No. Mechanical Interlock for the above MCCBs – *Ronis Key – Schneider.*<br>1 No. 630A 3P 36kA, MCCB with Micrologic 5.0* trip unit (*To load*) – *Schneider.*<br>*1* No. 250A 3P 25kA, MCCB with Micrologic 5.0* trip | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 1<br>PARTICULAR SPECIFICATIONS FOR UPS SWITCHGEAR | | | | | |

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| | **Brought Forward** | | | KES | | |
| | unit (*To load*) – *Schneider.*<br><br>**200Kva UPS Section 1.**<br><br>*2* No. 400A 4P 36kA, MCCB with Micrologic 5.0* trip unit – *Schneider.*<br><br>2 Nos. Direct Rotary Handle for the above MCCBs – *Schneider*<br><br>1 No. Mechanical Interlock for the above MCCBs – *Ronis Key – Schneider.*<br><br>1 No. 250A 4P 25kA, MCCB with Micrologic 5.0* trip unit (*To load*) – *Schneider.* | | | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 3**<br>Section No. 3<br>Bill No. 1<br>PARTICULAR SPECIFICATIONS FOR UPS SWITCHGEAR | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:2** | | | | | |
| | LOW VOLTAGE PANELS | | | | | |
| 1 | DATA Center | No | 1 | | | |
| | Panel UPS | | | | | |
| 2 | EQUIPMENT | m | 1 | | | |
| 3 | UPS 400 kVA (APC/ABB/Eaton or approved Equivalent) with 10 mins Backup and VRLA batteries | m | 1 | | | |
| | UPS 400 kVA (APC/ABB/Eaton or approved Equivalent) with 10 mins Backup and VRLA batteries | | | | | |
| 4 | **Modules to upgrade existing Vertiv APM (150 to 400kVA) and (150 to 200kVA)** | No | 10 | | | |
| | APM 500 50kVA module | | | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 3** | | | | | |
| | Section No. 3<br>Bill No. 2<br>UPS ROOM SYSTEM FOR DATA CENTER | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:3** | | | | | |
| | Floor Distribution Power Boards | | | | | |
| 1 | 12way distribution board complete with Earth stud heavy duty enclosure with removable gland plate and blanking plates Schneider electric Acti 9 Isobar or equivalent and approved from reputable brand. Features include:<br><br>-Busbar Rating at 125A 3P+N with breaking capacity of 25KA.<br>-Incomer breaker at 80A 3P<br>-16 way three phase outgoers | No | 1 | | | |
| 2 | 12way distribution board complete with Earth stud heavy duty enclosure with removable gland plate and blanking plates Schneider electric Acti 9 Isobar or equivalent and approved from reputable brand. Features include:<br><br>-Busbar Rating at 125A 3P+N<br>-Incomer breaker at 63A 3P<br>-12 way three phase outgoers | No | 2 | | | |
| | **Circuit Breakers and other switching devices** | | | | | |
| 3 | 10A SP MCB as Schneider Electric or approved equivalent | No | 36 | | | |
| 4 | 20A SP MCB as Schneider Electric or approved equivalent | No | 36 | | | |
| 5 | 32A SP MCB as Schneider Electric or approved equivalent | No | 36 | | | |
| 6 | 63A TP MCB as Schneider Electric or approved equivalent | No | 2 | | | |
| 7 | 80A TP MCB as Schneider Electric or approved equivalent | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **Low Voltage XLPE/PVC/AWS/PVC Cables-LSZH laid on cable ladder in tri-foil and/or firmly tied with cleats in trench** | | | | | |
| | 1Cx630mm² - 1run per phase and neutral | | | | | |
| 8 | AVC BY-PASS PANEL 01 to DATA CENTER MAINBOARD | m | 600 | | | |
| 9 | Cable glands for CU cables above | No | 8 | | | |
| 10 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| | 1Cx240mm² - 1run per phase and neutral | | | | | |
| 11 | FROM UPS INPUT AND OUTPUT BOARD TO 400KVA UPS AND BACK | m | 120 | | | |
| 12 | Cable glands for CU cables above | No | 16 | | | |
| 13 | Cable lugs for CU cables above complete with hydraulic crimping | No | 16 | | | |
| | 1Cx120mm² - 1runs per phase and neutral | | | | | |
| 14 | FROM UPS INPUT AND OUTPUT BOARD TO 200KVA UPS AND BACK | m | 120 | | | |
| 15 | Cable glands for CU cables above | No | 16 | | | |
| 16 | Cable lugs for CU cables above complete with hydraulic crimping | No | 16 | | | |
| | **600/1000V XLPE/LSZH Copper cable in shaft, sleeve, on cable tray or on surface, including strapping or clamping, supports etc. and to East African Cable quality.** | | | | | |
| | 4 core 25mm2 | | | | | |
| 17 | FROM RAW POWER FLOOR DB TO RAW POWER FLOOR SUB-MAIN DB | m | 50 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 18 | Cable glands for CU cables | No | 2 | | | |
| | above <u>4 core 16mm2</u> | | | | | |
| 19 | FROM MAIN CLEAN POWER FLOOR DBs TO CLEAN POWER FLOOR SUB-MAIN DBs | m | 30 | | | |
| 20 | Cable glands for CU cables above | No | 2 | | | |
| 21 | FROM MECHANICAL FLOOR DBs TO OFFICE MECHANICAL DB | m | 30 | | | |
| 22 | Cable glands for CU cables | No | 2 | | | |
| | above <u>4 core 6mm2</u> | | | | | |
| 23 | FROM DISTRIBUTION BOARD TO CRAC UNITS | m | 210 | | | |
| 24 | FROM DISTRIBUTION BOARD TO SPLIT UNITS | m | 50 | | | |
| 25 | FROM DISTRIBUTION BOARD TO VRF UNIT | m | 50 | | | |
| | <u>3 core 4mm2</u> | | | | | |
| 26 | FROM DISTRIBUTION BOARD TO BMS PANELS | m | 200 | | | |
| | **<u>600/1000V XLPE/LSZH Green Yellow Copper cable in shaft, sleeve, on cable tray or on surface, including strapping or clamping, supports etc. and to East African Cable quality.</u>** | | | | | |
| 27 | 1C 120mm2 | m | 150 | | | |
| 28 | 1C 95mm2 | m | 30 | | | |
| 29 | 1C 10mm2 | m | 50 | | | |
| 30 | 1C 6mm2 | m | 30 | | | |
| | **Carried Forward to Summary of Section No. 3** | | | KES | | |
| | Section No. 3<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:4** | | | | | |
| 1 | **Allow a Provisional Sum of Kenya Shillings Ten Million (10,000,000.00) to be used for special support structures for cable tray and ladder, fire stopping compounds, and water stopping compounds as manufactured by Fischer or Hilti** | | Item | | 10,000,000.00 | |
| | **Carried Forward to Summary of Section No. 3** | | | KES | | |
| | Section No. 3<br>Bill No. 4<br>MECHANICAL SUPPORTS AND WATER SEALS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO: 5** | | | | | |
| | **SMALL POWER AND LIGHTING** | | | | | |
| | **Supply, install, test, commission and set to work the following:-** | | | | | |
| | **WIRING** | | | | | |
| | **Lighting Points** | | | | | |
| 1 | Lighting point completely wired with1.5 $mm^2$ Flat Twin with Earth PVC insulated copper cables to East African Cables quality including all accessories but excluding luminaire. | No | 129 | | | |
| | **Power Points** | | | | | |
| 2 | Wiring for twin 13A switched socket outlet with 3 Core 2.5 $mm^2$ PVC - CU cables to East African Cables quality - radial circuit | No | 116 | | | |
| 3 | Wiring for Cooker Control Unit wired in 3 core 4.0 $mm^2$ PVC - CU cables to East African Cables quality - radial circuit. | No | 1 | | | |
| | **Access Control Points** | | | | | |
| 4 | Wiring for Access Control PSU with 3 x 1.5 $mm^2$ PVC- SC-CU cables to East African Cables quality - radial circuit. | No | 15 | | | |
| | **Mechanical Loads** | | | | | |
| 5 | Wiring for supply fan with 3 x 1.5$mm^2$ PVC insulated copper cables, to East African Cables quality, in a radial configuration; | No | 2 | | | |
| | **FITTINGS** | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 5<br>SMALL POWER & LIGHTING SYSTEM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **<u>Luminaires</u>** | | | | | |
| 6 | High Performance,600x600mm LED flat Panel - 45W daylight cool 5000K, as Philips or approved equivalent c/w Dimmable DALI Driver | No | 58 | | | |
| 7 | IP66, dust and moisture resistant LED luminaire.. 36W cool white 5000k as as Philips or equivalent and approved reputable brand c/w Dimmable LED DALI driver | No | 20 | | | |
| 8 | IP66, dust and moisture resistant LED luminaire. Class I electrical. 36W cool white 5000k c/w Battery backup and Dimmable DALI LED driver | No | 20 | | | |
| 9 | Modular [interlinkable, stylish]Suspended Linear Lights atleast 30W, Beam angle circa. 100 degrees,<br>1.2 m long , cool white as Imperial Lighting PROLINE 50 REC or equivalent and approved reputable brand c/w Dimmable LED DALI driver and with the following features:<br>· Mounting: suspended mounting<br>· Body material: Aluminium profile<br>· Colour: Standard white RAL 9003M<br>· Lumen output: Standard up to 4000 lm/meter<br>· LED module: Signify (Philips), Tridonic or equivalent SMD LED modules<br>· Colour temperature: 4000K<br>· Colour Rendering: CRI>80 in standard<br>· Driver: DALI<br>· Daylight/Occupancy sensor: Built-in XC sensor or wireless MCS sensor<br>· Emergency unit: In-built<br>· IP Class: IP20 in standard<br>· Power: 220-240V 50/60Hz<br>· Lighting direction: Direct lighting<br>· Light distribution: Symmetric<br>· Diffusor: OP white acrylic / MP19H microprismatic UGR<19<br>· Optics: White reflector<br>· Warranty: 5 Years standard warranty | No | 8 | | | |
| 10 | Gu10 downlight, recessed c/w 8W LED bulb , warmwhite as Philips or equivalent and approved reputable brand c/w Dimmable LED DALI driver | No | 16 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 5<br>SMALL POWER & LIGHTING SYSTEM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 11 | LED Emergency Exit Light c/w DALI Driver | No | 7 | | | |
| | **Power Point Fittings** | | | | | |
| 12 | 13A, Stylish, Brushed Metal, Twin switched socket outlet with neon light as MK/Schneider Electric or approved equivalent from a reputable brand as per BS 1363 | No | 36 | | | |
| 13 | Twin 13A switched socket outlet as MK or approved equivalent | No | 40 | | | |
| 14 | 13A, Red, Plastic, Twin switched socket outlet with neon light as MK/Schneider Electric or approved equivalent as per BS 1363 | No | 40 | | | |
| 15 | 20A DP Switch c/w neon light as MK or approved equivalent | No | 15 | | | |
| 16 | Cooker Control Unit as MK or approved equivalent | No | 1 | | | |
| 17 | Twin Pattress Box | No | 80 | | | |
| 18 | Single Pattress boxes | No | 34 | | | |
| 19 | Power pole complete with two (2) twin socket outlets , one (1) single plate twin data outlet and one (1) HDMI Plate | No | 2 | | | |
| 20 | Snake Vertebrae Cable Manager circa 1m in length c/w Push to Fit Floor Access Grommet - 140mm OD, 127mm floor cutout, max 40mm depth | No | 14 | | | |
| | **Carried Forward to Summary of Section No. 3** | | | KES | | |
| | Section No. 3<br>Bill No. 5<br>SMALL POWER & LIGHTING SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO: 6** | | | | | |
| | **KNX/Dali lighting Automation system** | | | | | |
| | **Supply Install, Test and commission the following items:** | | | | | |
| | **Design Services** | | | | | |
| 1 | Design and Programming for Lighting Automation to include:<br>• Single Line Diagrams<br>• Floor plan wiring diagrams<br>• Sequence of operation<br>• Programming and configuration of different scenes | | Item | | | |
| | **Actuators/Controllers** | | | | | |
| 2 | Indoor, IP54, Lighting Control Panel for housing all the lighting control back-end devices c/w the following components:<br>- Power supplies [sized as per estimated load]<br>-Wiring Duct<br>-Filtering and Surge Protection<br>-Terminal blocks [adequate for present and 20% future hard wired points]<br>-Ventilation grilles<br>-Any other components as per OEM's recommendations | No | 2 | | | |
| 3 | KNX Power supply with emergency power input as Schneider space logic or equivalent approved reputable brand with the following specifications:<br>· Maximum number of bus devices : 64<br>· Input voltage, 50-60 Hz : AC 220-240 V<br>· KNX: DC 28-31 V<br>· Output Current : 640mA | No | 2 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 6<br>LIGHTING AUTOMATION | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 4 | KNX - Dali Gateway as Schneider SpaceLogic DALI gateway Pro or equivalent approved with the following specifications:<br><br>KNX<br>KNX Medium: Twisted Pair<br>Security: KNX Data Secure<br>Ready DALI<br>Outputs: 1 Output D+/D<br>Type: Multi-master application controller<br>Number of ECGs: max. 64 (DALI-1, DALI-2)<br>Number of sensors: max. 8 (DALI-2)<br>DALI voltage: typical DC 18 V, short-circuit proof, max 250 mA, basic insulation (no SELV)<br>Shutdown delay: 600 ms after DALI short-circuit<br>Start-up attempt after shutdown: 5 s after short-circuit detection<br>Ethernet<br>Type: 100BaseT (100 Mbit/s)<br>Supports: IEEE 802.3<br>IP protection rating: IP20<br>Protection class: I<br>Overvoltage category: III<br>Degree of contamination: 2 | No | 3 | | | |
| 5 | KNX IP Interface as Schneider Electric SpaceLogic or equivalent and approved reputable brand to enable access of the KNX Bus from every point on the LAN as well as programming interface for ETS 5 Software and allowsto access the KNX bus over the Internet via VPN. | No | 2 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 6<br>LIGHTING AUTOMATION | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 6 | 6 channel , KNX switching actuator as Schneider Space logic or equivalent and approved brand with the following capabilities:<br><br>General Setting<br>Assignment of the functions to the channels<br>Extended Setting<br>• Sending delay after bus voltage recovery<br>• Cyclic sending live signal (1…65535 s, 0=inactive)<br>• Enable safety priority function<br>• Central control for switch or curtain function Switching actuator functions<br>• Relay state after bus voltage failure or recovery<br>• Relay state after ETS download<br>• Object value of the "Switch" object after bus voltage recovery<br>• Status feedback function for each channel<br>• Contact position if "Switch" object is "1" or "0"<br>• Time function for each channel including delay, flashing and staircase timer function<br>• Preset function<br>• Logic function<br>• Scene function<br>• Threshold function<br>• Safety function<br>• Forced function<br>• Locking function<br>• Central function | No | 3 | | | |
| | **<u>Control switches/Panels</u>** | | | | | |
| 7 | KNX Push-button with 2 operating buttons and status indicators and metallic finish as Schneider spacelogic or equal and approved reputable brand | No | 10 | | | |
| 8 | KNX Push-button with 4 operating buttons and status indicators and metallic finish as Schneider spacelogic or equal and approved reputable brand | No | 2 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 6<br>LIGHTING AUTOMATION | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 9 | KNX Push-button with 8 operating buttons and status indicators and metallic finish as Schneider spacelogic or equal and approved reputable brand | No | 1 | | | |
| 10 | KNX Smart Touch Control Screen as Schneider SpaceLogic KNX 4" Touch Unit or equivalent and approved reputable brand with the following specifications:<br>User Interface functions:<br>■ Different UI theme style<br>■ Screen saver<br>■ Orientation indicator<br>■ Proximity function triggered by object<br>■ Setting the backlight in normal/night mode<br>■ Setting the appearance of the screen Main functions<br>■ Brightness dimming<br>■ RGB dimming<br>■ RGBW dimming<br>■ Colour temperature dimming<br>■ Venetian blind position and slat<br>■ Air conditioner control<br>■ Room temperature control<br>■ Ventilation control<br>■ Audio control | No | 1 | | | |
| 11 | KNX Presence sensor as Schneider Electric spacelogic or equivalent and approved reputable brand with the following specifications:<br>• Number of channels: 5<br>• Protection type: Creep zone protection<br>• Type of setting: Light sensitivity adjustable<br>• Duty cycle: 15300 minutes<br>• Time delay range : 0...1 s (switch-on)<br>• Detection face Lateral: 7 m<br>• Detection angle 360°horizontal<br>• Device mounting:Flush/surface<br>• Mounting height 2.5-3m | No | 12 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 6<br>LIGHTING AUTOMATION | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Cabling** | | | | | |
| 12 | Certified EIB/KNX Bus Cable LSZH single pair building management cable. - LSZH FireFighter™ acc. to IEC60332-1, IEC60332-3, IEC61034, IEC60754-1 with the following specifications:<br>Conductor : Solid bare copper wire<br>Insulation : LSZH FireFighter™<br>No. Of Pairs : 1<br>Colour Code : Red, Black cores twisted to a pair<br>Tape : Plastic tape overlapped<br>Drain Wire : Solid bare copper wire<br>Screen :Aluminium/polyester tape<br>Outer Jacket : LSZH FireFighter™<br>Green | m | 500 | | | |
| 13 | DALI cable - 16awg- LSZH 600V rated with Harmonised Standard Dca-S2-D2-A1 | m | 700 | | | |
| | **Carried Forward to Summary of Section No. 3** | | | KES | | |
| | Section No. 3<br>Bill No. 6<br>LIGHTING AUTOMATION | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:7** | | | | | |
| | **Wireless Network Connectivity** | | | | | |
| 1 | **Wireless Access Point with the following features;**<br><br>• 10/100/1000 Ethernet PoE-enabled port<br>• Supports Wifi 6 (802.11ax) standard that enables dual-band capability(2.4GHz & 5GHz)<br>• Intelligent Quality of Service (QoS) features<br>• Web-Based Configuration<br>• Supports MU - MIMO configuration<br>• Internal Antennas<br>• Wireless throughput of 300Mbps<br>• Firmware upgradable via web interface<br>• VLAN Support<br>• DHCP Support | No | 5 | | | |
| | **End-User Network Connection Point** | | | | | |
| 2 | Single Port Data Outlet c/w 8pin Cat6A RJ45 Module as Siemons/Panduit or approved equivalent | No | 66 | | | |
| 3 | Dual Port Data Outlet c/w 2No. 8pin Cat6A RJ45 Modules as Siemons/Panduit or approved equivalent | No | 34 | | | |
| 4 | Brushed Steel [color to ID specs], Dual Port Data Outlet c/w 2No. 8pin Cat6A RJ45 Modules as Siemons/Panduit or approved equivalent | No | 20 | | | |
| | **Carried Forward**<br><br>Section No. 3<br>Bill No. 7<br>LOCAL AREA NETWORK | | | KES | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Core Layer Switches** | | | | | |
| 5 | 24 port Managed Network Switch as Cisco C9300X- 24Y with the following features:<br>• 24 x 1G/10G/25G BaseX SFP28 ports with modular uplinks<br>• Dual Power Supply<br>• Rack-mountable 1U<br>• 16GB RAM<br>• 16GB Flash Memory<br>• Layer 3 functionality<br>• Stackable<br>• Including all rack mount brackets, | No | 2 | | | |
| 6 | Cisco 10GB SFP+ Module - Multi-Mode Fibre Optic for uplink ports | No | 48 | | | |
| 7 | Cisco DNA Advantage license for the above switch<br>- 5 years | No | 2 | | | |
| 8 | 1U 8 Port Kvm Switch With Flip Up Console, 19 Inch Lcd Ip Ready Tripp-Lite B020-U08-19-Ip. | No | 4 | | | |
| | **Access Layer Switches** | | | | | |
| 9 | 24 port PoE+ Managed Network Switch as Cisco C9300L -24P-4X-E or equivalent Cisco model and with the following features:<br>• 24 Port PoE+<br>• Dual Power Supply<br>• Atleast 2No. 10Gbe Uplinks IP Base (2 SFP+ Ports)<br>• Including all rack mount brackets,<br>• Stacking cables included | No | 10 | | | |
| 10 | Cisco 10GB SFP+ Module - Multi-Mode Fibre Optic for uplink ports | No | 20 | | | |
| 11 | Cisco DNA Advantage license for the above switch<br>- 5 years | No | 10 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 7<br>LOCAL AREA NETWORK | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Storage Access Network Switches** | | | | | |
| 12 | 48 port PoE+ Managed Network Switch as Cisco modular Series and with the following features:<br>• 48 Port PoE+<br>• Dual Power Supply<br>• Atleast 2No. 40Gbe Uplinks IP Base (2 SFP+ Ports)<br>• Including all rack mount brackets,<br>• Stacking cables included | No | 4 | | | |
| 13 | Cisco 10GB SFP+ Module - Multi-Mode Fibre Optic for uplink ports | No | 8 | | | |
| 14 | Cisco DNA Advantage license for the above switch<br>- 5 years | No | 4 | | | |
| | **IT Room Network Infrastructure** | | | | | |
| | Passive Components | | | | | |
| 15 | 42U x 800mm deep, 600mm wide Cabinet, Black Powder Coated, complete with all power and cable articulation, curved perforated front and back doors, Brush Cable Top and Bottom Entry, removable side panels | No | 3 | | | |
| 16 | 12 way IEC C13 Basic metal PDU, 19" rack mountable | No | 6 | | | |
| 17 | 1U Blank Panels | No | 78 | | | |
| 18 | 1U Cable Managers | No | 10 | | | |
| 19 | 1U Brush Panel | No | 2 | | | |
| 20 | 1U CAT6A Patch Panel as Siemons/Panduit or approved equivalent | No | 10 | | | |
| | Back-bone Cabling | | | | | |
| 21 | 24 port duplex Multi-mode Fibre patch panel c/w duplex LC-LC connectors and Fiber Splicing Tray. Include all accessories to form a complete unit | No | 2 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 7<br>LOCAL AREA NETWORK | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 22 | Horizontal Single Sided Manager, 0RU, 5 Snap-in D-Rings, 4.29 in. Depth | No | 2 | | | |
| 23 | Fibre Patch Cords - Multi-mode - 2 meter - Duplex LC Connectors | No | 18 | | | |
| 24 | Fibre Patch Cords - Multi-mode - 3 meter - Duplex LC Connectors | No | 10 | | | |
| 25 | 4 Core, OM4 Multi-Mode, tight buffered fibre cabling for installation in sleeves and on cable trays | m | 80 | | | |
| 26 | 1 core OM4 LC Fibre Pigtail - 1.5m 2 | No | 36 | | | |
| 27 | core OM4 LC Fibre Pigtail - 3m Fibre | No | 10 | | | |
| 28 | Splicing, Incl ODTR testing | No | 20 | | | |
| | **S/FTP Horizontal Cabling for ACS and VSS** | | | | | |
| 29 | CAT6-RJ45 Un-Shielded | No | 5 | | | |
| 30 | Connector CAT6-RJ45 Shielded | No | 52 | | | |
| 31 | Connector | m | 10,170 | | | |
| 32 | CAT6A-U/UTP LSZH Network cable - White (For Data outlets) | m | 1,260 | | | |
| 33 | CAT6A-S/FTP LSZH Network cable - Grey (For ACS) CAT6-S/FTP LSZH Network cable - Green (For VSS) | m | 4,680 | | | |
| 34 | CAT6A-U/UTP Data Patch Lead - 1m - White (For Data outlets) | No | 113 | | | |
| 35 | CAT6-S/FTP Data Patch Lead - 1m - Grey (For | No | 26 | | | |
| 36 | ACS) CAT6-S/FTP Data Patch Lead - 1m - Green | No | 91 | | | |
| | (For VSS) **Labelling of devices** | | | | | |
| 37 | Labelling of devices | | | SUM | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 3** | | | | | |
| | Section No. 3<br>Bill No. 7<br>LOCAL AREA NETWORK | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:8** | | | | | |
| | **Conduiting complete with fittings to form complete pathways** | | | | | |
| 1 | Conduiting for Lighting points in 25 mm dia H/G PVC conduits. | No | 129 | | | |
| 2 | Conduiting for power points in 25 mm dia H/G PVC conduits. | No | 117 | | | |
| 3 | Conduiting for data points in 25 mm dia H/G PVC conduits to back boxes to receive data faceplates. | No | 59 | | | |
| 4 | Conduiting for HDMI points in 25 mm dia H/G PVC conduits to back boxes to receive data faceplates. | No | 19 | | | |
| 5 | Conduiting for access control points in 25 mm dia H/G PVC conduits to back boxes to receive fire alarm wall-mount devices. | No | 100 | | | |
| 6 | 25mm dia. PVC Flex Conduit | m | 169 | | | |
| | **Wall - Trunking** | | | | | |
| 7 | 200mm x 50mm powder-coated Steel trunking with two compartments for power and data. The accessories needed to complete the installation to be included. These include flat 90 degree corners, flat tees, flat crosses, divider to provide two chambers, screws and nuts, End caps, branch connection elements, straight joints, adjustable joint accessories and wall brackets. Colour as per Clients requirements. | m | 150 | | | |
| 8 | Ditto but twin socket knock-outs | No | 116 | | | |
| 9 | Ditto but single data outlet knock-outs | No | 54 | | | |
| | **Carried Forward** | | | KES | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | Power way cable ladder 3mm thick as per specification | | | | | |
| 10 | Cable Ladder of dimension 300 mm x100 mm | m | 40 | | | |
| 11 | Cable Ladder of dimension 600 mm x100 mm | m | 120 | | | |
| | Cable ladders Accessories 3mm thick Including Tees, Bends and Cross as per specification | | | | | |
| | Ladder Horizontal Bend Standard 300mm x 100mm | No | 8 | | | |
| 12 | Ladder Horizontal Bend Standard 600mm x 100mm | No | 4 | | | |
| 13 | Ladder Horizontal Tee Standard 300mm x 100mm-300mm x 100mm | No | 12 | | | |
| 14 | Ladder Horizontal Tee Standard 600mm x 100mm-600mm x 100mm | No | 2 | | | |
| 15 | Ladder Horizontal Cross Standard 600mm x 100mm- 600mm x 100mm | No | 3 | | | |
| | 2mm thick Cable trays for CCTV and Access Control cables as per specification | | | | | |
| | **Cable Trays** | | | | | |
| 16 | ELV Tray - 200 mm x50 mm deep perforated cable tray made of hot-dipped galvanized metal and powder coated to preferred color c/w all angle bends, Tees and end caps to detail and to approval. Includes equipotential bonding. | m | 380 | | | |
| 17 | LV Power Tray - 300X100mm deep solid-bottom cable tray made of hot-dipped galvanized metal and powder coated to preferred colour c/w all angle bends, Tees and end caps to detail and to approval. Includes equipotential bonding. | m | 380 | | | |
| 18 | Aircon Pipe Tray - 300X100mm deep solid-bottom cable tray made of hot-dipped galvanized metal and powder coated to preferred colour c/w all angle bends, Tees and end caps to detail and to approval. Includes equipotential bonding. | m | 150 | | | |
| | **Carried Forward to Summary of Section No. 3** | | | KES | | |
| | Section No. 3<br>Bill No. 8<br>CONTAINMENT<br>SYSTEM | | | | | |

| Bill No | SECTION SUMMARY - ELECTRICAL AND ASSOCIATED WORKS | Page No | | Amount | |
|---|---|---|---|---|---|
| 1 | PARTICULAR SPECIFICATIONS FOR UPS SWITCHGEAR | 29 | | | |
| 2 | UPS ROOM SYSTEM FOR DATA CENTER | 30 | | | |
| 3 | LOW VOLTAGE DISTRIBUTION SYSTEM | 33 | | | |
| 4 | MECHANICAL SUPPORTS AND WATER SEALS | 34 | | | |
| 5 | SMALL POWER & LIGHTING SYSTEM | 37 | | | |
| 6 | LIGHTING AUTOMATION | 42 | | | |
| 7 | LOCAL AREA NETWORK | 46 | | | |
| 8 | CONTAINMENT SYSTEM | 48 | | | |
| | **Carried to Final Summary** | | KES | | |
| | Section No. 3 | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO :** | | | | | |
| | **4 BILL NO:1** | | | | | |
| | **Supply and Install the following custom made Thermal containment system.** | | | | | |
| 1 | **Bidders to note that one end of the containment will be against the wall and allowance must be made for anchorage of the roofing system** | | 17 | | | |
| 2 | **Pod 2- 18 racks, 3 Inrow Cooling, contained against wall** | | 17 | | | |
| 3 | | | 17 | | | |
| | **Server Rack** | | | | | |
| 4 | | | 6 | | | |
| 5 | VE rack, SR-V061220S 42U (2000H) x600W x1200D,with castors & Side Panel (Split), Dual PDU/Cable Mgt Bracket, | No | 50 | | | |
| | Base Plate for 600mm racks | No | | | | |
| 6 | 1U Finger Type Cable Organizer w Cover, 1 pc | No | 1 | | | |
| 7 | 1U brush panel,- Tool-less removal (set of 3) | No | 1 | | | |
| 8 | 1U Blanking panel - Tool-less removal (set of 10) | | 1 | | | |
| 9 | **Network Rack** | | 1 | | | |
| 10 | VE rack, 42U, 2000H x800W x1200D,with casters, side panel, 2x PDU bracket | No | 3 | | | |
| | Base Plate for 800mm racks | No | | | | |
| | 1U Finger Type Cable Organizer w Cover, 1 pc | No | | | | |
| | 1U brush panel,- Tool-less removal (set of 3) | No | | | | |
| | 1U Blanking panel - Tool-less removal (set of 10) | No | | | | |
| | **Carried Forward** | | | | | |
| | Section No. 4<br>Bill No. 1<br>NON STANDARD RACKS AND THERMAL CONTAINMENT | | | KES | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 11 | 42U (Vertical) Finger Type Cable Organizer w Cover, 1 pc | No | 2 | | | |
| | **rack PDUs** | | | | | |
| 12 | Geist Monitored, 32A, 230V, 7.3kW, Vertical, (20) Locking IEC C13, (4) Locking IEC C19, 3m power cord with 2P+E (IP44), Black Powder Coat. | No | 36 | | | |
| | **Aisle Containment** | | | | | |
| 13 | 2000mm height motorized sliding door for 1200mm width aisle and suitable for 1200mm depth rack (two ends) | No | 1 | | | |
| 14 | 600mm width openable roof plate for 1200mm width aisle | No | 20 | | | |
| 15 | 800mm width openable roof plate for 1200mm width aisle | No | 1 | | | |
| 16 | SmartAisle2 aisle lighting supply and management package | No | 1 | | | |
| 17 | SmartAisle2 HMI management package | No | 1 | | | |
| | **Containment Access Control** | | | | | |
| 18 | Door access control ID card reader 112mm(L)×44mm(W) ×18mm(H) | No | 2 | | | |
| 19 | Door access control ID card | No | 10 | | | |
| 20 | RFID IP Door Controller | No | 1 | | | |
| 21 | Exit Button ,stainless | No | 1 | | | |
| 22 | ID Card Release Device(USB Port) | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 1<br>NON STANDARD RACKS AND THERMAL CONTAINMEN | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Monitoring** | | | | | |
| 23 | RDU Management package<br>1 - 8 digital / analogue output expansion<br>card 6 - Temperature and humidity sensor<br>2 - Sound and light warning<br>light 1 - Infrared Detectors<br>2 - Water Leak Detection Cable -Flooding tape -<br>10 m<br>1 - 4 digital input<br>sensor 1 - Magnetic<br>Roof state 2 - The top<br>button open<br>2 - The top button open the protective<br>cover 1 - Cable set top open | | Item | | | |
| 24 | Water sensor-12V~24VDCLOW-10~60℃-(5m) | No | 1 | | | |
| 25 | Smoke detective sensor | No | 1 | | | |
| 26 | 8DIAI extension card | No | 1 | | | |
| 27 | 4G sms modem, power via USB,with mounting brackey,USB cable 500mm length | No | 1 | | | |
| | **Cooling** | | | | | |
| 28 | In Row Cooling Unit - 45kW inclusive of outdoor condensor | No | 3 | | | |
| | **Carried Forward to Summary of Section No. 4** | | | KES | | |
| | Section No. 4<br>Bill No. 1<br>NON STANDARD RACKS AND THERMAL CONTAINMEN | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:2** | | | | | |
| | ***Bidders to note that Siemons/Panduit Factory Pre terminated Plug and Play Copper and Fiber solutions to be observed as a basis of quality expected equal and approved equivalent will be accepted upon written confirmation by the Engineer*** | | | | | |
| | **Central Patching Zone Racks** | | | | | |
| | ***Cable Management Rack Assembly comprising of the components listed below:*** | | | | | |
| 1 | Aluminium cable management rack system with the following features:<br>• 45 RU Space<br>• Size : 2.1m (H) x 609.66mm (W) x 584.2mm (D)<br>• Color Black<br>• To include accessories such as ground lug, quarter-turn hook and loop cable managers for front of rack. | No | 4 | | | |
| 2 | Complete Rack Grounding Kit assembly comprised of the following items :<br>• 1No. Copper Ground Bar<br>• 2No. 96" #6 AWG THW Green Insulated Conductor<br>• 2No. 12-24x5/8" Thread Forming Screws<br>• 20No. 12-24 x 1/2" Plated Machine Screws<br>• 1No. Compression Tap (usage optional)<br>• 1No. Abrasive Pad<br>• 2No. Adhesive Ground Label<br>• 1No. Antioxidant Compond<br>• 20 1/2" Lock Washers<br>• 1No. M5 Flange Nut | No | 4 | | | |
| 3 | Rack power distribution unit, basic, full height vertical 32A single phase | No | 8 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

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| | **Brought Forward** | | | KES | | |
| 4 | 19 in. Brush Guard Panel, 1U<br><br>Note: for pass-through of cables between the front and rear of a rack or cabinet while still providing thermal protection. | No | 20 | | | |
| 5 | Double-Sided vertical cable manager 2100mm (H) x 254mm (W) x 562mm (D) to be placed in between the CPZ racks and at both ends of the racks' assembly ; to be complete with all accessories | No | 4 | | | |
| 6 | 19 in. Horizontal Cable Manager w/4 in. Fingers, 2U | No | 4 | | | |
| 7 | 32A Industrial three pin socket, single phase plug and receptacle | No | 8 | | | |
| | **Copper Accesories**<br><br>**Standard Patching Equipment**<br><br>***The items below shall be installed in the Server Racks , Core-Switch Racks and Telco Racks as per drawings*** | | | | | |
| 8 | High density, shielded copper/fiber combo patch panel with the following features:<br>• Accepts upto 4No. 6port copper adapter plates for total of 24No. copper outlets with port identification on adapter plate<br>• Panel accepts upto 4No. Fiber Plug & Play Modules that use push-pull mechanism<br>• Supports category 5e to 7A and all multi-mode and single-mode fiber applications.<br>• Panels include tie-wraps, grounding kit, and mounting screws<br>• Panels feature an integrated grounding strip to ensure proper ground path from copper outlets to grounding point<br>• Built in cable manager provides ability to secures cables for proper strain relief<br>• Panel can be mounted directly on standard 19 inch rack or cabinet | No | 56 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

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| | **Brought Forward** | | | KES | | |
| 9 | 24 port shielded panel, Empty and to receive trunk cables pre-terminated with RJ45 modules c/w RJ45 patch-panel outlets | No | 8 | | | |
| 10 | Copper Adapter Plate, 6-port, black, made of light- weight high strength steel, to be fixed to the copper/fiber combo and 24 port shielded panels | No | 128 | | | |
| 11 | Horizontal Single Sided Manager, 0RU, 5 Snap-in D- Rings, 4.29 in. Depth | No | 8 | | | |
| | **Standard Patch-Cords** | | | | | |
| | ***The standard cords below shall be used as interconnect patch-cords (patch-panel to active equipment) in Server Racks and Core-Switch racks*** | | | | | |
| 12 | Cat6A, Shielded (S/FTP), RJ45-RJ45, LSOH, T568A/B, White, Stranded, 01M Patch-Cord | No | 64 | | | |
| 13 | Cat6A, Shielded (S/FTP), RJ45-RJ45, LSOH, T568A/B, White, Stranded, 02M Patch-Cord | No | 352 | | | |
| 14 | Cat6A, Shielded (S/FTP), RJ45-RJ45, LSOH, T568A/B, White, Stranded, 03M Patch-Cord | No | 352 | | | |
| | **Intelligent Patching Equipment** | | | | | |
| | ***The items below shall be installed in the CPZ Racks and shall be capable of monitoring the status of all copper links connected to it and relaying the information to the Master Control Panels of the Network Monitoring System via appropriate data- bus*** | | | | | |
| 15 | 24 port Smart Copper Patch Panel with the following features;<br>• On-panel intelligence including a combination of LEDs and a backlit graphic LCD to guide technicians on patch cord trace and diagnostic information.<br>• Includes mounting hardware, labels, cable ties and panel ground lug | No | 96 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **Intelligent Patch-cords** | | | | | |
| | ***The advanced cords below shall be used as cross- connect patch-cords (smart patch-panel to smart patch-panel) in CPZ racks; These cords are to feature a 9th wire and sensor pin contained in a robust molded boot. This embedded sensor technology enables tracking of connections between Smart Patch Panels;*** | | | | | |
| | ***Any equivalent cord technology that enables similar tracking of connections to be demonstrated fully before approval*** | | | | | |
| 16 | Cat6A, Shielded, 6A, RJ45-RJ45, LSOH, T568A/B, Blue, Stranded, 01M patch-cord. | No | 300 | | | |
| 17 | Cat6A, Shielded, 6A, RJ45-RJ45, LSOH, T568A/B, Blue, Stranded, 02M patch-cord. | No | 426 | | | |
| 18 | Cat6A, Shielded, 6A, RJ45-RJ45, LSOH, T568A/B, Blue, Stranded, 03M patch-cord. | No | 426 | | | |
| | **Fiber Accesories** | | | | | |
| | **Standard Fiber Patching Equipment** | | | | | |
| | ***The items below shall be fitted onto the Copper/Fiber Combo Patch panels present in the Server Racks , Core-Switch Racks and Telco Racks as per drawings*** | | | | | |
| 19 | 24 fiber LC to MTP Multimode OM4 50/125 10G Plug and Play Modules, Black with low loss | No | 16 | | | |
| 20 | 24 fiber LC to MTP SingleMode OS2 Plug and Play Modules , Black with low loss | No | 16 | | | |
| 21 | 12 fiber LC to MTP Multimode OM4 50/125 10G Plug and Play Modules, Black with low loss | No | 96 | | | |
| 22 | Horizontal Single Sided Manager, 0RU, 5 Snap-in D- Rings, 4.29 in. Depth | No | 104 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **<u>Standard Fiber Patch-Cords</u>**<br><br>***The standard fiber pigtails below shall be used as interconnect patch-cords (patch-panel to active equipment) in Server Racks, Core-Switch racks and Telco Racks*** | | | | | |
| 23 | LC - LC, Duplex, OM4, LSOH, 1m Fiber Patch-Cord | No | 64 | | | |
| 24 | LC - LC, Duplex, OM4, LSOH, 2m Fiber Patch-Cord | No | 256 | | | |
| 25 | LC - LC, Duplex, OM4, LSOH, 3m Fiber Patch-Cord | No | 448 | | | |
| 26 | LCU - LCU, Duplex, Single Mode OS1/OS2, LSOH, 1m Patch cord | No | 64 | | | |
| 27 | LCU - LCU, Duplex, Single Mode OS1/OS2, LSOH, 2m Patch cord | No | 64 | | | |
| 28 | LCU - LCU, Duplex, Single Mode OS1/OS2, LSOH, 3m Patch cord | No | 64 | | | |
| | **<u>Intelligent Fiber Patching Equipment</u>**<br><br>***The items below shall be installed in the CPZ Racks and shall be capable of monitoring the status of all fiber links connected to it and relaying the information to the Master Control Panels of the Network Monitoring System via the required data- bus*** | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

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| | **Brought Forward** | | | KES | | |
| 29 | 48-fiber LC-to-MTP Smart Fiber Enclosure, black, Multimode, OM4 with the following features:<br><br>• Smart — on panel intelligence tracks fiber jumper connections and drives LCD/LEDs for tech guidance<br>• High Density - Up to 48 fibers in a single 1U space<br>• Plug and Play - Multi-fiber MTP connectivity to provide ultra-fast deployment<br>• High Accessibility - Features sliding drawer for easy access to connectivity<br>• Integrated fiber managers for secure jumper routing<br>• Rack-mounted, 1U<br>• LCD Display<br>• Data Bus Connection port, RJ45 IN, RJ45 OUT, protocol RS485<br>• Includes 24 duplex MM, LC adapters, cable ties, panel ground lug, fiber management clips, front management bar, label holder and labels | No | 48 | | | |
| | **<u>Intelligent Patch cords</u>**<br><br>***The advanced cords below shall be used as cross- connect patch-cords (smart fiber enclosure to smart fiber enclosure) in CPZ racks; These cords to feature a sensor pin contained in a robust molded boot. This embedded sensor technology enables tracking of port connections between Smart Fiber enclosures;***<br><br>***Any equivalent cord technology that enables similar tracking of connections to be demonstrated fully before approval by the Engineer*** | | | | | |
| 30 | XGLO, LC - LC, Duplex, OM4, 1m Fiber Patch cord | No | 150 | | | |
| 31 | XGLO, LC - LC, Duplex, OM4, 2m Fiber Patch cord | No | 213 | | | |
| 32 | XGLO, LC - LC, Duplex, OM4, 3m Fiber Patch cord | No | 213 | | | |
| | **<u>Network Infrastructure Management System</u>** | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **<u>Management Software</u>**<br><br>Management Software to be used to collect, monitor and store network intelligence data from Smart panels, enclosures and connectivity via Master and Distribution Control Panels, delivering this information in a user-friendly and efficient set of network management features . The capabilities of the software should include:<br><br>• Enables real-time physical layer documentation and monitoring including discovery of IT devices, interactive floor images, rack elevations and end-to-end circuit traces<br>• Navigation tree shows the hierarchical relationship from a very high level (City/Campus/Building) down to the lowest level (devices and ports), enabling access to location and device properties<br>• Real-time database with auto-discovery stores status and location of all cabling and IT assets to minimize troubleshooting time and maximize equipment and rack utilization<br>• Detects and records all physical network activity and provides instant alerts on unauthorized access or modification using an extensive set of alarm filters<br>• The work order module assigns, directs and tracks work orders, ensuring accuracy, speed and documentation of activity<br><br>Note: Main software to be installed in the Management Server.<br>Operation and Maintenance License to be issued per Floor-mounted Asset (Rack) | | | | | |
| 33 | License per floor-mounted asset (racks) whose data links are monitored in the CPZ racks | No | 4 | | | |
| 34 | Maintenance license of the above Software (1 year) to ensure continual integrity and robustness of its operation | | | | | |
| | **Note: 1No. License per Floor-Mounted Asset (Rack)** | No | 4 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **Management Server** | | | | | |
| 35 | Management/Storage Server with the following features:<br>CPU<br>Intel Xeon E3-1220 and above<br>Minimum Disk Space<br>500 GB SSD<br>Physical<br>Memory 8 GB<br>Disk I/O Throughput<br>125MB/Second and above<br>Virtual Memory<br>Minimum: 1.5x Physical<br>Memory Operating System<br>As recommended in Software Manuals<br>Database<br>As recommended in Software<br>Manuals Web Server<br>As recommended in Software<br>Manuals Virtual Server<br>As recommended in Software Manuals | No | 2 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **<u>Data Acquisition Panels</u>** | | | | | |
| 36 | Control Panel for Intelligent Network Infrastructure Management System.<br><br>The Panel shall have the following features:<br><br>• §Report patching changes to the central database within 3 seconds in even the largest patch zone configuration<br>• §LCD Multi-Functional User Interface<br>• §Redundant Ethernet connections (Master only)<br>• §Redundant power connections<br>• §Monitor up to 120 intelligent patch panels/fiber enclosures<br>• §Panel capacity can be expanded using distribution control panels (up to 24 distribution control panels)<br>• §Maximum panel capacity of 2880 panels per patch zone<br>• §Mounts on standard 19" racks/cabinets<br>• §Until shall not exceed 1U rack mount space<br>• §Use standard category 5e shielded cable or patch cords to connect to intelligent panels<br>• §Provide redundant links to intelligent panels to ensure system reliability<br>• §Remote firmware upgrade for Control panel over LAN/WAN<br>• §Control panel shall distribute firmware upgrades to connected devices (Distribution panels and intelligent panels)<br>• §Control panels shall support Multi-language capability<br>• §Control panels shall report error conditions to the central database<br>• §Allow for either punch down or RJ45 connection of control bus cables<br>• §Supply power to all connected intelligent panels/fiber enclosures | No | 4 | | | |
| 37 | Secondary Supply for Panel | No | 4 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **Data Acquisition Bus** | | | | | |
| 38 | Cat6A (F/UTP), RJ45-RJ45, LSOH, T568A/B, White, Stranded, Data Cable<br><br>**The data bus to be looped in out of all smart fiber enclosures and smart copper patch panels upto the particular loop's master control panel.** | | Item | | | |
| | **Copper and Fiber Permanent Links** | | | | | |
| | ***Permanent Links shall include Factory Terminated Fiber and Copper Trunks Laid on Cable- Raceways hanging above racks in the White-Space and Telco Rooms*** | | | | | |
| | ***These are to be used to connect Patching equipment in***<br>***a) Telco-Rack to those in Core Switch racks;***<br>***b) Core Switch Racks to those in End of Row Network Racks ;***<br>***c) End of Row Network Racks to those in Server Racks.*** | | | | | |
| | **Plug and Play Copper Trunk** | | | | | |
| | 6-LEG, CATEGORY 6A/CLASS EA, F/UTP, SOLID, LS0H (IEC 60332-1) CABLE, DOUBLE-ENDED, WITH RJ45 OUTLET, VIOLET JACKET, EXPANDO (BLACK) WRAP, T568B, 500MHZ 13 M | | | | | |
| 39 | 13m | No | 46 | | | |
| 40 | 14m | No | 6 | | | |
| 41 | 15m | No | 8 | | | |
| 42 | 16m | No | 8 | | | |
| 43 | 17m | No | 8 | | | |
| 44 | 18m | No | 10 | | | |
| 45 | 19m | No | 4 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

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| | **Brought Forward** | | | KES | | |
| 46 | 20m | No | 4 | | | |
| 47 | 23m | No | 2 | | | |
| 48 | 24m | No | 2 | | | |
| 49 | 25m | No | 2 | | | |
| 50 | 18m - Panel Outlet to Plug Trunk | No | 192 | | | |
| | **Plug and Play Fiber Trunk** | | | | | |
| | Fiber plug & play Cable assembly, Low loss Standard Trunk (Female ), 12 Fiber, 50/125 Multimode OM4, LSOH, xxx Meter, Method C | | | | | |
| 51 | 13m | No | 15 | | | |
| 52 | 14m | No | 19 | | | |
| 53 | 15m | No | 4 | | | |
| 54 | 16m | No | 4 | | | |
| 55 | 17m | No | 4 | | | |
| 56 | 18m | No | 5 | | | |
| 57 | 19m | No | 2 | | | |
| 58 | 20m | No | 2 | | | |
| 59 | 23m | No | 1 | | | |
| 60 | 24m | No | 1 | | | |
| 61 | 25m | No | 1 | | | |
| 62 | MTPPro to LC Fiber Cable assembly, Low loss, 12 Fiber, Pulling, 50/125 Multimode OM4, LSOH, Female, Cisco 9512, RFP, 14Meter | No | 96 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

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| | **Brought Forward** | | | KES | | |
| 63 | Fiber plug & play Cable assembly, Standard loss Standard Trunk (Female ), 12 Fiber, 9/125 Singlemode OS2, LSOH, 14 Meter, Method C | No | 16 | | | |
| | **Carried Forward to Summary of Section No. 4** | | | KES | | |
| | Section No. 4<br>Bill No. 2<br>COPPER AND FIBER CABLING | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:3**<br><br>**Telcom Room**<br><br>***Critical Component's for Integrated Server Racks system (Rack, rPDU's, Cooling, UPS and monitoring system) should be from single OEM for Seamless Integration, pre- installed in one single part number and serial number*** | | | | | |
| | **Carried Forward**<br><br>Section No. 4<br>Bill No. 3<br>TELCO ROOM RACKS | | | KES | | |

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| | **Brought Forward** | | | KES | | |
| 1 | Integrated Single-Rack System complete with power distribution panel, UPS and battery, rack PDU<br>, power management unit, LCD touch screen panel and environmental sensors in a fully enclosed rack with factory pre-assembled,<br><br>**General:**<br>• 42U racks of dimensions 600mm X 1100mm X 2000mm (WXDXH)<br>• Environmental Remote Monitoring capable for Water leak detection, Temperature sensor & Door Sensors.<br>• Electrical system with inbuilt essential MCB mounted inside the cabinet & Lighting protection device<br>• Inbuilt Emergency ventilation system shall activate in the event of overheating<br>• minimum 22 U usable space distributed in 1 rack, to accommodate IT and network equipment & devices<br>• 5_ KVA rack mountable UPS with 10 mins of internal Battery Backup at 3KW load.<br>• Human Machine Interface Dispaly<br>• 2 x Basic PDU 8 x C13,32A<br>• IP 20 rating<br>**Standards:**<br>General safety requirements for Integrated rack:<br>**EN 609501:2006+A11:2009+A1:2010+A12:2011**<br>EMC requirements for Integrated rack:<br>**EN 55022:2010 EN 61000-3-11:2000** | No | 2 | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 4<br>Bill No. 3<br>TELCO ROOM RACKS | | | | | |

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| | **Brought Forward** | | | KES | | |
| 2 | Complete Rack Grounding Kit assembly comprised of the following items :<br><br>• 1No. Copper Ground Bar<br>• 2No. 96" #6 AWG THW Green Insulated Conductor<br>• 2No. 12-24x5/8" Thread Forming Screws<br>• 20No. 12-24 x 1/2" Plated Machine Screws<br>• 1No. Compression Tap (usage optional)<br>• 1No. Abrasive Pad<br>• 2No. Adhesive Ground Label<br>• 1No. Antioxidant Compond<br>• 20 1/2" Lock Washers<br>• 1No. M5 Flange Nut | No | 2 | | | |
| 3 | 32A Industrial three pin socket, single phase plug and receptacle | No | 4 | | | |
| | **Carried Forward to Summary of Section No. 4** | | | KES | | |
| | Section No. 4<br>Bill No. 3<br>TELCO ROOM RACKS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:4**<br><br>Supply, configure test and commission Data Center Infrastructure Management system with the following features as a minimum;<br><br>Digital Visualization;<br><br>1. 3 D<br>2. Temperature Neophram<br>3. System/Device Integration for north and southbound interfaces<br>4. Device Monitoring<br>5. Big Display<br>6.Alarm Management<br>8. Cooling Link Visualization<br>9. Report Management<br>10. Work Order Management<br>11. Capacity Management<br><br>**Refer to Particular Specifications Section for further details** | | | | | |
| 1 | Software and Hardware costs for 50 No. standard racks | | Item | | | |
| | **Carried Forward to Summary of Section No. 4**<br>Section No. 4<br>Bill No. 4<br>DATA CENTER INFRASTRUCTURE MANAGEMENT SYSTE | | | KES | | |

**SECTION SUMMARY - WHITE SPACE GOODS**

| Bill No | | Page No | | Amount | |
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| 2 | COPPER AND FIBER CABLING | 64 | | | |
| 3 | TELCO ROOM RACKS | 67 | | | |
| 4 | DATA CENTER INFRASTRUCTURE MANAGEMENT SYSTEM | 68 | | | |
| | **Carried to Final Summary** | | KES | | |

Section No. 4

| Item No | | Unit | Quantity | Rate | Amount | |
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| | **SECTION NO : 5**<br><br>**BILL NO:1**<br><br>Bidders to note that only Unified Security Management Software (VSS and ACS sharing the same database ) will be accepted. **"Genetec"** and **"Avigilon"** have been used as a basis of quality expected, equal and approved will only be accepted with express permission of the Engineer<br><br>**Unified System Management** | | | | | |
| 1 | Unified Security Management Software that integrates data from the cameras, access control readers/controllers, under vehicle scanning system, security barriers, traffic lights , intruder alarm devices and allows interoperability of these systems and easy management under one interface | | Item | | | |
| | **CCTV Surveillance System**<br><br>**Cameras** | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| 2 | <u>High Definition Analytical Dome Camera with the following features:</u><br>• Benchmark: Avigilon H6A dome camera<br>• 4Megapixel, IP-enabled,<br>• Image Sensor; Progressive Scan CMOS<br>• Support Motion Detection,<br>• Supported AI powered video Analytic events include: Object in Area/Enter Area/Leave Area/Stops in Area/Direction Violated/Loitering/Crosses Line/Tamper detection/crowd size/unusual crowd growth/unusual crowd size<br>• Object Types classifications supported include: Person, Vehicle Types (car, truck, motorcycle, bus, bicycle)<br>• Video compression format: H.265, H.264, MJPEG<br>• 120dB true WDR technology enables clear image in strong light scene<br>• Smart IR, upto 35m IR distance at 0 lux<br>• Supports upto 256GB Micro SD card<br>• IP54 protection, IK10/11<br>• ONVIF Profile S, T , G and M compliance<br>• Camera tamper detection<br>• Electronic Shutter Control Automatic, Manual<br>• Iris Control: Automatic,Open, Closed<br>• Day/Night Control: Automatic, Manual<br>• White Balance Automatic, Manual<br>• Backlight Compensation: Adjustable<br>• Privacy Zones: Up to 64 zones<br>• Support PoE power supply<br>• Include all Accessories (Including Mounting) | No | 39 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | <u>High Definition Analytical Bullet Camera with the following features:</u> | | | | | |
| 3 | • Benchmark: Avigilon H6A Bullet Camera<br>• 4Megapixel, IP-enabled,<br>• Image Sensor; Progressive Scan CMOS<br>• Support Motion Detection,<br>• Supported AI powered video Analytic events include: Object in Area/Enter Area/Leave Area/Stops in Area/Direction Violated/Loitering/Crosses Line/Tamper detection/crowd size/unusual crowd growth/unusual crowd size<br>• Object Types classifications supported include: Person, Vehicle Types (car, truck, motorcycle, bus, bicycle)<br>• Video compression format: H.265, H.264, MJPEG<br>• 120dB true WDR technology enables clear image in strong light scene<br>• Smart IR, upto 35m IR distance at 0 lux<br>• Supports upto 256GB Micro SD card<br>• IP67 protection<br>• ONVIF Profile S, T, G and M compliance<br>• Camera tamper detection<br>• Electronic Shutter Control Automatic, Manual<br>• Iris Control: Automatic,Open, Closed<br>• Day/Night Control: Automatic, Manual<br>• White Balance Automatic, Manual<br>• Back-light Compensation: Adjustable<br>• Privacy Zones: Up to 64 zones<br>• Support PoE power supply<br>• Include all Accessories (Including Mounting) | No | 13 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| 4 | <u>High Definition Analytical PTZ Camera with the following features:</u><br>• Benchmark: Avigilon H6A PTZ camera<br>• 4Megapixel, IP-enabled,<br>• 12X Digital Zoom<br>• Image Sensor; Progressive Scan CMOS<br>• Support Motion Detection,<br>• Supported AI powered video Analytic events include: Object in Area/Enter Area/Leave Area/Stops in Area/Direction Violated/Loitering/Crosses Line/Tamper detection/crowd size/unusual crowd growth/unusual crowd size<br>• Object Types classifications supported include: Person, Vehicle Types (car, truck, motorcycle, bus, bicycle)<br>• Video compression format: H.265, H.264, MJPEG<br>• 120dB true WDR technology enables clear image in strong light scene<br>• Smart IR, upto 35m IR distance at 0 lux<br>• Supports upto 256GB Micro SD card<br>• IP54 protection, IK10/11<br>• ONVIF Profile S, T , G and M compliance<br>• Camera tamper detection<br>• Electronic Shutter Control Automatic, Manual<br>• Iris Control: Automatic,Open, Closed<br>• Day/Night Control: Automatic, Manual<br>• White Balance Automatic, Manual<br>• Backlight Compensation: Adjustable<br>• Privacy Zones: Up to 64 zones<br>• Support PoE power supply<br>• Include all Accessories (Including Mounting) | No | 2 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| 5 | • Benchmark: Avigilon H6A PTZ camera<br>• 10 Megapixel, IP-enabled,<br>• 32X Digital Zoom<br>• Image Sensor; Progressive Scan CMOS<br>• Support Motion Detection,<br>• Supported AI powered video Analytic events include: Object in Area/Enter Area/Leave Area/Stops in Area/Direction Violated/Loitering/Crosses Line/Tamper detection/crowd size/unusual crowd growth/unusual crowd size<br>• Object Types classifications supported include: Person, Vehicle Types (car, truck, motorcycle, bus, bicycle)<br>• Video compression format: H.265, H.264, MJPEG<br>• Supports upto 256GB Micro SD card<br>• IP54 protection, IK10/11<br>• ONVIF Profile S, T , G and M compliance<br>• Camera tamper detection<br>• Electronic Shutter Control Automatic, Manual<br>• Iris Control: Automatic,Open, Closed<br>• Day/Night Control: Automatic, Manual<br>• White Balance Automatic, Manual<br>• Backlight Compensation: Adjustable<br>• Privacy Zones: Up to 64 zones<br>• Support PoE power supply<br>• Include all Accessories (Including Mounting) | No | 6 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **VMS Recording** | | | | | |
| 6 | 48TB Network Video Recorder c/w solid state hard-drives and with the following features:<br><br>1. Benchmark : Avigilon AI NVR2 Premium<br>2. Supports RAID 6 disk configuration<br>3. Supports H.265/H.264,ONVIF, RTSP,<br>4. Network Interface: 2 x 10 GbE SFP+ ports , 6 x 1 GbE RJ-45 ports (1000Base-T)<br>5. Mounting: Rack - mount<br>6. Memory: atleast 4 x 16 GB DDR5<br>7. 2 x 8 core Intel® Xeon® processor orequivalent<br>8. Recording Rate upto 900Mbps<br>9. Playback rate upto 600Mbps<br>10. Supports minimum of 110 cameras<br>11. Third-party IP cameras supported with ONVIF conformance: Profile S, Profile G, Profile T<br>12. Supports video output (HDMI/VGA)<br>13. Up to 8 Megapixels resolution recording<br>14. Backup mode Automatic<br>15. Dual -redudant hots-wappable power supply units<br>16. Pre-loaded with Video Management System Server Software<br>17. Supported Analytic events include: Object in Area/Enter Area/Leave Area/Stops in Area/Direction Violated/Loitering/Crosses Line/Tamper detection<br>18. Object Types classifications supported include: Person, Vehicle Types (car, truck, motorcycle, bus, bicycle) | No | 1 | | | |
| | **Camera Licenses** | | | | | |
| 7 | Facial Recognition License | No | 1 | | | |
| 8 | Camera License (if any)to allow full functionality of the Video Surveillance system including video analytics (Describe all licenses and functionality achieved) | No | 52 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **Workstation** | | | | | |
| 9 | CCTV & Access Control Workstation<br>• Processor: Intel® Core™ i7 (Latest Generation)<br>• Memory: 32 GB DDR4 RAM<br>• OS Drive: M.2 256GB PCIe NVMe Class 40 SSD<br>• Storage: 256 GB M.2 SSD + 500 GB HDD<br>• Network Interface: 2 × 1 Gigabit Ethernet RJ-45 ports (1000Base-T)<br>• Video Outputs :4 active (4 × mDP) or equivalent<br>• Optical Drive: DVD-RW [optional]<br>• Include keyboard, mouse, incl. OS software and licences | No | 1 | | | |
| 10 | 23 " Industrial grade full HD WorkStation Monitor with atleast 2 x HDMI ports and c/w all accessories including power cords | No | 1 | | | |
| | **System Configuration** | | | | | |
| 11 | Programming and Configuration of all Video Analytics | No | 52 | | | |
| | **Access Control System** | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **Door Devices** | | | | | |
| 12 | IP Based Fingerprint + Card reader with the following features:<br>• Fingerprint sensor : 500 dpi optical sensor<br>• Identification speed: 2,000 match in 1 second<br>• Fingerprint capacity: 10,000 templates (5,000 users)<br>• Log capacity: 50,000 events<br>• RF card : Proximity (125kHz EM), Mifare, Iclass (13.56MHz)<br>• Operation modes: Fingerprint, RF card, RF card + fingerprint<br>• Network interface: TCP/IP, RS485 (OSDP capable)<br>• Wiegand output: Configurable up to 64 bits<br>• TTL I/O : 2 inputs for exit switch and door sensor<br>• Internal relay: Deadbolt,EM lock,door strike,automatic door<br>• Sound and interface: Multi-color LED and multi- tone buzzer | No | 12 | | | |
| 13 | Contactless Smart Card Reader with the following features :<br>• Typical reading range: iCLASS Seos: 2.4" (6 cm), iCLASS: 3.6" (9 cm),MIFARE Classic: 2.4" (6 cm) MIFARE DESFire EV1/EV2: 2.4" (6 cm)<br>• Communications: Wiegand, Clock-and-Data, Open Supervised Device Protocol (OSPD) via RS485<br>• UL - Certified<br>• IP65 Rated | No | 12 | | | |
| 14 | Door Electro-Magnetic Lock (7kN) c/w door position contact | No | 21 | | | |
| 15 | Emergency Break Glass - 3 pole with the following features:<br>• Ressetable Design<br>• Built in buzzer status to set as silent, internal sound, continous sound<br>• output point to connect other equipment | No | 13 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| 16 | Magnetic Door Contact for Emergency Exit Doors' Status | No | 35 | | | |
| 17 | Indoor Local Door Alarm Sounder and Strobe | No | 1 | | | |
| | **System Controllers** | | | | | |
| 18 | Input Controller with the following features:<br>• Grade B, A, and AA line supervision<br>• 16 programmable supervised or non-supervised contacts<br>• 2 Form-C 5 A, 28VDC contacts for load switching<br>• 2 dedicated inputs for tamper and power failure status<br>• On-board termination jumpers<br>• DIP switch-selectable addressing<br>• Status LED for host communication and heartbeat<br>• Variable resistor values for line supervision<br>• Downloadable firmware<br>• Advanced Encryption Standard (AES) 128-bit or 256-bit encryption supported<br>• Enclosure included | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| 19 | Dual Reader Controller with the following features:<br>• Supports 2 readers<br>• Supports Data1/Data0, Clock/Data, Supervised and Unsupervised F2F and OSDP-compatible RS-485 readers and keypads<br>• Supports Open Supervised Device Protocol (OSDP) readers, including biometric template transfer and Secure Channel encryption<br>• Downloadable firmware<br>• Six Form-C 5 A at 28 VDC relay outputs<br>• Up to 16 different formats<br>• Issue code support for magnetic and Wiegand formats<br>• Door contact supervision (open/closed)<br>• REX push-button monitor<br>• Strike control output<br>• Bicolor reader status LED support and 2-wire LED support<br>• Beeper control<br>• Dedicated tamper and power failure circuits<br>• Support for offline reader access mode<br>• On-board jumpers for termination<br>• Advanced Encryption Standard (AES) 128-bit or 256-bit encryption supported<br>• Enclosure included | No | 12 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| 20 | Intelligent System Controller with the following features :<br>• On-board high-speed Ethernet 10/100Base-T upstream port . DHCP and fixed IP addressing supported.<br>• DNS device naming through DHCP extended commands<br>• Host dual path communication enabled - on- board Ethernet TCP/IP, direct wire (RS-485, 2-wire multidrop capable supporting a minimum of 8 devices downstream)<br>• 15 MB of available on-board, non-volatile flash memory<br>• Battery-back, non-volatile storage of 50,000 events<br>• Firmware stored in flash memory, background download of firmware updates supported<br>• 12 or 24 VDC input power<br>• Supports up to 16 different formats<br>• Biometric template storage support<br>• Enhanced anti-passback capabilities<br>• Up to 32,000 access level permissions<br>• 255 holidays with grouping<br>• 255 timezones, each with 6 intervals<br>• Alarm masking<br>• Individual extended held open and strike times<br>• Up to 9-digit user PIN codes<br>• Status LEDs for heartbeat & battery status, upstream and downstream communication, and memory write status<br>• Two dedicated inputs for tamper and power failure status<br>• Advanced Encryption Standard (AES) 128-bit algorithm for communication to reader and I/O modules<br>• Enclosure included | No | 2 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **Application Server** | | | | | |
| 21 | Access Control application server with the following features:<br><br>• Processor : Intel® Xeon® E-2124 3.3GHz, 8M cache, 4C/4T, turbo (71W)<br>• Card Readers : atleast 100 readers<br>• Max. Controllers: atleast 50<br>• Max. Simultaneous Operators: atleast 3<br>• Hard Disk Drive Configuration: 1TB 7.2K RPM SATA 6Gbps 3.5in Cabled Hard Drive<br>• Network Adapter Card: 2 × 10/100/1000 Mbps Network Interface Controller<br>• Remote Management supported<br>• Pre-installed with Access Control Management Software | No | 2 | | | |
| 22 | Reader Licenses (if any)to allow full functionality of the Access control system including video analytics (Describe all licenses and functionality achieved) | No | 24 | | | |
| | **Credential Devices** | | | | | |
| 23 | Digital Camera for Portrait photos, features include:<br><br>Resolution: 1920 x 1080 Max.<br>Auto-focus Lens<br>Host Interface: USB<br>Supports Computer and monitor | No | 2 | | | |
| 24 | Smart Contactless Card (batch of 100)as per the following specifications:<br><br>1. Description:iClass SEOS Contactless Smart Card, 8KB Memory Composite Card Body<br>2. Operating frequency: 13.56MHz<br>3.Proximity read range: Up to 100 mm.<br>4. Physical characteristics to BS ISO/IEC 14443-1. | | Item | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| 25 | Dual-Side Card printer with the following specifications:<br>• Sided Printing: Single or Dual<br>• Print Method: HDP Dye-Sublimation / Resin Thermal Transfer<br>• Resolution: 300 dpi<br>• Print Speed: up to 24 seconds per card / 150 cards per hour (YMC with transfer)<br>• Accepted Card Sizes: CR-80<br>• Warranty: 3 years printer | No | 1 | | | |
| 26 | Fingerprint enrollment | No | 2 | | | |
| 27 | reader | No | 2 | | | |
| 28 | Full Colour ribbon 750 images (Single Side) | No | 2 | | | |
| 29 | Film, approximately 1500 images (Single side) **Acces Control System configuration**<br>Programming and Configuration of all Alarms and Integration, e.g. Doors, Fire Escapes, etc. | | | SUM | | |
| | **Cabling and other accessories** | | | | | |
| 30 | **CCTV** | No | 52 | | | |
| 31 | Camera Cable Termination Box, white, weather proof | m | 13 | | | |
| 32 | 25mm dia. PVC Coated Galvanised Steel Flex Conduit for Outdoor Pole Mounted Cameras | | | | | |
| | 4M High galvanised and powder coated [white]Metallic Camera pole with lockable base for ancillary equipment- | No | 5 | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| 33 | 24 channel Cat6A Rack mount network surge protector with the following features:<br><br>• Robust 20kA per pair surge current rating<br>• nRapid-Replacement modular design to allow<br>• modules to be swapped from front of device<br>• without removing from rack<br>• nComplieswith all IEEE Power over Ethernet<br>• standards<br>• nCertification: UL/CE/LPCB/ISO etc | No | 2 | | | |
| | **Access Control** | | | | | |
| 34 | 4 core LSHF shielded communication cable (Door Devices) | m | 320 | | | |
| 35 | 8 core LSHF shielded communication cable (Door Devices) | m | 120 | | | |
| 36 | RS485 Communication Cable , Shielded - for ACS Controllers' Interconnection | m | 480 | | | |
| 37 | Enclosure with 2.0A PSU and 7 AMP/HR. Battery | No | 15 | | | |
| | **Common** | | | | | |
| 38 | 25mm dia. PVC Flex Conduit | m | 369 | | | |
| | **Carried to Final Summary** | | | KES | | |
| | Section No. 5<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO : 6**<br><br>**BILL NO:1**<br><br>**FIRST FLOOR OFFICE SPACE**<br><br>**Fresh Air Supply (To be connected to existing Toshiba VRF Air -Conditioning Equipment)**<br><br>**Fan**<br><br>**100% Fresh Air Unit** | | | | | |
| 1 | VRF Fresh Air Intake Indoor Unit<br><br>Cooling Capacity - **11.2 kw**<br>External static pressure - **196 pa**<br>Power requirements - **1 phase 50 Hz 230V (220- 240V)**<br>Standard air flow **- 2000 m3/h**<br>Power Consumption - **1.0 Kw**<br>Gas side **- φ12.7 mm**<br>Liquid Side **- φ6 mm**<br>Drawing Port - **φ25 mm**<br>Sound Pressure Level (dB(A)) - **50** | No | 1 | | | |
| | **Ductwork for above system** | | | | | |
| 2 | Galvanized sheet steel ductwork inclusive of all joints, bends, bracing, gaskets, supports, stiffeners, turning vanes, splitters, vapor seals, access hatches at every 3000mm and change of direction and any other equipment for completion.<br><br>Material Thickness 1.0 mm | m2 | 60 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 6<br>Bill No. 1<br>OFFICE SPACE VRF SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **Air Terminal Devices for above system** | | | | | |
| 3 | Extract Ventilation Grilles, made of Aluminium, with individually adjustable, horizontal blades<br><br>• Nominal sizes 300 mm x 200 mm<br>• Volume flow rate range **to be confirmed after sizing calculations.**<br>• Grille face made of aluminium with powder- coat finish<br>• Front border 32 mm<br>• Concealed fixing or countersunk holes<br>• Installation subframe<br>• Attachments for volume flow rate balancing and air direction control<br>• Concealed fixing or countersunk holes<br>• Double-layer Louver | No | 4 | | | |
| | **Ducted High Pressure Units** | | | | | |
| 4 | VRF Ducted Indoor Unit as<br><br>Cooling Capacity - **5.6 kw**<br>Power requirements - **1 phase 50 Hz 220-240V**<br>Height - **300**<br>**mm** Width **-**<br>**1463 mm**<br>Depth **- 756**<br>**mm**<br>Standard air flow **- 450**<br>**m3/h** Motor output - **360**<br>**watts** Gas side **-φ15.9 mm**<br>Liquid Side **- φ9.5 mm**<br>Drawing Port - **φ25 mm**<br>Sound Pressure Level (dB(A)) - **42** | No | 10 | | | |
| | Ductwork for above system | | | | | |
| 5 | Galvanized sheet steel ductwork inclusive of all joints, bends, bracing, gaskets, supports, stiffeners, turning vanes, splitters, vapor seals, access hatches at every 3000mm and change of direction and any other equipment for completion.<br><br>Material Thickness 1.0 mm | m2 | 100 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 6<br>Bill No. 1<br>OFFICE SPACE VRF SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | Air Terminal Devices for above system | | | | | |
| 6 | Supply Ventilation Grilles, made of Aluminium, with individually adjustable, horizontal blades<br><br>• Nominal sizes 300 mm x 200 mm<br>• Volume flow rate range **to be confirmed after sizing calculations.**<br>• Grille face made of aluminium with powder- coat finish<br>• Front border 32 mm<br>• Concealed fixing or countersunk holes<br>• Installation subframe<br>• Attachments for volume flow rate balancing and air direction control<br>• Concealed fixing or countersunk holes<br>• Double-layer Louver | No | 40 | | | |
| | **Carried Forward to Summary of Section No. 6** | | | KES | | |
| | Section No. 6<br>Bill No. 1<br>OFFICE SPACE VRF SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:2** | | | | | |
| | **FRESH AIR UNITS** | | | | | |
| 1 | Air to Air Heat Exchanger Indoor Unit as<br><br>Power requirements - **1 phase 50 Hz 220-240V**<br>Height - **900 mm** Width - **900 mm**<br>Depth - **290 mm**<br>Standard air flow **- 250 m3/h**<br>Temperature Exchange Efficiency - **78%** Enthalpy Exchange Efficiency - **70%** | No | 1 | | | |
| 2 | Ductwork for above system<br><br>Galvanized sheet steel ductwork inclusive of all joints, bends, bracing, gaskets, supports, stiffeners, turning vanes, splitters, vapor seals, access hatches at every 3000mm and change of direction and any other equipment for completion.<br><br>Material Thickness 1.0 mm | m2 | 4 | | | |
| 3 | Air Terminal Devices for above system<br><br>Supply Ventilation Grilles, made of Aluminium, with individually adjustable, horizontal blades<br><br>• Nominal sizes 300 mm x 200 mm<br>• Volume flow rate range **to be confirmed after sizing calculations.**<br>• Grille face made of aluminiumwith powder- coat finish<br>• Front border 32 mm<br>• Concealed fixing or countersunk holes<br>• Installation subframe<br>• Attachments for volume flow rate balancing and air direction control<br>• Concealed fixing or countersunk holes<br>• Double-layer Louver | No | 2 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 6<br>Bill No. 2<br>MECHANICAL VENTILATION SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **Fresh Air Fan** | | | | | |
| 4 | Systemair as 'K 250 EC Sileo complete with accessories as part Particular Specifications | No | 5 | | | |
| | **Extract Fans** | | | | | |
| 5 | Systemair as 'K 250 EC Sileo complete with accessories as part Particular Specifications | No | 5 | | | |
| | **Toilet Extract Fans** | | | | | |
| 6 | Systemair as 'K 100 EC Sileo complete with accessories as part Particular Specifications | No | 1 | | | |
| | **Air Terminal Devices for above system** | | | | | |
| 7 | Exhaust Ventilation Grilles, made of Aluminium, with individually adjustable, horizontal blades<br>• **Nominal sizes 125 mm Dia (4 No.)**<br>• Volume flow rate range **to be confirmed after sizing calculations.**<br>• Grille face made of aluminiumwith powder- coat finish<br>• Front border 32 mm<br>• Concealed fixing or countersunk holes<br>• Installation subframe<br>• Attachments for volume flow rate balancing and air direction control<br>• Concealed fixing or countersunk holes<br>• Double-layer Louver | No | 4 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 6<br>Bill No. 2<br>MECHANICAL VENTILATION SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| 8 | Supply Ventilation Grilles, made of Aluminium, with individually adjustable, horizontal blades<br><br>• **Nominal sizes 100 mm Dia (4 No.),125 mm**<br>• Volume flow rate range **to be confirmed after sizing calculations.**<br>• Grille face made of aluminium with powder- coat finish<br>• Front border 32 mm<br>• Concealed fixing or countersunk holes<br>• Installation subframe<br>• Attachments for volume flow rate balancing and air direction control<br>• Concealed fixing or countersunk holes<br>• Double-layer Louver | No | 4 | | | |
| 9 | Return Ventilation Grilles, made of Aluminium, with individually adjustable, horizontal blades<br><br>• **Nominal sizes 125 mm Dia (4No..) , 100 mm**<br>• Volume flow rate range **to be confirmed after sizing calculations.**<br>• Grille face made of aluminium with powder- coat finish<br>• Front border 32 mm<br>• Concealed fixing or countersunk holes<br>• Installation subframe<br>• Attachments for volume flow rate balancing and air direction control<br>• Concealed fixing or countersunk holes<br>• Double-layer Louver | No | 4 | | | |
| | **Carried Forward to Summary of Section No. 6** | | | KES | | |
| | Section No. 6<br>Bill No. 2<br>MECHANICAL VENTILATION SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:3** | | | | | |
| | Installations of the following Precision Air-conditioning indoor system as per section 10 of the specification document | | | | | |
| 1 | **Floor/High Wall Precision Split as per the specification document.** | | | | | |
| | **Distance between indoor and Outdoor unit is approximately 25 Meters** | No | 2 | | | |
| | **Carried Forward to Summary of Section No. 6** | | | KES | | |
| | Section No. 6<br>Bill No. 3<br>TELCO ROOMS PRECISION SPLIT UNITS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:4** | | | | | |
| 1 | **Perimeter Precision Split as per the specification document.**<br><br>**Distance between indoor and Outdoor unit is approximately 25 Meters** | No | 4 | | | |
| | **Carried Forward to Summary of Section No. 6** | | | KES | | |
| | Section No. 6<br>Bill No. 4<br>UPS ROOMS AIR-CONDITIONING UNITS | | | | | |

**SECTION SUMMARY - AIR-CONDITIONING SYSTEM**

| Bill No | | Page No | | Amount | |
|---|---|---|---|---|---|
| 1 | OFFICE SPACE VRF SYSTEM | 86 | | | |
| 2 | MECHANICAL VENTILATION SYSTEM | 89 | | | |
| 3 | TELCO ROOMS PRECISION SPLIT UNITS | 90 | | | |
| 4 | UPS ROOMS AIR-CONDITIONING UNITS | 91 | | | |
| | **Carried to Final Summary** | | KES | | |

Section No. 6

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO : 7** | | | | | |
| | **BILL NO:1** | | | | | |
| | **Fire Alarm & Detection System** | | | | | |
| | **Control & Monitoring** | | | | | |
| 1 | Integrated Fire Alarm & Emergency Control Panel, w/ LCD & Inbuilt 4 SLC Loop Card, Function Keys, Expanded Memory Charger, CPU w/ 640-Character Display and Serial Port, 240VAC, 50/60Hz, UL/FM Approved w/ Battery Backup Charger and Printer.<br>Compliant to EN54 Parts 2,4 and 13 | No | 1 | | | |
| 2 | Integrated Active Fire Alarm Repeater Panel with additional LED status indication, four programmable push buttons, Mute, Silence,Reset, Resound, Lamp Test and Evacuate Keys. | No | 1 | | | |
| 3 | IP gateway Module | No | 1 | | | |
| 4 | BMS Modbus Interface Module | No | 1 | | | |
| 5 | Graphics Monitoring Software For Monitoring and Control | | Item | | | |
| | **Detection & Initiation Devices** | | | | | |
| 6 | Intelligent Addressable Photoelectric Smoke Detector, White Color, 360 Degrees Viewing LED and Soft Addressing c/w Standard Base with inbuilt short circuit isolator | No | 35 | | | |
| 7 | Intelligent Addressable Photoelectric Smoke Detector, White Color, 360 Degrees Viewing LED and Soft Addressing c/w Sounder Base and remote monitoring led output | No | 7 | | | |
| | **Carried Forward** | | | KES | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 8 | Intelligent Addressable Fixed Temperature Thermal Detector, Detection: 57 Deg.C, White Color, 360 Degrees Viewing LED and Soft Addressing w/ Standard Base | No | 1 | | | |
| 9 | Intelligent Addressable Manual Call Point, Key Reset, Visible Viewing LED , Soft Addressing and integral short circuit isolator | No | 10 | | | |
| | **I/O Modules** | | | | | |
| 10 | Intelligent Addressable Relay Module w/ 1 Sets Of Form C Contacts and supports soft adressing | No | 12 | | | |
| 11 | Intelligent Addressable Relay Module w/ 2 Sets Of Form C Contacts and supports soft adressing | No | 3 | | | |
| 12 | Addressable Input module with soft addresing | No | 24 | | | |
| | **Signalling Devices** | | | | | |
| 13 | Horn/Strobe, 12/24 Volt, Red Color, Multi-Candela, 116 dB, Indoor, Wall/Ceiling Mounted, With Back box. | No | 10 | | | |
| 14 | Indicator Lamp for Low Level smoke detectors | No | 7 | | | |
| | **Cabling , Power Supply & Conduiting** | | | | | |
| 15 | 2C-2.5sq.mm Fire Resistive PH30 Cable, LSZH, 30 mins, LPCB Approved | m | 810 | | | |
| 16 | Communication Cable, LSZH, LPCB Approved - For Repeater panel connection to Fire Alarm Panel | m | 50 | | | |
| 17 | EN54 Supervised Power Supply 24 Vdc 5A, Overload Indication, Opening Tamper, Battery Backup Charger | No | 2 | | | |
| | **Cabling , Power Supply & Conduiting** | | | | | |
| 18 | Conduiting for fire alarm points in 25 mm dia H/G PVC conduits to back boxes to receive fire alarm wall-mount devices. | No | 73 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 7<br>Bill No. 1<br>FIRE DETECTION SYSTEM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 19 | 25mm dia. PVC Flex Conduit | m | 92 | | | |
| 20 | 25mm dia. GI Conduiting for fire alarm points to back boxes to receive fire alarm wall-mount devices and ceiling mounted (surface) devices | No | 30 | | | |
| | **Carried Forward to Summary of Section No. 7** | | | KES | | |
| | Section No. 7<br>Bill No. 1<br>FIRE DETECTION SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:2** | | | | | |
| 1 | Staircase Pressurization System as per Particular Specification complete functioning system comprising of the following(**Fire Staircase**):<br>a)Ventilation and Smoke Clearance Panel<br>b) Area of Ventilation Louvres (AOV)<br>c) Area of Ventilation Damper Fans<br>d) Pneumatic Valves<br>e) CO2 supply with dedicated Bottle Supply<br>f) Associated Temperature sensors<br>g) Associated motors<br>h) Cabling to and from Fire Alarm and BMS Panels<br>i) Configuration, testing and Commissioning | No | 1 | | | |
| | Motorized Fire Smoke Damper Control Panel | | | | | |
| 2 | Supply and install intelligent smoke and fire damper control system inclusive of cabling to all motorized fire dampers(Refer to 1.2 of Particular Mechanical Specification) | No | 1 | | | |
| | **Fire Damper for Above System** | | | | | |
| 3 | Supply and Install fire dampers.<br><br>Diameter 160 mm<br><br>**Characteristics**<br>– Classified according to EN 13501-3<br>– Airflow in either direction<br>– Release temperature 72 °C<br><br>**Construction features**<br>– Two casing lengths to allow for various uses<br>– Rectangular construction, rigid frame<br>– Flanges with pre-drilled holes on both ends<br>– Intermediate dimensions in 5 mm increments for both width and height are available<br>– Closed blade air leakage according to EN 1751, minimum class 2<br>– Casing air leakage to EN 1751, minimum class B | No | 12 | | | |
| | **Carried Forward to Summary of Section No. 7** | | | KES | | |
| | Section No. 7<br>Bill No. 2<br>STAIRCASE SMOKE PRESSURIZATION SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:3** | | | | | |
| | **Aspiration Detection System** | | | | | |
| | **ASD Panels** | | | | | |
| 1 | Aspiration Detection Controller, Laser Based Forward Light Scatter, 4 Inlet Sampling Line, 4 Alarm Levels, Patented Dual Technology LDD 3D3 Laser Dust Discrimination and Elimination System, Built-In RS485 Network Communication, Sheet Steel Enclosure. EN54/UL/FM | No | 3 | | | |
| 2 | Centralized Navigation Buttons and TFT Color Display Command Module. 20,000 Events Log, Built- In RS485 Network Communication. EN54/UL/FM | No | 1 | | | |
| | **Sampling Pipes & Fittings** | | | | | |
| 3 | 3m Pipe - 27 mm, Red Color, ABS | No | 28 | | | |
| 4 | Construction 90 Degree Bend, Red Color, | No | 28 | | | |
| 5 | ABS Construction Joint Coupler, Red Color, | No | 29 | | | |
| 6 | ABS Construction End Cap, Red Color, ABS | No | 5 | | | |
| | Construction **Cabling & Other ancillaries** | | | | | |
| 7 | RS485 Communication Cable, LSZH, LPCB Approved - For ASD Panel Interconnection | m | 150 | | | |
| 8 | EN54 Supervised Power Supply 24 Vdc 5A, Overload Indication, Opening Tamper, Battery Backup Charger | No | 3 | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 7** | | | | | |
| | Section No. 7<br>Bill No. 3<br>HIGH SMOKE SENSITIVITY SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:4** | | | | | |
| | ***Design and build Fire Gas Suppression system as per particular specifications for mechanical installations*** | | | | | |
| 1 | Submittals fire gas suppression performance specification and hydraulic calculations | | | SUM | | |
| | **Fire Gas (Inergen) Suppression System** | | | | | |
| | Supply, install, test and commission the following IG541 fire suppression system for White space | | | | | |
| | **(This section should be read with Technical specifications of this document where particular specifications for the system are found)** | | | | | |
| 2 | Container Assembly (UL Listed) with IG541 Agent by Manufacturer.**148 L CYLINDERS 1 No. fully charged with 148 kg agent** | No | 1 | | | |
| 3 | Container Label | No | 1 | | | |
| 4 | Container Bracket (Strap Type) | No | 1 | | | |
| 5 | Discharge Hose 50mm | No | 1 | | | |
| 6 | Actuation mechanism per system - UL Listed | No | 1 | | | |
| 7 | Manifold for the system complete with lockout, time delay, safety and vent devices | No | 1 | | | |
| 8 | **Fire Suppression system control equipment, UL Listed and conforming to EN54 and NFPA standards** | No | 1 | | | |
| 9 | addressable extinguishing control panel | No | 1 | | | |
| 10 | Manual Release | No | 1 | | | |
| | Monitor Module for above | | | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 7<br>Bill No. 4<br>FIRESUPPRESSION SYSTEM - UPS ROOM B | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 11 | Sounder-beacon, multi tone, shallow base | No | 2 | | | |
| 12 | Control Module for above | No | 2 | | | |
| 13 | Abort Switch | No | 1 | | | |
| 14 | Monitor Module for | No | 1 | | | |
| 15 | above Maintenance | No | 1 | | | |
| 16 | Switch Monitor Module for | No | 1 | | | |
| 17 | above<br><br>Low smoke, 0 halogen, 1.5mm$^2$ 2 core fire-proof/ flame proof cables and all necessary cabling for all smoke detctors, firm alarm panel and sounders as delta firetuff complete with flame-resistant terminations, and accessories. The cables to be capable of withstanding heavy flames for minimum 3 hours. | m | 200 | | | |
| 18 | **(The tenderers to include for flame testing of the cables for at least 30 minutes)** | No | 1 | | | |
| 19 | 24V 2A Power supply module comple with Battery and Accesories | No | 1 | | | |
| 20 | Warning Sign Inside | No | 1 | | | |
| 21 | Warning sign outside | No | 1 | | | |
| 22 | UL Listed Fire<br><br>Damper Room<br><br>integrity test | | Item | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 7<br>Bill No. 4<br>FIRESUPPRESSION SYSTEM - UPS ROOM B | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **<u>Pipework (Provisional Subject to Hydraulic Calculations)</u>**<br><br>Supply and fix seamless black Steel pipes SCH 40 conforming to ASTM A-53A ERW or ASTM A-106 A. All piping shall comply with NFPA 2001.<br><br>Fittings beyond Orifice union/nipple shall be, 300lb class fittings conforming to ANSI B-16.3. Ordinary cast iron fittings shall not be used. Piping shall be bracketed within 12" (0.3m.) of all discharge nozzles.<br><br>Tenderers must allow in their pipework prices for all the couplings, unions, sockets, nipples, tees, caps, connectors, joints, anchoring, support brackets etc in running lengths of pipes and also where necessary for fixing clips, holderbats, plugged and screwed. | | | | | |
| 23 | 65mm diameter seamless black Steel pipe as SCH 40 | m | 15 | | | |
| 24 | 40mm diameter seamless black Steel pipe as SCH 40 | m | 10 | | | |
| 25 | 65mm diameter elbow | No | 5 | | | |
| 26 | 40mm diameter elbow | No | 5 | | | |
| 27 | 40mm diameter equal tee | No | 5 | | | |
| | **<u>360 Degree Nozzle - Acoustic Type</u>** | | | | | |
| 28 | 40mm Brass Nozzle | No | 2 | | | |
| | **Carried Forward to Summary of Section No. 7** | | | KES | | |
| | Section No. 7<br>Bill No. 4<br>FIRESUPPRESSION SYSTEM - UPS ROOM B | | | | | |

**SECTION SUMMARY - FIRE DETECTION AND PROTECTION SYSTEM**

| Bill No | | Page No | | Amount |
|---|---|---|---|---|
| 1 | FIRE DETECTION SYSTEM | 95 | | |
| 2 | STAIRCASE SMOKE PRESSURIZATION SYSTEM | 96 | | |
| 3 | HIGH SMOKE SENSITIVITY SYSTEM | 97 | | |
| 4 | FIRESUPPRESSION SYSTEM - UPS ROOM B | 100 | | |
| | **Carried to Final Summary** | | KES | |

Section No. 7

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO : 8** | | | | | |
| | **BILL NO:1** | | | | | |
| | **Digital Displays** | | | | | |
| | LED Video wall (NOC Room) | | | | | |
| 1 | Fine Pitch, Indoor, wall-mounted LED Video wall as AET NX COB PLUS P1.25 or approved equivalent with the following features:<br>• Total Size: 7000mm*2000 mm (W x H)<br>• Pixel pitch: 1.25mm<br>• LED Type : Full-Flip-Chip COB<br>• Pixel Density: 640,000 pixels/㎡<br>• Pixel Density Cabinet : 129,600 pixels/cabinet<br>• Resolution of LED Module: 120 x 135 pixels<br>• Resolution of LED Cabinet: 480 x 270 pixels<br>• LED Module Size : 150 x 168.75 mm<br>• Cabinet Size (W × H × D) : 600 x 337.5 x 33.6 mm<br>• No. of Modules Per Cabinet(W × H): 4 x 2<br>• Aspect Ratio: 16:9<br>• Cabinet Material: Die-casting Aluminium<br>• Brightness: ≥1000 nits<br>• Max Contrast Ratio: 18000 : 1<br>• Horizontal Viewing Angle: ≥170°<br>• Vertical Viewing Angle: ≥170°<br>• Correlated Color Temperature: 5000~10000 K<br>• Frame Rate: 30~120 Hz<br>• Servicing : Front<br>• Certification: CE<br>• Refresh Rate: ≥7680Hz<br>• Gray Scale Processing : 16 bit<br>• Life span, typ.: 100, 000 Hrs | | Item | | | |
| 2 | Wall-mount support for the LED Video wall as per OEM's recommendations | | Item | | | |
| 3 | Spares such as modules, receiving cards, power supplies with quantities as per OEM's recommendations based on ther experience of their product | | Item | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 4 | Ancillary items to form a complete working LED video-wall system . These to include Power supply, LEd modules, Receiving cards and other items as per OEM's recommendations | | Item | | | |
| | <u>LED Video wall (WAR Room)</u> | | | | | |
| 5 | Fine Pitch, Indoor, wall-mounted LED Video wall as AET NX COB PLUS P1.25 or approved equivalent with the following features:<br>• Total Size: 7000mm*2000 mm (W x H)<br>• Pixel pitch: 1.25mm<br>• LED Type : Full-Flip-Chip COB<br>• Pixel Density: 640,000 pixels/㎡<br>• Pixel Density Cabinet : 129,600 pixels/cabinet<br>• Resolution of LED Module: 120 x 135 pixels<br>• Resolution of LED Cabinet: 480 x 270 pixels<br>• LED Module Size : 150 x 168.75 mm<br>• Cabinet Size (W × H × D) : 600 x 337.5 x 33.6 mm<br>• No. of Modules Per Cabinet(W × H): 4 x 2<br>• Aspect Ratio: 16:9<br>• Cabinet Material: Die-casting Aluminium<br>• Brightness: ≥1000 nits<br>• Max Contrast Ratio: 18000 : 1<br>• Horizontal Viewing Angle: ≥170°<br>• Vertical Viewing Angle: ≥170°<br>• Correlated Color Temperature: 5000~10000 K<br>• Frame Rate: 30~120 Hz<br>• Servicing : Front<br>• Certification: CE<br>• Refresh Rate: ≥7680Hz<br>• Gray Scale Processing : 16 bit<br>• Life span, typ.: 100, 000 Hrs | | Item | | | |
| 6 | Wall-mount support for the LED Video wall as per OEM's recommendations | | Item | | | |
| 7 | Spares such as modules, receiving cards, power supplies with quantities as per OEM's recommendations based on ther experience of their product | | Item | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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| | **Brought Forward** | | | KES | | |
| 8 | Ancillary items to form a complete working LED video-wall system . These to include Power supply, LEd modules, Receiving cards and other items as per OEM's recommendations | | Item | | | |
| | <u>OLED Displays</u> | | | | | |
| 9 | Smart OLED TV as LG or equal reputable brand as per specifications:<br>• Display technology: OrgaNic Light Emitting Diode (OLED)<br>• Display Size: 75"<br>• Bezel Color: Aluminium Frame Black Color<br>• Connectivity: Optical, 4 HDMI 2.1, USB, Bluetooth, LAN, WiFi, Apple AirPlay & Home<br>• Resolution: upto 4K @ 120Hz | No | 6 | | | |
| 10 | Pop-out wall mount TV stand for 75" TV screen | No | 6 | | | |
| | **<u>Video Transmission</u>** | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | Modular LED Video Wall Splicer | | | | | |
| 11 | Modular Video Wall Controller as Nova Star H5 or approved equivalent with the following features :<br>• Hot-swappable input and output cards<br>• 10 slots for input cards with atleast 4 inputs each<br>• At least 7 slots for output cards<br>• HDR10 and HLG processing<br>• Online status monitoring of all input and output cards<br>• LED 4K Sending Cards<br>• Each screen can have its own output resolution.<br>• Low latency<br>• Web control -Real-time response and 1000M/100M self-adaptive network control, allowing for multi-user collaboration<br>• Firmware update on Web page<br>• Self-test for fault detection<br>• Auto monitoring and alarms - Supports hardware monitoring, such as fan rotation speed, module temperature and voltage, running status, and sends fault alarms if necessary.<br>• Backup design<br>− Backup between devices<br>− Backup between LED 4K sending cards | No | 1 | | | |
| | Input Cards compatible to Video wall splicer | | | | | |
| 12 | 2 x HDMI 2.0 Input Card | No | 3 | | | |
| 13 | 4 x HDMI 1.4 input card | No | 7 | | | |
| | Output Cards compatible to Video wall splicer | | | | | |
| 14 | 20 x Ethernet Output Card | No | 1 | | | |
| 15 | 2 x HDMI 2.0 Ouput Card | No | 2 | | | |
| 16 | 4 x HDMI 1.4 Output Card | No | 4 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | Video Transmission Terminals | | | | | |
| 17 | 4K60 4:2:0 HDMI IN 1 nnGanTgwisted-Pair Wall nPlate Transmitter over Long"nReachHDBaseT Cat6 as Kramer WP-580T or approved equivalent with the following features:<br>• HDBaseT Technology<br>• Powered by PoE (Power over Ethernet/HDBaseT)<br>• Up to 70m (230ft) at 1080p ,Up to 40m (130ft) at 4K@60 (4:2:0) | No | 10 | | | |
| 18 | 4K60 4:2:0 HDMI IN 1 nnGanTgwisted-Pair Wall nPlate Receiver over Long"nReachHDBaseT Cat6 as Kramer WP-789R or approved equivalent with the following features:<br>• HDBaseT 1.0 transmitter<br>• Powered by PoE (Power over Ethernet/HDBaseT)<br>• Up to 70m (230ft) at 1080p ,Up to 40m (130ft) at 4K@60 (4:2:0) | No | 9 | | | |
| 19 | 4K60 4:2:0 HDMI Bidirectional PoE Receiver with optional RSn232& IR over Long nReachHDBaseT as Kramer TP-789R or approved equivalent with the following features:<br>• HDBaseT Technology<br>• PoE provider<br>• Up to 70m (230ft) at 1080p<br>• Up to 40m (130ft) at 4K@60Hz (4:2:0)<br>"·Control extension | No | 10 | | | |
| 20 | 4K60 4:2:0 HDMI Bidirectional PoE Transmitter with optional RSn232& IR over Long nReachHDBaseT as Kramer TP-780T or approved equivalent with the following features:<br>• HDBaseT 1.0 receiver<br>• PoE provider<br>• Up to 70m (230ft) at 1080p<br>• Up to 40m (130ft) at 4K@60Hz (4:2:0)<br>"·Control extension | No | 9 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 21 | 19inch 1U rack adapter for mounting above devices in video cabinet as Kramer RK-3T or RK-T2SB or approved equivalent | No | 19 | | | |
| | Video Transmission Cabling | | | | | |
| 22 | 1.8m High–Speed HDMI Right Angle Cable with Ethernet as Kramer C-HM/RA or approved equivalent with the following specifications :<br>• 1 x HDMI Male Right-Angle Connector<br>• 1 x HDMI Male Connector<br>• 24 kt Gold-Plated Connectors<br>• Max Resoution — 4K@60 (4:4:4)<br>• Supports HDMI with Ethernet<br>• Right angle connector on the display end<br>• Supports HDCP 2.2, HDR, deep color, x.v.Color™, Lip Sync, 7.1 PCM, Dolby TrueHD, DTS–HD, and CEC. | No | 19 | | | |
| 23 | CAT6A U/FTP Video & LAN Bulk Cable − Low Smoke & Halogen Free as Kramer BC_UNIKAT or approved equivalent | m | 1,330 | | | |
| | **Video Conferencing** | | | | | |
| | Video Conferencing System | | | | | |
| | Polycom G7500 Video conferencing system or equivalent and approved, complete with the following components: | | | | | |
| 24 | Video Codec as Polycom G7500 or equivalent and approved as per the following specifications:<br>INTEROPERABILITY<br>• Zoom Certified<br>• Microsoft Teams Certified<br>• All cloud service providers through Poly Video App Mode<br>• USB Device Mode<br>• Support for native 3rd party applications includes Zoom Rooms, Microsoft Teams, Ring Central, GoToRoom, Dialpad, BlueJeans, and Tencent (China only) | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | SECURITY<br>• Media encryption (H.323, SIP)<br>- AES-128, AES-256<br>• H.235.6 support<br>• Authenticated access to admin menus, web interface and APIs<br>• PKI/Certificate Management:<br>- TLS 1.2, 1.1, 1.0<br>- Self-signed and CA-signed certificate support<br>- CRL and OCSP-based certificate revocation checking<br>• Local account password policy configuration<br>• Security profiles<br>• Local account and login port lockout<br>• Secure defaults<br>• Remote logging with support for TLS<br>• Active directory external authentication<br><br>NETWORK<br>• IPv4<br>• IPv6<br>• 1x 10/100/1G Ethernet<br>• Auto-MDIX<br>• 3x 10/100/1G LLN supporting POE+/PSE<br>• H.323 and/or SIP up to 6 Mbps<br><br>VIDEO STANDARDS AND PROTOCOLS<br>• H.264 AVC, H.264 High Profile, H.265 VIDEO INPUT1<br>• 1x HDCI<br>• 1x HDMI<br>• 3x USB<br>• Camera switching via touch interface VIDEO OUT<br>• 2x HDMI<br>• Touch display compatible PEOPLE VIDEO RESOLUTION<br>• upto 4K, 30 fps (TX and RX) from 2048 Kbps CONTENT VIDEO RESOLUTION<br>• Input<br>- Upto UHD (3840 x 2160)<br>• Output<br>- Upto UHD (3840 x 2160) | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | - • Content frame rate<br>- 5–60 fps (up to 4K resolution at 15 fps in call)<br>CONTENT SHARING<br>• Poly Content App support<br>• Apple AirPlay<br>• Miracast<br>• 1x HDMI input<br><br>AUDIO INPUT<br>• Up to three 1x IP microphone arrays (20 ft pickup range each)<br>• 1x HDMI<br>• 1x 3.5 mm stereo line-in<br>• USB support for Biamp, Shure, QSC, and Extron audio DSPs<br>MICROPHONES<br>• Up to three IP microphone arrays (up to 20 ft pickup range each) AUDIO OUTPUT<br>• 1x HDMI<br>• 1x 3.5 mm stereo line-out OTHER INTERFACES<br>• 3x USB 3.0<br>• 1x USB-C<br>• 1x RS-232, 8-pin mini-DIN<br>• Bluetooth 5.02<br>• WiFi 802.11a/b/g/n/ac (MIMO) Multichannel Concurrency2<br>AUDIO STANDARDS AND PROTOCOLS<br>• 22 kHz bandwidth with Polycom Siren 22 technology<br>• 20 kHz bandwidth with G.719 (M-Mode) and Polycom Siren 22 technology<br>• 14 kHz bandwidth with Polycom Siren 14 technology, G.722.1 Annex C<br>• 7 kHz bandwidth with G.722, G.722.1<br>• 3.4 kHz bandwidth with G.711, G.728, G.729A | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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| | **Brought Forward** | | | KES | | |
| 25 | IP Table Microphone as Polycom G7500 or equivalent and approved, complete with accessories and with the following specifications:<br><br>• HD Audio<br>• Connects using Ethernet cable | No | 3 | | | |
| 26 | Video Conferencing Camera Polycom G7500 Eagle Eye IV or equivalent and approved as per the following specifications:<br><br>• Camera type. 1/2.33" CMOS.<br>• H/v resolution. 1920 x 1080.<br>• Output. SMPTE 296M 1280 x 720p60, SMPTE 274M 1920 x 1080p, 60/50.<br>• Lens focal length. f=3.76–37.6 mm.<br>• Lens f# 1.2.<br>• Zoom. 4x optical (black), 10x/12x (silver) optical/digital.<br>• Focus. Auto.<br>• Horizontal field of view. 65°, 85° with wide angle adaptor. | No | 2 | | | |
| 27 | Licenses (if any) required to allow full functionality of the system. Describe license and functionality | | Item | | | |
| 28 | Interactive Display as BenQ /NEC or approved equivalent reputable brand with the following specifications:<br><br>• Display Size: 65"<br>• Bezel Color: Aluminium Frame Black Color<br>• Back_Light : Direct type LED (D-LED)<br>• Resolution: 4K @ 60Hz<br>• Contrast Ratio: 4000:1<br>• Screen Surface: Anti-glare glass<br>• Touch Technology: IR Touch<br>• Response Time: <8ms<br>• Connectivity: USB 3.0, HDMI, Rj45 Ethernet, Wi-Fi<br>• Operating system: Android 11 atleast<br>• atleast 8GB ram and 32GB Rom<br>• Accessories such as Remote Control, Powerchord,Stylus to be included | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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| | **Brought Forward** | | | KES | | |
| 29 | Floor Standing Bracket for the above | No | 1 | | | |
| | <u>Audio Conferencing</u> | | | | | |
| 30 | Intelligent Audio conferencing Processor as per the following specifications:<br><br>• Connects 10 Dante audio inputs, 2 analog inputs, USB and a mobile device to an AV conferencing system or a PC-based video-conferencing application<br>• Includes DSP algorithms to enhance audio quality in AV conferences: 8 channels of microphone processing featuring AEC, noise reduction, and automatic gain control, IntelliMix automatic mixing, matrix mixing, delay,compressor and PEQ<br>• Flexible signal routing and connectivity: analog audio (2 block in / 2 block out) to connect to room AV conferencing system; USB (1 in/out) to connect to laptop or room PC; one 3.5 mm TRRS jack to connect to a mobile device to enable an additional participant to join<br>• Power-over-Ethernet (PoE+) eliminates the need for an outboard power supply<br>• Compact form factor is easy to mount without equipment rack<br><br>**The processor to be as Shure Intellimix P300 or approved equivalent** | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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| | **Brought Forward** | | | KES | | |
| 31 | Networked Ceiling-mount Loud Speaker as Shure MX5W-C or any other approved equivalent. The specifications are as shown below:<br><br>Connector<br>Type RJ45<br>Power Requirements<br>Power over Ethernet (PoE) Class 0 or PoE Plus Class 4 Plenum Rating<br>UL 2043 (Suitable for Air Handling Spaces)<br>Digital Signal Processing<br>Delay, Limiter, Signal Generator, Equalizer (4-band Parametric)<br>Other features:<br>-Software-based configuration and control.<br>-SystemOn Audio Asset Management software for remote management and troubleshooting<br>-Complete with ethernet cable for switch connection | No | 3 | | | |
| | Wireless Presentation System | | | | | |
| 32 | Wireless presentation system for War Room as Barco Wireless CX50 or approved equivalent c/w 1No.<br>Content-sharing hub and 2No. Content sharing dongles | | Item | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **IP based Public Adress System** | | | | | |
| 33 | 4-Channel ,Modular Public address and Voice Evacuation frame as TOA VX-3004F or equal and approved reputable brand with the following features:<br><br>Components included:<br>• Class D , 150w, 100v, modular digital power amplifier module as TOA VX-015DA orequal and approved - 4No.<br>• Line Output Module as TOA VX-300LO equal and approved - 4No.<br>Parameters<br>• Frequency response (Hz) : 40 Hz - 20 kHz: - 5to +1 dB(at 100 V line, 30 dB(*1) output )<br>• Minimum signal-to-noise ratio (dBA): 60dB<br>• Network Interface: 2No. Ethernet 100Base-TX<br>• Dual power supply | No | 1 | | | |
| 34 | Preamp Matrix Panel as TOA VX-3000PM OR or equal and approved brand with the following features :<br><br>• Equipped with 8 audio inputs with volume controls, 20 control inputs and 10 control outputs<br>• Provides unicast audio streaming functionality. | No | 1 | | | |
| 35 | System control panel as TOA VX3000CT or equivalent and approved reputable brand with the following features:<br><br>• Control panel with 9 function keys and 8 volume control knobs for easy operation<br>• Function keys are used for public address operation such as the activation of general broadcast.<br>• Volume controls allow volume level adjustment | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

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| | **Brought Forward** | | | KES | | |
| 36 | IP-based Desktop LCD call station as TOA RM-300X or approved equivalent with the following features:<br>• Desktop housing with gooseneck microphone<br>• Status and fault indicators for voice alarm purposes<br>• Built-in monitor loudspeaker with volume control<br>• Local audio line input (with stereo to mono conversion) for connecting an external audio source. The audio channel will be available on the network and can be played in any loudspeaker zone.<br>• A User number and PIN code can protect the device in public places against unauthorized access.<br>• The call station to fully comply to the standards for voice alarm applications<br>• IP-network connection and redundant Power over Ethernet | No | 5 | | | |
| 37 | IP-based Wall-mount LCD call station as TOA RM-200SF or approved equivalent reputable brand | No | 1 | | | |
| 38 | End of Line Unit as TOA VM-300SV or equivalent approved for detecting Speaker line failure be with high accuracy | No | 4 | | | |
| 39 | Ceiling loudspeaker , EN-54 compliant as TOA PC- 1860BS-C or equivalent and approved reputable brand with the following features:<br>• Rated Input 6 W (100 V), 3 W (70 V)<br>• Tappings 6 / 3 / 1.5 / 0.8 W (100 V), 3 / 1.5 / 0.8 / 0.4 W (70 V)<br>• Sensitivity (1 W, 1 m) 95 dB 94dB 95dB<br>• Frequency Response 170 Hz – 20 kHz 200 Hz – 20 kHz<br>• Mounting Hole Diameter 156 mm ±3 mm 150 mm ±3 mm<br>• Speaker Component 5" cone-type | No | 30 | | | |
| 40 | Speaker cable as per OEM's recommendations | m | 600 | | | |
| | **Carried to Final Summary** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>AUDIO VISUAL INSTALLATIONS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION**<br><br>**NO:9 BILL**<br><br>**NO:1** PRIME<br><br>COST SUMS | | | | | |
| 1 | Signage<br><br>Provide for Signage a Prime Cost Sum of Kenyan Shillings Five Hundred Thousand Only ( Kshs. 500,000.00 ) | | Item | | 500,000.00 | |
| 2 | | | | % | | |
| 3 | Add for profit (_____% )<br><br>Allow for general attendance on specialist installing Signage | | Item | | | |
| 4 | PROVISIONAL SUMS<br><br>Allow for a Provisional Sum of Ksh. 15,000,000.00 (Kenya Shillings Fifteen Million) for Offshore training by OEM for the Client Technical Team complete with certificate of participation for the following installed key equipment and/or factory witness testing (FWT):<br><br>a) White Space Goods<br>b) UPS Equipment | | Item | | 15,000,000.00 | |
| | | | | KES | | |
| | **Carried to Final Summary**<br><br>Section No. 9<br>Bill No. 1<br>PROVISIONAL SUMS | | | | | |

| Section No | **FINAL SUMMARY** | Page No | | Amount | |
|---|---|---|---|---|---|
| 1 | PRELIMINARIES AND GENERAL ITEMS | 2 | | | |
| 2 | BUILDERS WORKS | 26 | | | |
| 3 | ELECTRICAL AND ASSOCIATED WORKS | 49 | | | |
| 4 | WHITE SPACE GOODS | 69 | | | |
| 5 | SECURITY SERVICES | 83 | | | |
| 6 | AIR-CONDITIONING SYSTEM | 92 | | | |
| 7 | FIRE DETECTION AND PROTECTION SYSTEM | 101 | | | |
| 8 | AUDIO VISUAL INSTALALTIONS | 114 | | | |
| 9 | PRIME COST AND PROVISIONAL SUMS | 115 | | | |
| | Sub Total | | KES | | |
| | Add 7.5% of Sub-Total above as Contingency to be expended as per Law with express permission of the Client | % | | | |
| | Total (Sub-Total + Contingency) | | KES | | |
| | Add 0.03% of Sub-Total above as PPRA Capacity Building Levy | % | | | |
| | Total (Sub-Total + Contingency + Levy) | | KES | | |
| | Add 16% of Sub-Total as Value Added Tax (VAT) | | KES | | |
| | **TOTAL CARRIED FORWARD TO MAIN SUMMARY PAGE** | | KES | | |

**INCOMING POWER**

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO :** | | | | | |
| | **1 BILL NO:1** | | | | | |
| | **General Provision to be read in conjunction with Preliminaries Section in the Technical Specifications. Full compliance will be expected** | | | | | |
| 1 | Allow for full compliance of Preliminaries Items | | Item | | | |
| 2 | Cost of 10% Bank guarantee for performance Bond | | | SUM | | |
| 3 | Insurance for works and workers | | | SUM | | |
| 4 | Cleaning-up works. | | | SUM | | |
| 5 | Provisions for Data Sheets, drawings and brochures for all equipment to be supplied. | | Item | | | |
| 6 | Preliminaries Designs and Shop Drawings as outlined in the scope of works in the specification | | Item | | | |
| 7 | Warranties for Materials and Workmanship | | Item | | | |
| 8 | Materials for Testing and Commissioning | | Item | | | |
| 9 | Compliance with Site Specific Health & Safety Specification | | | SUM | | |
| 10 | Allow for MANUFACTURER RECOMMENDED SPARE PARTS | | Item | | | |
| | **Commissioning, testing, O&M Manuals,** | | | | | |
| 11 | **etc.** Commissioning, testing, O&M | | | SUM | | |
| | Manuals, etc. **Samples and Submissions** | | | | | |
| 12 | Submission of samples and/or technical submissions as may be required by the Engineer | | | SUM | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 1<br>Bill No. 1<br>CONTRACT PRELIMINARIES | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **O&M documentation and certificates** | | | | | |
| 13 | O+ M Technical documentation draft and final submission as specified, Including system setup on memory stick | | | SUM | | |
| 14 | Preparation and handing over of "As Built" drawings, indicating all conductor routes, exact spike positions and depths and provision of all test certificates for the entire building | | | SUM | | |
| 15 | Photo Report of Complete Installation | | | SUM | | |
| | **Testing and Commissioning** | | | | | |
| 16 | Testing and commissioning and Compliance Certificate for the complete Installation including Test report to local requirements | | | SUM | | |
| 17 | Commissioning Procedure as outlined by Original Equipment Manufacturer | | | SUM | | |
| | **Carried to Final Summary** | | | KES | | |
| | Section No. 1<br>Bill No. 1<br>CONTRACT PRELIMINARIES | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO :**<br><br>**2 BILL NO:1**<br><br>**EXTERNAL POWER ROOM**<br><br>**ELEMENT NO. 1**<br><br>**SUBSTRUCTURE (ALL PROVISIONAL)**<br><br>**Note: Tenderers are advised to allow for working space in their rates**<br><br>**NOTE: All Cement to be Ordinary Portland Cement with strength grade 42.5 and above.** | | | | | |
| | **Carried Forward**<br><br>Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | KES | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **NOTE: Classes of Rock Class I: Soft rock of the type known locally as "tuff" or "magadi" which in the opinion of the Client's representative cannot be considered as hard rock shall be known as Class I rock. Murram and Kunker is specifically excluded and will be reckoned as common excavation.**<br><br>**(ii) Class II: Very weathered black trap or lava containing many fissures and faults shall be known as Class II rock. This type of rock contains stones and boulders of unweathered or incompletely weathered black trap or lava. A boulder or outcrop of harder rock 13.5 cu. metre or less, and first quality Nairobi blue, grey or green building stone in a formation which is massive and geologically homogeneous, will be deemed to be Class II rock.**<br><br>**(iii) Class III: Black trap in a formation which is massive and geologically homogeneous shall be known as Class III rock.**<br><br>**The opinion of the Client's representative in classifying rock shall be final and binding. Common excavation shall mean excavation in any material which are not solid rock as defined in this Clause.** | | | | | |
| | **Site Clearance** | | | | | |
| 1 | Clear site of grass, bushed and small trees, grab roots and burn debris | m2 | 203 | | | |
| | **Excavations**<br><br>Excavations including trimming sides of excavations; maintaining and supporting sides and keeping free from water, mud and fallen material | | | | | |
| 2 | Excavation to reduce levels not exceeding 1.5m deep average depth 1.0m from stripped level | m3 | 203 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | Footings and Bases Excavations | | | | | |
| 3 | Excavation for strip foundation footing commencing at reduced levels not exceeding 1.50 metres deep | m3 | 63 | | | |
| 4 | Ditto for column bases not exceeding 1.5 metres deep from the reduced level | m3 | 92 | | | |
| | Rock excavation (Provisional) | | | | | |
| 5 | Extra over excavation in rock Class I | m3 | 20 | | | |
| 6 | Ditto but class II | m3 | 20 | | | |
| 7 | Ditto but class III | m3 | 31 | | | |
| | **Disposal** | | | | | |
| 8 | Backfiling around foundations | m3 | 33 | | | |
| 9 | Load and cart away surplus spoil where directed from the site | m3 | 325 | | | |
| | **Filling** | | | | | |
| 10 | Approved murram filling deposited in and well compacted in layers not exceeding 100mm thickness | m3 | 142 | | | |
| 11 | Hardcore filling compacted in 150 mm Thick (maximum) layers; 300 mm Thick | m2 | 189 | | | |
| 12 | 50 mm quarry dust blinding to surfaces of hardcore | m2 | 189 | | | |
| | **Anti- termite treatment** | | | | | |
| | Note - Areas are measured on plan and the rate shall include application to vertical surfaces as well | | | | | |
| 13 | Chemical anti-termite treatment executed complete by an approved specialist under a ten (10) year guarantee to surfaces of blinded hardcore | m2 | 203 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | **Damp proof membrane** | | | | | |
| 14 | JumboSeal 6000 code 'JSDPM GREY' or other equal and approved damp proof membrane laid under surface bed with 300 mm side and end laps (measured nett- no allowance made for laps) | m2 | 203 | | | |
| | Plain concrete class 15in: | | | | | |
| 15 | 50 mm blinding underfoundations | m2 | 42 | | | |
| 16 | Ditto under column bases | m2 | 62 | | | |
| | Vibrated Reinforced concrete class C25/30 achieving characteristic compressive strength of 30N/mm2 at 28days of 150mm cubes as per BS Standard of 15th August, 2005 in :- | | | | | |
| 17 | Foundations | m3 | 8 | | | |
| 18 | Columns | m3 | 2 | | | |
| 19 | Column | m3 | 29 | | | |
| 20 | Bases | m2 | 203 | | | |
| | 200mm thick floor slab | | | | | |
| | **Reinforcement** | | | | | |
| 21 | Steel mesh fabric reinforcement to B.S. 4483 | | | | | |
| | Mesh fabric reinforcement laid in slab or bed ( measured nett - no allowance made for laps ) - Ref A142 weighing 2.22 Kgs per square metre | m2 | 203 | | | |
| 22 | Deformed high yield ribbed bars reinforcement to BS 4449: 1997 with yield strength of 460N/mm2 : cut, bend and fix as directed : tenderers to allow in their unit rate, cost for cutting, bending, hoisting and fixing including all necessary trying wires, distance blocks, templates and spacer stools | kg | 6,435 | | | |
| | Assorted Bar Sizes | | | | | |
| | **Formwork** | | | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | Sawn softwood formwork | | | | | |
| 23 | to; Sides of strip footing | m2 | 28 | | | |
| 24 | Sides of column bases | m2 | 59 | | | |
| 25 | Sides of columns | m2 | 28 | | | |
| 26 | Edges of beds and steps, etc 75 to 150 mm High | m | 64 | | | |
| | **Walling** | | | | | |
| | Natural stone walling in cement sand (1:3) mortar | | | | | |
| 27 | 200 mm wall reinforced with whoop iron straps every alternate course | m2 | 87 | | | |
| | Bituminous felt damp proof courses laid on and including levelling cement and sand (1:3) screed | | | | | |
| 28 | In walling 200 mm wide | m | 70 | | | |
| | Precast concrete paving slabs , etc. jointed and grouted up in lime and sand (1: 3) mortar | | | | | |
| 29 | 50 mm Paving in generally 600 x 600 mm slabs laid on and including 50 mm bed of sand | m2 | 77 | | | |
| 30 | Supply ,fill and compact approved murram to 100 % MDD 150 mm | m2 | 77 | | | |
| | **TRENCH** | | | | | |
| | Excavations of channels including maintaining and supporting sides and keeping bottoms free from water, mud and fallen material, grading bottoms, backfilling in appropriate material and loading and carting away surplus excavated materials; sides of channels consisting of 150mm thick mass concrete bed and surround to sides | | | | | |
| 31 | For 650 mm wide concrete channels - 650mm deep | m | 12 | | | |
| | **Carried Forward** | | | KES | | |

Section No. 2
Bill No. 1
EXTERNAL POWER ROOM

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | Mild Steel Grating | | | | | |
| 32 | Mild steel grating comprising 50 x 8mm flat at 20mm centers welded to 40 x 40 x 4mm angle sub-frame, set in 50 x 50 x 7.8mm angle frame built into concrete sides with 100mm long x 12mm diameter fanged lugs welded on at 300mm centres, in lengths not exceeding 2000mm, complete with deep galvanizing and painting "black", 450mm wide. | m | 12 | | | |
| | Waterproofing to concrete trenches | | | | | |
| 33 | Prepare surfaces and apply Aquaflex roof premium waterproofing in two coats; in between the two coats of aquaflex, apply Mapetex Sel; including applying a primer "Mapecoat I 600W" in two coats before applying waterproofing; all drains, inlets and outlets pipes, vertical and horizontal joints, cracks should also be sealed with Mapeband easy; waterproofing as manufactured as Mapei or other equal and approved product; laid strictly in accordance with manufacturer's printed instructions by an approved Specialist SubContractor : Rate shall include surface treatment of concrete surfaces as per manufacturer's specification before application of waterproofing material : provide 10 year guarantee<br>Trenches; sides and bottom; laid to falls | m2 | 22 | | | |
| | **ELEMENT NO. 2** | | | | | |
| | **REINFORCED CONCRETE SUPERSTRUCTURE** | | | | | |
| 34 | Vibrated Reinforced concrete class C25/30 achieving characteristic compressive strength of 30N/mm2 at 28days of 150mm cubes as per BS Standard of 15th August, 2005 in :-<br>Beams | m3 | 58 | | | |
| 35 | Columns | m3 | 17 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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| | **Brought Forward** | | | KES | | |
| 36 | 200mm thick suspended slab | m2 | 417 | | | |
| | Reinforcement (Provisional) | | | | | |
| | Deformed high yield ribbed bars reinforcement to BS 4449: 1997 with yield strength of 460N/mm2 : cut, bend and fix as directed : tenderers to allow in their unit rate, cost for cutting, bending, hoisting and fixing including all necessary trying wires, distance blocks, templates and spacer stools | | | | | |
| 37 | Assorted Bar Sizes | kg | 26,136 | | | |
| | Marine ply or equal and approved fair faced formwork to; | | | | | |
| 38 | Sides and soffits of beams | m2 | 507 | | | |
| 39 | Sides of columns | m2 | 221 | | | |
| 40 | Soffits of suspended slabs | m2 | 417 | | | |
| 41 | Edges of suspended slab 75mm to 150mm high | m | 128 | | | |
| | **ELEMENT NO. 3** | | | | | |
| | **STAIRS** | | | | | |
| | **Mild Steel Staircase** | | | | | |
| 42 | Supply and install purpose made mild steel 1500mm diameter circular staircase comprising of the following details: 40 x 3mm thick flat handrail top, 12mm diameter holding rods; 152mm diameter central pipe mast, 1/40 x 3mm thick flat bar; stiffener plates; mahogany wooden tread; prime surfaces of steel and apply approved gloss oil paint; prepare and apply polyurethane varnish to all treated timber surfaces; all steel details to Structural Engineer's details. | No | 1 | | | |
| | **ELEMENT NO. 4** | | | | | |
| | **EXTERNAL** | | | | | |
| | **WALLING** | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | WALLING | | | | | |
| | Load bearing"Ruiru" machine cut natural stone walling bedded and jointed in cement and sand (1:3) mortar | | | | | |
| 43 | 200mm thick walling, cement sand mortar (1:3) reinforced with whoop iron straps every alternate course | m2 | 514 | | | |
| | Parapet Walling | | | | | |
| 44 | 200mm thick parapet walling, cement sand mortar (1:3) reinforced with whoop iron straps every alternate course | m2 | 131 | | | |
| | **ELEMENT NO. 5** | | | | | |
| | **INTERNAL** | | | | | |
| | **WALLING** | | | | | |
| 45 | Precast concrete class 20 (12mm,aggregate), including formwork, finishing fair face on all exposed surfaces, and hoisting and placing in position, bedding and jointing in cement and sand (1:3) mortar | | | | | |
| | 200 x 300 mm lintel, reinforced with and including four 12mm diameter mild steel rods and 6mm stirrups at 200mm centres | m | 12 | | | |
| 46 | Load bearing"Ruiru" machine cut natural stone walling bedded and jointed in cement and sand (1:3) mortar | m2 | 22 | | | |
| | Walling reinforced as described, 200 mm | | | | | |
| | **ELEMENT NO. 6** | | | | | |
| | **ROOFING AND ROOF FINISHES** | | | | | |
| | **LOWER AND UPPER ROOF FINISHES** | | | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | Clay quarry flooring tiles and fittings to B.S. 1286 Type A bedded and jointed in cement abd sand 1:1 and pointed in tinted cement | | | | | |
| | "Eurocon" concrete paving tiles fixed in accordance with manufacturer's specifications bedded and jointed in cement and sand 1:1 and pointed in tinted cement | | | | | |
| | Precast concrete traffic tiles | | | | | |
| 47 | 20 mm tiles size 225 x 225 mm bonded to felt roofing with hot bitumen bonding compound | m2 | 221 | | | |
| 48 | Raking cutting | m | 88 | | | |
| 49 | Cut and fit around rain water outlet grating | No | 4 | | | |
| | Cement and sand (1:4) beds and backings | | | | | |
| 50 | Beds to receive roofing , to falls finished with a wood float, thickness 75 mm | m2 | 221 | | | |
| 51 | Screed topping to APP finished with a steel trowel, thickness 20 mm | m2 | 221 | | | |
| 52 | Screeds to gutter bottoms finished with a steel trowel, thickness 75 mm | m2 | 131 | | | |
| | Fulbora Outlets | | | | | |
| 53 | 150mm diameter aluminium fulbora outlet cast into concrete complete with grating including jointing to plastic pipes and water-tight joint to water roofing membrane | No | 4 | | | |
| | Heavy gauge grey PVC | | | | | |
| 54 | pipes | m | 48 | | | |
| 55 | 150mm diameter down pipes held onto walls with and including holder bats at 1000c/c | No | 4 | | | |
| | Ditto for shoe | | | | | |
| | **ELEMENT NO. 7** | | | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **DOORS** | | | | | |
| | **Security Doors** | | | | | |
| | Two hour fire check Steel Doors | | | | | |
| 56 | Double Door in 900mm operable leave and 2No. 300mm wide side panels; with Vision Panel (200 x 450mm)6mmthk Glass-1no; 120min Fire Rated; Powder Coated to RAL Colour 1.2mm thick Shutter/1.5mm thick Frame; Honeycomb Infill; 45mm thick;<br>Hardware:-<br>Hinges-4 x 3 x 3mm-8nos;<br>Panic Rim Exit Bar (Silver Finish)-1no;<br>External Trim-1no;<br>Flush Bolt-1pr<br>Dust Proof-<br>1no; Door<br>Closer-1no;<br>Door Stopper-1no;<br>Door overall size 1800 x 3300mm high.<br><br>All to ASSA ABLOY or approved equivalent Standards:<br>• LPS 1175 Issue 6 SR3<br>• Upgradable to FD30(S) - FD240(S) in accordance with BS 476 Part 22: 1987<br>• BSEN 14351-1: 2006 + A1 2010 | No | 2 | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 57 | Single Door in 900mm; with Vision Panel (200 x 450mm) 6mmthk Glass-1no; 120min Fire Rated; Powder Coated to RAL Colour 1.2mm thick Shutter/1.5mm thick Frame; Honeycomb Infill; 45mm thick;<br>Hardware:-<br>Hinges-4 x 3 x 3mm-8nos;<br>Panic Rim Exit Bar (Silver Finish)-1no;<br>External Trim-1no;<br>Flush Bolt-1pr<br>Dust Proof-<br>1no; Door<br>Closer-1no;<br>Door Stopper-1no;<br>Door overall size 900 x 2400mm high.<br><br>All to ASSA ABLOY or approved equivalent Standards:<br>• LPS 1175 Issue 6 SR3<br>• Upgradable to FD30(S) - FD240(S) in accordance with BS 476 Part 22: 1987<br>• BSEN 14351-1: 2006 + A1 2010 | No | 2 | | | |
| 58 | **Fire Escape Doors**<br><br>Steel Single Flush Door 120 min Fire Rated; Powder Coated to RAL Colour 1.2mm thick Shutter/1.5mm thick Frame;<br>Honeycomb Infill; 45mm<br>thick; Hardware:-<br>Hinges-4 x 3 x 3mm-4nos;<br>Rim Panic Exit Bar with Trim-1set,<br>Door Closer-1no;<br>Door Stopper-1no;<br><br>Door overall size 1200 x 3700mm high<br><br>All to ASSA ABLOY or approved equivalent Standards:<br>• LPS 1175 Issue 6 SR3<br>• Upgradable to FD30(S) - FD240(S) in accordance with BS 476 Part 22: 1987<br>• BSEN 14351-1: 2006 + A1 2010 | No | 3 | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | Prepare and apply one coat of JOTUN jota shield penetrating majestic primer; one coat jota shield filler and two finishing coats of jota shield tex ultra majestic range paint as per manufacturer's recommendations; colour to Architects approval; All paints to be JOTUN or approved equivalent. | | | | | |
| 59 | General surfaces of steel doors ( both sides measured overall) | m2 | 62 | | | |
| | **ELEMENT NO. 8** | | | | | |
| | **WINDOWS** | | | | | |
| | **Fixed Louvred Windows/Vents** | | | | | |
| | Supply, assemble and fix the following purpose made mild steel casement window fabricated from 20mm x 3mm mild steel T-sections comprising of frame and casement incorporating mild steel hood with louvres to later detail: | | | | | |
| 60 | Window overall size 3600mm x 3600mm high | No | 4 | | | |
| | **Painting and Decoration** | | | | | |
| 61 | Prepare and apply one undercoat and two finishing coats of gloss oil paint to surfaces of glazed steel windows | m2 | 104 | | | |
| | **ELEMENT NO. 9** | | | | | |
| | **EXTERNAL WALL** | | | | | |
| | **FINISHES** | | | | | |
| 62 | Cement and sand ( 1: 4 ) rendering<br><br>Rendering to walls finished with a steel trowel,thickness 15 mm<br><br>Textured Paint | m2 | 724 | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | Prepare and apply textured paint as Mamoran or other equal and approved applied as per the manufacturers instruction and to the Architect's approval. | | | | | |
| 63 | Rendered walls | m2 | 724 | | | |
| | externally **ELEMENT NO.** | | | | | |
| | **10 INTERNAL WALL** | | | | | |
| | **FINISHES** | | | | | |
| | **Lime Plaster** | | | | | |
| 64 | 12mm thick lime plaster applied in stages as approved; 9mm thick base first coat and 3mm thick second coat smooth trowelled, levelled and plumb. Surface preparation and curing to strictly adhere to specifications and details. | m2 | 45 | | | |
| | Plaster to walls | | | | | |
| | **Painting and Decorations** | | | | | |
| | Note: All paint to be Fire Retardant | | | | | |
| 65 | Prepare and apply one coat of JOTUN jota shield penetrating majestic primer; one coat jota shield filler and two finishing coats of jota shield tex ultra majestic range paint as per manufacturer's recommendations; colour to Architects approval; All paints to be JOTUN or approved equivalent. | m2 | 45 | | | |
| | Plastered walls | | | | | |
| | **ELEMENT NO.** | | | | | |
| | **11 FLOOR** | | | | | |
| | **FINISHES** | | | | | |
| | **Epoxy finish** | | | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | Cement and sand (1:4) screed: to concrete surfaces: in | | | | | |
| 66 | Hardened self levelling screed finish to receive polyurethane finish (MS) | m2 | 385 | | | |
| | Polyurethane floor coating as Mapei or Fosroc spread on clean and dried floors in approved primer, base and top coats layers, colour and finish as per manufacturers' instructions all to architect's approval | | | | | |
| 67 | 4mm thick polyurethane PU floor finish | m2 | 385 | | | |
| | Supply and apply industrial non-toxic self leveling epoxy surface finish including screed , applied as specified by the manufacturer; Finish to include ground earthing tape installed prior to application of the conductive top coat in accordance to Electrical Engineer's Approval. | | | | | |
| 68 | 4mm thick to floors | m2 | 385 | | | |
| | **ELEMENT NO. 12** | | | | | |
| | **CEILING FINISHES** | | | | | |
| | **Lime plaster** | | | | | |
| | 12mm thick lime plaster applied in stages as approved; 9mm thick base first coat and 3mm thick second coat smooth trowelled, levelled and plumb. Surface preparation and curing to strictly adhere to specifications and details. | | | | | |
| 69 | Plaster to soffits | m2 | 411 | | | |
| | **Painting and decorating** | | | | | |
| | Note: All paint to be Fire Retardant | | | | | |
| | **Carried Forward** | | | KES | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | Prepare and apply one coat of JOTUN jota shield penetrating majestic primer; one coat jota shield filler and two finishing coats of jota shield tex ultra majestic range paint as per manufacturer's recommendations; colour to Architects approval; All paints to be JOTUN or approved equivalent. | | | | | |
| 70 | Plastered soffits of suspended slabs | m2 | 411 | | | |
| | **ELEMENT NO.** | | | | | |
| | **13** | | | | | |
| | **BALUSTRADING** | | | | | |
| | **The following in Terrace Balustrading** | | | | | |
| 71 | Mild steel | | | | | |
| | 900 mm high balustrade consisting of 75mm diameter x 3 mm iron railing section, top rail, bottom rail and main balusters at 1000 mm centres built into mortice in concrete,25 x 25 x 2 mm intermediate balusters at 125 mm centres all welded together | m | 88 | | | |
| | **ELEMENT NO. 14** | | | | | |
| | **WATERPROOFING** | | | | | |
| | **WORKS (ALL PROVISIONAL)** | | | | | |
| | **ROOF FINISHES** | | | | | |
| 72 | Vibrated Reinforced concrete class C25/30 achieving characteristic compressive strength of 30N/mm2 at 28days of 150mm cubes as per BS Standard of 15th August, 2005 in :- | m2 | 221 | | | |
| | 200mm thick suspended slab with air fins to later detail; approved by the Structural Engineer | | | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

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| | **Brought Forward** | | | KES | | |
| | Cement and sand (1:4) beds and backings | | | | | |
| 73 | Beds to receive roofing , to falls finished with a wood float, thickness 75 mm | m2 | 221 | | | |
| | Mineral APP modified membrane or other equal and approved with surface finish weighing 4kg/sm; laid on primer with torch-on process from an approved manufacturer; finish to surfaces: with at least 100mm overlaps along the side laps, lap joints shedding water towards the drains; all executed by a specialist under 10 years guarantee : ; complete with all necessary surface preparation, all to SE approval; as described | | | | | |
| 74 | To screeded roofs laid to falls and cross falls not exceeding 15 degrees from horizontal; thickness 4mm | m2 | 221 | | | |
| 75 | Skirting including turn in to groove, height 300 mm | m | 88 | | | |
| 76 | Cut and fill around rain water outlet grating | No | 4 | | | |
| 77 | Make good around large pipe | No | 4 | | | |
| | **ROOF GUTTER** | | | | | |
| | Mineral APP modified membrane or other equal and approved with surface finish weighing 4kg/sm; laid on primer with torch-on process from an approved manufacturer; finish to surfaces: with at least 100mm overlaps along the side laps, lap joints shedding water towards the drains; all executed by a specialist under 10 years guarantee : ; complete with all necessary surface preparation, all to SE approval; as described | | | | | |
| 78 | Gutter linnings, girth 1200mm | m | 88 | | | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:2** | | | | | |
| | **KENYA POWER ROOM** | | | | | |
| | **DEMOLITIONS AND REPAIRS** | | | | | |
| | **DEMOLITION WORKS (ALL** | | | | | |
| 1 | **PROVISIONAL)** | m2 | 88 | | | |
| 2 | Carefully rub down existing decorative paint, make good surface for new interior wall finish. | m2 | 51 | | | |
| 3 | Ditto but to ceiling | m2 | 51 | | | |
| 4 | Carefully demolish existing floor finish and cart away arising debris. | m2 | 51 | | | |
| 5 | Carefully scarify existing floor in preparation to receive new floor finish. | | | | | |
| | Provide a Sum for any other necessary demolition works that may be required by the Architect/Engineer for smooth execution of the works. | | | | | |
| | *The above Items will be based ONLY on written instructions and shall be evaluated prior to commencement and assessed after execution by the Project Quantity Surveyor for payment consideration* | | Item | | 50,000.00 | |
| 6 | Repairs | | | | | |
| | Allow for filling up existing clay vent blocks with mass concrete and chicken wire mesh infill to approval | m2 | 29 | | | |
| | **DOORS** | | | | | |
| | Doors | | | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | Steel Louvered Door | | | | | |
| 7 | Steel louvred Double Door in equal leaves with Vision Panel (200 x 450mm)6mmthk Glass-1no; 120min Fire Rated; Powder Coated to RAL Colour 1.2mm thick Shutter/1.5mm thick Frame; Honeycomb Infill; 45mm thick; Hardware:- Hinges-4 x 3 x 3mm-8nos; Panic Rim Exit Bar (Silver Finish)- 1no; External Trim-1no; Flush Bolt-1pr Dust Proof- 1no; Door Closer-1no; Door Stopper-1no; Door overall size 1800 x 2400mm high. | No | 1 | | | |
| | Fire Rated Escape Door | | | | | |
| 8 | Steel Single Flush Door 120 min Fire Rated; Powder Coated to RAL Colour 1.2mm thick Shutter/1.5mm thick Frame; Honeycomb Infill; 45mm thick; Hardware:- Hinges-4 x 3 x 3mm-4nos; Rim Panic Exit Bar with Trim-1set, Door Closer-1no; Door Stopper-1no; | | | | | |
| | Door overall size 900 x 2400mm high | No | 1 | | | |
| | **INTERNAL WALLING FINISHES** | | | | | |
| | Lime Plaster | | | | | |
| | Cement and Sand mortar (1:4) | | | | | |
| | 12mm thick lime plaster applied in stages as approved; 9mm thick base first coat and 3mm thick second coat smooth trowelled, levelled and plumb. Surface preparation and curing to strictly adhere to specifications and details. | | | | | |
| 9 | Plaster to repaired surfaces | m2 | 58 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 2<br>Bill No. 2<br>KENYA POWER ROOM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | Prepare and apply three coats first quality silk vinyl paint to; | | | | | |
| 10 | Rubbed faces of internal walls | m2 | 88 | | | |
| 11 | Plastered surfaces | m2 | 58 | | | |
| | **CEILING FINISHES** | | | | | |
| | **Painting and decorating** | | | | | |
| | Prepare and apply three coats first quality silk vinyl paint to; | | | | | |
| 12 | Ceiling surfaces | m2 | 51 | | | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 2<br>KENYA POWER ROOM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:3**<br><br>**RISER DUCTS**<br><br>**DOORS**<br><br>**Security Doors**<br><br>Two hour fire check Steel Doors | | | | | |
| 1 | Single Door in 800mm; with Vision Panel (200 x 450mm) 6mmthk Glass-1no; 120min Fire Rated; Powder Coated to RAL Colour 1.2mm thick Shutter/1.5mm thick Frame; Honeycomb Infill; 45mm thick;<br>Hardware:-<br>Hinges-4 x 3 x 3mm-8nos;<br>Panic Rim Exit Bar (Silver Finish)-1no; External Trim-1no;<br>Flush Bolt-1pr<br>Dust Proof-1no; Door Closer-1no;<br>Door Stopper-1no;<br>Door overall size 800 x 2400mm high.<br>All to ASSA ABLOY Standards:<br>• LPS 1175 Issue 6 SR3<br>• Upgradable to FD30(S) - FD240(S) in accordance with BS 476 Part 22: 1987<br>• BSEN 14351-1: 2006 + A1 2010 | No | 30 | | | |
| | **Carried Forward to Summary of Section No. 2** | | | KES | | |
| | Section No. 2<br>Bill No. 3<br>RISER<br>DUCTS | | | | | |

**SECTION SUMMARY - BUILDERS WORKS**

| Bill No | | Page No | | Amount | |
|---|---|---|---|---|---|
| 1 | EXTERNAL POWER ROOM | 18 | | | |
| 2 | KENYA POWER ROOM | 21 | | | |
| 3 | RISER DUCTS | 22 | | | |
| | **Carried to Final Summary** | | KES | | |
| | Section No. 2 | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION** | | | | | |
| | **NO:3 BILL** | | | | | |
| | **NO:1** | | | | | |
| | **Supply and installed Generator Enclosure as per the general specification** | | | | | |
| 1 | **Generator Enclosure** | | | | | |
| | 400 KW Engine, standard containerized **Data Centre Continuous Running rated Generator** Including GCP,Internal Fuel Tank and Split Board | No | 3 | | | |
| 2 | **Services for the above 3No. enclosures** | | Item | | | |
| 3 | Detailed engineering and shop drawing | | Item | | | |
| 4 | Detailed controls for Piping and instrumentation diagrams | | Item | | | |
| | BIM Model (Revit compatible) of unit | | | | | |
| | **Transport and Logistics for the above 3No. enclosures** | | | | | |
| 5 | Transport and offloading to site | | Item | | | |
| | Delivery to site (Curb side delivery) including coordination and planning of logistics | | | | | |
| 6 | **Installation for the above 3No. enclosures** | | Item | | | |
| 7 | Install and connect all 400 kw enclosures required to effect a fully functional generator installation | Hrs | 8.00 | | | |
| 8 | Hardware for testing (Loadbanks, temp cabling) | | Item | | | |
| | Connect, configure and commission of all sub-systems (fire suppression and detection, CCTV, data and access control) | | | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 3<br>Bill No. 1<br>PRIME RATED GENERATORS | | | | | |

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| | **Brought Forward** | | | KES | | |
| 9 | Connection of all ancillary equipment including fuel lines from manifold to generators, silencers & exhausts, pipes between generators and remote coolers, power and controls between generators and remote cooler fans etc. | | Item | | | |
| | **<u>Testing and commissioning for the above 3No. enclosures</u>** | | | | | |
| 10 | Factory trained technician to be present during the testing and commissioning for the supplied equipment | | Item | | | |
| | **Carried Forward to Summary of Section No. 3** | | | KES | | |
| | Section No. 3<br>Bill No. 1<br>PRIME RATED GENERATORS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:2** | | | | | |
| 1 | **Bunded Fuel Tanks a15,000 liters capacity complete with Fuel filtration System;** | | | | | |
| | **Bidders to Note that 'ORCA' from South Africa has been used as a Bench Mark on Quality Expected. Equal and approved equivalent will be** | No | 2 | | | |
| 2 | **accepted** | No | 1 | | | |
| | **Tank Filling Point** | | | | | |
| 3 | **Vapour Recovery Vents** | m | 10 | | | |
| 4 | Class 'C' Galvanized Iron pipe 50mm diameter | No | 2 | | | |
| 5 | Vapour Recovery Vents | No | 2 | | | |
| | **Fuel Control Panel (PLC)** | | | | | |
| | **Pipe Works and Fittings** | | | | | |
| | **Product Pipes (Pressurized System)** | | | | | |
| | **Pipework (Provisional subject to remeasurement)** | | | | | |
| 6 | Supply and Install Stainless Steel | m | 200 | | | |
| 7 | Pipework 25mm diameter | No | 25 | | | |
| 8 | 25mm diameter elbow | m | 6 | | | |
| | 25mm Hose pipe for final delivery | | | | | |
| 9 | **Fittings and Accessories for above** | No | 3 | | | |
| 10 | Fire Safety Valve | No | 18 | | | |
| 11 | Three Way Ball | No | 6 | | | |
| | Valve | | | | | |
| | Motor Operated Ball Valve | | | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 3<br>Bill No. 2<br>BULK AUTOMATED FUEL SYSTEM | | | | | |

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| | **Brought Forward** | | | KES | | |
| 12 | Ball Valve Manual | No | 40 | | | |
| 13 | Operated Ball Valve | No | 3 | | | |
| 14 | Solenoid Operated Check | No | 12 | | | |
| 15 | Valve | No | 6 | | | |
| 16 | Electric driven | No | 5 | | | |
| 17 | pump Level | No | 5 | | | |
| 18 | Indicator | No | 2 | | | |
| 19 | Level | No | 6 | | | |
| 20 | transmitter | No | 3 | | | |
| 21 | Level Alarm | No | 3 | | | |
| 22 | Level Switch | No | 3 | | | |
| 23 | Flow Indicator | No | 3 | | | |
| | Pressure Alarm | | | | | |
| | Fuel Filter | | | | | |
| | Fuel Separator | | | | | |
| | **Carried Forward to Summary of Section No. 3** | | | KES | | |
| | Section No. 3<br>Bill No. 2<br>BULK AUTOMATED FUEL SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:3** | | | | | |
| | **Supply and install Bespoke Critical Power Master Control System panels as per the specifications, drawings and schematics. The panels to be designed and configured to ensure they are fault tolerant and concurrently maintainable. Final design to be confirmed by supplier / installer during workshop drawing submittal approval stage to guarantee that the full intention of the design is met and that the system will function as one functional unit. Specialist supplier to confirm logic and intention – all included in price** | | | | | |
| | Master Control Panel 01 [MCP 01] | | | | | |
| 1 | Indoor, IP54, Critical Power Master Control Panel as per the specification document.<br><br>Minimum physical requirements:<br>-Minimum panel requirements as per BMS Panel specifications<br><br>Functional Requirements<br>-To control and monitor Mains and Back-up Critical Power system components to ensure Power System's Fault tolerance and Concurrent Maintainability as defined in the MCP specifications document.<br><br>Control System Robustness<br>- Fault tolerance : Master Control Panel [MCP 01]functions/ elements to be mirrored by a Back-up Control Panel [MCP 02] that automatically takes over the functionalities of the former in the event of a failure.<br>-Concurrent Maintainability : Manual switch-over between the two MCPs to be included to allow for planned maintenance.<br>-System health of MCP components especially PLC controllers, PSUs etc to be reported regularly to the BMS.<br>-Dual Power supply to Panel components via Static Transfer Switch with atleast one UPS power input.<br>-Surge Protection | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 3<br>CRITICAL POWER MASTER CONTROL PANELS | | | | | |

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| | **Brought Forward** | | | KES | | |
| | -Panel Temperature monitoring and Cooling<br><br><u>Monitored and Controlled Sub-systems as per specifications</u><br>- 3No. 400kW DC Rated Gensets via 3No. Generator Control Panels<br>-Generator 2-way Distribution Board via motorised breakers and keyswitches<br>-Low Voltage Main distribution (Main LV Panel 01 & 02) via motorized breakers and key switches<br>- Fuel System<br><br><u>Software and Network Elements as per specifications [quantities as per specialists' design]</u><br>- Network Switches<br>- PLC Controllers<br>- Human Machine Interfaces<br>- BMS integration Gateways<br><br><u>Ancillary Components as per specifications [quantities as per specialist's design]</u><br>- HMI Screen for local supervision of all elements within the panel<br>- Power supplies [sized as per estimated load]<br>-Electrical signal transducers<br>-Control Transformers<br>-Wiring Duct<br>-Filtering and Surge Protection<br>-Control Panel Local Indication Lights<br>-Control Panel Selector Switches<br>-Combination Alarm/horn Indication<br>-Terminal blocks<br>-Internal Power isolators<br>-Static Transfer Switches for dual supply<br>-Ventilation grilles<br>-Thermostat controlled Fan or equivalent internal cooling system as per OEM's recommendation<br>-Any other components as per OEM's recommendations<br><br><u>Panel Size</u><br>To be as per specialist's design based on the number and size of internal components<br><br><u>Master Control Panel 02 [MCP 02]</u> | | Item | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 3<br>CRITICAL POWER MASTER CONTROL PANELS | | | | | |

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| | **Brought Forward** | | | KES | | |
| 2 | Indoor, IP54, Critical Power Master Control Panel as per the specification document.<br><br><u>Minimum physical requirements:</u><br>-Minimum panel requirements as per BMS Panel specifications<br><br><u>Functional Requirements</u><br>-To control and monitor Mains and Back-up Critical Power system components to ensure Power System's Fault tolerance and Concurrent Maintainability as defined in the MCP specifications document.<br><br><u>Control System Robustness</u><br>- Fault tolerance : Master Control Panel [MCP 01]functions/ elements to be mirrored by a Back-up Control Panel [MCP 02] that automatically takes over the functionalities of the former in the event of a failure.<br>-Concurrent Maintainability : Manual switch-over between the two MCPs to be included to allow for planned maintenance.<br>-System health of MCP components especially PLC controllers, PSUs etc to be reported regularly to the BMS.<br>-Dual Power supply to Panel components via Static Transfer Switch with atleast one UPS power input.<br>-Surge Protection<br>-Panel Temperature monitoring and Cooling<br><br><u>Monitored and Controlled Sub-systems as per specifications</u><br>- 3No. 400kW DC Rated Gensets via 2No. Generator Control Panels<br>-Generator 2-way Distribution Board via motorised breakers and keyswitches<br>-Low Voltage Main distribution (Main LV Panel 01 & 02) via motorized breakers and key switches<br>- Fuel System<br><br><u>Software and Network Elements as per specifications [quantities as per specialists' design]</u><br>- Network Switches<br>- PLC Controllers<br>- Human Machine Interfaces | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 3<br>CRITICAL POWER MASTER CONTROL PANELS | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | - BMS integration Gateways<br><br><u>Ancillary Components as per specifications [quantities as per specialist's design]</u><br>- HMI Screen for local supervision of all elements within the panel<br>- Power supplies [sized as per estimated load]<br>-Electrical signal transducers<br>-Control Transformers<br>-Wiring Duct<br>-Filtering and Surge Protection<br>-Control Panel Local Indication Lights<br>-Control Panel Selector Switches<br>-Combination Alarm/horn Indication<br>-Terminal blocks<br>-Internal Power isolators<br>-Static Transfer Switches for dual supply<br>-Ventilation grilles<br>-Thermostat controlled Fan or equivalent internal cooling system as per OEM's recommendation<br>-Any other components as per OEM's recommendations<br><br><u>Panel Size</u><br>To be as per specialist's design based on the number and size of internal components | | Item | | | |
| | **<u>Design and Programming Services</u>** | | | | | |
| 3 | Design and Programming for BMS/PMS system by Power specialist to include:<br><br>· Single Line Diagrams<br>· Floor plan wiring diagrams<br>· Sequence of operation/functional description<br>· Programming Flow Charts<br>· Programming Simulations<br><br>Any other services required as per OEM's recommendation to be included | | Item | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 3<br>Bill No. 3<br>CRITICAL POWER MASTER CONTROL PANELS | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 4 | Allow for liason with the sub-contractors for the following systems to ensure full intent of the system is achieved as per the specifications:<br><br>- Power Distribution Panel builder<br>-Generator and Fuel system | | Item | | | |
| | **Carried Forward to Summary of Section No. 3** | | | KES | | |
| | Section No. 3<br>Bill No. 3<br>CRITICAL POWER MASTER CONTROL PANELS | | | | | |

**SECTION SUMMARY - GENERATOR AND FUEL STORAGE SYSTEM**

| Bill No | | Page No | | Amount |
|---|---|---|---|---|
| 1 | PRIME RATED GENERATORS | 25 | | |
| 2 | BULK AUTOMATED FUEL SYSTEM | 27 | | |
| 3 | CRITICAL POWER MASTER CONTROL PANELS | 32 | | |
| | **Carried to Final Summary** | | KES | |
| | Section No. 3 | | | |

## SECTION NO:4

## BILL NO:0

### MAIN LV PANELS O1& 02

One Free standing panel, to **IP42** suitable for indoor installation, front access, compliant with standards IEC 61439-1 concerning the construction of Type Tested Assemblies, **Form 3B**, comprising of the following specification.

Type Tested as **Prisma iPM.**

Complete with: -

**Incomer Sections.**

2 No. 2000A 4P 50kA, Drawout Manual ACB, with micrologic 5.0* (LSI protection) – *Schneider.*

1 No. 1250A 4P 65kA, Drawout Manual ACB, with micrologic 5.0* (LSI protection) – *Schneider.*

3 No. RYB Phase Presence Indicator Lamps c/w protection fuses.

5 Nos. Digital Multifunction Meter, Powerlogic PM5320 Complete with protection and CTs – *Schneider*

Set of Power Logic heat detectors – Schneider

Set of Wireless thermal sensors TH110 – Schneider 1

No. Panel server, concentrator Modbus gateway.

**Automatic Changeover Section.**

2 No. 2000A 4P 65kA, Drawout Motorized ACB, with micrologic 5.0* (LSI protection) – *From Mains & For Generators Supply– Schneider.*

1 Set of Mechanical Interlock for the above ACBs – *Schneider*

1 Set of Automatic Changeover Controller and control circuit for the automatic changeover operation.

2 Nos. Digital Multifunction Meter, Powerlogic PM8240 (Mains Incomer Section to ATS)

– *Schneider*

1 Set of 2500/5A Current Transformers and protection fuses for the above meter.

**Outgoers Section.**

2 No. 1600A 4P 65kA, Drawout Manual ACB, with micrologic 5.0* (LSI protection) – *Schneider.*

1 No. 630A 4P 36kA, MCCB, with micrologic 5.0* (LSI protection) – *Schneider.*

1 No. **300kVAr** PFC Bank comprising of: -

1 No. 630A **4P** MCCB, 36kA, Compact NSX, Adjustable Type with Micrologic 5 . 0 * Trip Unit – *Schneider*

1 Set. VarPlus PFC 12 step Controller and Step Indicators – *Schneider*

1 Set VarPlus Heavy Duty Capacitors and TeSys D Capacitor Duty Contactors - *Schneider*

1 No. Self-regulating cooling fan and

louvre. 1 No. Set of controls circuit for

the APFC Bank.

Steps considered are as follows: - (5,10,10,25,25,25,25,25,50,50,50) KVArs

## AVC PANEL 01

Free standing panel, to **IP42** suitable for indoor installation, front access, compliant with standards IEC 61439-1 & 2 concerning the construction of Type Tested Assemblies, **Form 3B**, comprising of the following specification.

Type Tested as **Prisma iPM.**

Complete with: -

### Incomer Section.

1 No. 2000A 4P 65kA, Drawout Manual ACB, with micrologic 5.0* (LSI protection) – *Schneider.*

1 No. RYB Phase Presence Indicator Lamps c/w protection fuses. Set

of Power Logic heat detectors – Schneider

Set of Wireless thermal sensors TH110 – Schneider 1

No. Panel server, concentrator Modbus gateway.

**AVC Bypass Section.**

*1* No. 2000A 4P 65kA, Drawout Manual ACB, with micrologic 5.0* (LSI protection) *To AVC – Schneider.*

*2* No. 2000A 4P 65kA, Drawout Motorized ACB, with micrologic 5.0* (LSI protection) *From AVC and AVC Bypass – Schneider.*

### Outgoer Section.

2 No. 2000A 4P 65kA, Drawout Manual ACB, with micrologic 5.0* (LSI protection) – *Schneider.*

2 Nos. Digital Multifunction Meter, Powerlogic PM5320 Complete with protection and CTs –

*Schneider*

## AVC PANEL 02

One Free standing panel, to **IP42** suitable for indoor installation, front access, compliant with standards IEC 61439-1 & 2 concerning the construction of Type Tested Assemblies, **Form 3B**, comprising of the following specification.

Type Tested as **Prisma iPM.**

Complete with: -

**Incomer Section.**

1 No. 2000A 4P 65kA, Drawout Manual ACB, with micrologic 5.0* (LSI protection) – *Schneider.*

2 No. RYB Phase Presence Indicator Lamps c/w protection fuses.

1 Nos. Digital Multifunction Meter, Powerlogic PM5320 Complete with protection and CTs – *Schneider*

Set of Power Logic heat detectors – Schneider

Set of Wireless thermal sensors TH110 – Schneider 1

No. Panel server, concentrator Modbus gateway.

**AVC Bypass Section.**

*1* No. 2000A 4P 65kA, Drawout Manual ACB, with micrologic 5.0* (LSI protection) *To AVC – Schneider.*

*2* No. 2000A 4P 65kA, Drawout Motorized ACB, with micrologic 5.0* (LSI protection) *From AVC and AVC Bypass – Schneider.*

**200Kva UPS Section 1.**

2 No. 630A 4P 36kA, MCCB with Micrologic 5.0* trip unit – *Schneider.*

2 Nos. Direct Rotary Handle for the above MCCBs – *Schneider*

1 No. Mechanical Interlock for the above MCCBs – *Ronis Key – Schneider.*

**Outgoer Section.**

4 No. 630A 4P 36kA, MCCB with Micrologic 5.0* trip unit (*To load*) – *Schneider.* 2 No. 250A 4P 25kA, MCCB with Micrologic 5.0* trip unit (*To load*) – *Schneider.* 3 No. 63A 4P 25kA, MCCB with TMD (*To load*) – *Schneider.*

Section No. 4
PARTICULAR SPECIFICATIONS FOR MAIN POWER EQUIPMENT

**POWER MONITORING**

PME 2023- Connects and displays information from various electrical equipment within the installation.

The configuration under this scope has been considered for:

- All the Power quality and energy meters
- All the Thermal Sensors and Heat tags on the

panel The system is configured to:

- Display real time data on dashboards that are user configurable
- Alarm notifications for events
- Historical Data Collection

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:1** | | | | | |
| | 11KV Ring Main Unit Outdoor type - 2 way | | | | | |
| 1 | Supply of configuration (1no.Incomer 630A CB + 2Nos Outgoing 630A CB) Non-Extensible Manual operating type with CT protection relay(VIP400) without metering unit. Brand as Schneider/ABB or approved Equivalent | No | 1 | | | |
| 2 | High Voltage cable as specified in or approved equivalent standards from RING MAIN RING UNIT to Cast Resin Distribution transformer. Size 95mm sq 3C. | m | 30 | | | |
| 3 | High Voltage cold shrink cable termination as specified or approved equivalent standards. | No | 8 | | | |
| | POWER DISTRIBUTION TRANSFORMER The Contractor shall supply labour and supply, deliver, install, fix, connect, test, label and commission the works, clean, complete and working to every detail as described below and in the related specifications and /or on the drawings to the satisfaction of the Consulting Engineers. NOTE: Kindly Note that all Bidders Will be required to give the Manufacturers Authorization Letter from the Local Supplier. This will be Mandatory in the Evaluation. 1600KVA 11/0.433KV CAST RESIN DISTRIBUTION TRANSFORMERS | | | | | |
| 4 | 1600 kVA, 11/0.415 kV, Cu/Cu, Dry Type Distribution Transformer with Off load Tap Changer without Enclosure (IP00) | No | 2 | | | |
| | Note Earthing provision for above equipment is measured elsewhere in this document | | | | | |
| | LOW VOLTAGE PANELS | | | | | |
| 5 | Main LV Panel 1 | No | 1 | | | |
| 6 | Main LV Panel 2 | No | 1 | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 4** | | | | | |
| | Section No. 4<br>Bill No. 1<br>EXTERNAL POWER ROOM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:2** | | | | | |
| | AUTOMATIC VOLTAGE CONDITIONER | | | | | |
| 1 | AVC ABB Type PCS 100 AVC-40 Automatic voltage conditioner 1000kVA or approved Equivalent | No | 2 | | | |
| | Note Earthing provision for above equipment is measured elsewhere in this document | | | | | |
| | LOW VOLTAGE PANELS | | | | | |
| 2 | AVC Panel 1 | No | 1 | | | |
| 3 | AVC Panel 2 | No | 1 | | | |
| | UPS | | | | | |
| 4 | EQUIPMENT<br>UPS 200 kVA APC/Vertiv/Eaton/ABB or apprved equivalent with 10 mins Backup and VRLA batteries | No | 1 | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 4** | | | | | |
| | Section No. 4<br>Bill No. 2<br>INTERNAL POWER ROOM ON GROUND FLOOR | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:3** | | | | | |
| | **POWER PANELS AS PER IEC 61439-2** | | | | | |
| 1 | **GENERATOR AUXILLIARY BOARD** | | | | | |
| | Supplying, installation, testing and commissioning free standing panel, FTTA (Fully Type Tested Assemblies), modular, extensible, Form 2b separation with internal arc withstand of 85kA for 0.4s , 500V AC, 50HZ, 125A rated busbars, comprising: | | | | | |
| | CABLE ENTRY:- TOP Cable entry type | | | | | |
| | **A. INCOMER** | | | | | |
| | a) 1No. Change Over assemblies of 2No. 125Amps 4P mechanically and electrical interlocked motorised MCCB and associated PLC, with adjustable overcurrent settings, having a short circuit breaking capacity of 25KA at 415Vac, 50Hz. | | | | | |
| | **B. OUTGOERS** | | | | | |
| | a) 1No. 32Amp TPN MCCB | | | | | |
| | b) 2No. 32Amp SPN MCB | No | 2 | | | |
| | c) 5No. 10Amp SPN MCB | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | <u>Floor Distribution Power Boards</u> | | | | | |
| 2 | 24way distribution board complete with Earth stud heavy duty enclosure with removable gland plate and blanking plates Schneider electric Acti 9 Isobar or equivalent and approved from reputable brand. Features include:<br><br>-Busbar Rating at 250A 3P+N with breaking capacity of 25KA.<br>-Incomer breaker at 250A 3P<br>-24 way three phase outgoers | No | 6 | | | |
| 3 | 16way distribution board complete with Earth stud heavy duty enclosure with removable gland plate and blanking plates Schneider electric Acti 9 Isobar or equivalent and approved from reputable brand. Features include:<br><br>-Busbar Rating at 125A 3P+N with breaking capacity of 25KA.<br>-Incomer breaker at 125A 3P<br>-16 way three phase outgoers | No | 12 | | | |
| 4 | 12way distribution board complete with Earth stud heavy duty enclosure with removable gland plate and blanking plates Schneider electric Acti 9 Isobar or equivalent and approved from reputable brand. Features include:<br><br>-Busbar Rating at 125A 3P+N with breaking capacity of 25KA.<br>-Incomer breaker at 80A 3P<br>-16 way three phase outgoers | No | 6 | | | |
| 5 | 12way distribution board complete with Earth stud heavy duty enclosure with removable gland plate and blanking plates Schneider electric Acti 9 Isobar or equivalent and approved from reputable brand. Features include:<br><br>-Busbar Rating at 125A 3P+N<br>-Incomer breaker at 63A 3P<br>-12 way three phase outgoers | No | 12 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Circuit Breakers and other switching devices** | | | | | |
| 6 | 10A SP MCB as Schneider Electric or approved equivalent | No | 336 | | | |
| 7 | 20A SP MCB as Schneider Electric or approved equivalent | No | 582 | | | |
| 8 | 32A SP MCB as Schneider Electric or approved equivalent | No | 504 | | | |
| 9 | 40A SP MCB as Schneider Electric or approved equivalent | No | 72 | | | |
| 10 | 30A TP MCB as Schneider Electric or approved equivalent | No | 12 | | | |
| 11 | 40A TP MCB as Schneider Electric or approved equivalent | No | 6 | | | |
| 12 | 63A TP MCB as Schneider Electric or approved equivalent | No | 12 | | | |
| 13 | 80A TP MCB as Schneider Electric or approved equivalent | No | 6 | | | |
| 14 | 125A TP MCB as Schneider Electric or approved equivalent | No | 6 | | | |
| | **Low Voltage XLPE/PVC/AWS/PVC Cables-LSZH laid on cable ladder in tri-foil and/or firmly tied with cleats in trench** | | | | | |
| | 1Cx630mm² - 3runs per phase and neutral | | | | | |
| 15 | TRANSFORMER 01 to MAIN LV PANEL 01 MAINS BUSBAR SECTION | m | 100 | | | |
| 16 | Cable glands for CU cables above | No | 24 | | | |
| 17 | Cable lugs for CU cables above complete with hydraulic crimping | No | 24 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 18 | TRANSFORMER 02 to MAIN LV PANEL 02 MAINS BUSBAR SECTION | m | 100 | | | |
| 19 | Cable glands for CU cables above | No | 24 | | | |
| 20 | Cable lugs for CU cables above complete with hydraulic crimping | No | 24 | | | |
| | 1Cx630mm² - 1run per phase and neutral | | | | | |
| 21 | GENERATOR SPLIT BOARD 01 to MAIN LV PANEL 01 GENERATOR BUSBAR SECTION | m | 100 | | | |
| 22 | Cable glands for CU cables above | No | 8 | | | |
| 23 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| 24 | GENERATOR SPLIT BOARD 01 to MAIN LV PANEL 02 GENERATOR BUSBAR SECTION | m | 100 | | | |
| 25 | Cable glands for CU cables above | No | 8 | | | |
| 26 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| 27 | GENERATOR SPLIT BOARD 02 to MAIN LV PANEL 02 GENERATOR BUSBAR SECTION | m | 100 | | | |
| 28 | Cable glands for CU cables above | No | 8 | | | |
| 29 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| 30 | GENERATOR SPLIT BOARD 02 to MAIN LV PANEL 01 GENERATOR BUSBAR SECTION | m | 100 | | | |
| 31 | Cable glands for CU cables above | No | 8 | | | |
| 32 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 33 | GENERATOR SPLIT BOARD 03 to MAIN LV PANEL 01 GENERATOR BUSBAR SECTION | m | 100 | | | |
| 34 | Cable glands for CU cables above | No | 8 | | | |
| 35 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| 36 | GENERATOR SPLIT BOARD 03 to MAIN LV PANEL 02 GENERATOR BUSBAR SECTION | m | 100 | | | |
| 37 | Cable glands for CU cables above | No | 8 | | | |
| 38 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| 39 | FROM AVC BYPASS PANEL 02 TO NEW 1000A BUSBAR | m | 400 | | | |
| 40 | Cable glands for CU cables above | No | 16 | | | |
| 41 | Cable lugs for CU cables above complete with hydraulic crimping | No | 16 | | | |
| | 1Cx500mm² - 2 runs per phase and neutral | | | | | |
| | MAIN LV PANEL 01 TO AVC BY-PASS PANEL 01 | m | 120 | | | |
| 42 | | No | 16 | | | |
| 43 | Cable glands for CU cables above | No | 16 | | | |
| 44 | Cable lugs for CU cables above complete with hydraulic crimping | m | 120 | | | |
| 45 | MAIN LV PANEL 02 TO AVC BY-PASS PANEL 02 | No | 16 | | | |
| 46 | Cable glands for CU cables above | No | 16 | | | |
| | Cable lugs for CU cables above complete with hydraulic crimping | m | 240 | | | |
| 47 | AVC 01 TO AVC BY-PASS PANEL 01 AND BACK | No | 64 | | | |
| | Cable glands for CU cables above | | | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 4<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 48 | Cable lugs for CU cables above complete with hydraulic crimping | No | 64 | | | |
| 49 | AVC 02 TO AVC BY-PASS PANEL 02 AND BACK | m | 240 | | | |
| 50 | Cable glands for CU cables above | No | 64 | | | |
| 51 | Cable lugs for CU cables above complete with hydraulic crimping | No | 64 | | | |
| | 1Cx240mm² - 1runs per phase and neutral | | | | | |
| 52 | FROM AVC BYPASS PANEL 01 TO 200KVA UPS INPUT AND OUTPUT BOARD | m | 60 | | | |
| 53 | Cable glands for CU cables above | No | 8 | | | |
| 54 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| 55 | FROM UPS INPUT AND OUTPUT BOARD TO 400A RISER BUSBAR | m | 300 | | | |
| 56 | Cable glands for CU cables above | No | 8 | | | |
| 57 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| 58 | FROM UPS INPUT AND OUTPUT BOARD TO 200KVA UPS AND BACK | m | 120 | | | |
| 59 | Cable glands for CU cables above | No | 16 | | | |
| 60 | Cable lugs for CU cables above complete with hydraulic crimping | No | 16 | | | |
| | **600/1000V XLPE/SWA/PVC Copper cable in shaft, sleeve, trench, on cable tray or on surface, including strapping or clamping, supports etc. and to East African Cable quality.** | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | 4 core 95mm2 | | | | | |
| 61 | FROM SOLAR OUTPUT PANEL TO MAIN LV PANEL 01 & 02 | m | 100 | | | |
| 62 | Cable glands for CU cables above | No | 4 | | | |
| 63 | Cable lugs for CU cables above complete with hydraulic crimping | No | 16 | | | |
| 64 | FROM MAIN LV PANEL 01 & 02 TO SPRINKLER PUMP BOARD | m | 100 | | | |
| 65 | Cable glands for CU cables above | No | 4 | | | |
| 66 | Cable lugs for CU cables above complete with hydraulic crimping | No | 16 | | | |
| | 4 core 35mm2 | | | | | |
| 67 | FROM AVC BY-PASS PANEL 01 TO GENERATOR AUXILIARY BOARD 01 | m | 40 | | | |
| 68 | Cable glands for CU cables above | No | 2 | | | |
| 69 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| 70 | FROM AVC BY-PASS PANEL 01 TO GENERATOR AUXILIARY BOARD 02 | m | 40 | | | |
| 71 | Cable glands for CU cables above | No | 2 | | | |
| 72 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| 73 | FROM AVC BY-PASS PANEL 02 TO GENERATOR AUXILIARY BOARD 01 | m | 40 | | | |
| 74 | Cable glands for CU cables above | No | 2 | | | |
| 75 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 76 | FROM AVC BY-PASS PANEL 02 TO GENERATOR AUXILIARY BOARD 02 | m | 40 | | | |
| 77 | Cable glands for CU cables above | No | 2 | | | |
| 78 | Cable lugs for CU cables above complete with hydraulic crimping | No | 8 | | | |
| | **600/1000V XLPE/LSZH Copper cable in shaft, sleeve, on cable tray or on surface, including strapping or clamping, supports etc. and to East African Cable quality.** | | | | | |
| | 4 core 95mm2 | | | | | |
| 79 | FROM BUSBAR TAP-FF TO 250A FLOOR DISTRIBUTION BOARDS | m | 60 | | | |
| 80 | Cable glands for CU cables above | No | 12 | | | |
| 81 | Cable lugs for CU cables above complete with hydraulic crimping | No | 48 | | | |
| 82 | FROM UPS INPUT/OUT BOARD TO 200KVA UPS | m | 60 | | | |
| 83 | Cable glands for CU cables above | No | 12 | | | |
| 84 | Cable lugs for CU cables above complete with hydraulic crimping | No | 48 | | | |
| | 4 core 35mm2 | | | | | |
| 85 | FROM BUSBAR TAP-FF TO 125A CLEAN POWER FLOOR DISTRIBUTION BOARDS | m | 120 | | | |
| 86 | Cable glands for CU cables above | No | 12 | | | |
| 87 | Cable lugs for CU cables above complete with hydraulic crimping | No | 48 | | | |
| 88 | FROM RAW POWER BOARD TO 125A MECHANICAL LOADS FLOOR DISTRIBUTION BOARDS | m | 60 | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 4<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

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|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 89 | Cable glands for CU cables above | No | 12 | | | |
| 90 | Cable lugs for CU cables above complete with hydraulic crimping | No | 48 | | | |
| | 4 core 25mm2 | | | | | |
| 91 | FROM RAW POWER FLOOR DBs TO RAW POWER FLOOR SUB-MAIN DBs | m | 180 | | | |
| 92 | Cable glands for CU cables | No | 12 | | | |
| | above 4 core 16mm2 | | | | | |
| 93 | FROM MAIN MECHANICAL LOAD FLOOR DBs TO MECHANICAL LOAD FLOOR SUB-BOARDS | m | 180 | | | |
| 94 | Cable glands for CU cables above | No | 12 | | | |
| 95 | FROM MAIN CLEAN POWER FLOOR DBs TO CLEAN POWER FLOOR SUB-MAIN DBs | m | 180 | | | |
| 96 | Cable glands for CU cables above | No | 12 | | | |
| | **600/1000V XLPE/LSZH Green Yellow Copper cable in shaft, sleeve, on cable tray or on surface, including strapping or clamping, supports etc. and to East African Cable quality.** | | | | | |
| 97 | 1C 120mm2 | m | 1,780 | | | |
| 98 | 1C 95mm2 | m | 480 | | | |
| 99 | 1C 25mm2 | m | 60 | | | |
| 100 | 1C 10mm2 | m | 180 | | | |
| 101 | 1C 6mm2 | m | 540 | | | |
| | **Carried Forward to Summary of Section No. 4** | | | KES | | |
| | Section No. 4<br>Bill No. 3<br>LOW VOLTAGE DISTRIBUTION SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:4** | | | | | |
| | **CLEAN POWER BUS-RISER** | | | | | |
| | **Supply,install,test and commission the following vertical rising main busbar system. The product to be as Schneider Canalis/ABB/Eaton/Vertiv or approved equivalent.** | | | | | |
| | **Bidders to note that this busway system will be installed in an electrical duct** | | | | | |
| | Run Components | | | | | |
| 1 | Rated Current 400A and above.<br>Faulty current 50KA for 1sec<br>Permissible temperature rise 40 degrees centigrade Busbar material Aluminium Alloy 6101<br>Derating factor due to material = 1<br>Derating factor due to enclosure =0.75<br>Total de-rating factor=1*0.75*0.86=0.66<br><br>Busbars complete with enclosure and external PE Aluminium tape. | m | 30 | | | |
| | Feed Unit | | | | | |
| 2 | 400A TPN + E Power Feed Unit complete with monitoring. | No | 1 | | | |
| | Fixing System | | | | | |
| 3 | This includes following:<br>• Bottom support<br>• Floor guide<br>• Floor support | | Item | | | |
| | Tap-off Units | | | | | |
| 4 | Tap off box TPN+E 1No. 100A MCCB outgoers complete with monitoring RJ45/RS485 Port | No | 6 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 4<br>RISER BUSBARS SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | End Cap | | | | | |
| 5 | 400A TPN+E End cap for the busbar System. | No | 1 | | | |
| | **RAW POWER BUS-RISER** | | | | | |
| | **Supply,install,test and commission the following vertical rising main busbar system. The product to be as Schneider Canalis/ABB/Eaton/Vertiv or approved equivalent.** | | | | | |
| | **Bidders to note that this busway system will be installed in an electrical duct** | | | | | |
| | Run Components | | | | | |
| 6 | Rated Current 1000A and above.<br>Faulty current 50KA for 1sec<br>Permissible temperature rise 40 degrees centigrade Busbar material Aluminium Alloy 6101<br>Derating factor due to material = 1<br>Derating factor due to enclosure =0.75<br>Total de-rating factor=1*0.75*0.86=0.66 | | | | | |
| | Busbars complete with enclosure and external PE Aluminium tape. | m | 30 | | | |
| | Feed Unit | | | | | |
| 7 | 1000A TPN + E Power Feed Unit complete with monitoring. | No | 1 | | | |
| | Fixing System | | | | | |
| 8 | This includes following:<br>• Bottom support<br>• Floor guide<br>• Floor support | | Item | | | |
| | Tap-off Units | | | | | |
| 9 | Tap off box TPN+E 1No. 250A MCCB outgoers complete with monitoring RJ485 Port | No | 6 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 4<br>RISER BUSBARS SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | <u>End Cap</u> | | | | | |
| 10 | 1000A TPN+E End cap for the busbar System. | No | 1 | | | |
| | **Carried Forward to Summary of Section No. 4** | | | KES | | |
| | Section No. 4<br>Bill No. 4<br>RISER BUSBARS SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:5** | | | | | |
| 1 | **Allow a Provisional Sum of Kenya Shillings Twenty Five Million (25,000,000.00) to be used for special support structures for cable tray and ladder, fire stopping compounds, and water stopping compounds as manufactured by Fischer or Hilti** | | Item | | 25,000,000.00 | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 4** | | | | | |
| | Section No. 4<br>Bill No. 5<br>MECHANICAL SUPPORTS AND WATER SEALS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO: 6** | | | | | |
| | **SMALL POWER AND LIGHTING** | | | | | |
| | **Supply, install, test, commission and set to work the following:-** | | | | | |
| | **WIRING** | | | | | |
| | **Lighting Points** | | | | | |
| 1 | One way Lighting point completely wired with1.5 $mm^2$ Flat Twin with Earth PVC insulated copper cables to East African Cables quality including all accessories but excluding luminaire. | No | 29 | | | |
| 2 | Lighting Switch point completely wired with 1.5 $mm^2$ Flat Twin with Earth PVC insulated copper cables to East African Cables quality including all accessories but excluding the light switch. | No | 5 | | | |
| 3 | Exterior Lighting point completely wired with 2.5 $mm^2$ 3 core PVC/SWA/PVC insulated copper cables to East African Cables quality including all accessories but excluding luminaire. | m | 375 | | | |
| | **Power Points** | | | | | |
| 4 | Wiring for twin 13A switched socket outlet with 3 Core 2.5 $mm^2$ PVC - CU cables to East African Cables quality - radial circuit | No | 14 | | | |
| | **Access Control Points** | | | | | |
| 5 | Wiring for Access Control PSU with 3 x 1.5 $mm^2$ PVC- SC-CU cables to East African Cables quality - radial circuit. | No | 4 | | | |
| | **Mechanical Loads** | | | | | |
| 6 | Wiring for supply fan with 3 x 1.5$mm^2$ PVC insulated copper cables, to East African Cables quality, in a radial configuration; | No | 2 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 6<br>SMALL POWER & LIGHTING SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 7 | Wiring for Split Aircon with 3 x 6.0 mm$^2$ PVC insulated copper cables, to East African Cables quality, in a radial configuration; | No | 4 | | | |
| 8 | 4c x 6 mm2 - 600/1000V 4 core XLPE/SWA/PVC Copper cable in shaft, sleeve, trench, on cable tray or on surface, including strapping or clamping, supports etc. and to East African Cable quality | m | 50 | | | |
| | **FITTINGS** | | | | | |
| | **Light Switches** | | | | | |
| 9 | 10A one gang two way switch as MK or approved equivalent | No | 5 | | | |
| | **Luminaires** | | | | | |
| 10 | IP66, dust and moisture resistant LED luminaire. Class I electrical. 36W cool white 5000k c/w Battery backup and Dimmable DALI LED driver | No | 26 | | | |
| 11 | LED Emergency Exit Light c/w DALI Driver | No | 3 | | | |
| 12 | 100W 12000 lumen LED luminaire with at least 120lm/W and IP66, IK08, 4000K, and at least 50,000h service life, as Schneider Electric Mureva floodlight suitable for security lighting or approved equivalent. | No | 15 | | | |
| 13 | 6m single-arm street lighting round-section tapering column complete with 1.0m bracket with 15 degrees tilt angle manufactured from Class C galvanised steel pipe with and all accessories to meet mounting height requirements. | No | 15 | | | |
| | **Power Point Fittings** | | | | | |
| 14 | Twin 13A switched socket outlet as MK or approved equivalent | No | 14 | | | |
| 15 | 20A DP Switch c/w neon light as MK or approved equivalent | No | 12 | | | |
| | **Carried Forward to Summary of Section No. 4** | | | KES | | |
| | Section No. 4<br>Bill No. 6<br>SMALL POWER & LIGHTING SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:7** | | | | | |
| | **External Lighting** | | | | | |
| 1 | 6m single-arm street lighting round-setion tapering column complete with 1.0m bracket with 15 degrees tilt angle manufactured from Class C galvanised steel pipe with and all accessories to meet mounting height requirements. | No | 36 | | | |
| 2 | 150W 18000 lumen LED luminaire with at least 120lm/W and IP66, IK08, 4000K, and at least 50,000h service life, as Schneider Electric Mureva floodlight suitable for secuirty lighting or approved equivalent. | No | 36 | | | |
| 3 | Post-top LED luminaire, 50W, 2500 lumen, IP66, IK08 as Thorn Avenue D2, mounted on a 4m high galvanised steel pole to approval. | No | 10 | | | |
| 4 | 4m high architectural street lighting column, Class C galvabised steel pipe, complete with all accessories including two lighting points to meet mounting height requirements, to the architect's approval. | No | 10 | | | |
| 5 | 200mm x 200mm Direct Burial Junction Box IP68 rating, Plastic Enclosure with stainless steel screws, 4 x 50MM Knockouts | No | 46 | | | |
| 6 | Weatherproof, vandal-protected feeder pillar kiosk complete with 32A TPN+E copper busbars, Photocell switch in the feeder pillar complete with contactor and wiring, MCBs, 25A 24-hour Mechanical Timer Switch CurrentRating - 16Amps/Mounting Type-Din rail/ Suitable for street lights, time-controlled electrical systems/ high end control chip for accurate timing, stable and reliable/ Long service life, electrical 10 ⁴5 times, mechanical 10 ⁴7 times.<br>Feeder pillar to have a hinged lockable door and meter viewing window, powder coated to approved shade. | No | 5 | | | |
| 7 | 2 core 4.0mm2 XLPE/SWA/PVC Cu cable for light wiring | m | 720 | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 4**<br>Section No. 4<br>Bill No. 7<br>EXTERNAL LIGHTING | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:8** | | | | | |
| | **Conduiting** | | | | | |
| 1 | Conduiting for Lighting points in 25 mm dia H/G PVC conduits. | No | 34 | | | |
| 2 | Conduiting for power points in 25 mm dia H/G PVC conduits. | No | 14 | | | |
| 3 | Conduiting for access control points in 25 mm dia H/G PVC conduits to back boxes to receive fire alarm wall-mount devices. | No | 28 | | | |
| 4 | Conduiting for points in 25 mm dia GI conduits. | No | 74 | | | |
| 5 | 50mm uPVC duct pipe c/w all necessary fittings to form a complete pathway and burried in ground with concrete surround for external lighting power cables | m | 375 | | | |
| | **Wall - Trunking** | | | | | |
| 6 | 200mm x 50mm powder-coated Steel trunking with two compartments for power and data. The accessories needed to complete the installation to be included. These include flat 90 degree corners, flat tees, flat crosses, divider to provide two chambers, screws and nuts, End caps, branch connection elements, straight joints, adjustable joint accessories and wall brackets. Colour as per Clients requirements. | m | 190 | | | |
| 7 | Ditto but twin socket knock-outs | No | 14 | | | |
| | Power way cable ladder 3mm thick as per specification | | | | | |
| 8 | Cable Ladder of dimension 600 mm x100 mm | m | 291 | | | |
| | Cable ladders Accessories 3mm thick Including Tees, Bends and Cross as per specification | | | | | |
| 9 | Ladder Horizontal Bend Standard 600mm x 100mm | No | 20 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 4<br>Bill No. 8<br>CONTAINMENT<br>SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 10 | Ladder Horizontal Tee Standard 600mm x 100mm- 600mm x 100mm | No | 9 | | | |
| 11 | Ladder Horizontal Cross Standard 600mm x 100mm- 600mm x 100mm | No | 2 | | | |
| 12 | Ladder Vertical Inside Bend Standard 600mm x 100mm | No | 5 | | | |
| 13 | Ladder Vertical Outside Bend Standard 600mm x 100mm | No | 7 | | | |
| | 2mm thick Cable trays for CCTV and Access Control cables as per specification | | | | | |
| | **Cable Trays c/w fittings such as bends, tees, etc** | | | | | |
| | Power Tray | | | | | |
| 14 | 200 mm x50 mm deep perforated cable tray made of hot-dipped galvanized metal and powder coated to preferred color c/w all angle bends, Tees and end caps to detail and to approval. Includes equipotential bonding. | m | 220 | | | |
| | ELV Tray | | | | | |
| 15 | 200 mm x50 mm deep perforated cable tray made of hot-dipped galvanized metal and powder coated to preferred color c/w all angle bends, Tees and end caps to detail and to approval. Includes equipotential bonding. | m | 220 | | | |
| | Aircon Tray | | | | | |
| 16 | 200X100mm deep solid-bottom cable tray made of hot-dipped galvanized metal and powder coated to preferred colour c/w all angle bends, Tees and end caps to detail and to approval. Includes equipotential bonding. | m | 60 | | | |
| | **Carried Forward to Summary of Section No. 4** | | | KES | | |
| | Section No. 4<br>Bill No. 8<br>CONTAINMENT<br>SYSTEM | | | | | |

| Bill No | SECTION SUMMARY - ELECTRICAL AND ASSOCIATED WORKS | Page No | | Amount | |
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| 1 | EXTERNAL POWER ROOM | 39 | | | |
| 2 | INTERNAL POWER ROOM ON GROUND FLOOR | 40 | | | |
| 3 | LOW VOLTAGE DISTRIBUTION SYSTEM | 49 | | | |
| 4 | RISER BUSBARS SYSTEM | 52 | | | |
| 5 | MECHANICAL SUPPORTS AND WATER SEALS | 53 | | | |
| 6 | SMALL POWER & LIGHTING SYSTEM | 55 | | | |
| 7 | EXTERNAL LIGHTING | 56 | | | |
| 8 | CONTAINMENT SYSTEM | 58 | | | |
| | **Carried to Final Summary** | | KES | | |
| | Section No. 4 | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION** | | | | | |
| | **NO:5 BILL** | | | | | |
| | **NO:1** | | | | | |
| | Grid tie PV Solar System with a **net output of 83** kW peak as specified in section or an approved equivalent with less than 3% variance on the expected net output. | | | | | |
| 1 | Bidders to note that the panels will be roof mounted on a parking lot at ground level and the inverter and other accessories located in power room 1. | | Item | | | |
| 2 | Photovoltaic Array system | | Item | | | |
| 3 | Inverter | | Item | | | |
| 4 | AC surge | | Item | | | |
| 5 | protection DC | | | | | |
| | surge protection | | Item | | | |
| 6 | Data Manager or reliable monitoring, control and grid-compliant output regulation. | | Item | | | |
| 7 | Complete with associated communication | m | 200 | | | |
| 8 | cabling. Grid Analyser | m | 80 | | | |
| 9 | DC Cabling. | | Item | | | |
| | AC Cabling. | | | | | |
| | DC Disconnector | | | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 5** | | | | | |
| | Section No. 5<br>Bill No. 1<br>CAR PARK INSTALLATIONS | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:2** | | | | | |
| | **PV Modules** | | | | | |
| 1 | **Photovoltaic modules**<br><br>Monocrystalline Solar Module-Solar (Tier 1 Supplier).The array panels will be rated at 615w or above. | No | 225 | | | |
| 2 | Connect 1No. Optimizers rated between 40-60w per every 2No. panels in the string. Ensure that the optimizers are compatible with the voltage and current specifications of the solar panel. | No | 113 | | | |
| | **Inverter** | | | | | |
| 3 | High yield Inverter 30kW Inverter/ Similar ( Max 40kWp DC ) max efficiency 98.7%, compatble with bifacial module and built-in PID recovery function. Input voltage 1100V DC and 415V ac. | No | 6 | | | |
| 4 | **Single-core heavy-duty cross-linked insulated and sheathed flexible (LSHF) DC cables**<br><br>Solar DC cable 6mm² | m | 450 | | | |
| 5 | **Connectors**<br><br>Solar cable MC4 connector | No | 300 | | | |
| 6 | **FIXED STATIC TILT RAILS (Module mounting)**<br><br>FPR Fixed panel Racking System made of galvanized steel to secure the solar panel on the roof structure complete with stands to hold the panels at acceptable tilt angle complete with mounting accessories | | Item | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 2<br>ROOF TOP INSTALLATIONS | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Solar Module Bird spikes** | | | | | |
| 7 | Install bird spike to prevent birds from perching or nesting on the solar modules especially at the highest point of the array/module structure | | | SUM | | |
| | **System Protection** | | | | | |
| 8 | Early streamer Emission Lightning Protection System | | Item | | | |
| 9 | Surge protection Devices (SPDs) 40KA to protect the solar panels to be installed in the junction box to protect panels and other electrical components from voltage spikes cause by lightning or switching operations. | | Item | | | |
| | **Cable containment** | | | | | |
| 10 | PVC conduits 20mm | m | 700 | | | |
| | **Battery Package** | | | | | |
| 11 | External Outdoor rated, metallic powdercoated , Solar Battery enclosure c/w battery of capacity of atleast 40kWh | | Item | | | |
| | **Multi-core heavy-duty cross-linked insulated and sheathed flexible (LSHF) DC cables** | | | | | |
| 12 | 2 Core 35mm² copper cable | m | 100 | | | |
| | **Controls** | | | | | |
| 13 | Combiner Box shall have 6No. 25A 2pole breakers and outgoing 3No. 125A 2pole breakers at 1100V DC.<br><br>Enclosure:<br>- Weather-proof and dust-proof (IP54 rating)<br>- Suitable for indoor installation | No | 2 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 5<br>Bill No. 2<br>ROOF TOP INSTALLATIONS | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Earthing** | | | | | |
| 14 | Cabling, Earthing/Grounding Strip,Cable Tray, Connectors & Accessories | | Item | | | |
| 15 | Allow for 40KA DC surge arrestors for the PV Modules | | Item | | | |
| | **DC Package** | | | | | |
| 16 | Cabling, Earthing Strip,Cable Tray, Connectors & Accessories | | Item | | | |
| | **STR (Module mounting** | | | | | |
| 17 | Steel Structure, Clamps angles and Clips accessories for mounting the solar panels on the main building rooftop. | | Item | | | |
| | **Module Cleaning** | | | | | |
| 18 | Module Cleaning System - water points on the roof for 144 modules | | Item | | | |
| | **Access** | | | | | |
| 19 | Structure Access and Safety support- roof access, walk ways and associated corrective protective equipment | | Item | | | |
| | **Metering** | | | | | |
| 20 | CT, PT, Check and Main meter with enclosure and provision to connect to solar, grid and generator | | Item | | | |
| 21 | **Trunking and cable trays**<br>Trunkin and cable trays | | Item | | | |
| 22 | **Design, Studies and audits**<br>Roof structural audits, preliminaries, Designs and Calculations. | | Item | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 5<br>Bill No. 2<br>ROOF TOP INSTALLATIONS | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Monitoring** | | | | | |
| 23 | Allow for full system on site and off site monitoring and production and display screen at power room for the entire solar plant system | | Item | | | |
| | **Installation** | | | | | |
| 24 | Labour Charges | | Item | | | |
| | **Carried Forward to Summary of Section No. 5** | | | KES | | |
| | Section No. 5<br>Bill No. 2<br>ROOF TOP INSTALLATIONS | | | | | |

| Bill No | SECTION SUMMARY - PV SOLAR SYSTEM | Page No | | Amount | |
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| 2 | ROOF TOP INSTALLATIONS | 64 | | | |
| | **Carried to Final Summary** | | KES | | |
| | Section No. 5 | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO :** | | | | | |
| | **6 BILL NO:1** | | | | | |
| | **Bidders to note that the design is based on Appliance Technologies Lightning and Earthing Solution(at3w). Equal and Approved offers will be accepted for as long as its expressly approved by the engineer.** | | | | | |
| | **EXTERNAL ACCESSORIES** | | | | | |
| 1 | 250x250x250mm polypropylene earth | No | 20 | | | |
| 2 | pit 235x40x25mm bonding bar for earth | No | 10 | | | |
| 3 | pit 30 x 3 mm copper coated steel | m | 550 | | | |
| 4 | tape (m) | No | 20 | | | |
| 5 | ø28mmx2mAPLIROD®dynamic electrod+AT-020F | No | 15 | | | |
| 6 | Earth bar 6way, M10+2 disconnect. links | No | 40 | | | |
| 7 | 50mm² M10 tin-platedCu compres terminal | m | 400 | | | |
| 8 | 50mm² PVC insulated stranded Cu | No | 25 | | | |
| 9 | cable(m) M8 double thread self-drilling | No | 200 | | | |
| 10 | screw | No | 150 | | | |
| | 16mm2 PVC insulated stranded Cu | | | | | |
| 11 | cable Cu-Sn 16mm2 M10 | No | 2 | | | |
| 12 | **WELDING MATERIAL** | No | 2 | | | |
| 13 | Straight tape to tape vertical mould T | No | 2 | | | |
| 14 | shape cable/cable mould | No | 2 | | | |
| | T shape cable/tape mould | | | | | |
| | Lineal cable/cable mould | | | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 6<br>Bill No. 1<br>MAIN EARTHING SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 15 | Apliweld-T: 20 units welding | No | 10 | | | |
| 16 | tablets Model S clamp for | No | 2 | | | |
| 17 | specific moulds Ignition unit kit | No | 1 | | | |
| 18 | V3 | No | 10 | | | |
| 19 | Apliweld-E:Electronic | No | 2 | | | |
| | starter(10ud) Basic tool set | | | | | |
| 20 | Apliweld-E | No | 25 | | | |
| 21 | **ACCESSORIES** | No | 25 | | | |
| 22 | Plane washer M8 stainless steel DIN125 | m | 40 | | | |
| | Tuerca M8 inox DIN 934 | | | | | |
| | Tubing D13mm Green/Yellow (m) | | | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 6** | | | | | |
| | Section No. 6<br>Bill No. 1<br>MAIN EARTHING SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:2** | | | | | |
| | **Bidders to note that the design is based on Appliance Technologies Lightning and Earthing Solution(at3w). Equal and Approved offers will be accepted for as long as its expressly approved by the engineer.** | | | | | |
| | **AIR TERMINALS** | | | | | |
| 1 | DAT CONTROLER® REMOTE 30 | No | 1 | | | |
| | **ACCESSORIES** | | | | | |
| 2 | Brass adap.pieceM20, 1½"mast p cab/tape | No | 1 | | | |
| 3 | ø1½" x 6m galv. steel mast (3 sect) | No | 1 | | | |
| 4 | 30cm light anchorage (2support to screw) | No | 1 | | | |
| 5 | 30x2mm tinned copper tape (m) | m | 125 | | | |
| 6 | St.S buckle clip for tape to wall | No | 142 | | | |
| 7 | 2m Gv.S guard tube for tape | No | 2 | | | |
| 8 | 250x250x250mm polypropylene earth | No | 4 | | | |
| 9 | pit 235x40x25mm bonding bar for earth | No | 2 | | | |
| 10 | pit ø5/8"x2m thrd 254µ Cu-bond earth | No | 6 | | | |
| 11 | rod Naval brass clamp for cable/tape | No | 6 | | | |
| 12 | + rod CONDUCTIVER PLUS (Gel) | No | 2 | | | |
| 13 | Naval brass tape and cable square clamp | No | 2 | | | |
| 14 | 5/8" copper alloy threaded coupling | No | 1 | | | |
| 15 | 5/8" St.S threaded driving stud | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 6<br>Bill No. 2<br>LIGHTENING AND SURGE PROTECTION SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **SMART SOLUTIONS** | | | | | |
| 16 | SMART LIGHTNING LOGGER | No | 1 | | | |
| | **Bidders to note that the design is based on Appliance Technologies Lightning and Earthing Solution(at3w). Equal and Approved offers will be accepted for as long as its expressly approved by the engineer.** | | | | | |
| | **SURGE PROTECTION** | | | | | |
| 17 | ATSHOCK T 25 TNS: 4 ATSHOCK 25 | No | 2 | | | |
| 18 | Circuit breaker 3P+N 100A + Auxiliar | No | 6 | | | |
| 19 | Con ATSUB-4P 65 | No | 2 | | | |
| 20 | TNS.Imax=65kA.Up=900V | No | 2 | | | |
| 21 | ATSUB-4P 40 TNS.Imax=40kA.Up=700V | No | 2 | | | |
| 22 | SURGE LOGGER | No | 2 | | | |
| 23 | Power Supply Tester | No | 7 | | | |
| 24 | Fuse holder 3+N | No | 2 | | | |
| 25 | 14x51 Fuse 50A gG | No | 50 | | | |
| 26 | 14x51 Fuse holder | No | 4 | | | |
| 27 | 3+N 22x58 Fuse 80A | No | 4 | | | |
| | gG 22x58 | | | | | |
| | ATCOVER 230M. Imax=30kA. Up=900V.2P | | | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 6** | | | | | |
| | Section No. 6<br>Bill No. 2<br>LIGHTENING AND SURGE PROTECTION SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:3** | | | | | |
| | **Bidders to note that the design is based on Appliance Technologies Lightning and Earthing Solution(at3w). Equal and Approved offers will be accepted for as long as its expressly approved by the engineer.** | | | | | |
| 1 | SMART SYSTEM FOR CENTRALISED MONITORING OF EARTHING SYSTEMS: | | | | | |
| | 1.EXTERNAL POWER ROOM GROUND FLOOR A&B) | No | 2 | | | |
| 2 | SMART SYSTEM FOR CENTRALISED MONITORING OF EARTHING SYSTEMS | | | | | |
| | GENERATOR ROOM<br>1. MEB - MAIN EARTH BAR 1 | | | | | |
| | AVC ROOM 1A<br>2. MEB - MAIN EARTH BAR 2 | | | | | |
| | AVC ROOM 1B<br>3. MEB - MAIN EARTH BAR 3 | | | | | |
| | AVC ROOM 2A<br>4. MEB - MAIN EARTH BAR 4 | | | | | |
| | AVC ROOM 2B<br>5. MEB - MAIN EARTH BAR 5 | | | | | |
| | DATA CENTER UPS ROOM FIRST FLOOR | | | | | |
| | 6. MEB - MAIN EARTH BAR 6 | | | | | |
| | TELCO ROOM SECOND FLOOR<br>7. MEB - MAIN EARTH BAR 7 | | | | | |
| | 8. MEB - MAIN EARTH BAR 8 | No | 20 | | | |
| | **Carried Forward to Summary of Section No. 6** | | | KES | | |
| | Section No. 6<br>Bill No. 3<br>SMART EARTHING CENTRALIZED MONITORING SYSTEM | | | | | |

**Bill No**

**SECTION SUMMARY - EARTHING, LIGHTENING AND SURGE PROTECTION STSTE**

| | | Page No | Amount |
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| 1 | MAIN EARTHING SYSTEM | 67 | |
| 2 | LIGHTENING AND SURGE PROTECTION SYSTEM | 69 | |
| 3 | SMART EARTHING CENTRALIZED MONITORING SYSTEM | 70 | |

**Carried to Final Summary** KES

Section No. 6

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO : 7** | | | | | |
| | **BILL NO:1** | | | | | |
| | **Access Control System** | | | | | |
| | **Door Devices** | | | | | |
| 1 | IP65 rated IP-Based Fingerprint + Card reader with the following features:<br>• Operation : Stand-alone and distributed system<br>• Fingerprint sensor : 500 dpi optical sensor<br>• Identification speed: 2,000 match in 1 second<br>• Fingerprint capacity: 10,000 templates (5,000 users)<br>• Log capacity: 50,000 events<br>• RF card : Proximity (125kHz EM), Mifare, Iclass (13.56MHz)<br>• Operation modes: Fingerprint, RF card, RF card + fingerprint<br>• Network interface: TCP/IP, RS485 (OSDP capable)<br>• Wiegand output: Configurable up to 64 bits<br>• TTL I/O : 2 inputs for exit switch and door sensor<br>• Internal relay: Deadbolt,EM lock,door strike,automatic door<br>• Sound and interface: Multi-color LED and multi- tone buzzer | No | 4 | | | |
| 2 | Contactless Smart Card Reader with the following features :<br>• Typical reading range: iCLASS Seos: 2.4" (6 cm), iCLASS: 3.6" (9 cm),MIFARE Classic: 2.4" (6 cm) MIFARE DESFire EV1/EV2: 2.4" (6 cm)<br>• Communications: Wiegand, Clock-and-Data, Open Supervised Device Protocol (OSPD) via RS485<br>• UL - Certified<br>• IP65 Rated | No | 4 | | | |
| 3 | Door Electro-Magnetic Lock (7kN) c/w door position contact | No | 8 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 7<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 4 | Magnetic Door Contact for Emergency Exit Doors' Status | No | 8 | | | |
| 5 | Indoor Local Door Alarm Sounder and Strobe | No | 4 | | | |
| 6 | Outdoor Local Door Alarm Sounder and Strobe | No | 4 | | | |
| | **Credential Devices** | | | | | |
| 7 | Digital Camera for Portrait photos, features include:<br><br>Resolution: 1920 x 1080<br>Max. Auto-focus Lens<br>Host Interface: USB<br>Supports Computer and monitor | No | 1 | | | |
| 8 | Smart Contactless Card as per the following specifications:<br><br>1. Description:iClass SEOS Contactless Smart Card, 8KB Memory Composite Card Body<br>2. Operating frequency: 13.56MHz<br>3.Proximity read range: Up to 100 mm.<br>4. Physical characteristics to BS ISO/IEC 14443-1. | | Item | | | |
| 9 | Dual-Side Card printer with the following specifications:<br><br>• Sided Printing: Single or Dual<br>• Print Method: HDP Dye-Sublimation / Resin Thermal Transfer<br>• Resolution: 300 dpi<br>• Print Speed: up to 24 seconds per card / 150 cards per hour (YMC with transfer)<br>• Accepted Card Sizes: CR-80<br>• Warranty: 3 years printer | No | 1 | | | |
| 10 | Fingerprint enrollment reader | No | 1 | | | |
| 11 | Full Colour ribbon 750 images (Single Side) | No | 1 | | | |
| 12 | Film, approximately 1500 images (Single side) | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 7<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Acces Control System configuration** | | | | | |
| 13 | Programming and Configuration of all Alarms and Integration, e.g. Doors, Fire Escapes, etc. | | | SUM | | |
| | **Network & Cabling** | | | | | |
| | **Network Infrastructure** | | | | | |
| | Network Switch | | | | | |
| 14 | 12 port PoE+ Managed Network Switch as Cisco or approved equivalent and with the following features:<br>• 12 Port PoE+<br>• Dual Power Supply<br>• Atleast 2No. 10Gbe Uplinks IP Base (2 SFP+ Ports)<br>• Including all rack mount brackets,<br>• Stacking cables included | No | 4 | | | |
| 15 | Cisco 10GB SFP+ Module - Multi-Mode Fibre Optic for uplink ports | No | 4 | | | |
| 16 | Cisco DNA Advantage license for the above switch<br>- 5 years | No | 2 | | | |
| | Passive Devices | | | | | |
| 17 | 12U x 500m deep, 600mm wide Swing frame Cabinet,<br>Black Powder Coated, complete with all power and cable articulation, curved perforated front and back doors, Brush Cable Top and Bottom Entry, removable side panels | No | 2 | | | |
| 18 | 6 way IEC C13 Basic metal PDU, 19" rack mountable | No | 4 | | | |
| 19 | 1U Cable Managers | No | 8 | | | |
| 20 | 1U CAT6A Patch Panel as Siemons/Panduit or approved equivalent | No | 4 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 7<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 21 | 12 port duplex Multi-mode Fibre patch panel c/w duplex LC-LC connectors and Fiber Splicing Tray. Include all accessories to form a complete unit | No | 2 | | | |
| | <u>Cabling and other accessories</u> | | | | | |
| 22 | Fibre Patch Cords - Multi-mode - 2 meter - Duplex LC Connectors | No | 12 | | | |
| 23 | 4 Core, OM4 Multi-Mode, tight buffered fibre cabling for installation in sleeves and on cable trays | m | 500 | | | |
| 24 | | No | 32 | | | |
| 25 | 1 core OM4 LC Fibre Pigtail - | No | 32 | | | |
| 26 | 1.5m Fibre Splicing, Incl ODTR | No | 4 | | | |
| 27 | testing CAT6-RJ45 Shielded | m | 360 | | | |
| 28 | Connector | No | 4 | | | |
| 29 | CAT6A-S/FTP LSZH Network cable - Grey (For ACS) CAT6-S/FTP Data Patch Lead - 1m - Grey | m | 20 | | | |
| 30 | (For ACS) | m | 80 | | | |
| 31 | 4 core LSHF shielded communication cable (Door Devices) | No | 4 | | | |
| 32 | 8 core LSHF shielded communication cable (Door Devices) | m | 8 | | | |
| 33 | Enclosure with 2.0A PSU and 7 AMP/HR. Battery | | | SUM | | |
| | 25mm dia. PVC Flex Condui | | | | | |
| | **<u>Labelling of devices</u>** | | | | | |
| | Labelling of devices | | | | | |
| | **Carried to Final Summary** | | | KES | | |
| | Section No. 7<br>Bill No. 1<br>INTERGRATED CCTV AND ACCESS CONTROL SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO :** | | | | | |
| | **8 BILL NO:1** | | | | | |
| | **VRF External Power Room System** | | | | | |
| | **Condensing unit** | | | | | |
| 1 | Supply and install of Condensing units. Units to be as Daiikin/Toshiba or approved equivalent | | | | | |
| | a) 50 KW Nominal Cooling/Heating Capacity | No | 1 | | | |
| 2 | Electrical connection from isolator to unit | | | SUM | | |
| 3 | Commissioning and balancing of unit | | | SUM | | |
| 4 | Anti-vibration mountins on unit | | | SUM | | |
| 5 | Condensate drain connection of unit | | | SUM | | |
| 6 | Hail guards on unit | | | SUM | | |
| 7 | Wiring from central controller to all indoor and outdoor units, complete in trays or galvanised steel conduit | | | SUM | | |
| 8 | Supply and programming of the VRF Central Controller | | | SUM | | |
| | **Copper Refrigerant Piping (incl. support, insulation, painted, labels, etc.) Actual lengths to be confirmed after OEM system selection** | | | | | |
| 9 | ø22 Straight Piping | m | 40 | | | |
| 10 | ø28 Straight Piping | m | 20 | | | |
| | Extra Over Copper Refrigerant Pipe Fittings (incl. support, insulation, painted, labels, etc.) | | | | | |
| 11 | ø22-ø10 Reducer | No | 5 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 1<br>EXTERNAL POWER ROOM VRF SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 12 | ø28-ø10 | No | 5 | | | |
| 13 | Reducer ø28- | No | 5 | | | |
| 14 | ø15 Reducer | No | 5 | | | |
| 15 | ø22 Bend | No | 5 | | | |
| | ø28 Bend | | | | | |
| 16 | **Supply of VRF Split type Room Air Conditioning Units, incl. tie-in to closest condensate line** | No | 3 | | | |
| 17 | | No | 3 | | | |
| | Ductable indoor unit Airflow 16 kw cooling load | | | | | |
| 18 | | No | 3 | | | |
| | Wired remote controllers | | | | | |
| 19 | | No | 3 | | | |
| | Final fix electrical connection from closest isolator | | | | | |
| | Final fix condensate connection | | | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 8** | | | | | |
| | Section No. 8<br>Bill No. 1<br>EXTERNAL POWER ROOM VRF SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:2** | | | | | |
| | **Ductwork for entire system** | | | | | |
| 1 | Galvanized sheet steel ductwork inclusive of all joints, bends, bracing, gaskets, supports, stiffeners, turning vanes, splitters, vapor seals, access hatches at every 3000mm and change of direction and any other equipment for completion.<br>Material Thickness 1.0 mm | m2 | 40 | | | |
| | **Fresh Air Fan** | | | | | |
| 2 | Systemair as 'K 250 EC Sileo or approved equivalent complete with accessories as part Particular Specifications | No | 3 | | | |
| | **Extract Fans** | | | | | |
| 3 | Systemair as 'K 250 EC Sileo or approved equivalent complete with accessories as part Particular Specifications | No | 3 | | | |
| | **Air Terminal Devices for above system** | | | | | |
| 4 | Exhaust Ventilation Grilles, made of Aluminium, with individually adjustable, horizontal blades<br>• **Nominal sizes 125 mm Dia (4 No.)**<br>• Volume flow rate range **to be confirmed after sizing calculations.**<br>• Grille face made of aluminiumwith powder- coat finish<br>• Front border 32 mm<br>• Concealed fixing or countersunk holes<br>• Installation subframe<br>• Attachments for volume flow rate balancing and air direction control<br>• Concealed fixing or countersunk holes<br>• Double-layer Louver | No | 3 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 2<br>MECHANICAL VENTILATION SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 5 | Supply Ventilation Grilles, made of Aluminium, with individually adjustable, horizontal blades<br><br>• **Nominal sizes 100 mm Dia (4 No.),125 mm**<br>• Volume flow rate range **to be confirmed after sizing calculations.**<br>• Grille face made of aluminium with powder- coat finish<br>• Front border 32 mm<br>• Concealed fixing or countersunk holes<br>• Installation subframe<br>• Attachments for volume flow rate balancing and air direction control<br>• Concealed fixing or countersunk holes<br>• Double-layer Louver | No | 3 | | | |
| 6 | Return Ventilation Grilles, made of Aluminium, with individually adjustable, horizontal blades<br><br>• **Nominal sizes 125 mm Dia (4No..) , 100 mm**<br>• Volume flow rate range **to be confirmed after sizing calculations.**<br>• Grille face made of aluminium with powder- coat finish<br>• Front border 32 mm<br>• Concealed fixing or countersunk holes<br>• Installation subframe<br>• Attachments for volume flow rate balancing and air direction control<br>• Concealed fixing or countersunk holes<br>• Double-layer Louver | No | 3 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 8<br>Bill No. 2<br>MECHANICAL VENTILATION SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Fire Damper for Above System** | | | | | |
| 7 | Supply and Install fire dampers.<br><br>Diameter 160 mm<br><br>**Characteristics**<br>– Classified according to EN 13501-3<br>– Airflow in either direction<br>– Release temperature 72 °C<br><br>**Construction features**<br>– Two casing lengths to allow for various uses<br>– Rectangular construction, rigid frame<br>– Flanges with pre-drilled holes on both ends<br>– Intermediate dimensions in 5 mm increments for both width and height are available<br>– Closed blade air leakage according to EN 1751, minimum class 2<br>– Casing air leakage to EN 1751, minimum class B | No | 20 | | | |
| | **Carried Forward to Summary of Section No. 8** | | | KES | | |
| | Section No. 8<br>Bill No. 2<br>MECHANICAL VENTILATION SYSTEM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:3** | | | | | |
| | Installations of the following Precision Air-conditioning indoor system as per specification document | | | | | |
| 1 | **Perimeter Precision Split as per specification document. (Stulz/Vertiv/Rittal or approved equivalent)** | | | | | |
| | **Distance between indoor and Outdoor unit is approximately 25 Meters** | No | 3 | | | |
| | **Carried Forward to Summary of Section No. 8** | | | KES | | |
| | Section No. 8<br>Bill No. 3<br>POWER ROOM PRECISION AIR-CONDITIONING UNITS | | | | | |

**SECTION SUMMARY - AIR-CONDITIONING SYSTEM**

| Bill No | | Page No | | Amount | |
|---|---|---|---|---|---|
| 1 | EXTERNAL POWER ROOM VRF SYSTEM | 77 | | | |
| 2 | MECHANICAL VENTILATION SYSTEM | 80 | | | |
| 3 | POWER ROOM PRECISION AIR-CONDITIONING UNITS | 81 | | | |
| | **Carried to Final Summary** | | KES | | |
| | Section No. 8 | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION NO :** | | | | | |
| | **9 BILL NO:1** | | | | | |
| | **Fire Gas(Inergen) Suppression System** | | | | | |
| | ***Design and build Fire Gas Suppression system as per particular specifications for mechanical installations*** | | | | | |
| 1 | Submittals fire gas suppression performance specification and hydraulic calculations | | | SUM | | |
| | **Fire Gas (Inergen) Suppression System** | | | | | |
| | Supply, install, test and commission the following IG541 fire suppression system for White space | | | | | |
| | **(This section should be read with Technical specifications of this document where particular specifications for the system are found)** | | | | | |
| 2 | Container Assembly (UL Listed) with IG541 Agent by Manufacturer.**67.5 L CYLINDERS 1 No. fully charged with 70 kg agent** | No | 1 | | | |
| 3 | Container Label | No | 1 | | | |
| 4 | Container Bracket (Strap Type) | No | 1 | | | |
| 5 | Discharge Hose 50mm | No | 1 | | | |
| 6 | Actuation mechanism per system - UL Listed | No | 1 | | | |
| 7 | Manifold for the system complete with lockout, time delay, safety and vent devices | No | 1 | | | |
| 8 | **Fire Suppression system control equipment, UL Listed and conforming to EN54 and NFPA standards**<br>addressable extinguishing control panel | No | 1 | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 9<br>Bill No. 1<br>FIRE SUPPRESSION SYSTEM - KENYA POWER ROOM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 9 | Intelligent Addressable Photoelectric Smoke Detector, White Color, 360 Degrees Viewing LED and Soft Addressing c/w Sounder Base and remote monitoring led output | No | 5 | | | |
| 10 | Intelligent Addressable Fixed Temperature Thermal Detector, Detection: 57 Deg.C, White Color, 360 Degrees Viewing LED and Soft Addressing w/ Standard Base | No | 1 | | | |
| 11 | Manual Release | No | 1 | | | |
| 12 | Monitor Module for above | No | 1 | | | |
| 13 | Sounder-beacon, multi tone, shallow base | No | 2 | | | |
| 14 | Control Module for above | No | 2 | | | |
| 15 | Abort Switch | No | 1 | | | |
| 16 | Monitor Module for | No | 1 | | | |
| 17 | above Maintenance | No | 1 | | | |
| 18 | Switch Monitor Module | No | 1 | | | |
| 19 | for above<br><br>Low smoke, 0 halogen, 1.5mm$^2$ 2 core fire-proof/ flame proof cables and all necessary cabling for all smoke detctors, firm alarm panel and sounders as delta firetuff complete with flame-resistant terminations, and accessories. The cables to be capable of withstanding heavy flames for minimum 3 hours. | m | 150 | | | |
| 20 | **(The tenderers to include for flame testing of the cables for at least 30 minutes)** | No | 1 | | | |
| 21 | 24V 2A Power supply module comple with Battery and Accesories | No | 1 | | | |
| 22 | Warning Sign Inside Warning sign outside | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 9<br>Bill No. 1<br>FIRE SUPPRESSION SYSTEM - KENYA POWER ROOM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 23 | UL Listed Fire | No | 1 | | | |
| 24 | Damper Room | | Item | | | |
| | integrity test | | | | | |
| | **Pipework (Provisional Subject to Hydraulic Calculations)** | | | | | |
| | Supply and fix seamless black Steel pipes SCH 40 conforming to ASTM A-53A ERW or ASTM A-106 A. All piping shall comply with NFPA 2001. | | | | | |
| | Fittings beyond Orifice union/nipple shall be, 300lb class fittings conforming to ANSI B-16.3. Ordinary cast iron fittings shall not be used. Piping shall be bracketed within 12" (0.3m.) of all discharge nozzles. | | | | | |
| | Tenderers must allow in their pipework prices for all the couplings, unions, sockets, nipples, tees, caps, connectors, joints, anchoring, support brackets etc in running lengths of pipes and also where necessary for fixing clips, holderbats, | | | | | |
| 25 | plugged and screwed. | m | 15 | | | |
| 26 | 30mm diameter seamless black Steel pipe as SCH 40 | m | 5 | | | |
| 27 | 20mm diameter seamless black Steel pipe as SCH 40 | No | 2 | | | |
| 28 | 20mm diameter elbow 30mm | No | 1 | | | |
| 29 | diameter elbow 30mm | No | 1 | | | |
| | diameter equal tee | | | | | |
| 30 | **360 Degree Nozzle - Acoustic Type** | No | 2 | | | |
| | 20mm Brass Nozzle | | | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 9** | | | | | |
| | Section No. 9<br>Bill No. 1<br>FIRE SUPPRESSION SYSTEM - KENYA POWER ROOM | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:2** | | | | | |
| | **Fire Gas(Inergen) Suppression System** | | | | | |
| | ***Design and build Fire Gas Suppression system as per particular specifications for mechanical installations*** | | | | | |
| 1 | Submittals fire gas suppression performance specification and hydraulic calculations | | | SUM | | |
| | **Fire Gas (Inergen) Suppression System** | | | | | |
| | Supply, install, test and commission the following IG541 fire suppression system for White space | | | | | |
| | **(This section should be read with Technical specifications of this document where particular specifications for the system are found)** | | | | | |
| 2 | Container Assembly (UL Listed) with IG541 Agent by Manufacturer.**140 L CYLINDERS 1 No. fully charged with 150 kg agent** | No | 1 | | | |
| 3 | Container Label | No | 1 | | | |
| 4 | Container Bracket (Strap Type) | No | 1 | | | |
| 5 | Discharge Hose 50mm | No | 1 | | | |
| 6 | Actuation mechanism per system - UL Listed | No | 1 | | | |
| 7 | Manifold for the system complete with lockout, time delay, safety and vent devices | No | 1 | | | |
| 8 | **Fire Suppression system control equipment, UL Listed and conforming to EN54 and NFPA standards**<br>addressable extinguishing control panel | No | 1 | | | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 9<br>Bill No. 2<br>FIRESUPPRESSION SYSTEM - GROUND FLOOR EXISTING | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 9 | Intelligent Addressable Photoelectric Smoke Detector, White Color, 360 Degrees Viewing LED and Soft Addressing c/w Sounder Base and remote monitoring led output | No | 5 | | | |
| 10 | Intelligent Addressable Fixed Temperature Thermal Detector, Detection: 57 Deg.C, White Color, 360 Degrees Viewing LED and Soft Addressing w/ Standard Base | No | 1 | | | |
| 11 | Manual Release | No | 1 | | | |
| 12 | Monitor Module for above | No | 1 | | | |
| 13 | Sounder-beacon, multi tone, shallow base | No | 2 | | | |
| 14 | Control Module for above | No | 2 | | | |
| 15 | Abort Switch | No | 1 | | | |
| 16 | Monitor Module for | No | 1 | | | |
| 17 | above Maintenance | No | 1 | | | |
| 18 | Switch Monitor Module | No | 1 | | | |
| 19 | for above<br><br>Low smoke, 0 halogen, 1.5mm$^2$ 2 core fire-proof/ flame proof cables and all necessary cabling for all smoke detctors, firm alarm panel and sounders as delta firetuff complete with flame-resistant terminations, and accessories. The cables to be capable of withstanding heavy flames for minimum 3 hours. | m | 150 | | | |
| 20 | **(The tenderers to include for flame testing of the cables for at least 30 minutes)** | No | 1 | | | |
| 21 | 24V 2A Power supply module comple with Battery and Accesories | No | 1 | | | |
| 22 | Warning Sign Inside Warning sign outside | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 9<br>Bill No. 2<br>FIRESUPPRESSION SYSTEM - GROUND FLOOR EXISTING | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 23 | UL Listed Fire | No | 1 | | | |
| 24 | Damper Room | | Item | | | |
| | integrity test | | | | | |
| | **Pipework (Provisional Subject to Hydraulic Calculations)** | | | | | |
| | Supply and fix seamless black Steel pipes SCH 40 conforming to ASTM A-53A ERW or ASTM A-106 A. All piping shall comply with NFPA 2001. | | | | | |
| | Fittings beyond Orifice union/nipple shall be, 300lb class fittings conforming to ANSI B-16.3. Ordinary cast iron fittings shall not be used. Piping shall be bracketed within 12" (0.3m.) of all discharge nozzles. | | | | | |
| | Tenderers must allow in their pipework prices for all the couplings, unions, sockets, nipples, tees, caps, connectors, joints, anchoring, support brackets etc in running lengths of pipes and also where necessary for fixing clips, holderbats, | | | | | |
| 25 | plugged and screwed. | m | 40 | | | |
| | 40mm diameter seamless black Steel pipe as SCH 40 | | | | | |
| 26 | 20mm diameter seamless black Steel pipe as SCH 40 | m | 10 | | | |
| 27 | 20mm diameter elbow | No | 5 | | | |
| 28 | 40mm diameter elbow | No | 2 | | | |
| 29 | 40mm diameter equal | No | 2 | | | |
| | tee | | | | | |
| 30 | **360 Degree Nozzle - Acoustic Type** | No | 4 | | | |
| | 20mm Brass Nozzle | | | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 9** | | | | | |
| | Section No. 9<br>Bill No. 2<br>FIRESUPPRESSION SYSTEM - GROUND FLOOR EXISTING | | | | | |

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **BILL NO:3** | | | | | |
| | **Pump room** | | | | | |
| | Design, manufacture, works testing, supply and delivery to site, moving into position, election, connecting up, site testing, witness testing, proving to the inspectors, demonstrating to the Employer and maintenance of the complete installation as per conditions of contract and the specification and on drawings.<br>High pressure water mist to be in accordance with FM 5560, NFPA 2001, & NFPA 13 | | | | | |
| | Installation and commissioning of new fire pumpset | | | | | |
| | **Pumping Set** | | | | | |
| 1 | Pumping Set<br>Electric pump unit with two duty pumps and two standby pumps, 22 KW motors, HP manifold with 1 regulating valve and design pressure 140 bar. Inclusive of high pressure pilot lamp, inlet service valve, outlet service valve, 380VAC- 415VAC with frequency converters and circuit breaker motor protection and manufactured to the below standards:<br><br>EN 14972-1:2020<br>EN 60204-1:2018<br>EN ISO 12100:2011<br>BS 8489-1: 2016<br><br>Unit Specifications<br>Flow capacity - 120 l/min<br>Operating Pressure - 80 bars | No | 1 | | | |
| | **Pilot Pump** | | | | | |
| 2 | High pressure pilot pump, 0.75 kW IE2 motor type, 5.2 l/m flow rate, 40 bar max. pressure | No | 1 | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 9<br>Bill No. 3<br>HIGH PRESSURE WATER MIST SUPPRESSION SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | **Safety Relief Valve** | | | | | |
| 3 | Pressure relief valve pilot operated | No | 2 | | | |
| | **Regulating Valve** | | | | | |
| | Supply and installation of valves, instrumentation, etc. complete with gaskets, bolts, flanges, etc as described in the specifications and shown on the drawing. | | | | | |
| 4 | Pressure requlating valve | No | 2 | | | |
| 5 | Isolation Valve | No | 2 | | | |
| | **Pump Filter** | | | | | |
| 6 | Filter for pump unit with cartridge including shutoff valve with switch, 10 micron filter element | No | 1 | | | |
| | **Gauges and Sensors** | | | | | |
| 7 | Pressure gauge, stainless steel, glycerine filled and gauge cock | No | 2 | | | |
| | **Plant room Ventilation** | | | | | |
| 8 | Supply and install mounted fan complete with motor guard, weather louvre, timer and temperature sensors | No | 1 | | | |
| | **Dry pipe Sprinkler System** | | | | | |
| | Design, manufacture, works testing, supply and delivery to site, moving into position, erection, connecting up, site testing, witness testing, proving to the inspectors, demonstrating to the Employer and maintenance of the complete installation as per conditions of contract and the specification and on drawings. | | | | | |
| | High pressure water mist to be in accordance with SFM 5560, NFPA 2001, & NFPA 13 | | | | | |
| | **Carried Forward** | | | KES | | |
| | Section No. 9<br>Bill No. 3<br>HIGH PRESSURE WATER MIST SUPPRESSION SYSTEM | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| | Sprinkler reticulation to be in accordance with SFM 5560, NFPA 2001, & NFPA 13 | | | | | |
| | **Deluge Control Valve** | | | | | |
| 9 | 30mm Deluge Installation control valve assembly complete Inlet service valve & Outlet service valve. Inlet: Solenoid 24V.Test function: Ball valve. as detailed on the drawings. | No | 4 | | | |
| | **Open Sprinkler Heads** | | | | | |
| 10 | AISI316L pendent open nozzle, K-Factor =3.65, operating pressure 60 bar, flow rate 28.3 l/m for Machinery in enclosures exceeding 260 m³ with necessary swivel piping bends, hangers and support | No | 12 | | | |
| | **High Pressure Hose reel Reel** | | | | | |
| 11 | Hose reel cabinet with spray gun 4.0, 50 m long, dynamic braking of the hose reel enables intuitive handling, water gun is equipped with a jet and spray function. | No | | | | |
| | **Sprinkler Piping** | | | | | |
| | High-pressure water mist pipes and fittings are made of high-quality stainless steel (Material 1.4404), Welded stainless steel pipes acc. to EN 10217-7, W2Rb, TC2, Material 1.4404, Annealed, Tolerances acc. to EN ISO 1127 D4/T3, Alloy surcharge on high-pressure water mist stainless steel pipes, 160 bar operating pressure | | | | | |
| | Straight Piping | | | | | |
| 12 | 30Ø mm | m | 50 | | | |
| 13 | 15Ø mm | m | 20 | | | |
| | Bends | | | | | |
| 14 | 30Ø mm | No | 5 | | | |
| | **Carried Forward** | | | KES | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 15 | 15Ø | No | 5 | | | |
| | mm | | | | | |
| 16 | Tees | No | 5 | | | |
| 17 | 30 mm | No | 5 | | | |
| | 15Ø mm | | | | | |
| 18 | Fire Suppression system control equipment, UL Listed and conforming to EN54 and NFPA standards | No | 1 | | | |
| 19 | Addressable Extinguishing Control Panel, 6 Areas | No | 1 | | | |
| 20 | 24V 5A Power supply module comple with Battery and Accesories | No | 1 | | | |
| 21 | Horn/Strobe, 12/24 Volt, Red Color, Multi-Candela, Outdoor IP65, 105 dB, Wall/Ceiling Mounted, With Back box | No | 1 | | | |
| 22 | Combined Manual Release and Abort Switch | No | 1 | | | |
| | Unit Maintenance Switch | | | | | |
| | | | | KES | | |
| | **Carried Forward to Summary of Section No. 9** | | | | | |
| | Section No. 9<br>Bill No. 3<br>HIGH PRESSURE WATER MIST SUPPRESSION SYSTEM | | | | | |

**SECTION SUMMARY - FIRE PROTECTION SYSTEM**

| Bill No | | Page No | | Amount |
|---|---|---|---|---|
| 1 | FIRE SUPPRESSION SYSTEM - KENYA POWER ROOM | 85 | | |
| 2 | FIRESUPPRESSION SYSTEM - GROUND FLOOR EXISTING POWER ROOM | 88 | | |
| 3 | HIGH PRESSURE WATER MIST SUPPRESSION SYSTEM | 92 | | |
| | **Carried to Final Summary** | | KES | |

Section No. 9

| Item No | | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | **SECTION**<br><br>**NO:10 BILL**<br><br>**NO:1**<br><br>PRIME COST SUMS<br><br>Landscaping | | | | | |
| 1 | Soft and Hard Landscaping | | Item | | 1,000,000.00 | |
| 2 | Provide for Landscaping a Prime Cost Sum of Shillings One Million Only ( Kshs. 1,000,000.00) | | | % | | |
| 3 | Add for profit (_____% )<br><br>Allow for general attendance on specialist providing plants and planting | | Item | | | |
| 4 | Signage | | | | | |
| 5 | Provide for Signage a Prime Cost Sum of Kenyan Shillings Five Hundred Thousand Only ( Ksh 500,000.00) | | Item | % | 500,000.00 | |
| 6 | Add for profit (_____% )<br><br>Allow for general attendance on specialist installing Signage | | Item | | | |
| 7 | PROVISIONAL SUMS<br><br>Allow for a Provisional Sum of Ksh. 15,000,000.00 (Kenya Shillings Fifteen Million) for Offshore training by OEM for the Client Technical Team complete with certificate of participation for the following installed key equipment and/or factory witness testing (FWT):<br><br>a) Critical Power System<br>b) Generator and Fuel System | | Item | | 15,000,000.00 | |
| | | | | KES | | |
| | **Carried Forward** | | | | | |
| | Section No. 10<br>Bill No. 1<br>PROVISIONAL SUMS | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **Brought Forward** | | | KES | | |
| 8 | Allow a Provisional Sum of Ksh. 10,000,000.00 (Kenya Shillings Ten Million)as Capital Contribution for Kenya Power | | Item | | 10,000,000.00 | |
| | **Carried to Final Summary** | | | KES | | |
| | Section No. 10<br>Bill No. 1<br>PROVISIONAL SUMS | | | | | |

| Section No | **FINAL SUMMARY** | Page No | | Amount | |
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| 1 | PRELIMINARIES AND GENERAL ITEMS | 2 | | | |
| 2 | BUILDERS WORKS | 23 | | | |
| 3 | GENERATOR AND FUEL STORAGE SYSTEM | 33 | | | |
| 4 | ELECTRICAL AND ASSOCIATED WORKS | 59 | | | |
| 5 | PV SOLAR SYSTEM | 65 | | | |
| 6 | EARTHING, LIGHTENING AND SURGE PROTECTION STSTEM | 71 | | | |
| 7 | SECURITY SERVICES | 75 | | | |
| 8 | AIR-CONDITIONING SYSTEM | 82 | | | |
| 9 | FIRE PROTECTION SYSTEM | 93 | | | |
| 10 | PRIME COST AND PROVISIONAL SUMS | 95 | | | |
| | Sub Total | | KES | | |
| | Add 7.5% of Sub-Total above as Contingency to be expended as per Law with express permission of the Client | % | | | |
| | Total (Sub-Total + Contingency) | | KES | | |
| | Add 16% of Sub-Total as Value Added Tax (VAT) | | KES | | |
| | Total (Sub-Total + Contingency) | | KES | | |
| | Add 0.03% of Sub-Total above as PPRA Capacity Building Levy | % | | | |
| | Grand Total carried forward to Main Summary Page | | KES | | |
| | **TOTAL CARRIED FORWARD TO MAIN SUMMARY PAGE** | | KES | | |

# APPENDIX 2

**SPECIFICATIONS FOR PROPOSED ENHANCEMENTS AND IMPROVEMENT OF ELECTRICAL POWER SYSTEMS AND ASSOCIATED DATA CENTRE WORKS AT KISUMU BRANCH FOR CENTRAL BANK OF KENYA**

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# 1. PREAMBLES AND NOTES

## 1.1 Parties and project responsibility matrix

### Project Management Team

CBK Project Team shall be responsible for overall management of the project and shall remain overall approver and decision-making organ of the project.

### The Consultant

CBK have appointed consultants in the project who shall have delegated authority and shall be responsible for contract administration and supervision of the project, herein be referred to as 'The Consultant'.

### Contractor

The contractor shall mean the entity contracted to execute the works, personnel, agents and subcontractors engaged for the works and shall be responsible for execution of works in accordance with the contract conditions and shall herein be referred to as 'The Contractor'.

## 1.2 Definitions and abbreviations

Abbreviation used in these Bills of Quantities shall be interpreted as follows: -

"**Approved**" shall mean approved by the Consultant and CBK

"**As Directed**" shall mean directed by the Consultant

"**Architect/Engineer**" shall mean the Consultant

"**B.S.** " shall mean The current British Standard BMS shall mean Building Management System

"**C. M**" or "**M3**" shall mean Cubic metres

"**CCTV**" shall mean Closed Circuit Television

"**CV**" shall mean Curriculum Vitae

"**Ditto**" shall mean The whole of the preceding description except as qualified in the section in which it occurs. Where it occurs in brackets it shall mean the whole of the preceding description which is contained within the approximate brackets.

"**GIFA**" shall mean Gross Internal Floor Area

"**GBA**" shall mean Gross Building Area as measured in accordance with RICS and IPMS guidelines.

"**Kg**" shall mean Kilograms

"**KPC**" shall mean Kenya Power Company

"**L.M**" or "**M**" shall mean Linear Metre

"**M.S**" shall mean Measured separately

"**No**" or "**N**" shall mean Number

"**S.M**" or "**M²**" shall mean Square Metres

"**VAT**" shall mean Value Added Tax

"**CBK**" shall mean Central Bank of Kenya Office

"**UPS**" shall mean Uninterrupted Power Supply

"**PV**" shall mean Photovoltaic

"**LPG**" shall mean Liquified Petroleum Gas

**Notes:**

a) Bidders are required to study general and particular conditions of contract and price under particular preliminaries section.

b) The Contractor is recommended to examine the drawings and general specifications used for the preparation of this bid. No claim arising from failure to comply with this recommendation will be considered. Bidders shall be required to examine all drawings for consistency and should there be an ambiguity or inconsistency across the documents, then this shall be promptly communicated to the procurement. No claim will be entertained for failure to scrutinize the bid documents and reporting of ambiguity. All bidders will be advised by CBK with regard to any queries on drawings and general specifications.

c) Bidders are referred to the Definitions and Abbreviations section contained in the Preliminaries section for the abbreviations stated in the Bills of Quantities.

d) The Contractor may be required to share during the course of the contract or hand-over at completion of the contract the site offices, stores and hoarding to other Contractor's at no cost.

e) Items not priced shall be deemed to have been included in rates for other priced items.

f) This is a fixed unit-rate contract. (The unit-rates shall remain fixed for the duration of the contract and no fluctuations of prices shall be allowable.)

**1.3 Description of site**

The site of the works is located at CBK-KISUMU BRANCH, Kisumu County, Kenya.

**1.4 Deliveries & removal**

The project is within an active site, fully operational facility which operates in normal working hours with various conferences, operations and meetings going on. Deliveries of goods, materials, tools and equipment shall therefore be done in a manner that does not cause any hindrances or inconvenience to the normal operations. For start-up it may be done prior to the day of the initial start of the first workday or it can be done on Saturdays, during the work day it should at least be done outside of the peak period of CBK staff arriving at work in the mornings, preferably early morning hours before staff arrival, mid-day deliveries at 1300 hours and last delivery 1 hour before close of day which can be either 1500 hours if work ends at 1600 and 1600 hours if work ends at 1700hours. Advance permission has to be obtained from CBK Security. Deliveries are to be made through the designated gates approved by security team. The Contractor is to notify CBK at least 48 hours in advance of deliveries in order that relevant clearance is obtained. Heavy materials deliveries: Delivery of heavy materials to site shall be governed to comply with delivery times in accordance with the Local Authority requirements.

**1.5 Sufficiency of bid**

The Contractor shall be deemed to have satisfied themselves before bidding as to the correctness and sufficiency of their bid for the works and of the rates and prices used in arriving at the fixed unit-rate(s) stated in the priced bills of quantities which rates and prices shall cover all the obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the works.

DRAWINGS

i) Before submitting the bid, bidders may examine all the drawings after formal application to the Client and satisfy themselves regarding all details as no claim by reason of ignorance to this connection will be allowed.

ii) The bidder shall satisfy themselves as to the correctness of all drawings and measurements. If the bidder finds any discrepancy on the drawing or between the drawings and the bills of quantities, they shall immediately refer the same to CBK who shall decide which direction shall be followed.

iii) Figured dimensions will be used in preference to scales mentioned on or attached to any drawing.

iv) The Contractor is to take the necessary particulars for ordering materials and work from the drawings and the work in progress on the building and not use the Bills of Quantities for that purpose.

### 1.6 Request for information

All requests from the Contractor shall be in writing in the form of a RFI pro- forma containing the following basic information:

i) Contractor's Name
ii) Project Name
iii) Author of RFI
iv) RFI Number
v) RFI Date
vi) Subject Title
vii) Subject Matter RFI"€™s shall be issued in numerical order and if multiple pro forma booklets are produced they shall be in consecutive series.

### 1.7 Works to be executed in a highly sensitive environment

Operating within the CBK facility requires exceptional attention to detail, careful planning, and strict adherence to operational, safety, and security standards. The Contractor shall plan, review, and execute all activities so as to safeguard business continuity and avoid disruption to CBK operations. Key obligations include minimizing nuisance and disruption to site operations and personnel; maintaining safety and security through coordinated and approved movements and activities; monitoring site conditions continuously and adapting promptly to unforeseen issues; ensuring business continuity during construction; and maintaining civil and respectful conduct when communicating or interacting with CBK staff. The Bidder shall adhere to these principles and commit to a collaborative, detail-oriented approach subject to CBK approval.

### 1.8 Cooperation with stakeholders and other contractors on site

Collaboration with CBK team is mandatory to ensure smooth integration of contractor activities with ongoing site management tasks. Bidders' attention is drawn to the fact that other works by other vendors will be running concurrently. Cooperation by all parties, including syncing deliveries and use of any CBK designated areas for storage of materials, waste etc shall be required. The contractor must ensure open and constant communication with these teams, addressing any potential impacts to operations well in advance.

### 1.9 Prohibition of publicity

CBK is a highly guarded organization where security and operation of activities remain highly confidential. The Contractor shall not, without the prior written consent of CBK, use the Central Bank of Kenya,s name, logo, or any information related to the Project for any advertising, marketing, or publicity purposes. The Contractor shall not issue any press releases, public announcements, or engage in any form of media communication regarding the project without the prior written approval of the Central Bank of Kenya.

### 1.10 site visit

Bidders shall be required to visit the site at a date to be advised by CBK, to acquaint themselves with the nature of the site, access to site, delivery logistics, source of various materials and all matters relating site and its operations. Bidders shall be required to liaise with CBK for additional information on site visit arrangement including clarity on date and time of visit and security clearance procedures. The bidder and any of their personnel or agents shall be required to request for conditional permission to enter the site upon complying with all security procedures as shall be required. The permission shall be deemed to be based upon the bidder, their personnel and agents indemnifying CBK and their personnel and agents from and against all liability and upon the bidder being responsible for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses (however caused) which would not have arisen other than due to the exercise of such permission. The bidder is required to visit the site and shall be deemed to have acquainted themselves therewith as to the nature of the site, position and means of access etc and no claim in this connection will be allowed before or after award of the contract. No claims will be allowed for travelling expenses which may be incurred by the bidder in visiting the site or preparing the bid for the works.

### 1.11 Statement of works (brief description of works)

Provide brief statement of works.

The Works comprise the supply, installation, testing, commissioning, documentation, training, handover, and maintenance of Incoming Power and Data Center associated works comprising but not limited to: and associated works as follows:

a) Construction of New External Power Room
b) Refurbishment of Exisitning Kenya Power Room and Riser Ducts
c) 3 * 400 KW Data Center Continous Running Gensets, Fuel Tanks and Master Control Panels
d) Low Voltage Switcgears, Transformers, distribution cabling and associated works
e) PV Solar System
f) Earthing and Lightening Protection
g) Security Services
h) Fire detection and Protection Installations
i) White Space Goods
j) Audio Visual Instalaltions

### 1.12 Supervision

The Works shall be executed under the direction and to the entire satisfaction of the Consultant, who shall have CBK's specifically delegated authority and shall always have access to the Works and to the yards and workshops of the Contractor or other places where work is being prepared for the building works.

### 1.13 Proprietary materials and alternatives

## Identified proprietary items:

Identification of a proprietary item, product or system does not necessarily imply exclusive preference for the item so identified, but indicates the necessary properties, performance and/or appearance of the item, and available warranties. Where items are identified as a proprietary item or product they have generally been selected for their appearance and performance. Substitutions will only be considered if the substitutions are identical in appearance, and equal and greater in performance. Artificial and fake substitutions such as pattern printed board products must not be deemed to be identical appearance to specified natural products. If substitutions to the documented proprietary items, products, methods or systems are proposed, submit sufficient information shall be required to permit evaluation of the proposed substitution including the following: Evidence of conformity to a cited standard Samples Essential technical information, in English Reasons for the proposed substitutions Advantages to the Central Bank of Kenya Statement of the extent of revisions to the contract documents Statement of the extent of revisions to the construction program Statement of cost implications including costs outside the contract Statement of consequent alterations to other parts of the Works Documentary evidence demonstrating that the proposed substitution of materials and products meet the technical and design intent aspects of the design in the contract Documentary evidence demonstrating the proprietary item or product's equal or better compliance with relevant standards Documentary evidence demonstrating that the substitution is consistent with the contract documents and is as effectual as the identified proprietary item Proprietary materials, products and items are specifically noted as the preferred selection. Substitutions will only be considered under the following conditions: Substitutions are submitted for approval insufficient time to permit proper evaluation Evidence is provided that the documented proprietary items, products or systems are unavailable within the time constraints of the construction program Once substitutions have been submitted and approved, they shall not be varied nor shall further substitutions be offered or proposed without specific written permission. Substitutions offered by reason of the specified item or product not being ordered in sufficient time will not be considered a valid reason for substitution demonstrate that the proposed substitutions to proprietary items or products meet the technical and design intent aspects of the current design Performance based specifications: Where items are specified by performance the Contractor shall submit evidence to show compliance with the performance criteria provided in the specification and drawings.

### 1.14 Value engineering

The bidder may propose alternatives only after award of the contract and shall be required to demonstrate how the alternatives give value to the project (cost saving or time). Bid submission shall however strictly comply to prescribed standards and specifications.

Alternatives shall meet or exceed the performance requirements specified in the bid document and shall be approved by the Consultant and CBK.

### 1.15 Blasting

Unless otherwise agreed with the relevant authorities no blasting shall be allowed to be carried out on site. Any rock that is encountered with must be removed by use of sledgehammers, heavy-duty rippers mounted to tractors or by compressor.

### 1.16 Provisional work

All "Provisional" and other work liable to adjustment or remeasurement under this Contract shall be left uncovered for a reasonable time to allow all measurements needed for such adjustment to be taken by the Consultant. Immediately the work is ready for measurement, the Contractor shall give notice to the Consultant. If the Contractor makes default in these respects, they shall, if the Consultant so directs, uncover the work at their own expense to enable the measurements to be taken.

### 1.17 Existing works and protection of completed works

The Tenderer is hereby advised that main builders and infrastructure works have already been executed by the Main Works Contractor and/or other contractors within the project area. The Tenderer shall be deemed to have inspected and familiarized himself with the nature, extent, condition, and location of such existing and completed works prior to submission of tender.

The Tenderer shall take all necessary precautions to protect existing structures, finishes, installations, services, equipment, and completed works from damage during the execution of his works. Any damage caused directly or indirectly by the Tenderer, his employees, subcontractors, or suppliers shall be made good by the Tenderer at his own cost and to the satisfaction of the Engineer/Project Manager.

No additional payment shall be made for compliance with this requirement, and all costs associated with inspection, protection, temporary coverings, safeguarding measures, and reinstatement of damaged works shall be deemed to be included in the Tender Sum.

### 1.18 General and special attendance

The Contractor shall be deemed to have allowed for providing all general attendance and special attendance necessary for the proper execution, completion, testing, commissioning, and maintenance of his works.

General attendance shall include, but not be limited to, site management, supervision, labour, access to work areas, coordination with other contractors, unloading, handling, storage of materials, attendance at meetings, setting out, cleaning, waste disposal, and all other routine support services required for the execution of the works.

Special attendance shall include, but not be limited to, the provision of scaffolding, lifting equipment, hoisting facilities, temporary supports, temporary weather protection, plant, tools,

testing equipment, power, water, security measures, protection of completed works, and any other specialist services or facilities necessary for the proper execution of the works.

The Contractor shall make his own arrangements for all such attendance and no separate or additional payment shall be made in respect thereof. All costs associated with the provision of general attendance and special attendance shall be deemed to be included in the Contract Sum.

### 1.19 Domestic sub-contractors & specialists

The Contractor shall employ approved specialist domestic subcontractors. The Contractor shall provide attendance to specialist subcontractors and undertake the necessary builders' work in connection with such works and services. Where such builders' work is not separately identified under the measured section of these Bills of Quantities, it shall be deemed to be included in the Contractor's overall rates.

### 1.20 Implementation options & central bank of kenya's direct contracts

The Central Bank of Kenya shall have the right to employ other Contractors (hereinafter referred to as "Direct Contractors") to execute any special or other works whether contained in this Contract or not, concurrently with the work being executed under this Contract. In addition, the Central Bank of Kenya shall have the right to send on to the Works any furniture, furnishings, curtaining, carpeting and fittings and have same installed by their own employees or by Direct Contractors. The Contractor shall not be entitled to any percentage, profit or discount on the value of any work executed by "Direct Contractorsbut shall nevertheless allow these Direct Contractors and the Central Bank of Kenya's employees to have access to the Works, allocate reasonable space in the building for the storage of their materials, tools and equipment, and co-ordinate the work of and "attend upon" such Direct Contractors as necessary all to the satisfaction of the Consultant and CBK. Any such costs associated with such direct contracts shall be deemed included in the Bid. The Contractor shall have the duty to undertake all such works as measured in the required quality and hence must ensure adequate rates are provided.

**Note:**

The Contractor shall allow such Direct Contractors to work on site without encumbrances and shall ensure that all direct contractors are inducted into the safety regime of the Contractor.

### 1.21 Accommodation and labour camps on site

No accommodation on site will be permitted for the Contractors staff or work people including those of sub-contractors other than the security staff. The Contractor shall NOT be permitted to house any other workers on site. The Contractor should make their own arrangements to house the workers elsewhere and/or organize for their transportation to and from site. Any application for exemption from this requirement shall be at CBK's discretion.

### 1.22 Area to be occupied by contractor to be approved & authorized by cbk

The area of the site which may be occupied by the Contractor for use as storage and for the purpose of erecting workshops, etc., shall be defined on the site by the Consultant and CBK. All operations of the contractor, including without limitation, storage of equipment, materials, supplies and parts, within CBK premises or property, shall be confined to areas authorized or approved by CBK. The Contractor's personnel shall not enter or pass through and shall not store or dispose off any of its equipment or materials in any areas within CBK's premises or property without appropriate authorization from CBK.

### 1.23 Transport to and from the site

The Contractor shall include in their fixed unit-rates, for the transport of materials, workmen, etc., to and from the site of the proposed Works, at such hours and by such routes as are permitted by the authorities.

### 1.24 Prime cost sums and rates

a) The words "Prime Cost" (or the initials "PC") wherever appearing in the Contract Documents shall mean net cost exclusive of any trade, cash or other discount whatsoever but inclusive of the cost of packing. Such cost shall be the sums due to the Sub-Contractor or Supplier after adjustment where applicable in respect of measurements or rates.
b) Any increases or decreases in these Prime Cost Sums and Rates resulting from the adjustments and properly paid by the Contractor shall be added to or deducted from the Contract Sum in the final account. In substantiation the Contractor will be required to produce to the Consultant all quotations, invoices and receipted accounts as shall be necessary to show the details of the sums actually paid.
c) Prime Cost Rates shall be deemed to be exclusive of VAT, delivery to site and fixing. Any sum added by the Contractor in these Bills of Quantities in respect of profit upon any Prime Cost will be deducted at the final settlement of accounts and a sum will be added the amount of which will bear the same proportion to the sum added as the net amount properly expended bears to the original PC sum.

### 1.25 Fair wages

The Contractor shall pay rates of wages and observe hours and conditions of labor not less favorable than the minimum rates of remuneration and minimum conditions of employment applicable. The Contractor is to comply with the Regulation of Wages and Conditions of Employment Act, Building and Construction Industry Wages Council and is to be responsible for compliance by sub-contractors employed in the execution of the Contract. If required, the Contractor is to notify the Consultant and CBK of the name and addresses of all such sub-contractors. Any Contractor or sub- contractor not so complying will not be permitted to bid for other work for such period as CBK may determine. Should a claim be made to the Consultants alleging the Contractor's default in payment of fair wages of any workman employed on the Contract and if proof thereof satisfactory to the Consultant is furnished in accordance with the Contract, the Consultant may, failing payment by the contractor,

recommend payment of the claim by CBK and offset from any monies due or which may become due to the Contractor under this contract. The Contractor shall furnish to the Consultant, where so required, such particulars of the rates of wages, hours and conditions of Contract referred above, as the Consultant may direct.

### 1.26 Standards levy

The Contractor is required to ascertain at their own cost of any legal notices, regulations or laws which require payment by the Contractor of a Standard levy to the Kenya Bureau of Standards.

### 1.27 Training levy

The Contractor is required to ascertain at their own cost of any legal notices, regulations or laws which require payment by the Contractor of a Training levy for any Contract.

### 1.28 Withholding tax

The Contractor shall ensure that they have full knowledge of the workings of withholding tax in a tax, particularly VAT, exempt project.

### 1.29 Value added tax (vat)

The contractor shall include VAT at the current rate.

### 1.30 Copyright

The copyright of this document is vested in CBK and they may not be reproduced in whole or in part without CBK's written permission.

## 2. PRELIMINARIES

### 2.1 Contractor's investigation for service infrastructure & other utilities

No work may commence without a full and detailed validation of existing service infrastructure already executed by others. The Contractor is expected to use available documentation to plan for the Works particularly where tapping and connection to established system.

The contractor shall be expected to employ skill and carefully identify, protect and avoid cutting, damaging or disrupting the active existing site services during the execution of the Works. If the Contractor has any doubt to services encountered, then the contractor shall immediately notify the Consultant and CBK for instructions and guidance on how to proceed.

The contractor must assess where and when services will need to be disconnected and work closely with CBK to schedule these disruptions with minimal impact. Any interruptions to power, water, communications, or other utilities must be planned well in advance and communicated clearly to all affected parties. The contractor shall provide temporary measures where there are interruption of services (power, water, UPS etc) including provision of consumables and leasing of temporary equipment)

Detailed Review and Run-Through: A preliminary run-through of the planned activities must be conducted with the project management and CBK. This ensures all parties understand the sequence of works, potential risks, and mitigation strategies. Note: Mock scenarios or simulations may be required to validate the contractor's readiness and coordination efforts.

**2.2 Security of works (within allocated site area)**

The Contractor shall be entirely responsible for the security of all the works, stores, materials, plant, personnel, etc., both owned by the Contractor and sub-contractors and shall provide all necessary watching, lighting, site hoarding and other precautions as necessary to ensure the security and the protection of the public. The contractor shall liaise with CBK Security on access control and clearance protocols to CBKs approval. The bidder shall obtain the list of security companies from CBK and MUST deploy approved security personnel to man the site. Maximum precautions must be exercised to uphold existing security in the vicinity of the Works. The Contractor shall comply with all security requirements in accordance with the Central Bank of Kenya' security regulations currently in force and all instructions issued by the Central Bank of Kenya with regard to upholding of security arrangements and will be held responsible for any breach of security by their employees. The Contractor shall be held responsible for any breach of security by any of their agents, employees, personnel etc. The movement of the Contractor's staff/labour must be confined strictly to the Works and the Contractor's working and storage areas. At no time shall the contractor and his agents, be allowed to gain access to non-designated/restricted areas within the compound and must always stick operations within the allocated site. The contractor's staff shall not engage in horseplay and loitering on site. All areas on site outside the temporary hoarding are designated as "out of Bounds' areas for the Contractor's employees and the Contractor will be required to comply strictly with this rule. Contractors, site staff and vehicles entering the compound on a daily basis will require prior clearance and to be issued with Ground Passes to the CBK compound. Any additional staff or vehicles requiring entry during the course of the project will require similar clearance. Contractors must anticipate regular badge checks, equipment inspections, and vehicle reauthorization processes. Any lapse in clearance will result in denied access to the site. Ground passes must be worn and visible at all times. Vendors may be required to provide clearance certificate as part of security vetting exercise.

**2.3 Phased implementation and sectional completion**

CBK may require section of works and specific milestones to be fast-tracked and delivered prior to overall completion date. The Contractor shall abide by any phased implementation of the works as shall be directed by the Consultant to suit the requirements of CBK and achieve milestones if any. Where required, the bidder shall submit a methodology, with alternative phasing proposals for approval; if any. Bidders are also notified that no contractual claims or increase in prices will be allowed due to any Phased implementation of the works. If the contractor fails to complete any section by the specified date, liquidated damages for the relevant portion shall apply proportionately. The last date of the contract works is however to be completed within the overall Contract Completion Period; and shall be the substantive

date for commencement of defects liability period. No claim associated with phasing of works shall be entertained.

**2.4 Working hours and overtime**

The Contractor's working hours shall be in tandem with CBK's working hours as follows:

Mon to Friday - 8am to 5pm, Nairobi time

Saturdays - 8am to 1pm, Nairobi time

Sundays - No Work

The Contractor shall liaise with the Consultant and CBK for approval of any other working hours. The Contractor shall be responsible for any extra costs for overtime working that they consider necessary in order to complete the work within the contract period or recover delays. If overtime is worked in accordance with a written instruction issued by the Consultant, the Contractor will be reimbursed in respect of such overtime to the extent only of the additional net cost in line with Construction Industry Wages Council and excluding any bonuses, profits and overheads.

**2.5 Insurances**

The Contractor shall obtain and shall, for the term of the contract and any extension thereof, maintain policies of insurance, with reputable insurance companies approved by CBK.

Minimum policy requirements

All insurance policies providing the minimum insurance coverage shall

i) Name the Central Bank of Kenya as an additional insured except worker compensation. In addition, the general liability policy shall contain cross liability clause.
ii) Include waiver of subrogation of the contractor's insurers rights against the Central Bank of Kenya.
iii) Provide that CBK shall receive sixty (60) days' written notice from the insurance carrier, underwriter or provider prior to any cancellation or change of insurance coverage provided under the insurance policy or policies concerned.
iv) Include the provision for primary and non-contributing basis with respect to any other insurance that may be available to CBK.
v) Name the CBK as loss payee for any claims resulting from this contract.
vi) The Contractor shall be responsible to fund all amounts within any policy deductible or retention.

**2.6 Performance bond**

The contractor shall provide to the Central Bank of Kenya, performance security in the form of appended bank guarantee (first demand guarantee) in accordance with prescribed form specimen. The performance security shall remain valid and in force until the end of defects liability period.

**2.7 Waste management**

The provision of waste disposal at the waste storage area shall be separated into the following materials as a minimum:

i) Cardboard
ii) Timber
iii) Ferrous metals
iv) Non-ferrous metals
v) Soft Plastic
vi) Polystyrene
vii) Insulation
viii) Concrete
ix) Glass
x) Bricks and masonry blocks

Each bin must be color coded and clearly labelled on all four of its sides specifying which materials are to be placed in the bin. All bins must be emptied or changed on a regular basis to ensure that the bins never reach more than 99% of maximum capacity. This will ensure that recyclable waste is not inadvertently placed in the incorrect bin due to the correct bin being full. Records must be kept of materials used including data sheets and quantities for future compliance records

**2.8 Hazardous substances**

The Contractor is responsible for identification, labarotory analysis and the safe removal of all hazardous substances arising from work execution that may include contaminated soil, asbestos, lead, lead paint, polychlorinated biphenyls (PCBs) and the like to approved standards of removal and handling of hazardous substances.

**2.9 Environmental Management Plan (EMP)**

The Contractor shall develop, review, update where necessary, and implement the Environmental Management Plan (EMP) prepared by the Consultant. The Environmental Management Plan shall, on a bare minimum, include:

i) Details of the proposed management structure and responsibilities of the persons responsible for environmental protection and monitoring
ii) Details of the induction, training, and awareness programs, aimed at the total workforce, proposed to be implemented.
iii) Details of auditing procedures proposed to be implemented to ensure adherence to environmental policies.
iv) Specific project environmental constraints
v) Environmental correspondence, reporting and record keeping procedures
vi) Risks and responsibilities (including risk assessments and method statements as well as organizational responsibilities)
vii) Environmental audit procedures
viii) Environmental incident and emergency response (non- conformance management)
ix) Environmental training procedures

x) Solid waste management
xi) Toxic waste management
xii) Chemical product management
xiii) Temporary drainage management
xiv) Water quality monitoring
xv) Dust and air quality management
xvi) Ecological protection
xvii) Archaeological protection
xviii) Excavated materials management
xix) Reinstatement management
xx) Borrow pits (Internal and external from CBK compound)
xxi) Construction Methods (Plants, machinery and equipment)
xxii) Access roads during construction
xxiii) Pollution monitoring and control (spillage, refueling locations, emergency spillage kits, etc.)
xxiv) Any special requirements in the EIA guideline (appended).

The EMP will also incorporate a construction emissions reduction plan, demolition waste management plan, an indoor air quality plan, Construction waste management plan, erosion and sedimentation control, soil management, site protection as well as observing world's best construction safety standards. Possible emissions reduction initiatives include:

i) Use energy efficient lighting (e.g. fluorescent, LED or HID)
ii) Control light pollution.
iii) Meter water

### 2.10 Hoarding, security fence and approvals

Where required, the contractor shall provide temporary hoarding around the site of the works. Bidders are required to visit site, inspect the site and erect the hoarding immediately on commencement of the contract works. The Contractor shall install hoarding around the site and secure the perimeter fence. Hoarding to have guarded entry points to secure the site. The hoarding shall be in painted fabricated mild steel framing, including adopting, replacing and amending as may be necessary and redecorating on commencement of works and maintaining the same throughout the construction period; hoarding may be left in place upon completion of works in this scope. All hoarding shall be painted in color approved by the Consultant and no advertisements whatsoever shall be put on the hoarding without the approval of the Consultant. The Contractor shall allow CBK to use hoarding face for any sign writing or advertising as required. All statutory charges in connection with hoarding shall be paid by the Contractor. Hoarding shall be constructed in phases and relocated and re-constructing as shall be required, all as per the Consultant's hoarding plan (appended). Bidders are therefore required to consider in their pricing, the cost of relocating and re-constructed of the hoarding to Consultant's approval.

### 2.11 Dust screens

Temporary 1.5m high solid metal hoarding The Contractor shall provide dust screen over the hoarding extending the overall hoarding height to approximately 6m high: comprising: Heavy duty dust netting fixed on and including 100 x 100 x 3mm mild steel RHS posts at 3 .0 meters centers : all to NEMA requirements and regulations: Contractor to allow for paying of all statutory charges etc. and compliance with all requirements and regulations : Allow for cleaning and maintenance of the dust netting throughout the construction period: The Contractor shall pay for all permits and approval fees related to erection and maintenance. Length of dust screen - 1500m

### 2.12 Occupational health & safety

All bidders shall be expected to have operational knowledge and strictly comply to the Occupational Health & Safety Act, 2007. The site shall have a competent Health & Safety Officer who shall enforce compliance of the Act. Safety officers shall be required to prepare the safety policy specific to the construction site. The 'golden rules' of the site safety shall be summarized and pinned on the notice board. As part of safety policy, visitors (and any new person to site) shall be taken through a safety moment and induction session with a view to ensure the understanding of site safety. In addition to complying with the requirements of the Occupational Safety & Health Act 2007 and the Factories Act, the Contractor and Sub-Contractors shall be required to comply in all respects with the Factories (Building Operations and Work of Architectural Construction) rules All contractors staff together with visitors to site shall be expected to have safety helmet (to specific color codes), reflector jackets and safety boots (at the bare minimum) together with all other PPE safety gear necessary for their areas of operation. NOTE: The Contractor will be held responsible and shall give written Notice not later than Seven (7) days after the beginning of the building operations included in this Contract stating the particulars included in this Contract. The Contractor will further be required to identify a Site Safety Officer in accordance with the above Rules who will be responsible for the health and safety of workers on the site. A log of all incidences, accidents and near misses shall be entered into incidence logbook by competent personnel. The Contractor, subcontractors and their agents are required to study, understand and comply with the health safety strategic management plan and Health and Safety specification appended to the bid document.

### 2.13 Site levels

Before commencing work the Contractor must arrange for and agree with the Consultant the existing site levels and similarly establish and agree on a benchmark.

### 2.14 Setting out

The Contractor shall set out the Works in accordance with the dimensions and levels shown on the drawings and shall be responsible for the correctness of all dimensions and levels so set out and will be required to amend all errors arising from inaccurate setting out at their own cost and expense. Setting out will be done using survey equipment that is able to use Global Positioning System (GPS) signals to minimize errors as much as possible. In the event of any error or discrepancy in the dimensions or levels marked on the drawings being discovered, such

errors or discrepancies must be corrected and reported by the Contractor to the Consultant and CBK.. The setting out of works shall include setting out of all subcontractor's work. The survey plan established shall be submitted to the Consultant and CBK for approval, use and retention. The Land Surveyor shall establish at least six (6) additional benchmarks which shall be handed over to CBK on completion of works for future reference.

Contractor working area, access and movements

The Contractor's working storage and dumping area, and all their activities will be confined to locations to be as indicated in bid site layout drawings and agreed with the Consultant and CBK at the commencement of the works. The movement of the Contractor's vehicles and workmen will be restricted to areas and routes to be agreed with the Consultant before commencing the Contract Works and these should strictly be adhered to throughout the course of the Contract unless otherwise agreed.

### 2.15 Temporary roads

Site access roads Upon the completion of the Works the Contractor shall remove such temporary roads, temporary culverts, bridges etc., and make good and reinstate all works and services disturbed to the satisfaction of the Consultant.

### 2.16 Contract samples & prototypes

Samples and Prototypes listed in the Trade Sections of the Specification shall be obtained and submitted in sufficient time to permit proper evaluation, approval and where necessary modification and re-submission prior to any requirement to commence fabrication or stockpile materials for work for which the Sample or Prototype is required as a Control. Delays caused by or arising from the late submission of Samples or Prototypes shall not be, nor deemed to be, a justification for any claim for an extension of time for completion of the Works or cost variation to the contract. Inspections off site: Where appropriate, allow for inspection of samples and prototypes in the factory. Where the factories are located in areas outside Nairobi and other countries, the contractor shall allow for all costs including travel and accommodation for consultant's staff travel for inspection and assessment of samples, equipment, materials and any other prototypes as required or directed by the Consultant and CBK.

**Submission Procedure**:

All samples submitted for review shall be identified by an attached label showing the project name, Contractor's name, the word "Sample", the sample number and numbered consecutively in order of submission. Acceptance: Samples shall be accompanied by the Contractor's Sample Submission and Acceptance Form' containing the following information:

i) Project name
ii) Contractor's names
iii) sample number
iv) Date of samples
v) Sample generic name

vi) Sample description
vii) Building location
viii) Specification Section name
ix) Space for Consultants' review notes and acceptance
x) Space for CBK review Notes and remarks
xi) Acceptance

Large Samples: Samples of a bulky nature may be kept on site for review with a request for review made to the appropriate reviewer.

Sample Room: The Contractor shall provide on the site a designated Sample Room

### 2.17 Sample display and store

The Contractor shall allow under this item for construction of a lockable space for storage of approved samples.

### 2.18 As built drawings

The Contractor including all the sub- contractors shall engage competent drafting staff to prepare "As-built drawings" in AutoCAD, Revit by Autodesk, or any other approved specialist design software to consultants' approval: copies shall be shared electronically in both editable and non-editable format for the Consultant's interim approval prior to final submission. As-built drawings shall show all work above and below ground, with any corresponding identification, where applicable. Drawings shall be to scale of 1:100 for general layout drawings, 1:250 for Site Plans and 1:10, 1:20, 1:50 for details or any other scale as directed. As-built drawings shall indicate all services installations as executed on site. All drawings shall be accurately dimensioned and clearly detailed including all relative inverts and levels, valves, stopcocks, changes in direction, points of access, junction fittings, sizes, flow capacity and other relevant information. Submission of these As-built drawings" is a condition precedent to achieving substantial completion and issuance of respective certificate and shall be provided together with Operation and Maintenance Manuals. The as-built drawings shall form the basis for recording the locations of all services including but not limited to the following: Ring main for power reticulation Water supply (including cocks, ties, branches, valves etc.) Stormwater (including pits, inverts, etc.) Sewerage (including pits, I.O's inverts, etc.) Fire Service (including control valves, etc.) Underground Electrical Supply Cables Conduits cast into slabs Lightning protection ICT Installations Any other services installed by the Contractor and subcontractors.

### 2.19 Shop drawings

The Contractor shall prepare for review and approval by the Consultant and CBK detailed shop drawings generated in AutoCAD and Revit by Autodesk, or any other approved software including shop drawings for all specialist works by domestic sub-contractors. Following the Consultant's review of the shop drawings the Contractor shall immediately make the necessary amendments and resubmit for approval. The Contractor shall issue to the Consultant a soft copy and four printed copies of the approved shop drawings for use and transmission to CBK. The scrutiny of shop drawings by the Consultant shall be for general

conformity, including conformity with the work of others and to co-ordinate the contract work in space. Such approval shall not imply any further indication of correctness. The Contractor shall obtain and check the manufacturer's shop drawings, certified prints, and other pertinent data for conformance with all requirements of the Drawings and Specifications in ample time to permit satisfactory progress of the work. After completion of such checking and verification by the Contractor, the Contractor shall sign and stamp such drawings, which stamp shall state as follows:

Specification Section/Drawing Number: …….

Checked By: (Contractor Name) ……..

Signed by: (Consultant's Name) ……

Enough shop drawings and review data shall be submitted to the Consultant and CBK. Sufficient time for the review of all shop drawing submittal shall be allowed in Contractor's schedule. The Contractor and Sub- Contractor shall provide As-Built drawings in all the specialist services on practical completion of works

### 2.20 Warranties

The Contractor including all the sub-contractors shall allow for warranties to commence from date of certificate of substantial completion in accordance with the manufacturer's specifications

### 2.21 Operation and maintenance manuals

General: Submit operation and maintenance manuals for installations where requested in the Contract Documents, including but not limited to the items listed below: Maintenance manuals for corrosion protection - Structural steel finishes: Information: Submit Operating & Maintenance Manuals that contain the following details:

i) Scope of work carried out- Application methods
ii) An inventory of installed components listing type and manufacturer
iii) An inspection, testing and maintenance program in tabular form showing the frequency and the level of routing attentions required throughout the life of each component
iv) Manufacturer's literature on all component provided
v) A list of relevant applicators giving addresses and contact telephone numbers
vi) Maintenance manuals
vii) An inspection, testing and maintenance program in tabular form showing the frequency and the level of routing attentions required throughout the life of each component

**Procedures for operation** and emergency conditions, where applicable Safety features and controls, where applicable

An inspection, testing and maintenance program in tabular form showing the frequency

### 2.22 Maintenance spares & tools

Spares shall be supplied as additional material and/or equipment for use by the CBK after the 12 months Operation and Maintenance period and shall not be used during this period for

replacement of faulty materials or equipment except on approval by CBK and installed or replaced free of charge and a replacement stock procured. Spare components and materials required to be provided shall be procured, securely packaged and/or boxed, identified with suitable labelling and any cross reference to relevant drawings and delivered to CBK prior to and as a condition of the issue of the Notice of substantial completion. Register: Spares register with all relevant identifying information shall be maintained and provided to the Consultant and CBK in an approved electronic spreadsheet format using Microsoft Excel or any other software as directed. The latest version of spares register shall be submitted to the Consultant and CBK together with the documents required for substantial completion.

### 2.23 Minimum requirements at substantial completion

The Contractor shall have completed the Works, including the following items before the issuing of a "Notice of Certificate of Substantial Completion. External Cleaning: The Contractor shall Clean out manholes, pits, sumps and drains, remove debris, nails, washers and other foreign matter from external floor slabs and sweep free of metal shavings and dust Thoroughly clean all works, , taking great care not to scratch or damage the surfaces; any scratched or damaged surfaces will be required to be repaired or replaced at the Contractor's cost, clear debris any scratched or damaged glass will be required to be replaced at the Contractor's cost Remove all hoardings, fences and temporary buildings and structure The Contractor shall: Remove debris and surplus material, paying particular attention to concealed spaces such as plumbing ducts, lift wells, lifts wells, cupboards and the like Thoroughly clean internal surfaces, including glass and mirrors strictly following the manufacturer's or supplier's printed instruction and paying particular attention to removing dust, paint, spots, finger marks, stains, excess adhesive, smears and other blemishes, taking great care not to scratch or damage the surfaces; any scratched or damaged surfaces will be required to be replaced at the Contractor's cost Remove labels, protective paper and the like from sanitary ware and other items Ease doors and operable windows, adjust oil and clean hinges, locks, closers, floor springs and other hardware Check locks for satisfactory operation as appropriate and arrange for immediate remedial action where keys do not operate Account for all keys delivered to the site and pay for the supply and installation of all lock cylinders and keys where the full complement of keys cannot be produced Systematically label keys with stamped metal or plastic tags and hand over to CBK, clearly

### 2.24 Existing property and environment

The Contractor shall take every precaution to avoid damage to all existing property including roads, cables, drains, other services, landscaping and will be held responsible for all damage thereto, arising from the execution of this Contract, and shall make good all such damage when directed at the Contractor's own expense. The Contractor will be required to install vehicle cleaning system for all construction site entrances and exists

### 2.25 Business continuity

The site is a live environment with operations and the Contractor must make all efforts to ensure minimal disruption, noise, etc., during the construction of the Works. The contractor

must thoroughly understand CBK operations that could be affected by the planned works, including security protocol, transport & logistics, administrative, and operational aspects of the organization. Special attention must be paid to sensitive areas and critical service zones (currency areas, Data Centres, server rooms, banking hall, etc.) to ensure no disruptions occur to essential services. Areas demarcated as restricted areas must remain operational and are off-limits to contractor staff unless authorised. Movements between approved zones must follow the approved planned pathways. Noise, Dust, Debris and Obstructions: The Contractor shall at all times take all reasonable steps to minimise nuisance to residents and occupiers of the surrounding properties and others (including nuisance from noise, dust, debris and obstructions) arising from the Works and shall promptly comply with all reasonable requests from such persons for the cessation of such nuisance. The Contractor shall comply with the provisions of local authorities in observing this clause. The Contractor is to notify CBK in advance of planned activities with excessive noise and dusty activities. Steps to reduce noise to include but not limited to: Delivery of raw materials to site to be done only during the day Noisy tasks takes place at day time only Use of serviced vehicles and machinery is also expected to reduce noise levels Notify the staff/security of the intended works prior to beginning construction. Ensure that noise & vibration levels emanating from machinery, vehicles and noisy construction activities (e.g. excavation) are kept at a minimum for the safety, health and protection of workers within the vicinity of high noise levels and nearby communities. Maintain the construction equipment in good working conditions as per the operation manual. Construction workers should be aware of the sensitive nature of work place they are operating in and advised to limit verbal and other forms of noise. Contractor will coordinate to determine timing and more importantly what specific noise controls and mitigations may be needed (beyond standard construction measures) Mitigation measures against air pollution to include but not limited to:

- Choose manual demolition methods as the dust produced will be less; this has an added advantage of enabling the recovery of as much scrap as possible.
- Sprinkle water on dusty materials such as gravel, sand, ballast during offloading;
- Speed limit on trucks that will be ferrying demolition material
- The heights from which excavated materials are dropped will be controlled to a minimum practical height to limit the fugitive dust generation from unloading; and
- All stockpiles of aggregate will be enclosed or covered entirely by impervious sheeting or sprayed with water so as to maintain the entire surface wet.
- By using water-spraying vehicle upon the unpaved road, fly off dust can be prevented
- Vehicles transporting materials that have the potential to generate dust will have properly fitting side and tail boards.
- Materials transported by vehicles will be covered entirely by clean impervious sheeting, with the cover properly secured and extended over the edges of the side and tail boards to ensure that the materials do not leak from the vehicle.
- Materials will also be dampened, if necessary, before transportation in order to prevent earth movement from the site due to construction activity and run of onto public road drains, the site will be inspected regularly.
- On-site vehicle speeds will be controlled to reduce dust re-suspension and dispersion by traffic within the sites (Vehicle speeds shall be limited to a maximum of 20km/h).

- Strict measures shall be applied for the handling of construction materials in powder form such as cement, lime, concrete additives, etc.
- Excavation, handling and transport of erodible materials shall be avoided under high wind conditions or covered by tarpaulin while on transit.
- Wet all access roads during hauling of construction material during dry days.
- Maintain periodically all equipment and machinery as per the operation manual.

Mud: The Contractor is to ensure that vehicles leaving the site do not bring mud and the like on to adjoining streets. The Contractor is to provide a wash-down area adjacent to the site boundary vehicular exits to enable the wheels and other parts of construction vehicles to be cleaned of mud and the like prior to exiting the site and entering the adjacent streets.

Mosquito Control: The Contractor shall take all reasonable steps for mosquito control by ensuring that no ponding of water is allow to remain on the site that could cause the hatching of mosquitoes.

Worker's Behaviour: The Contractor shall ensure that the behaviour of workers on the site does not offend the occupants of the adjoining buildings and streets, and shall remove from the site anyone whose behaviour is declared unacceptable.

Noise control and monitoring: The Contractor shall monitoring systems to visually check noise and air quality levels during construction. Mitigation measures should be implemented to prevent disturbances to occupants. Additionally, the Contractor should schedule noisy activities during times when the campus has the fewest occupants. It is imperative that all CBK operations remain fully functional and uninterrupted throughout the duration of the works. The site is a highly sensitive environment, requiring the contractor to operate with 100% sensitivity to the specific needs and intricacies of the CBK. The contractor must take every step to familiarise themselves with the operations, functions, and systems of the site, ensuring that their activities are conducted in a manner that preserves the integrity of the organisation's critical work. The contractor shall allow a contingency plan of 20 calendar days for work stoppage due to unavoidable bank events. Special attention must be paid to sensitive areas and critical service zones to ensure no disruptions occur to essential services.

### 2.26 Protection of existing utility, services and property

Prior to commencement of any work the Contractor is to ascertain by own initiative the exact position, depth and level of all existing electric cables, water pipes or other services in the area and shall make whatever provisions may be required by the authorities concerned for the support and protection of such services. Any damage or disturbance caused to any service shall be reported immediately to the Consultant and the relevant authority and shall be made good to their satisfaction at the Contractor's expense. The Contractor shall exercise utmost care and precaution to ensure that all existing CBK property and public utilities are well protected, and that business continuity is maintained during construction operations. Any damage to such property and utilities caused by the Contractor or Sub- Contractors shall be repaired or restored at contractor's cost to the satisfaction of the Consultant and CBK. In the event of any damage to existing site services caused by the Contractor's operations, the

Contractor shall be liable for liquidated damages. The amount of liquidated damages shall be as evaluated by CBK team for each day the service remains disrupted, in addition to the cost of repairs and any other associated costs.

### 2.27 Stockpile materials for emergency repairs.

The Contractor shall maintain a stock of essential materials and equipment on-site to address any emergencies that may arise due to accidental damage to existing services. This stock shall include, but not be limited to, pipes, fittings, cables, and other relevant items necessary for immediate repair.

### 2.28 Statutory regulations and bye laws

The Contractor is to comply with all local regulations and by-laws of the Local Authority including serving of notices and paving of fees.

### 2.29 Materials, tools, plant and scaffolding

The proposed project is regarded by the Central Bank of Kenya as a high-level sensitive project, and it is expected that the quality of material and work is to be of the highest standard. All materials and workmanship used in the execution of the works shall be of the best quality and description unless otherwise described. Any materials for the works condemned by the Consultant and CBK shall immediately be removed from the site at the Contractor's expense. All such plant, tools and scaffolding shall comply with all regulations whether general or local in force throughout the period of the Contract and shall be altered or adapted during the Contract as may be necessary to comply with any amendments in or additions to such regulations.

### 2.30 Off-site storage of materials

Where storage of materials for the Works is required off-site, the Contractor shall ensure that the materials are insured in the name of the Central Bank of Kenya, stored in a secure undercover location, packaged or protected to prevent damage during delivery and storage, certified as belonging to the Central Bank of Kenya where payment for unfixed materials is sought, located close enough to the site to allow inspection by CBK, and secured in accordance with the Contract where early payment is required. Generally, payment for materials stored off-site shall not be allowed unless approved by CBK. The Contractor shall arrange for inspection by the Consultant and CBK of materials, components, and fabricated items at the relevant factories, warehouses, or other sources for quality-control inspection of samples, prototypes, testing, examples of custom-made work, and similar items.

### 2.31 Services coordinator

The Contractor shall employ a suitably experienced Building Services Co-Ordinator, who shall be responsible for the co-ordination of the installation, testing and commissioning of the building services. The Building Services Co-Ordinator shall ensure that coordinate all-services drawings are prepared which clearly demonstrates compliance with documented requirements, Coordinate Mechanical, Electrical, Plumbing, ICT, Security, and Fire Protection designs, Review drawings for clashes and conflicts, ensure compliance with uptime, applicable standards, Local building regulations, Client technical standards and chair MEP

coordination meetings. The MEP coordinator shall coordinate installation of server racks , containment systems, overhead and underfloor services, Power Whips, Busbar systems, Fibre pathways and ensure Hot aisle/cold aisle design integrity, adequate airflow management, Required maintenance clearances; coordinate Utility power systems, Transformers, generators, UPS systems, ATS systems, Busways, PDUs, Earthing and bonding etc

6.Co-ordinate the services inspection and handover processes. Co-ordinate the training of the Central Bank of Kenya's and/or operators''€™staff in the operation of the services systems. Co-ordinate the integration of the new systems with the existing systems to the satisfaction of the Consultant and CBK.

### 2.32 Public and private roads, pavement, etc.

The Contractor will be required to make good at their own expense any damage they may cause to the present approach road surfaces during the period of the Works.

### 2.33 Police regulations

The Contractor is to allow for complying with all instructions and regulations of the Police Authorities.

### 2.34 Contractors' superintendence

The Contractor shall constantly keep on the Works a literate English-speaking Agent or Representative, competent and experienced in the kind of work involved, who shall give their whole time to the superintendence of the Works. Such Agent or Representative shall receive on behalf of the Contractor, directions and instructions from the Consultant and such directions and instructions shall be deemed given to the Contractor in accordance with the Conditions of Contract. The Agent shall not be replaced without the specific approval of the Consultant. It is to be a specific condition of this Contract that the contractor shall provide onsite throughout the period up to the date for Practical Completion a suitably qualified, experienced and competent person to ensure that the works are carried out to the standard required by the specifications and detailed on the Drawings; and shall ensure that upon any termination of employment a suitable replacement is found. The Consultant may interview the Contractor's proposed Representative. Curriculum Vitae of past experience and qualifications. The personnel proposed for the works shall have relevant experience in similar works. CBK's decision will be final regarding the suitability of the proposed Representative.

### 2.35 Traffic arrangements

The designated routes and zones outlined form the foundation of a detailed traffic management plan, ensuring the safe and efficient movement of vehicles and pedestrians within the Facility. The Contractor will be required to agree the access route to the site with the Central Bank of Kenya before commencement of the Contract Works and must adhere to this route throughout the course of the Contract, unless agreed otherwise. All Temporary Roads must be constructed and maintained to ensure stability, reduce dust, and accommodate heavy vehicle with pedestrian routes and crossings shown designated for safe passage of personnel across traffic areas. These crossings will be supported by physical barriers and

appropriate signage. The Contractor may be required to observe certain traffic rules and regulations pertaining to the use by their vehicles of the roads adjacent to the site. These rules and regulations should be investigated by the contractor at the commencement of the Contract. All traffic flow, as indicated on the routes, must incorporate: Speed limit enforcement zones. Clearly marked stop points at intersections. Emergency vehicle routes that are kept clear at all times. Temporary signage and lighting must be installed at all critical points identified in the diagram to guide vehicle and pedestrian movement safely.

### 2.36 Schedule of works

The contractor shall prepare and submit a detailed project schedule of works for approval by CBK and the Consultant in accordance with the Contract. The schedule of works is to be in a computerized format done in Primavera, Microsoft Project, or any other approved software or format. The schedule of works should clearly indicate the critical path, and the Contractor will update the schedule on a monthly and/or weekly basis during the course of the Contract clearly indicating the actual dates against the approved baseline dates. The schedule shall show in detail the construction time and order in which each section of the work is to be carried out and be sub-divided into elements, trades and tasks. The time schedule is to be agreed with the Consultant. At the end of each month the Contractor is to incorporate actual start and finish dates into the time schedule and produce a construction schedule update and analysis for the Consultant. The analysis is to show actual start and finish dates, identify out of sequence work, critical activities and any constraints which have or may affect the progress of the works. During the execution of the works the Contractor will incorporate any changes to the time schedule only if approved `in writing' by the Consultant arising for whatsoever reason and produce a revised schedule. The Contractor will provide the Consultant with soft editable copy of the time schedule including monthly updates and analyses together with four printed copies of the relevant data. Note: The contractor shall allow in the overall schedule of works, published holidays as per the annual calendar.

### 2.37 Sub-contractors' attendance

The Contractor shall provide general and special attendance to Sub-Contractors as required for the proper execution of the Sub-Contractor Works. General attendance shall include use of the Contractor's scaffolding while erected on site, provision of power, water, lighting, watching, sanitary accommodation, mess rooms, welfare facilities, space for offices, stores, plant, and materials, and clearing away rubbish produced by Sub-Contractors. Special attendance shall include taking delivery, meaning the provision of unskilled labour necessary to unload plant and materials received on site and place them within the Sub-Contractor's storage space or store, and hoisting, meaning the provision of unskilled labour and use of the Contractor's standing plant to assist in raising Sub-Contractor plant and materials to the required levels, but not placing them in final position.

GENERAL ATTENDANCE - The following services are described as "allow for general attendance"

a) Use, for the purpose of the Sub-Contractor Works of any scaffolding belonging to or provided by the Contractor while it remains so erected upon the site, provided that no warranty or other liability on the part of the Contractor or the sub-contractors shall be created or implied in regard to the fitness, condition or suitability of the said scaffolding.
b) Provision of power, water, lighting, watching and attendance for the purpose of the Sub-Contract Works
c) Use of sanitary accommodation, mess rooms and welfare facilities
d) Provision of space for erection of offices or stores or space for storage of plant and materials) Clearing away rubbish produced by them

SPECIAL ATTENDANCE. The following services are applied under a separate item and were described under the following headings shall mean.

a) "Taking delivery" shall mean the provision of unskilled labor necessary to attend upon the sub- contractor's workmen for the purpose of unloading plant and materials when received upon the site and placing in position within the Sub- Contractor's storage space or store.
b) "Hoisting" shall mean the provision of unskilled labor and the use of any Contractor's standing plant for the purpose of assisting the Sub- Contractor's workmen in hoisting the Sub- Contractor's plant and materials to the various levels but not placing in its final position

### 2.38 Water

The Contractor shall provide at their own risk and cost all water for use in connection with the Works including the work of sub- contractors; make arrangements with the Local Authority for the installation of a separate meter for all water used by the contractor throughout the Contract and pay all costs and fees in connection therewith. The Contractor shall also provide temporary storage tanks and tubing, etc., as they may consider necessary and clear away at completion. All tanks for permanent retention/incorporation shall not be used for this item. Alternatively, the Contractor may make separate arrangements at their own risk with the Central Bank of Kenya for the use of the water from the existing water supply on site and for paying all charges thereto including connection and consumption. No guarantee is given on the availability of water or its quality. No claims for lack of water or water pressure will be entertained. All water shall be fresh, clean and pure, free from earthy, vegetable or organic matter, acid or alkaline substance in solution or suspension. Water used in the mixing of concrete shall conform to BS EN 1008:2002-Mixing water for concrete Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete.

### 2.39 Lighting and power

The Contractor shall provide at their own risk and cost all artificial lighting and power for use on the works, including all sub-contractors and specialists' requirements and including all temporary connections, wiring, fittings etc., and clearing away on completion, The Contractor shall pay all fees and obtain all permits in connection therewith. The Contractor may install their own generator on site with the approval of the Kenya Power Company Ltd. (K.P.C.) and

the Central Bank of Kenya, if required. All such temporary works shall be cleared away on completion. No claims due to lack of electricity or due to power fluctuations will be accepted. All watching and lighting shall comply with the requirements of CBK and the Consultant.

### 2.40 Concrete tests

Benchmark and Testing of Concrete

NOTE: The Contractor must allow for all costs in connection with the making of the cubes, curing, transport, crushing by Local Authority and obtaining the test certificate: to BS EN 206 and BS 8500 Set of four 150 x 150 x 150 mm concrete test cubes in sufficient quantity as shall be directed by the consultant.

### 2.41 Other tests

The Contractor shall be required to carry Site Acceptance Tests (SATs) and other tests as shall be required during the execution of the works as directed. Testing shall include provision of power, water and all other consumables where required. Such tests shall be documented and copies submitted to the Consultant. Sufficient notice shall be given prior to undertaking designated tests requiring to be witnessed. 5 working days for site tests; and10 working days for local pre-delivery tests. The contractor shall allow for submission of samples for testing by approved independent specialist authority accredited to undertake testing works. Any tests undertaken on site shall use instruments calibrated by accredited authority. Tests shall include but not limited to the following:

Note: Testing and commissioning shall include all chemicals, power, fuel amongst other pre-conditions necessary to achieve the testing procedure. This will also include connections to existing systems. The contractor shall pay for all fees required for testing.

### 2.42 Site office, contractor's temporary buildings

The Contractor shall visit site, inspect any temporary structures, provide, erect and maintain temporary office accommodation having adequate lighting, furniture and fittings for their use and ample temporary watertight sheds for the proper storage and protection of materials and for the use of artisans. Storage of material within the existing building will not be permitted without the written authority of the Consultant. Any storage so permitted must comply with any restrictions or conditions imposed by the Consultant. The Contractor shall also provide, erect a separate temporary office with a total floor area of not less than 15 square meters having adequate lighting, furniture and fittings and separate storage space for the exclusive use of the Sub-Contractors and Suppliers. The Contractor shall provide the necessary portable eco toilet facilities for staff and workmen both for the Contractor's and the Sub-contractors' at an approved location on site. The toilets shall be provided, erected and maintained to the requirements and satisfaction of the Central Bank of Kenya and Consultant and be kept at all times in a thoroughly clean and sanitary condition. The Contractor shall also provide, erect main temporary facilities for use by workers for washing, drinking water, first aid and shelter from rain, all to the approval of the Consultant and CBK. The Contractor shall allow for provision of non-alcoholic refreshments during the site meetings. Cooking and eating facilities

for workers will not be permitted on the site without CBK's written approval. Facilities required including but not limited to: Fully furnished, serviced, cleaned and maintained offices and amenities that includes all provision of consumables such as tea, coffee, sugar, soap, detergent, toilet paper, healthy potable water supply, chilled/boiling water dispensers and the like Full air conditioning of office and storage spaces; thermostatically controlled with time switch Tea room provided with appropriate cutlery, crockery, glasses, microwave oven, hot plate, large refrigerator and dishwasher Appropriate serving trays, trolley, water jugs, thermos and the like for conferences Reception area with waiting chairs and a large coat cupboard for storage of visitors coats, umbrellas and the like.

### 2.43 Temporary structures

a) The Contractor shall allow for providing and clearing away on completion of the Works such as temporary hoardings, fencing, gates, planked walkways, guard rails, etc. may be necessary for the protection of the workers, occupants of the building and adjacent structures and for the proper execution of the Works. All such temporary structures shall be constructed with the approval of the Consultant and CBK's full satisfaction and in such a manner as to cause minimum inconveniences and disturbance to pedestrians and road users using the adjacent roads. All such temporary structures shall comply in all respects with the National laws, rules and regulations currently in force and applicable to such structures. All temporary structures shall be erected in a manner so that the unloading or loading of materials causes minimum obstruction to the use of adjacent roads and other facilities.
b) All temporary structures shall be kept properly lit throughout the periods of darkness and any corners or projections shall be painted white.
c) Temporary structures shall not be used or permitted to be used for advertisement purposes except with the consent of the Consultant.
d) All temporary structures shall be always maintained in good order and condition to the satisfaction of the Consultant.
e) All temporary structures shall be removed when so required by the Consultant or at the end of the period for which it is required. The Contractor shall indemnify and shall keep CBK indemnified against any expense, loss, claim or in connection with the temporary structures

### 2.44 Telephone

The Contractor is not required to provide for a telephone but may do so for at their convenience and pay all costs and changes in connection therewith.

### 2.45 Adverse weather conditions

The bidder is referred to monthly historical data and records of weather patterns recorded by Kenya Meteorological department for the last 10 years (Home Kenya Meteorological Department) Contractors Method Statement and Programmed should reflect how the wet seasons envisaged during the contract period by the Kenya National Meteorological department at the time of bidding, will be accommodated within the contract period. The contractor shall, in addition, make a reasonable estimate of recovery time in overall

programmed, following adverse rainfall, including but not limited to mopping up removal of water from excavations and trenches "Adverse Weather Conditions" shall mean weather conditions that are severe, unusual, and unexpected

### 2.46 Temporary disposal of rainwater

The Contractor shall provide and maintain all necessary temporary gutters, downpipes, chutes, drains, etc. for conveying rainwater from the buildings. The Contractor shall allow for temporary drainage, pumping and piping for keeping the premises and site free from accumulation of water at all times.

### 2.47 Site photographs

The Contractor shall seek approval and allow for taking digital site photographs on a weekly basis to the satisfaction of the Consultant. Soft copies of the photographs shall be provided to CBK and the Consultant. Hard copies shall be filed in a clean project album supplied by contractor on site and handed over to CBK on completion of the project Note: CBK is a restricted site and therefore the Contractor shall strictly observe security guidelines while taking photos. Photographs outside of the construction site shall not be allowed.

### 2.48 Sign board

The Contractor shall visit site, inspect and provide,erect where directed and maintain during the whole period of building operations and remove at completion, one approved temporary notice board to the Consultant's standard design and giving a brief description of the Works and showing the names of the Central Bank of Kenya, the Consultant and the Contractor with sufficient space to append the names of Nominated Sub-Contractors and Suppliers when known. The lettering concerning the Consultant is to be not more than 50mm high.

### 2.49 Contractor's report

The Contractor shall provide to the Consultant progress report on a weekly and monthly basis (or as directed by the Consultant) for onward transmission to CBK. The Contractor's report shall be in approved format, and shall include project overview, progress charts, milestones, deliveries to site, achievements and any challenges in period under review. The report shall further provide weekly look-ahead, testing results, labor and equipment statistics, approved project photographs, Quality Assurance & Quality Control (QA/QC) documentation, list of notices, claims, safety statistics, environmental statistics, comparison of planned and actual progress, matters arising, early warning, log of Request for Information (RFI) & Request for Approvals (RFA) together with any mitigation measures for any delays.

### 2.50 Other CBK contractors and contractor's specialists

The Contractor shall accept responsibility for providing the following services for direct contracts and specialists as before described:

i) GENERAL ATTENDANCE.

The following services are described as "allow for general attendance":

a) Use, for the purpose of other CBK contractor's Works of any scaffolding belonging to or provided by the Contractor while it remains so erected upon the site, provided that no warranty or other liability on the part of the Contractor or other CBK contractors and contractor's specialists shall be created or implied in regard to the fitness, condition or suitability of the said scaffolding;
b) Provision of water, lighting, watching and attendance for the purpose of the direct contractors and contractor's specialists.
c) Use of sanitary accommodation, mess rooms and welfare facilities.
d) Provision of space for erection of offices or stores or space for storage of plant and materials.
e) Clearing away rubbish produced by them.

ii) SPECIAL ATTENDANCE. The following services are stated under a separate item and were described under the following headings shall mean;
a) "Taking delivery" shall mean the provision of unskilled labor necessary to attend upon the supplier's workmen for the purpose of unloading plant and materials when received upon the site and placing in position within storage space or store;
b) "Hoisting" shall mean the provision of unskilled labor and the use of any Contractor's plant for the purpose of assisting other CBK supplier's workmen in hoisting their plant and materials to the various levels but not placing in its final position.
c) "Providing Power" shall mean the provision of power during the course of the Works and during the period of maintenance.

**2.51 Protection of work**

The Contractor shall cover up and protect all finished work from damage including provision of temporary plywood or polythene sheet. In the event of any damage occurring to the Works, materials, fiber cables, power cables, security infrastructure, sewer line, drains, gullies, paths or other works on the site in temporary possession of the Contractor for the purpose of this Contract, either from the weather, want of proper protection, defects, or insufficiency of the Works or any other cause whatsoever during the progress of the Works, the Contractor alone shall be responsible and shall without extra charge, immediately make good all damage and pay all costs which may be levied.

**2.52 Local regulations and by-laws**

The Contractor is to comply with all local regulations and by-laws of the Local Authority including serving of notices and paying of fees particularly any works outside CBK Facility. However, the contractor shall liaise with CBK with regard to this requirement.

# ELECTRICAL INSTALLATION SPECIFICATIONS

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## 1. Project Overview

Central Bank of Kenya (hereafter referred to as 'Client') intends to overhaul and modernize incoming and distribution of its power system.

The key features of the facility are as follows:

Incorporate adequate levels of redundancy in distribution systems to minimize failure of critical power paths and in turn the total loss of supply to critical loads.

Provide a high degree of resilience to suit operation of the facility for 24 hours per day, 365 days per year.

Backup systems shall operate automatically, but shall incorporate manual override to allow for maintenance and testing requirements.

Incorporate adequate provisions to allow systems to be safely maintained, adjusted or replaced, without isolation of supply to critical load centres or systems supporting critical function.

A minimum of N+1 redundancy shall be maintained throughout the electrical infrastructure to ensure Concurrent Maintainability of capacity components (noting that certain sub-system within the design will have enhanced resilience meeting replicating an N+2 or N+N configuration. It shall be possible to maintain operation on the failure of any single supply point or maintain any supply point without interruption to the incoming supply.

The Electrical services shall be installed in manner so that there is zero downtime on the facility for future phase tie-ins.

This Specification is for the Electrical Installation of Services within the Site.

## 2. Scope of Works Description

The extent of work covered by these documents includes the supply, delivery, testing, commissioning and subsequent maintenance of Electrical Installation system as detailed in this specification and on the accompanying drawings.

Provide materials, labour, cartage, tools, plant, appliances, accessories and fixings necessary for the proper execution of the works, together with all minor and incidental works.

The following list identifies the work to be undertaken by the Contractor. The listed items are not intended to limit or exclude any items required by the contract documents.

It is the responsibility of the contractor to coordinate the supply installation commissioning and final Integrated Site Testing (IST).

The Electrical Services work shall comprise the provision of the following:

### 2.1 Electrical Services Installation

Underground services ducts for MV, LV, Data and Fibre cables

Incoming MV supply mains

Metering, including sub metering and Embedded Tariff Network Metering

MV Submains Installation

LV Submains Installation Protective Earthing System

LV Busway System Installation

Technical Earthing System

Earth cabling/tape, pits and bars as outlined in this specification and associated service

drawings.
Light and power sub circuit wiring
Provision of sub circuit wiring, from the associated Mechanical Switchboard to all mechanical plant equipment, including final termination to a local maintenance isolator to be located adjacent to each item of mechanical plant.
Provision installation and connection of wiring interface between each Generator Control system,
Main Switchboard and UPS synchronization panel.
Provision installation and connection of wiring interface between each Generator Control system, Main Switchboard
Provision installation and connection of power wiring and monitoring interface associated with the Hydraulic, fire and BMS Controls as detailed.
Cable Containment system (cable ladders, trays, basket, ducts, busway and associated supports)
Supply of lockable Communication pits and conduits for installation
Coordination of installation of LV and ELV cable pits and conduits for installation.
Coordination of installation of MV cable pits and conduits for installation.
Power for Fire/Security(CCTV, Access Control, Intercom and Intruder Alarm) /ICT/BMS services
Luminaires and standard lighting control system.
Emergency Lighting
External lighting
Socket outlets
Skirting wiring duct
Telecom block cabling
Lightning protection system
Earthing System
Data wiring
Control wiring
Mechanical controls wiring
Disabled Toilet Alarm (Office Building)
Connection of all equipment supplied to the BMS and EMS Network interface point
Interfaces and coordination with the Fire, BMS, EMS Electrical Control System and Security services.
Coordination and supply and installation of all power and control cabling required as part of the Security Installation
Coordination and supply and installation of all power and control cabling required as part of the Lift Installation.
Coordination and supply and installation of all power and control cabling and I/O Units as required as part of the Fire Detection Installation.
Spares

Miscellaneous works and equipment
Turn on/Energization of all switchboards including submission of Safe Work Method Statements (SWMS) and all procedures in accordance with BS 7671regulations.
Testing and commissioning
Witnessed Site Acceptance testing
Integrated System Testing (14 days).
Handover Testing
Training and tuition
As-built documentation. Provide draft documents 2 weeks prior to final commissioning and IST testing. Final documents to be provided at practical completion.
Operational maintenance manuals
Cleaning of site following all works
Preventative maintenance

### 2.2 Lighting/Emergency Lighting Control and Monitoring System

The Electrical Services Sub-contractor shall supply install commission and test a simple PIR based lighting control system throughout.
All switching of dimmable lights must be ramped up or down in a smooth controlled manner, not stepped function.
The general principle for the lighting control system shall be controlled accordingly for the below areas as follows:

### 2.3 Lightning Protection System

The lighting protection system shall be designed by a lighting protection specialist subcontracted to the electrical contractor.
The system shall be provided in accordance with BS EN 62305 All Parts. The Lightning Protection system shall be isolated electrically in its entirety from the building structure and components.
Electrical Services Sub-contractor shall:
Supply and Install air terminals complete connection to dedicated (isolated) copper tape down conductors.
Bonding of all exposed metal on the roof/s (i.e. Condensers/Platforms etc.) shall not be to the Lightning Protection system rather to the Main building Earthing system.
Test points shall be provided
Surge Protection in each main switchboard (by the switchboard services sub- contractor)

### 2.4 Communications Services

Provide materials, labour, cartage, tools, plant, appliances, accessories and fixings necessary for the proper execution of the works, together with all minor and incidental works.

### 2.5 Integrated Site Testing

System Acceptance Testing and all testing required for Uptime Tier Accreditation works.
Temporary Load Bank
Supply of 300kW Resistive/reactive load bank for the duration of commissioning and IST testing. Allow for 14-working days hire, including associated cabling and protection.

### 2.5.1 Mechanical Installation Trade

Provide estimated harmonic current details up to the 35th harmonic and maximum and normal demands of all mechanical services switchboards served from electrical submains and switchboards and liaise and co-ordinate the works with the Electrical Services Contractor.

### 2.5.2 Vertical Transportation Installation Trade

Provide discrimination details of switchgear, harmonic current details up to the 35th harmonic and maximum demand of all lift services switchboards served from electrical submains provided by the Electrical Services Contractor and liaise and co- ordinate the works with the Electrical Services Contractor. (Electrical Services Contractor to provide details of voltage drop, fault level and earth fault loop impedance at all switchboards served by submains provided by the Electrical Services Contractor from which the Lift Services Contractor derives the supply for the lift services installation including the co-ordination of discrimination of switchgear at the respective switchboards.)
Provide suitable mounting for CCTV camera in each lift car and trailing cables and cabling. Termination point in each lift machine room.
Provide suitable mounting for access control reader in car control panel in each lift car and trailing
Cables and termination points at car control panel and each lift machine room.
Co-ordination and attendance as required to prove correct operation of the lift interface with the security system.

### 2.5.3 Fire Services Installation Trade

Provide discrimination details of switchgear, harmonic current details up to the 35th harmonic and maximum demand of all fire services switchboards and equipment served from electrical submains and switchboards provided by the Electrical Services Contractor and liaise and co-ordinate the works with the Electrical Services Contractor. (Electrical Services Contractor to provide details of voltage drop, fault level and earth fault loop impedance at all switchboards served by submains provided by the Electrical Services Contractor or at switchboards from which the Fire Services Contractor derives the supply for the fire services installation or equipment including the co-ordination of discrimination of switchgear at the respective switchboards.)
Control and Indicating Equipment Panel (FAP) and fire detection system. (ElectricalServices Contractor to provide and connect submains to FAP)
Portable fire extinguishers
Provision of a voltage free contact at the Control and Indicating Equipment Panel (CIE) for the automatic release of electrically locked doors on fire alarm
Provide fire alarm output for security monitoring
Joint co-ordination responsibility with the Electrical Services Contractor for the following:
Provision of all personnel and equipment necessary for commissioning of all systems fire mode

operations
Confirmation of required number and location of interface connections associated with all systems for fire mode operations.

### 2.5.4 Security Services Installation Trade

Provide discrimination details of switchgear, harmonic current details up to the 35th harmonic and maximum demand of all security services switchboards and equipment served from electrical submains and switchboards provided by the Electrical Services Contractor and liaise and co- ordinate the works with the Electrical Services Contractor. (Electrical Services Contractor to provide details of voltage drop, fault level and earth fault loop impedance at all switchboards served by submains provided by the Electrical Services Contractor or at switchboards from which the Security Services Contractor derives the supply for the fire services installation or equipment including the co-ordination of discrimination of switchgear at the respective switchboards.)
Security Control and Indicating Equipment systems (Electrical Services Contractor to provide and connect submains to equipment)
Provide Security alarm output for Fire monitoring
Joint co-ordination responsibility with the Electrical Services Contractor for the following:
Provision of all personnel and equipment necessary for commissioning of all systems security mode operations

### 2.5.5 Distribution System Operator (DSO) Company

Medium voltage cable reticulation from Substation.
Substation equipment, cabling, earthing and commissioning.

### 2.5.6 Electrical Retailer

Metering equipment, not provided under the main body of works.

### 2.5.7 Project Engineer

Arrangement of lease agreements and supply contracts with Distribution Company.
Payment of all charges associated with the substation installation and incoming Medium voltage cables.

## 3. Standards

### 3.1 Underground Services Ducts

All Underground Services shall comply with the following requirements, and the additional requirements of this specification:

| | |
|---|---|
| IEC 61386 | Conduit Systems for Electrical Installations' |
| IEC 61386-24 | Conduit systems for electrical installations – Particular requirements for conduit systems buried underground |
| IEC 62262 | Colour code for buried plastics piping' |
| EN 124 | Gully tops and manhole tops for vehicular and pedestrian areas – Design requirements, type testing, marking, quality control' |
| EN 12620 | Aggregates for concrete' |
| IEC 60423 | Specification for unplasticized PVC pipe for industrial uses Health and Safety |
| Authority | Local Health and Safety Regulations |
| EN 7671Rules | Code of Practice for Design Selection and Erection of Low Voltage Switchgear Assemblies |

### 3.2 Power Distribution

All Power Distribution Services shall comply with the following requirements, and the additional requirements of this specification:

| | |
|---|---|
| IEC 61386 | Conduit systems for cable management |
| EN 50085 | Cable trunking systems and ducting systems for electrical installations |
| IEC 61537 | Cable tray systems and cable ladder systems for cable management |
| EN ISO 12944 | Paints & Varnishes - Corrosion Protection of Steel Structures by protective paint systems. |
| EN 10346 | Continuously hot-dip coated steel flat products for cold forming. Technical delivery conditions |
| EN ISO 1461 | Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods |
| EN ISO 2081 | Metallic and other inorganic coatings. Electroplated coatings of zinc with supplementary treatments on iron or steel |
| EN 61439-6:2012 | Low-voltage switchgear and controlgear assemblies - Part 6: Busbar trunking systems (busways) |
| IEC 60364 | The IET Wiring Regulations |
| The Safety, Health and Welfare Act 2005 | Safety, Health And Welfare At Work (Construction) Emergency Lighting |

### 3.3 Emergency Lighting

All Emergency Lighting Services shall comply with the following requirements, and the additional requirements of this specification:

| | |
|---|---|
| IEC 60364-5-56 | Emergency Lighting Standard |
| EN 1838 | Lighting Applications - Emergency Lighting |
| EN 13032-3 | Measurement an d Presentation of Photometric Data of Lamps and Luminaires - Part 3: Presentation of Data for Emergency Lighting of Work Places |
| EN 50171 | Central Power Supply Systems |
| EN 50172 | Emergency Escape Lighting Systems |
| IEC 60331-1 | Method of Test for Resistance to Fire of Unprotected Small Cables for Use in Emergency Circuits |
| IEC 60245-8 | Electric cables - Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U) - Part 3-11: Cables with special fire performance - Flexible cables with halogen-free thermoplastic insulation, and low emission of smoke |
| IEC 60529 | Degrees of Protection Provided by Enclosures (IP Code) |
| IEC 60598-2-22 | Luminaires - Part 2-22: Particular Requirements - Luminaires for Emergency Lighting |
| IEC 62034 | Automatic Test Systems for Battery Powered Emergency Escape Lighting |
| ISO 3864-1 | Graphical symbols - Safety colours and safety signs - Part 1: Design principles for safety signs and safety markings |
| ISO 3864-4 | Graphical symbols - Safety colours and safety signs – Part 4; Colorimetric and photometric properties of safety sign materials |
| ISO 7010 | Graphical symbols - Safety colours and safety signs - registered safety signs |

### 3.4 General Lighting

All General Lighting Services shall comply with the following requirements, and the additional requirements of this specification:

| | |
|---|---|
| IEC 60598 | Luminaires |
| IEC 62663 | Energy Performance Of Buildings - Energy Requirements For Lighting |
| IEC 60050-845 | Light and lighting - Basic terms and criteria for specifying lighting requirements |
| IEC 12464 -1 | Light and lighting |
| IEC 61058-1 | Switches for appliances |
| IEC 60079 | Explosive atmospheres |
| IEC 62663-1 | Road lighting |

### 3.5 General Power

All General Power Services shall comply with the following requirements, and the additional requirements of this specification:

| | |
|---|---|
| IEC 60669 | General requirements for electrical accessories |
| IEC 60664-1 | Insulation coordination for equipment within low-voltage systems. Principles, requirements and test |
| IEC 60529 | Degrees of protection provided by enclosures (IP code) |

## 4. Particular Specification Electrical Installation

### 4.1 Electricity Service

The intake panel will be installed in a container, on site, along with the MEDIUM panels. The contractor shall maintain the same phase sequence as provided by the Electricity Distributor. The KPLC metering panel will be located in a room provided at the Kisumu building.

Liaise with the Electricity Distributor for details of supply to the site and programming of works.

### 4.2 Perspective Fault Level

The prospective fault level current for the 11kV reticulation is ≤25kA. The prospective fault level at the point of supply was shall be calculated from details of the transformer size, impedance, etc., as shall be provided by Kenya power.

All parts of the installation, main switchboard and equipment shall be sized and selected to withstand the stresses caused by the prospective fault level for a period of one second.

### 4.3 Balancing

Ensure that the installation is balanced as far as reasonably possible, between phases. This shall apply to the overall installation and loads connected to each submain and distribution switchboard.

### 4.4 Power For Testing

Make all necessary arrangements and applications, etc., for the full permanent power to be connected before the date of practical completion.

The time of connection shall be arranged to suit the building program.

Ensure submains, controls and associated items for equipment and systems installed by others are connected prior to testing.

Lighting and power outlets shall not be connected to the supply for general usage before practical completion without prior approval.

Arrange for the Project Engineer to make all necessary applications to the Electricity Retailer for supply agreements which will be transferred to his name from the date of practical completion.

Connection of permanent supply prior to practical completion may be made in the name of others subject to approval.

### 4.5 MV Cabling

#### 4.5.1 Scope

The scope of this specification covers the quality requirements for the manufacturing, testing and commissioning of the Medium Voltage (MV) Power Cables.

#### 4.5.2 Standards

All Works shall be performed in accordance with the latest relevant British Standards and local Codes and Practices and associated published specifications.
The version of Standards referenced shall be the current version on the date of Contract.
Where Standards referenced are superseded by other Irish Standards, the newer standard shall apply. As a minimum, the Works shall comply with the following standards: IEC 60270
High-voltage test techniques - Partial discharge measurements

| | |
|---|---|
| IEC 60949 | Calculation of thermally permissible short-circuit currents, taking into account non-adiabatic heating effects |
| IEC 61986 | Short-circuit temperature limits of electric cables with a rated voltage from 6 kV (U = 7,2 kV) up to 30 kV (U = 36 kV |
| IEC 60364 | The IET Wiring Regulations-Wiring Electrical Installations |
| IEC 60502 | Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) |
| IEC 60060 | High voltage test techniques |
| IEEE 400.2 | Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF) |

### 4.5.3 MV Cable Specifications

| Parameter | Requirement |
|---|---|
| Cable rated voltage | 6.35/11kV (24) kV |
| No of cores | 3 core (multi-core) / or 3 x Single Core |
| MV Cable Sizes (CSA) | As nominated in the cable schedules |
| Type of conductor | Copper, stranded circular |
| Conductor screen | Semi-conductive XLPE |
| Insulation medium | Polymeric insulated medium (XLPE) |
| Screening details | Individual screened, course faultprotection heavy duty screens |
| Armor | Required |
| Other | PVC over sheath |
| Cable marking information | Yes, each phase to be colour identified, cable no. and length markings on outer sheath. |

| Parameter | Requirement |
|---|---|
| Drum | Wooden drum |
| Sample tests | 2 off, Beginning and end of manufacture run |
| Cable outer sheath colour | Black |
| Sheath material | PVC – V90 |
| Parameter | Requirement |
| Required earth fault current | 10 kA/ 1s |
| Required fault current rating | 25 kA/ 1s (minimum) |
| Core Identification | The cores of the cables shall be readily identifiable by number or colour tracing throughout its length |

### 4.5.4 Cable Protection

The Contractor shall provide mechanical protection of cable on drum including capped cable ends and wrap the drums in black corflute or similar approved protection to prevent ultraviolet light affecting the cables.

### 4.5.5 Core Identification

The cores of the cables shall be readily identifiable by number or colour tracing throughout its length.

### 4.5.6 Derating

The sizes of conductors as specified are the minimum size that shall be provided.

The size, grouping, spacing, enclosure and location of cables shall be installed so that the current rating of the conductors as permitted by the relevant Code after the appropriate derating factors have been applied, is not less than the specified current rating of the circuit breaker or fuse which protects the conductor.

The current rating of the protective device may exceed the derated current rating of the cable as permitted by the wiring rules for cables serving items of equipment which are subject to short time overload current, e.g., motors.

Where conductors are installed, grouped, spaced or enclosed in such a manner that their derated current rating is less than the specified current rating of the protective device, the size of the conductor shall be increased to provide a current rating of the conductor which is not less than the specified current rating of the respective protective circuit breaker or fuse.

### 4.5.7 Testing

Minimum Requirements
The Contractor shall carry out all necessary and required tests during the progress of the work, and provide all testing apparatus for this purpose. Prior to testing, details of proposed test methods and calibration certificates and validity dates for apparatus to be used for testing shall be submitted for approval to the Engineer.
The Contractor shall conduct tests as detailed in this specification and perform all additional tests as instructed to commission the power cables.
The Contractor shall ensure that all power cables are duly tested in accordance with relevant applicable Irish and International standards.
Costs associated with testing and commissioning shall be the responsibility of the Contractor and included in the Contract Sum.
Test Certificates
The Contractor shall provide to the Engineer all relevant copies of routine tests on the cables Test certificates shall be submitted prior to delivery of the cables to site.
The Contractor shall provide the Engineer with copies of all test results.
Site Acceptance Tests
The electrical contractor shall perform the following tests after receiving delivery of the cable to site:
One Minute Insulation Resistance Test of each core
5 kV Megger Test
The test shall be conducted between:
Each phase and earth (screen); and
Each phase
The site acceptance tests will form the basis for acceptance of each cable drum. Any drum that fails site acceptance test will be totally rejected and a new drum shall be requested by the electrical contractor from the Contractor.

### 4.5.8 Packaging, Handling and Transport

Packaging
The cables shall be wound onto drums and cable ends sealed.
The drums shall be treated to resist attack by termites and shall be rot-proofed.
Drums shall be clearly and indelibly labelled plus the following additional information:
Name of Client
Address of Client
Contract number

Title of Project
Length of cable
Size of cable
Type of cable
Cable rated voltage
Location of cable ends
It is acceptable to transport multiple cables of the same cross-sectional area as one cable length on a cable drum. In this case, each cable that comprises the single length shall have its cable identification details recorded on the cable drum.
Delivery
Delivery shall be made without any damage to the site and unloaded by the Contractor to a position to be designated by the Project Engineer.
The Contractor shall make provision for the storage of cables prior to installation.
Notice of intention to deliver the cables to site shall be given to the Engineer:
Two (2) weeks before proposed delivery date; and
Reconfirmed seven (7) working days before the proposed delivery date.
The notice of proposed delivery shall be supported by transportation methods and route including traffic management plans.
All deliveries shall be coordinated and timed to reduce any interruption to traffic on the site.
Right of Rejection
The Project Engineer reserves the right to reject any drum of cable found not to be in accordance with this specification or which arrives at site in a condition, which in the opinion of the Engineer, is not satisfactory due to damage in transit.

## 4.6 Underground Services Ducts

### 4.6.1 General

Services ducts for MV and LV electricity, public lighting, telecommunications and, together with associated cable chambers, shall be installed in accordance with the requirements indicated on the relevant drawings and in accordance with the standards listed below.

All ducts and chambers shall comply with any requirements in the relevant utility provider specifications. The positioning and depth of service ducts shall generally conform to the recommendations set out in the EPRA Guidelines but with the following specific minimum cover depths:

| | Recommended Minimum Depths | |
|---|---|---|
| Service | Footway | Carriageway |
| MV Electricity | 900mm | 900mm |
| LV Electricity | 600mm | 750mm |
| Public Lighting | 600mm | 750mm |
| Telecommunications | 600mm | 750mm |

All underground cables shall be fully ducted along their entire length.

### 4.6.2 Service Ducts Requirements

Unless otherwise specified, service ducts shall generally be HDPE single wall pipes with a minimum wall thickness of 5mm complying with IEC 61386-24.

Where specified as being required by a particular utility provider (e.g. Kenya power or EPRA), ducts shall be uPVC single wall pipes with a minimum wall thickness of 3.8mm complying with Class B or better of IEC 60423.

Ducts shall be manufactured from 100% virgin material.

All pipes, bends, coupling, etc. shall be from a single manufacturer.

All ducts shall be suitable for the depth of burial and the types of cables to be pulled through them.

Ducts shall be of 'Normal' duty in accordance with IEC 61386.

Ducts shall comply with IEC 61386 in terms of duct deformation (<5% deformation requirement for 450N loading on 200mm sample) and impact resistance requirements (no crack for 5kg striker, 12 samples and 570mm fall height>28 Joules).

Ducts shall have a smooth low friction inner surface completely free of ripples, sharp edges and protrusions. Friction coefficient <50.28

Duct ovality to be 2.00mm max.

Ducts shall be constructed in 6.6m lengths (approximately) with a socket at one end and a corresponding spigot at the other with the plain end bevelled to allow easy jointing of ducts on site.

Ducts shall have a circumferential mark to indicate the correct push-in distance for duct jointing for spigot and socket joints.

The internal diameter of all ducts shall be as indicated on the Contract Drawings and detailed in this specification. Minimum internal diameter of ducts shall be 100mm.

Long radius bends only shall be used with a minimum Duct Bend Radius of 1.2m for all bends. The colour coding of service ducts shall generally conform to BS IEC 60093 as follows:

| Service | Colour |
|---|---|
| MV Electricity | Red |
| LV Electricity | Red |
| Public Lighting | Red |
| Telecommunications | Green |

In addition to colour coding, the ducts shall be stamped with the words "Danger Electricity Cables", "Public Lighting", "Telecommunications Cables", "Traffic Cables" etc. as appropriate printed in large block capitals continuously along their length, to the approval of the Engineer. Legends shall be minimum 18mm high black lettering at maximum 1m intervals.

Materials shall contain pigments and UV stabilisers to provide maximum colour stability and weathering. All pigments shall be of high purity and shall resist leeching in contact with soil acids.

### 4.6.3 Specific Requirements for LV Ducts

Ducts shall have an internal diameter as shown on the drawings.

Marker tape shall be yellow with the following words printed on it: "Caution Electric Cable Below".

Minimum clearance to other services (apart from large pipelines or high pressure pipes) shall be 300mm.

### 4.6.4 Specific Requirements for Telecommunications, Data & Fibre

Ducts shall be 100mm internal diameter.

Marker tape shall be yellow with the following words printed on it: "Telecommunications Cable" and the name of the network operator or authority responsible for the ongoing maintenance of the duct system. Minimum clearance to electricity services shall be 300mm.

Telecommunications ducts along the main runs shall be plug-and-socket air-tight and water-tight to facilitate the blowing of fibre optic cables.

### 4.6.5 Duct handling and Storage

Care should be taken when loading/unloading ducts to avoid damage to the ducts. Any damaged or defective ducts shall be marked in a conspicuous manner and removed from site.

Ducts shall be stored on a smooth flat horizontal surface, supported by side supports at intervals of not

more than 1.5m and fully in accordance with the manufacturer's recommendations. Ducting supplied in factory strapped bundles may not require side supports, however care should be taken when removing strapping when tension may be released.

Socket ducts shall be stacked in layers in accordance with manufacturer's recommendations and with the socket at alternate ends of each layer. The socket on one layer should project beyond the duct spigots on the layer below so that the ducts are evenly supported along their length.

Duct stacks shall not exceed 7 layers with a maximum height of 2m.

The method of stacking shall be such as to ensure that the integrity of the ducts is maintained and that distortion is avoided.

Ducts shall not be stored in a place where they are likely to be in contact with surface water or other foreign matter which could make its way into the ducts.

Ducts shall not be stored in total (builder's provider's yard and site etc.) for a period longer than 1 year.

### 4.6.6 Excavation, Bedding and Surround for Service Ducts

Material for the bedding and surround to all ducts and multi-ducts shall be clean and sharp and conforming to EN 12620:2008.

Ducts shall be evenly and solidly bedded and all sand shall be compacted to the degree specified without voids to ensure adequate support. Particular care shall be taken to endure that sand is compacted into the spaces in between any multi-ducts.Ducts passing under carriageways shall be completely surrounded with lean-mix ST2 concrete to a minimum radial thickness of 150mm.

### 4.6.7 Duct Laying

Each duct shall be carefully examined immediately prior to laying and any damaged or defective ducts shall be marked in a conspicuous manner and removed from site.

All duct systems shall be installed so that no undue strain is placed on cables when pulled. Cable manufacturer's recommendations shall be followed.

Ducts shall be aligned as straight as possible in the horizontal and vertical directions. All sweeps shall be gradual as possible and jointed above ground prior to installation.

The location and arrangement of the various duct banks shall generally be as indicated on the Contract Drawings, but the precise positions/lines of the duct banks shall be agreed between the Contractor and the Engineer on commencement of the works.

Ducts shall not be laid in trenches where water is lying in the bottom.

Every effort must be made to prevent dirt ingress into the ducts. Allowing dirt to enter ducts on the basis that the dirt should be removed later during the duct cleaning process is not acceptable.

Bricks or other hard packings shall not be used as temporary duct supports.

For ducts in trefoil formation, the ducts shall be bound together with duct ties at 3m intervals or more frequently as required to maintain the duct formation.

Horizontal and vertical separation between ducts shall be maintained through the use of manufactured injection moulded plastic duct spacers. 300mm or 600mm horizontal spacers shall be used to achieve horizontal spacing from other utilities as required. Spacers shall be installed at intervals as recommended by the manufacturer or at minimum intervals of 2m, whichever is lower. The Contractor shall ensure that backfill is installed and compacted correctly around the spacers to eliminate any point loading of ducts. Vertical spacers shall not be used for installation of ESB Networks ducting in accordance with their standard specification for network ducting.

Where duct routes are located within the loading zone of influence of existing structures the trench shall be filled with concrete of minimum strength 10N/mm2 in order to ensure the structural integrity of the adjacent structure, as may be directed by the Engineer.

Ducts shall be laid on the trench bed with the sockets towards the duct layer. The spigot end and inside of the duct to be joined shall be thoroughly cleaned with a dry rag. A duct shall be temporarily inserted to prevent ingress of soil or foreign material prior to jointing.

Ducts shall be laid so as to drain naturally towards one or both ends, where adequate provision for drainage shall be made. Adequate precautions shall be taken to prevent the cable duct system acting as a storm-water or ground water drainage system. A minimum fall of 1 in 200 shall be provided for drainage purposes.

Ducts shall be laid with the legend facing upwards.

The spigot end of the duct shall be pushed into the socket initially by hand and then driven in to achieve proper engagement by tapping with a hammer against a suitable wooden batten placed across the remote socket. Full engagement is when the indicator on the duct seals properly. Joints shall be made in such a manner as to avoid any sharp internal edges that may interfere with cabling operations.

Cutting of ducts shall be with a suitable non-electrical hand cutting tool. All cut ends shall be square to the axis of the duct and all burrs removed before use. Cutting of occupied ducts, if required, shall be carried out with extreme care.

Ducts not required to enter a jointing chamber shall by-pass the chamber either to the side or beneath the chamber. In certain circumstances and with the approval of the Engineer, ducts may pass through the chambers uninterrupted

Ducts for road crossings shall be straight and, wherever possible, perpendicular to the axis of the road.

### 4.6.8 Crossing of Electrical Ducts

A minimum radial clearance of 300mm between the outer services of ducts shall be provided where telecommunications or traffic ducts cross electricity ducts. Wherever possible, the telecommunications or traffic ducts shall cross above the electricity ducts. Where it is not possible to provide the minimum 300mm clearance, a reduced separation may be agreed with the Engineer on the basis that mechanical protection overlaid with marker warning strip shall be inserted between the crossing ducts. This mechanical protection may be in the form of concrete blocks or tiles, or hot dip galvanised steel plating to the approval of the Engineer. Such approval will only be given in exceptional situations.

### 4.6.9 Duct Cleaning and Testing

Immediately following the installation of any duct run, the interior of the duct shall be thoroughly cleaned by twice drawing an approved brush through the ducts, once in each direction. The cleaning procedure shall be in accordance with the manufacturer's recommendations and to the approval of the Engineer.

The mandrel shall be cylindrical, polished hardwood or iron, 300mm long having spherical ends and a diameter equal to the internal diameter of the ducts -10% or the internal diameter of the ducts -10mm, whichever is larger.

Mandrels should pass through the whole length of the completed ducts when testing.

### 4.6.10 Marker tape and Identification

Marker tape should be laid directly above each section of duct at a depth of 300mm above the top of the duct.

Marker tape should provide full lateral cover over the ducts and should be in vertical alignment with the duct run. For large duct configurations, more than one width of tape may be necessary to cover the extra width of the duct section.

Marker tape shall be manufactured from high quality material to an approved international or national standard in order to assure its long-term performance with regard to physical integrity and readability.

Marker tape should be not less than 200mm wide and coloured high visibility yellow. Marker tape shall be marked with the relevant lettering detailed above for individual services in large black block capitals continuously along its length.

Marker tape including a metal foil strip shall not be used.

### 4.6.11 Cable Pulling

All trenches excavated for the laying of cable ducts shall be completely backfilled and compacted before cable installation work is commenced.

Prior to cable installation, each duct shall again be proved by drawing a mandrel through it to the same specification as detailed in section 11.

If two or more cables are to be installed in the same duct, the aggregate of their cross-sectional areas shall not exceed 30% of the cross-sectional area of the duct.

### 4.6.12 Duct Sealing

After cables are installed, all ducts shall be sealed where they enter buildings or service tunnels using a multi-cable transit sealing system. This shall include rubber split insert sleeves to ensure cable separation and a high quality silicone based sealant layer. The system shall have the following characteristics:

Suitable for both horizontal and vertical ducts
Flexible seal which resists movement, shock and vibration
Watertight
Gastight
Fire retardant
Rodent resistant
Easy re-entry for adding, removing or replacing cables
No frame required
Can seal irregular shaped openings
Suitable for trefoil cables
Resistant to methane, hydrogen sulphide and chlorine
Resistant to submersion and contact with petrol and diesel
Age tested to 50 years
No maintenance required
The system used shall be the RISE Duct Seal system by CSD Sealing Systems or equal and approved.
Polyurethane expanding foam is not acceptable as a duct sealing system.

### 4.6.13 Cable Chambers

Cable chambers shall be provided where required to facilitate cable entry to buildings, at intersections, at changes of direction, and at regular intervals on straight runs to facilitate the future installation and maintenance of cables.

Cable chamber locations and approximate dimensions are indicated on the Contract Drawings and set out in the Cable Chamber Schedule. However, the Contractor shall be responsible for the final positioning, setting out and sizing of each cable chamber to ensure co-ordination of the whole of the works and compliance with the Contract Documents and Drawings.

Adequate and safe access/egress to the cable chambers shall be provided to facilitate the installation and future maintenance of cables.

Cable chambers shall:

Have neat fitting holes drilled for conduit/pipe entries and 4 x 50 mm holes in the bottom of the pits for the drainage purposes;
Be installed level and with the lids flush with finished ground level;
Have a 150 x 150 x 1.6 mm brass plate fixed to the cable pit cover; and
Have the plate suitably engraved according to the service cables within the pit, e.g., power, communications, and the like. The engraving shall be legible and durable to approval.
Provided with suitable covers dependent upon location on site. Pits located directly on roadways shall
Be suitable for vehicular traffic and provided with heavy duty trafficable Class 'D' cover.
Shall be prefabricated units manufactured from fibrous cement.
Be installed in accordance with manufacturer's directions and shall be suitable
Shall be prefabricated units manufactured from fibrous cement.
Install cable chambers at locations shown on coordinated Civil Engineers layout drawings.
Cable chambers shall be provided with suitable covers dependent upon location on site. Pit covers for MV pits shall be provided with suitable lifting points for removal by crane

Pits shall be provided with 150mm deep, 10mm aggregate below to assist with drainage. Penetrations shall be fitted with bell mouths to prevent damage to cables due to sharp penetration edges. Install all chamber level and with the lids flush with finished ground level.

Cable chambers that are built in-situ in lieu of precast chambers may be considered as an alternative, subject to approval by the Engineer. Where offered, the Contractor shall provide detail drawings of the proposed pit construction for evaluation by the Engineer. Power Distribution & Wiring

The Electrical Sub-Contractor shall supply and install all distribution and wiring systems and equipment as described here and as indicated on the drawings. All new cabling used on the project shall be as noted in the cable schedules

Electrical distribution shall comprise of sub-distribution wiring of all general services circuits from the local floor sub distribution boards, and terminate within the floor void busbar track units

The types, ratings, number of cores and sizes of all cables shall be as shown on the drawings. During production of working/installation drawings, the Electrical Sub-Contractor shall obtain confirmation of all mechanical and other services loads. If any changes have resulted due to final plant selections, then the Electrical Sub-Contractor shall re-assess the cable sizes. However, sizes smaller than those detailed in the documents will not be permitted.

Circuits feeding control panels, plant and equipment shall be configured as single radial circuits. Small power outlets shall be wired as ring circuits or radial circuits, depending on location and function.

Containment systems shall be laid in the floor/ceiling voids and in the service chassis to form the main containment system for the final sub-circuits on all floors. As indicated on the drawing the Electrical Sub-Contractor is responsible for sizing, supplying and installing all secondary and final containment systems needed to complete the installation.

The Electrical Sub-Contractor shall install a separate Circuit Protective Conductor (CPC) for each final circuit unless specified elsewhere. Under no circumstances shall the conduit/trunking system be used as, or form part of, a circuit protective conductor.

The Electrical Sub-Contractor shall determine the mounting heights of high level sockets, high level primary electrical containment, etc. from the schedule of mounting heights. All other mounting heights to be determined from the Architects drawings.

All socket outlets shall be supplied, installed and wired up as detailed on the drawings and scheduled in the panel board schedules by the Electrical Sub-Contractor. They shall comprise the number of gangs indicated and shall be of the switched type.

In those areas where general purpose socket outlets are indicated they shall be 13A, 3 rectangular pin type, complete with shutters, neon indicators where applicable, having single or double pole switches and shall be to IEC 60884-1.

Fused connection units shall match the socket outlets and shall be with or without cord outlets to suit individual applications. Every effort shall be made to conceal all flexible cables for final connection to fixed appliances by using connection units without flex outlets and cable outlet plates located either behind the appliances or located so close to the appliance cable inlet point as to make the length of exposed flexible cable as short as possible.

Radial circuits serving socket outlets shall be protected by means of residual circuit breaker devices having tripping current setting not exceeding 30mA.

Local isolators/sockets for specific fixed equipment shall be supplied and installed at the locations shown on the relevant drawings.

Isolators shall be sized and rated as shown on the drawings and manufactured as in the preferred schedule of manufacturers.

Small power wiring in floor voids shall be laid directly onto the floor slab to follow dedicated painted routes.

Installation heights for electrical devices shall be as per the schedule in the appendices at the rear of the document or as per the architect's drawings.

Circuit protective conductors shall be the size of the main conductor up to 16mm2, otherwise as per drawings.

### 4.6.14 Cable Ladder

Cable ladder shall be manufactured in accordance with EN 61537.

The appropriate corrosion protection will be determined by reference to EN ISO 12944.

In general, cable ladder installed internally shall be galvanised to EN 10346. Cable ladders installed externally and in internal areas of high humidity and corrosion shall be galvanised to EN ISO 1461. In highly corrosive and clean room environments stainless steel cable ladder shall be installed.

Cable ladders shall be medium duty and sized as shown on the general arrangement drawings

Cable ladders will be 3000 or 6000mm in length.

Cable ladders installed externally shall be fitted with covers.

All accessories (bends, tees, intersections, internal and external risers, offsets, and reducers etc.) shall be supplied by the manufacturer.

Cable ladders shall be supported at span distances not greater than 1.5m or as specified by the manufacturer. The deflection conditions of EN 61537 must be met at all times.

Additional supports will be positioned no further than 300mm from accessories. Only support brackets with load capacities tested in accordance with EN 61537 will be used.

Vertical cable ladder systems will be used in risers. Cables will be secured with U clamps supplied by the manufacturer.

Any cuts will be treated to return the cable ladder to the condition of manufacture. Cable ladders will meet the following requirements:

Electrical continuity without additional earth bonding.
Magnetic shield insulation without cover 10dB, with cover 15dB, G mesh cable basket 15dB.
Electromagnetic compatibility to VDE 0870-1.
Supplied folded up for ease of transport and storage (45, 60 and 110mm sidewall only).
Continuous side perforation slots.

The facility to fit snap-in segregation strips into the base of the cable ladder (45, 60 and 110mm sidewall only).
Covers will be supplied with pre-installed turnbuckles.
Sprung steel clips will be manufactured from stainless steel.
Cable ladders for life safety and fire-fighting applications and those that run along and across escape routes shall be tested in accordance with DIN 4102 Pt12 and approved for function maintenance classes E30 to E90.

Fire-resistant cables shall be segregated from non-fire-resistant cables. Fire resistant cables shall be supported on a system that has an approval of equal duration to that of the cables it is supporting.

Cables that run along and across escape routes shall be supported on a system that has a stability approval equal to the duration specified for the safe evacuation of the building.

All ladder routed externally shall be provided with UV hoods/covers.

### 4.6.15 Cable Tray

Cable tray shall be manufactured in accordance with EN 61537.

The appropriate corrosion protection will be determined by reference to EN ISO 12944.

In general, cable tray installed internally shall be galvanised to EN 10346. Cable trays installed externally and in internal areas of high humidity and corrosion shall be galvanised to EN ISO 1461. In highly corrosive and clean room environments stainless steel cable tray shall be installed.

Cable trays shall be medium size as per general arrangement drawings

Cable trays will be 3050mm in length (3000mm usable length). Cable trays installed externally shall be fitted with covers.

All accessories (bends, tees, intersections, internal and external risers, offsets, and reducers etc.) shall be supplied by the manufacturer.

Cable trays shall be supported at span distances not greater than 1.5m or as specified by the manufacturer. The deflection conditions of EN 61537 must be met at all times.

Additional supports will be positioned no further than 150mm from accessories. Only support brackets with load capacities tested in accordance with EN 61537 will be used.

Cable trays will have adequate space to allow for the correct installation and fixing of all cables plus 30% spare capacity for future use.

Any cuts will be treated to return the cable tray to the condition of manufacture. Cable trays will meet the following requirements:

Interlocking ends with self-locking couplers that do not require additional bolting.

Electrical continuity without additional earth bonding.

Magnetic shield insulation without cover 20dB, with cover 50dB.

Electromagnetic compatibility to VDE 0870-1.

Transfer impedance without cover 1.14mΩ/m, with cover 0.71mΩ/m.

Embedded perforations in the base of the cable tray for increased ventilation and simplified connection to the support system.

Both lengthways and crossways perforation slots in the base of the cable tray.

Continuous side perforation slots 7 x 20mm.

The facility to fit snap-in segregation strips into the base of the cable tray.

Covers will be supplied with pre-installed turnbuckles.

Sprung steel clips will be manufactured from stainless steel.

Cable trays for life safety and fire-fighting applications and those that run along and across escape routes shall be tested in accordance with DIN 4102 Pt12 and approved for function maintenance classes E30 to E90.

Fire-resistant cables shall be segregated from non-fire-resistant cables. Fire resistant cables shall be supported on a system that has an approval of equal duration to that of the cables it is supporting.

Cables that run along and across escape routes shall be supported on a system that has a stability approval equal to the duration specified for the safe evacuation of the building.

All tray routed externally shall be provided with UV hoods/covers.

### 4.6.16 Cable Trunking

Cable trunking shall be manufactured in accordance with IEC 61084.

In general, cable trunking installed internally shall be galvanised to EN 10143. In highly corrosive and clean room environments stainless steel cable trunking shall be installed. Trunking lids will be fitted with turnbuckles that are closed and opened with a No2 pozi screwdriver.

The gauges of steel used to manufacture cable trunking will conform to IEC 60423.

Cable trunkings will conform to EN 60529 1991: IP 30. Cable trunkings will be 3000 in length. All accessories (bends, tees, intersections, internal and external risers, offsets, and reducers etc.) shall be supplied by the manufacturer. All couplers and accessories will be fitted with back welded nuts and secured with M5 screws.

Cable trunkings shall be supported at span distances not greater than 1.5m or as specified by the manufacturer. The deflection conditions of EN 61537 must be met at all times.

Additional supports will be positioned no further than 150mm from accessories. Only support brackets with load capacities tested in accordance with EN 61537 will be used.

Copper earth links 12.5 x 42mm will be fixed across all trunking joints and earthed as appropriate.

Cable trunkings will have adequate space to allow for the correct installation and fixing of all cables plus 40% spare capacity for future use.

Any cuts will be treated to return the cable trunking to the condition of manufacture. Where cable trunkings pass through fire walls and floors, fire barriers with an approval equal in duration to that of the partition through which it penetrates shall be installed.

### 4.7 Conduit and Final Circuit Cable Installations

Conduit and fittings shall be in accordance with IEC 61038. Conduit shall be Heavy gauge, welded, Class 4, hot-dipped galvanised steel, zinc-coated screw threads and zinc bichromate outer coating to comply with IEC 61386. Rigid steel conduit and fittings shall conform to IEC 60669. Cables in conduit shall be protected throughout their length by screwed welded galvanised class 4 steel conduit, terminating in cast iron or pressed steel boxes at the fittings, switches, etc. Conduit shall not be smaller than 20 mm dia. or have metal tubing less than 1.8 mm. The thickness of metal shall increase in proportion to the increase in diameter

NB All containment systems for any service (fire detection & alarm, emergency lighting etc) shall be provided in a closed steel system.

oblong intersection joint 'T' and other necessary boxes shall be screwed full thread into which the conduit shall fit tightly. Screw cutting oil shall be used as a lubricant when screw cutting, which must be afterwards carefully removed.

Tubes are to be properly screwed, the thread fully worked and when screwed up no rings shall be noticeable on the outside of the tubes. Conduits are to be mechanically and electrically continuous across all joints and earthed in accordance with the Clause marked "Earthing" (Note: separate independent full size earthing conductors shall be installed throughout).

At junction and ceiling roses, galvanised steel junction boxes shall be used. At ganged switch positions special multiple switch boxes shall be used.

Conduit is to be concealed throughout and it shall be fixed in chases by means of suitable crampets, or concealed within stud partitions. The conduit where sunk in the walls shall have at least 15mm cover of plaster from the external surface. Chases for conduits shall be filled with sand and cement to 7mm from the finished surface. All bends shall be made as far as possible from conduit and no bends shall have a radius smaller than 2.5 times the outside diameter of the conduit. Elbows and tees shall not be used except in positions approved by the Engineers. When complete the conduit must be water tight and electricity continuous throughout.

No cables are to be inserted until the conduit and boxes are fixed and the plastering complete and no pull greater than 15 kg shall be exerted.

Socketed and screwed brass bushes shall be used on all ends through which cables or wire are moved in either direction.

The cables shall be as per the cable schedules.

The cables shall be insulated 600 Volt grade. The cables shall be supplied with the following colours:

| | |
|---|---|
| Earth-Protective-Bonding | - Green/Yellow |
| Neutral | - Blue |
| First Phase | - Brown |
| Second Phase | - Black |

Connections between cables shall be made by means of mechanical connections of approved type. Conductor sizes for services other than lighting and sockets shall be as outlined hereafter or as indicated on drawing or schedule. A separate full circuit size earth wire shall be run with all circuits taken in trunking and conduit.

Every connection shall be easily accessible and shall have resistance not greater than that of the equivalent length of the largest conductor to which the connector is fixed.

### 4.7.1 Installation of Wiring

All cables shall:

Be adequately fixed and supported with purpose made clips, cleats or saddles
Be installed to permit adequate air circulation around each cable
Be installed between equipment without any joints
Be installed on the loop in, loop out principle without the use of connectors for sub circuit wiring
Be installed so that they can readily be withdrawn for the purposes of relocation and/or rewiring
Be loomed on the square grid form parallel to walls, etc
Be installed such that they are not bent through a radius less than the minimum bending radius recommended by the manufacturer
Where installed together over parallel routes, be spaced apart to provide a gap of one cable diameter, minimum, between adjacent circuit or submain groups
Installed free of joints (MV cable joints shall not be permitted unless approved in writing by the Project Engineer)
Be fixed to permanent structural components of the building where the cables supply emergency circuits, such as fire services, lifts, emergency lighting, etc. Additionally, these cables shall be positioned above ducts, pipes and other building components which may

become dislodged and cause interference to the cables. Fixings and supports for these cables shall be suitable for the required fire resistant integrity

Be spaced from telecommunication and other wiring systems in accordance with IEC 60364 and AS/ACIF S 009.

### 4.7.2 Single Insulated Cables

Single insulated cables shall:

Be enclosed within conduits or cable troughing

Not be drawn into conduit systems until the conduit run is complete and swabbed out

Be jointed only at outlet or switch positions.

### 4.7.3 Insulated and Sheathed Cables

Insulated and sheathed cables shall:

Be enclosed within concealed conduit where run in rendered walls or concrete

Be installed through suitably sized and bushed access holes positioned vertically or horizontally in line where run within stud partitions

Be secured in position at 600 mm, maximum, centres by approved methods where installed in accessible locations, for example above demountable ceilings

Not be secured or clipped where installed in inaccessible locations such as cavities and stud partitions

Be protected by steel conduits where installed in locations which are liable to mechanical damage and where specified herein

Be installed using the loop in system without the use of junction boxes being interposed

Be installed on cable trays or in wiring ducts where six or more cables are installed over common routes

Be grouped together and fixed to cable trays for single core conductors which form a circuit or submain group

Be installed in trefoil formation for single core cables sized 70 $mm^2$ or larger using purpose made clamps such that proximity effects in adjacent ferrous metals are minimised and equal reactance values between phases are achieved

Be fitted with a cable gland on all circular cables where they penetrate equipment enclosures

Be fixed directly to the underside of the slab/roof structure where installed in false ceiling spaces by means of approved clips and/or saddles or tied to catenary wires with approved nylon strap fasteners.

### 4.7.4 Fire Rated Cables

Fire Rated cables shall:

Be installed in accordance with IEC 60331 to provide a fire resistance exposure of 120 minutes

Be protected against mechanical damage relative to type of cable installed, location where installed, method of installation and requirements for emergency system served

Be fixed with double point saddles except where installed and supported on continuous cable trays
Be secured to the building structure in positions which are secure against damage
Be secured with steel bolts and anchors; plastic fixings are not acceptable
Not be installed below pipes, ducts, trays, etc., which may dislodge in a fire situation and impair the operation
Be fitted with fire rated junction boxes where connections are unavoidable
Be installed in trefoil configuration where single core cables are utilised
Be installed in earth galvanised steel conduit where required to achieve EMC shielding requirements

### 4.7.5 Derating

The sizes of conductors as specified are the minimum size that shall be provided.

The size, grouping, spacing, enclosure and location of cables shall be installed so that the current rating of the conductors as permitted by the relevant Code after the appropriate derating factors have been applied, is not less than the specified current rating of the circuit breaker or fuse which protects the conductor.

The current rating of the protective device may exceed the derated current rating of the cable as permitted by the wiring rules for cables serving items of equipment which are subject to short time overload current, e.g., motors.

Where conductors are installed, grouped, spaced or enclosed in such a manner that their derated current rating is less than the specified current rating of the protective device, the size of the conductor shall be increased to provide a current rating of the conductor which is not less than the specified current rating of the respective protective circuit breaker or fuse.

### 4.7.6 Cable Terminations

Provide proprietary type cable termination lugs for all conductors except where tunnel terminations are provided on equipment.

Provide the following terminations on copper cables:

Compression lugs requiring the use of a ratchet or hydraulic crimp tool having equivalent cross sectional area to the cables being connected or
Proprietary clamp lugs designed and manufactured for the purpose
Minimum crimping standards shall be as follows:

Cables to 35 mm2 -indent crimping
Cables 35-95 mm2 - single hexagonal crimp
Cables 120 mm2 and over - double hexagonal crimp
All cable terminations shall be accessible throughout the installation. Solder lugs are not acceptable.

All cable terminations shall be shrouded or insulated to prevent inadvertent contact with live parts. Provide proprietary type cable terminations for all aluminium conductors.

The following lugs are acceptable:

Compression lugs manufactured to suit the size and shape of conductor and installed as recommended by the manufacturer utilising oxide inhibiting paste
Fusion welding by means of Exothermic process or oxy propane, installed in accordance with the manufacturer's published recommendations
Aluminium jointing shall only be undertaken by cable jointers experienced in the method of joint proposed.

Bolt aluminium lugs to terminals utilising high tensile fine thread bolts and nuts fitted with Belleville washers.

All cable terminations shall be shrouded or insulated to prevent inadvertent contact with live parts.

### 4.7.7 Circuiting

Provide separate circuits for lighting and power.

The circuiting requirements must be specified in the documents otherwise the Contractor might provide a minimal number of circuits as there is no restriction on the number of points in IEC 60364 Wiring Rules.

Arrange circuits to lighting and power outlets in accordance with the following requirements:

***Light Circuits*** (2.5 mm2 minimum)

Total earth leakage of the connected load no greater than one-third of 30mA.
Quantity of luminaires per circuit shall fully consider and comply with the manufacture's guidelines and recommendations.
Take into consideration starting characteristics of control gear and lamps and protection circuit breaker rating
Total number of fluorescent luminaires with electronic ballasts per 10A circuit to be no greater than 10 No.
All of the above and not greater than 75% of maximum capacity of installed cable rating.

***Power Circuits*** (4.0 mm2 minimum)

Maximum of 5 off 13A socket outlets in non air conditioned areas, e.g., car park, plantroom.
Maximum of 10 off 13A socket outlets in air conditioned areas.
10A double outlet considered as two socket outlets.
Individual circuit for each item of permanently connected equipment.
Individual circuit for each 16A socket outlets.

### 4.7.8 Flexible Conduit

Flexible conduit shall be used at final connections to potentially vibrating pieces of equipment, such as motors, etc. The flexible conduit shall consist of a helically wound galvanised steel strip with an LSZH outer sheath. The PVC conduit system shall be provided with manufacturer's termination fittings to ensure an overall protection class of IP66.

The flexible conduit shall be manufactured to comply with IEC 61386.

### 4.7.9 Mains Power Cabling Installations

Cables shall be XLPE Insulated, LSZH Sheathed, Fire Retardant to be as per the cable schedule

They shall be of 600/1000V grade and shall comply with IEC 60502. They shall have copper stranded conductors. Multi-core cables shall be single wire armoured and single core cables shall be aluminium strips armoured.

They shall be installed as outlined below. All cables shall be suitable for installation on cable tray, ladder, in ducting or buried in the ground. The cables shall be installed in strict compliance with the manufacturer's requirements and bends in the cables shall be of the minimum radius of 8 times the overall diameter of the cable for cables large than 25mm.

All runs of cable inside the building shall be supported on cable ladder on Unistrut brackets. In all instances the spacing of supports shall comply with the manufacturer's recommendations.

All cables shall be terminated in the manufacturer's glands. Termination of the cable cores shall be by means of manufacturer's compression termination lugs in accordance with the manufacturer's instructions. The cable amounting shall be carefully made off in the manufacturer's gland at each entry.

Bonding to the metal work for the earthing shall be by proprietary earth tags. Armour alone shall not be relied on as the earth conductor and, where necessary, a separate earth wire shall be installed alongside the armoured cable.

Sub-mains cables shall be 4 Core Cu- XLPE Insulated, LSZH Sheathed, Fire Retardant with separate CPC's for cables over 16.0 sq.mm, and 5 Core Cu-PVC SWA for cables of 16.0sq.mm or less (unless otherwise noted on within cable schedules). Cables shall be sized as scheduled on the electrical drawings.

In general, main cables shall be run in PVC underground ducts or on cable tray/ladder inside the building, with final design to determine the final routes and methodologies. Sub-mains cables shall be installed in PVC ducts and fixed to cable tray. Cable tray shall be perforated type, galvanised medium gauge sheet steel.

Sub-mains cables shall be installed on cable trays at a spacing of twice the diameter of the larger adjoining cable with nylon cable ties.

Where cables are run underground externally excavation of trenches and reinstatement shall be carried out by the Building Contractor. The Electrical contractor shall include for all layouts

necessary to lay the cables in position at a minimum depth of 1200 mm below ground level (to the top of the duct). It is the responsibility of the Electrical Contractor to ensure that underground cable ducting meets the performance requirements as set out in the BS 7671Rules. Plastic marker tape with a repetitive inscription "Danger - Buried Electric Cables Below" shall be installed 299 mm below ground level, along the route of external cables.

The maximum permitted volt drop from the Main Distribution Board to any final outlet shall be 4% overall.

Cables shall be manufactured, tested and installed in accordance with the following specifications:

| | |
|---|---|
| Fire Retardant | IEC 60332-3 |
| Low Smoke emitting | IEC 61034 |
| Halogen Free | IEC 60754 |
| XLPE Insulated Copper Conductor | |

### 4.7.10 Floorbox

They shall be multi-compartment boxes comprising of a 4 compartment galvanised steel frame, a lid, accessory plates and cable outlet assembly.

Each outlet box shall be provided with power, voice and data outlets as required to meet the needs of the specific room or area as per the drawings.

Each outlet box is to be fitted with a recessed hinged lid suitable for accepting carpet tile. The lid shall be easily removable and reversible and hinged from either of two sides. They shall be self-closing in accordance with EN 61534-22. Lids shall have a recessed handle for easy accessibility with robust cord caps.

Raised Floorboxes powered from the Under-floor Busbar 4 compartment box, 95mm deep containing

1no 20Amp 30mA RCBO, 2no. Twin sockets, 1no 4 x RJ45 data plate.

Floorboxes shall come pre-wired with power track tap-off and prewired with a 5M standard connection lead.

### 4.7.11 Fused Connection Units

Fused Connection outlets shall be installed for the following services:-

Small Power Services, Serving fixed outlets, supplied via mains from the local distribution board.

Each spur shall be wired on a separate 3x4 sq mm LSZH cabling, in galvanised steel conduit, from a 20A 2Pole MCB (or RCBO if serving water heaters) in the distribution board.

Each spur shall be installed in galvanised sheet steel conduit boxes for flush mounting. Fused connection units shall be installed for local isolation of equipment, including (but not limited to):

Fire Detection and Alarm Equipment
Intruder Detection and Alarm Equipment
Access Control Equipment
CCTV Equipment
Disabled Refuge System Equipment
Door Hold Devices
Fire Smoke Dampers
Leak Detection Equipment
Mechanical Plant (below 1kW)
Window Control Panel
Automatic Opening Vent Control Panel
Smart Glass Systems
AV Systems
Public Address Systems
Telephone Systems
ICT Systems
Automatic Doors
Aspirating Detection Equipment
Automatic Taps
Sundry Equipment
Gas Proving Systems
Mechanical Plant, Local fans, local controllers etc.
Fused connection units for local isolation shall be complete with neon indication, and shall be graphite plate finish with white switches.

### 4.7.12 Isolators

All disconnectors, switch disconnectors, switches and circuit breakers shall be provided with the means to enable them to be locked in the 'off' position. When used as earthing switches they shall be capable of being locked 'on' when closed to the earth connection.

Generally, Isolator Circuits shall be cables with one outlet per circuit and as follows:

| | |
|---|---|
| 16Amp | 4sq.mm + 2.5sq.mm Earth |
| 20Amp | 4sq.mm + 2.5sq.mm Earth |
| 25Amp | 6sq.mm + 4sq.mm Earth |
| 32Amp | 10sq.mm + 6sq.mm Earth |
| 50Amp | 16sq.mm + 10sq.mm Earth |

63Amp 16sq.mm + 10sq.mm Earth

Three Phase Socket Outlets shall be Surface Mounted, interlocked as MK Commando Range or equivalent.

Cabling to 16AMP Three-Phase Sockets shall be sq. mm. cables with 2.5sq.mm earth in conduit/trunking with a separate circuit per outlet.

Cabling to 32AMP Three-Phase Sockets shall be 6sq.mm cables with 4sq.mm earth in conduit/trunking with a separate circuit per outlet

### 4.7.13 Wiring for Miscellaneous Services

The electrical subcontractor shall include for wiring to all Group 2 and 3 equipment. All final connections, terminations and testing should be included for.

All miscellaneous services such as petrol interceptor alarms, sump pumps, utility meters and 3rd party equipment shall be provided with power and data connections, as required.

3Phase Isolators shall be provided at equipment Hoist positions.

### 4.7.14 Segregation of Services

Cables of various voltages, functions and separate supply sources, shall be segregated from each other and spaced sufficiently far apart to eliminate interference between services. The cabling of low voltage (below 50v) emergency lighting systems may use the same main containment as that of Fire Alarm loop wiring subject to prior approval and risk assessment.

### 4.7.15 Fire Stopping

Where cableway systems pass through fire compartment walls and floors the fire barrier must be maintained by installing suitable fire seals around cables, turnings, conduits etc.

The Electrical Contractor shall include for all fire sealing of all electrical services. The fire seals shall provide a fire resistance not less than that provided by the building fabric.

The Contractor shall be responsible for ensuring that such activities do not cause any damage to the services installed.

Where trunking systems in excess of 2500 mm2 cross - sectional area pass through fire compartment walls and floors the Contractor shall install an intumescent pad fire seal inside the trunking. In vertical rising ducts these fire seals shall be installed at every floor level. Fire seals for use inside trunking systems shall be purposely designed and shall not reduce the current carrying capacity of the cables within. PVC trunking systems shall be fitted with an intumescent wrap, which shall be capable of crushing the trunking in the event of fire.

Trunking covers shall be cut at both sides of walls where they pass through for ease of access to the trunking.

Major openings for the passage of cable trays and trunkings shall be sealed using intumescent fire and smoke seal pillows or intumescent high-density rock fibre slab.

## 4.8 Electrical Services to Mechanical Installation

### 4.8.1 General

The Electrical sub-contractor shall supply, install, connect, test and commission all power and control wiring associated with the mechanical installation. The operation of control devices, control panels and mechanical plant shall be the responsibility of others and shall not form a part of this Contract.

The Electrical sub-contractor shall refer to the Electrical and Mechanical Services drawings and specifications to ascertain the location of the mechanical plant control devices and equipment that require electrical services.

All control wiring shall be carried out in 4 core 0.75sqmm screened cable such as Beldon 8723 or equal and approved. The Electrical sub-contractor shall install all cabling in conduit or trunking.

All power wiring shall be carried out using low smoke low flame (LSZH) cables.

The Electrical sub-contractor shall supply and install all isolators, emergency lock stop push buttons and switched fused spur outlets as necessary for the correct completion of the installation. These shall be appropriately rated for the environment in which they are to be installed.

The Electrical Sub-Contractor shall be responsible for the main power supply and wiring and installation of control devices as listed on the schedule. Control devices shall be supplied by the Mechanical Sub- Contractor to all mechanical services plant and equipment.

The cabling shall be as follows:

Power cabling - as per schedule
Control cabling - as per schedule.
Exposed control cabling – as per schedule but screened Belden with additional PVC outer sheath suitable for exposed conditions installed within conduits.
The following details the extent of Controls System included in both the Electrical Sub-Contractor's and mechanical Sub-Contractor's scope of works.

The general responsibilities shall be that the DDC hardware, software, field equipment, co-ordination drawings and commissioning shall be the responsibility of the Mechanical Sub-Contractor, whereas the supply, installation and termination of all field cabling (power and controls) and isolators shall be the responsibility of the Electrical Sub-Contractor.Luminaires

### 4.8.2 General

The electrical sub-Contractor shall supply, install, connect, upgrade, test and commission the whole of the lighting installation as shown on the drawings and described in the Specification.

The type of luminaire required for each location is specified on the drawings and in the luminaire schedule. The electrical sub-Contractor shall erect and install these luminaries at the locations indicated on the drawings. The exact location of each luminaire shall be determined from the Architect's reflected ceiling plans and NOT by scaling any other drawings.

The electrical sub-Contractor shall supply a complete lighting installation including all cabling and accessories required to complete the installation. All existing light fittings which are to be retained are to be re-lamped throughout. The electrical contractor will also include for replacing any light fittings which are found to be faulty or damaged. All cabling to be undertaken in single core copper cables in trunking and conduit throughout. The electrical sub-Contractor shall include for the supply and installation of all lamps for the various types of luminaires.

Where more than one phase is switched from the multi-gang switch location, proprietary metallic phase barriers shall be provided.

The electrical sub-Contractor shall supply and install luminaires at the locations indicated on the drawings. The exact location of each luminaire shall be determined from the Architect's reflected ceiling plan and NOT by scaling any other drawings.

No substitutions or alternative luminaires will be considered unless the electrical sub-Contractor is able to demonstrate that the performances and effects created by such substitution are in no way different from those achieved from luminaires specified.

Ballasts shall be suitable for use with their respective lamp type.

The Electrical Contractor shall ensure that all the luminaires required for the project are placed on order at due time to ensure delivery to suit the project construction programme. However, approval of the Architect shall be obtained for final selection of the luminaires before the orders are placed.

Under no circumstances will LSF single core cables be permitted to enter any of the luminaires. Final connection to the respective luminaires shall be carried out using heat resisting flexible cables. No power cable smaller than 2.5mm2 shall be used for final connecting in the lighting installation.

No luminaires that use thermoplastic material shall be installed in this project.

### 4.8.3 Luminaires

**General**

Provide luminaires as shown on the luminaire schedule and/or indicated on the drawings in compliance with the following:
In accordance with specified requirements whether standard luminaires or not
To IEC 60598 requirements and to associated approvals and test specifications nominated therein and to EMC Regulations and IEC 61000 for minimum radio interference

Provided with compatible control gear and accessories suitable for use with the lamps specified to achieve the performance published in the manufacturer's data
Ensure all luminaires have been thermally tested with all equipment and specified accessories; to prove thermal rating of the lamp, lamp holder and leads is not exceeded.
All luminaires shall be CE marked and labelled "distinctly and durably in accordance with IEC:60598, including the manufacturers make and model. Luminaires shall also comply IEC 60364 Rules. The construction, marking and connection of luminaires shall comply IEC:60598-1 "Luminaires, General Requirements and Tests".

**Samples:**

Samples shall
Be supplied for all luminaires; however, drawings and/or prototypes may be submitted prior to submission of production samples provided they are sufficient in detail to give clear indication of final appearance and suitability for the required application in regard to ceiling co-ordination and/or special locations
Be complete with lamps, starters, control gear, diffusers, supports and flexible cord with three pin plug top
Be labelled indicating the applicable luminaire reference shown in the documents or the area for which they are intended to be used.
Internal Wiring of Luminaires Internal wiring of luminaires shall:
Be 105oC, minimum, 250 V Grade, stranded flexible cord, insulated cable of minimum 1 mm2 cross sectional area
Be neatly secured within the luminaire clear of all control gear. Adhesive tape shall not be used for looming and securing cabling
Be terminated in a large bore, fixed, terminal block mounted adjacent to cable entry
and of adequate size to accommodate three off 2.5 mm2 conductors in each terminal, unless connecting to a flexible cord, in which case the terminals need only accommodate single 2.5 mm conductors
Be colour coded
contain flexible cable anchors and grommetted penetrations where flexible leads are being used
Have adequate insulation to withstand the maximum ignition voltage imposed
Be suitable for the lampholder being adopted
For recessed luminaires, be provided with multicore PVC/PVC flexible cord fitted with a plug top of suitable length to enable the luminaire to be installed from beneath the ceiling. In instances where a plug and lead are not required wiring shall terminate in an externally mounted terminal block having large base terminals
Internal wiring for luminaires with discharge lamp sources shall meet the above requirements in addition to the following:
Be a minimum of 150oC braided silicone insulation, or equivalent.

### 4.8.4 LED (Light Emitting Diodes) Luminaire Technology

**Manufacturer**

Light emitting diodes (LEDs) shall be manufactured by a reputable manufacturer such as Osram, Cree, Xicato, Luxeon and Nichea with proven experience in LED production. The luminaire manufacturer shall meet any certification available by the LED manufacturer. Failure to comply with manufacturer recommendations shall impact upon LED lifetime and reliability.
Thermal Parameters
LED module mounting shall be designed to ensure the junction temperature of any LED does not exceed the manufacturer's recommended maximum operating temperature. Thermal dissipating of the module shall be designed for the operating temperature and wattage of the unit.
LED luminaires shall be thermally tested to ensure maximum junction temperature is not exceeded whilst operating in any environment between -10oC to +38oC.
Optical Parameters
LED Contractor shall provide LED batch bin number, recording luminous flux, wavelength/colour and forward voltage of LED. Batch information to be included as part of the operation and maintenance manual or as part of the fixture's order/serial number. Binning shall be within the following MacAdam Ellipse ranges;
Internal luminaires - 3 steps
External or carpark luminaires - 4 steps. LED Characteristics
LED lamp characteristics shall be demonstrated by provision of a test report which shall include the following:
Graphical representation (with error bars) of lumen output versus time (L70 curve)
Graphical representation (with error bars) of colour shift versus time
Graphical representation (with error bars) of input power versus time
Summary table showing lumen maintenance (percent) after 6,000 hours of testing
Summary table showing change in input power (percent) after 6,000 hours of testing
Summary table showing change in colour after 6,000 hours of testing
LM-79 reports at T= 0 and T= 6,000 hours
Descriptions and details of the product under test and test setup. Lamp Life
White LEDs shall have an L70 figure of 35,000 hours or better. L70 is defined as the point at which an LED source lumen output reduces to 70% of its initial lumens, and is likely to be different for each LED type.
Colour Rendering
White LEDs shall have a CRI >85. Drivers
Generally, drivers shall match optimum and maximum current to suit the LED over the whole range of input voltages.
Dedicated drivers shall be provided with the following features as a minimum:
Automatic reset in the event of a fault
Isolation between the primary and secondary sides

Dimming with linear characteristics
Operation in ambient temperatures of -20oC to +50oC
Low power loss
Integral electronic overload protection circuitry
Integral electronic over temperature protection circuitry
Integral electronic short circuit protection circuitry.
Power factor: >0.95
Minimum Luminous Efficacy
Optical direct light output ratios of fittings only (not lamps) related to power:
White 72 lm/W
Warm 65 lm/W
Manufacturer luminous efficacy is stated for a 25oC (77oF) ambient with a current of 20mA in an environment that does not build-up heat around the LED.
Transformers
Generally, transformers shall match optimum and maximum current to suit the LED over the whole range of input voltages.
Dedicated transformers shall be provided with the following features as a minimum:
Comply with IEC & CE Standards
Automatic reset in the event of a fault
Isolation between the primary and secondary sides
Dimming with linear characteristics
Operation in ambient temperatures of -20oC to +50oC
Low power loss
Integral electronic overload protection circuitry
Integral electronic over temperature protection circuitry
Integral electronic short circuit protection circuitry.
LED Warranty
The supplied manufacturer L70 lifetime data will be used as a basis for determination of replacements for premature failure.

### 4.8.5 Installation of Luminaires

**General**

All luminaires shall:
Be installed parallel or normal to the building structure
Be compatible with the building structure and maintain sufficient clearance in all positions where they are located
Be regularly and uniformly spaced with respect to the areas in which they are installed
Be installed subject to the agreement of the Builder immediately prior to the final paint application
Ensure that a suitable fixing medium is available for all luminaires. If special fixings are necessary, e.g., battens in ceiling construction or extra purlins, anchorages, etc., ensure they

are specified to be provided by the Electrical Services Contractor or are provided by other trades and are included in Work Associated with Other Trades or Parties
Be left in a clean, operating and undamaged condition at the time of practical completion
Be supported from rigid and permanent sections of the building, such as primary ceiling rails, rafters, slabs, etc
In cases where air flow causes swaying of luminaires, luminaire suspension system shall be provided with rod suspension.
Connected to the building wiring via a three core flexible cord and plug top into a plug socket outlet connected to the fixed building wiring and securely fixed to the building structure or catenaries and not to ceiling suspension. Plug adaptors or twin plug sockets are not acceptable for this purpose.
Lighting, Aiming and Commissioning
The Contractor shall focus all adjustable light fixtures under the direction of the Engineer. As far as possible this work shall be carried out during normal working hours, but where and as required, shall be carried out during the hours of darkness.
Provide all access equipment as necessary for carrying out the lighting commissioning works.
The Contractor shall allow for the attendance during all setting up work of the light control system undertaken by the Control System Manufacturer/Contractor trained personnel. The Contractor shall ensure that the control system has been fully commissioned by the Control System Manufacturer prior to this programming work.
Commissioning activities as above, may need to be repeated and the Contractor shall allow for attendance, etc., for such repeat work as required by either the Engineer and/or the Project Engineer.

## 4.9 Self Contained Emergency Lighting System

### 4.9.1 General

Provide an emergency luminaire and illuminated exit sign installation as follows:
Of the self-contained type
Complying with all relevant clauses in the Luminaires section of this specification
Complying with IS 3217
Provide certification of luminaire photometric performance data, by an independent and registered party.
BSI or an equivalent independent test house shall be used to produce photometric tests certification on the emergency luminaires verifying the lighting distribution/photometrics of fitting and the initial and end of life total light outputs.
Classified by an approved authority in accordance with IEC 60598, the classification being clearly marked on the luminaire label
Be labelled in accordance with IEC 60598
Complying with the requirements of the regulating Authority
Numerically identified with a permanent approved engraved labels with numbers

corresponding with the log book identification and as installed drawings

### 4.9.2 Installation

Install emergency luminaires and illuminated exit signs in accordance with the Lighting Installation section of this specification and connect to an unswitched active from the adjacent normal lighting circuit.

Self contained illuminated exit signs shall additionally be connected to a switched active with a labelled switch located in the local switchboard which shall control the normal mains voltage operated lamp.

Provide recess mounted emergency luminaires, with 3 core PVC/PVC flexible cable, fitted with a polarized 3 pin plug top.

Provide recess mounted emergency lights incorporated in a normal lighting luminaire with a 4 core PVC/PVC flexible cords and polarised 4 pin plug top.

Flexible cords shall be of sufficient length to enable the luminaire to be connected into a matching plug socket incorporated within the building wiring.

### 4.9.3 Emergency Luminaires

Emergency luminaires shall:

Of LED lamp type
Be non-maintained type
Contain a mains failure relay
Be adequately ventilated
Contain sealed nickel cadmium cells with the following features:
Suitable for operation up to 70°C
Securely fastened in position with purpose made clamps separately housed in a battery pack
Located clear of any heat source
Connected to external components via quick connect tab and receptacle connectors
Positioned to permit removal and replacement without removing other components and with the luminaire mounted in position
Minimum installation life of seven years and a guaranteed life of three years when operated in accordance with manufacturer's directions
Have reverse battery polarity protection
Comply with the relevant clauses in the luminaire section of this specification
Where installed in accessible locations in public areas, be protected from damage and easy removal by a clear polycarbonate cover
Have a two rate constant current constant voltage battery charger with the following features:
Boost charging rate of not less than 300 mA
Trickle charging rate of not more than 100 mA

Automatic selection of boost or trickle rate charging mode with trickle charging rate applying for approximately 95% of the time under normal conditions
LED indication of operation and charging mode
Be provided with a test switch to simulate mains failure.

### 4.9.4 Illuminated Exit Signs

Emergency exit luminaires shall:
Be of LED lamp type
Incorporate exit legends and directional arrows as detailed in the schedule or as determined on site
Incorporate the same features as specified for Emergency Luminaires.

### 4.9.5 Log Book and Maintenance

Provide the log book and maintenance manual for the emergency lighting system as a part of the operating and maintenance manual for the whole project.
In addition, provide one separate copy of the log book and maintenance manual for the emergency lighting system.
The log book and maintenance manual shall comprise:
Hard cover plastic ring binder
Embossed lettering for project title and manual title on the front cover
Front page with Project, Project Engineer, Contractor, Architects' and Engineers' names and addresses
Index
Sections as required and separated by indexed section dividers. A3 sized copies of all floor plans showing locations of emergency lights and illuminated exit signs
Description and manufacturer's brochures and catalogue number of all emergency luminaires and illuminated exit signs in the project
A schedule of all emergency luminaires and illuminated exit signs depicting location, manufacture, catalogue number, circuit and switchboard origin
Log sheets for six and twelve monthly test of functions. Each luminaire shall be listed by location and luminaire number in the log sheet and sufficient sheets shall be provided for recording test results over a five year period

### 4.9.6 Monitoring System

A computer based central maintenance and monitoring system shall be provided in order to carry out the testing of the single point self-contained emergency lighting system. The monitoring system shall include:
Communications cabling from the computer to the emergency luminaires
A data monitoring circuit
Capability to display the system or system sections on screen

Monitoring of the associated data circuit for open circuit or short circuit faults
Ability to address luminaires individually or in selected groups for battery duration testing
A lamp test and lamp failure indication
Dedicated circuitry within each emergency luminaire to enable communications with the central system
Capability of a 30% expansion in the number of circuits/luminaires
Log book and maintenance manual
Have a permanent memory, not dependant upon electrical supply being maintained
The system shall be programmed to automatically perform the discharge duration tests at three monthly intervals.
The discharge test shall be programmed to test 50% of all emergency lights over two stages.
The first stage test shall be for each alternate emergency light in the installation so that remaining lights are available for normal operation.
The second test of remaining emergency lights shall be programmed to start 24 hours after the first stage test.
Tests shall be performed in daylight hours when the building is not normally occupied at a time as advised by the Project Engineer.
Provide a fully configured data base and software to allow monitoring to the central monitoring unit. Provide assistance to other Contractors as required to achieve a fully working system.

### 4.9.7 Testing and Maintenance

Test the emergency lighting system to the satisfaction of the regulatory Authority. Demonstrate the operation of the emergency lighting system by performing the 12 monthly test prior to the date of practical completion.
All units which fail to operate for the required period will be rejected and shall be replaced with new units which shall be similarly tested after installation.
Results of the test at practical completion shall be recorded in the log book. Perform the six and twelve monthly tests and record the results in the log book.
Rectify all defects, including replacement of failed lamps during the defects liability period.
The log book shall be retained on site.

## 4.10 Light And Power Accessories

### 4.10.1 Socket outlets

The electrical sub-contractor shall supply and install all general services throughout as indicated on the drawings. This shall include all cleaner's sockets/hives, floor grommets, under-desk slinky, over and under desk power modules, under-floor busbar and floor box outlets.
There shall be a maximum of 6 No twin socket outlets per circuit. All general socket outlet circuits shall be protected by residual current devices of 30mA maximum trip setting. The protection devices shall be suitable for operation in circuits supplying switch mode power supply units and frequency converters. The building contains a raised access floor where

cabling can be routed to desks via floor grommets supplied by the Electrical Contractor. Floor grommets shall be as CMD 210mm diameter (Product Code PCFG238) provided by Core Electrical.

### 4.10.2 Socket outlets (Technical & Office Areas)

The electrical sub-contractor shall supply and install all general services throughout as indicated on the drawings.
Single phase socket outlets shall:
For socket outlets, comprise a 13A rocker operated switch and three pin plug base with flat earth pin, mounted under a common moulded impact resistant plastic flushplate
For special purpose socket outlets be provided with 16A or 20A mechanisms as specified
Comprise two switches and plug bases within a common standard sized flushplate for double socket outlets
Be of the protected type where installed in service areas
Comply with IP67 where located external to the building or in damp situations
Be of a selected standard colour range
Be located clear of building planning modules and grid lines so that future wall positions will not conflict with outlet positions
Be horizontally mounted
Be of standard plate size 115 mm x 70 mm
Be flush mounted in a wallbox having adjustable metal fixing lugs where located in masonry walls
Be flush mounted within a metal bracket fixed to a stud or noggin where located in stud partitions
Be fitted with an engraved circuit identification label
Be labelled with machine engraved and filled lettering designating circuit and switchboard number on a blank switch filler incorporated in an additional switch position on the flushplate
In special and nominated on the drawings the following additional requirements shall be provided:
Blank fillers for essential circuits shall be red
Be labelled NO RCD on outlets connected to circuits which are not protected by a Residual Current Device
Be of the same type and manufacture as light switches
Be installed at a mounting height as directed on site

### 4.10.3 Fused Connection Units (Technical & Office Areas)

Permanently connected equipment will be supplied and set into position and connected to other services by other trades unless otherwise specified.
Provide isolating switches for each item of equipment complying with the following details:
Same current rating as the circuit wiring

Mounted adjacent each item of equipment being connected
Type ip67 where installed externally to the building or in damp situations
Protected type and surface mounted where located in service areas, roof spaces and service ducts and flush mounted in other areas
Be labelled as specified in marking and labels to indicate the circuit and switchboard number
Enclose conductors between fixed conduit and equipment in a length of PVC flexible hose fitted with brass grip type fittings of sufficient length to enable the equipment to be withdrawn for servicing.
Where equipment must be moved from its installed position to enable access to wiring connections, e.g., electric stove, oven, etc., provide a stranded galvanised steel cable fixed to the structure and the appliance so that it prevents any stress on the cable and connectors when the appliance is in the withdrawn position.
Make all final connections and leave ready for testing and commissioning by others unless otherwise specified.
Provide wiring and isolating switch and leave provision for the extension of circuit wiring into equipment nominated as being provided by others.
Determine the correct location of the wiring and/or conduit entry for equipment supplied by others.

Works Associated With Emergency Generator Fuel System

### 4.10.4 General

The work shall comprise the supply and installation of the following:
Bulk above fuel storage tank installation.
Complete with fixing bolts and straps, fittings and pipework
Fuel polishing systems to convey fuel from the bulk storage tank/s to day tank/s, which in turn supply the generator.
Painting and identification of all piping
Remote contents gauge fuel level transducer to tank, fill point and control panel displays, warnings, alarms and interface to emergency power generation control system
Provision of as installed drawings and manuals
Testing and commissioning of the works, including fuel for testing
Secondary containment envelope for above-ground fuel storage tank
Comprehensive leak detection systems

### 4.10.5 Fuel Polishing System

A bulk fuel system polishing/conditioning system installed to allow the following functions:
Circulated the fuel to reduced oxidation stagnation
Filtration (water separator) of fuel (10 micron)
The conditioning system shall operate to recirculate filter and water separate the contents of the fuel tank in a 4 to 5 hour period.

Fuel pumps shall be equipped with leak detection and spill containment
Fuel polishing pumps shall be three phase equal to axial screw type Mirrlees Triro or gear pump Ebsray.
The polishing system shall operate in the following manner:
The control system associated with the fuel system control will automatically control the fuel poilishing scheduling. The pump shall run on an automatic cycle of 4 to 5 hours in every 24 hours period
The fuel control system shall monitor the flow of fuel and water detection during this operation, transmit status information to the fuel system controller for sitewide monitoring via the BMS system.
Fuel pumps shall be provided with a means of manual/auto/off control from the fuel control panel

### 4.10.6 Pipework

All fuel and water piping for the generator system shall be provided for a complete operational system. Generally, all above ground fuel oil piping shall be in black mild steel, whilst all underground piping shall be synthetic type.

Arrange all pipework to allow the complete drainage of all sections.

Contractor to provided supervision of excavation for and backfilling around the pipework. Fuel Oil Pipework - Above Ground:

All fuel oil pipework shall be black steel medium pipe to the relevant standard as scheduled, and corrosion protected.

Jointing of pipework shall either be by welding or by the provision of flanged joints unless otherwise specified. Flexible couplings shall be provided to pumps and to diesel sets.

All slag shall be removed after welding and welds shall be wire brushed. Flash shields together with adequate ventilation shall be provided in areas where tradesmen are working alongside welders.

Flanged joints shall be provided wherever welded joints are impracticable and where required for erection purposes at connection to fittings in steel piping 32 mm or over and at all flanged valves. All flanges and bolts shall be provided in accordance with relevant standards as scheduled. Flanges shall be suitable for working pressure and service, as set out in relevant standards as scheduled. Flanges adjoining butterfly valves shall be of the weld neck type. Jointing flanges shall be parallel and misaligned flanges shall be rejected. All bolts and nuts shall be passivated zinc or cadmium plated. Bolts and nuts shall be hexagon headed and of the correct diameter, length and number for each pair of flanges. Flanged joints shall incorporate approved gasket material not more than 1.6 mm thickness, designed especially for the duty and used in conjunction with an approved jointing paste. Where joints are

required for pipes less than 32 mm in diameter, approved unions or screwed flanges may be used in conjunction with an approved jointing paste Loctite PST 567 or equal.

All branch connections except in the case of headers shall be constructed to be swept in the direction of flow. Where the use of swept branch connections is considered impracticable, the approval of the Superintendent should be sought for the use of either standard or fabricated fittings.

All fittings shall be constructed of materials consistent with the piping material. Reducer fittings shall be of bevelled type, either concentric or eccentric, as required.

Tees in lines 32 mm and over shall be bevelled end tees and in lines under 32 mm, tees may be welded or screwed.

Except where pulled bends are used, bends shall be standard long radius elbows. Where pulled bends are used, no appreciable flattening or corrugating of the pipe shall be accepted.

Small bore drainage pipework up to 25 mm diameter above ground may be run in tinned copper, using silver soldered joints.

The materials, wall thickness, design pressure and test pressure shall be as follows:

Material: Steel and Copper to relevant standards as scheduled.
Design Pressure: typically 1400 kPa
Test Pressure: typically 2100 kPa

### 4.10.7 General Information

There shall be three main components - the control/slave panels, network expansion panels and the remote units.
Remote units shall be wired in a radial (star-wired) configuration. Control/NEP panels are loop wired on the network.
Any number of jack sockets (for the roaming telephone) shall be daisy chained (up to 500m). One handset shall be operational per line at any one time.
Back boxes are required for the jack sockets and toilet alarm items. All other outstations (and the control panel) shall be surface mounted or flush mounted with bezel.
The control panel shall be typically wall mounted in a central control room.
Remote units are wall mounted in locations such as refuge areas, stairwells, fallback positions, corridors and other 'gathering' points, at a height easily reached by users.
All outstations shall be powered from the line, including the roaming telephone enclosure and disabled toilet alarms.
The system shall be configured via the encoder on the control panel or by connecting a laptop to the Ethernet port in the panel (cable supplied).
It shall be possible to connect disabled refuge, fire telephone, emergency/steward telephone, roaming telephone jack sockets and disabled toilet alarms to one panel.
It shall be possible to fit up to two disabled toilet alarms to one line. (Or one toilet alarm with

two ceiling pulls.) These units shall be directly powered from the line.

### 4.10.8 Cabling Requirements

Disabled refuge - two core, fire resisting, non-enhanced (see 'IEC 62642-9 below).
Fire telephone/roaming telephones - two core, fire resisting, enhanced.
Disabled toilet alarms - two core, fire resisting to first DTA Kit (spur to second DTA Kit - two core security).
Network loop - 2 x two-core fire resisting cable (enhanced recommended).
Up to 500m cable run between each remote unit and the control/NEP panel.
Up to 500m cable run between each control/NEP panel.
Maximum overall length of the network is 5Km (i.e. network ring length + cable length to the furthest outstation = <5Km).
BS5839-9:standard fire resisting cables SHALL be considered suitable for:
EVC systems for use in disabled refuges but not for firefighting in (a) sprinklered buildings; (b) unsprinklered buildings less than 30m in height, provided that evacuation takes place in three or fewer phases.

### 4.10.9 Demonstration and Training

In addition to attendances and brief system training at a client handover seminar the contractor will allow training to be given to personnel nominated by the client at a time to be agreed with the client. The contractor shall provide for 2 No. 2 hour training sessions at the agreed time. The training is to include basic system operations and procedures including use of the logbook.

## 5. Security

### 5.1 Access Control System

The Access Control system specified comprises of several key elements:

Door Controllers
Card Reader Technology (Swipe In/Swipe Out to eliminate anti pass back)
Biometric Reader Technology (At Mantrap Entrance to data centre)
Door Locks.
Push to Exit
The system components are shown for each door on the Security Layout drawings. As a minimum, the access control readers must be:

Compatible with industry standard security credential formats
Compatible with NFC/Bluetooth virtual credentials
Open Supervised Device Protocol (OSDP) output
Tamperproof, waterproof, and weather resistant (IP66 where necessary)
Variable in size to accommodate its installation locations

Provide a minimum card reading range of 3cm
Provide localised visual and audible notifications/alerts

### 5.2 Door Controllers

Each Local Access door has an associated door controller which is linked together over a RS485 network. The Master door controller is connected to the

LAN/Ethernet network via a Cat6a backbone cabling infrastructure.

Each Master door controller and is configured with an IP address. The system connects up to 124 doors per controller loop.

### 5.3 Biometric Reader Technology

There are a number of areas/doors that are provided with a where a higher level of security. These areas are provided with biometric readers, which in effect is a two-step verification process before access is granted into the secure space, an additional layer of security.
The following areas are provided with Biometric readers and security
Access doors into each customer room
Biometric enrol device located at Security desk.
The 2-step verification process associated with the introduction of the Biometric reader in addition to the card verification to provide an enhanced level of security.
The biometric fingerprint reader verifies the identity of the card holder by checking if the fingerprint data stored on the iClass card matches that of the fingerprint of the individual seeking access.
When a card holder uses the card on the iClass biometric reader and the fingerprint has been validated by the biometric sensor, the card number programmed in the iClass / Omni Class card is sent to the access control device.

### 5.4 Door Lock Equipment

The Door Locking system mechanism to be used throughout the Data Centre on doors where restricted access applies is (Abloy) Solenoid Door Lock, handle controlled used in narrow profile doors. Where solenoid locks are not used a surface maglock (heavy duty 500KG holding force) with relay monitoring will be used.
The AACS must remotely control the electric lock and upon a valid access card read the lock must be unlocked, allowing entry
The locks must also be electrically monitored, and log an audit trail of entry/exit as well as alarms such as lock tampering
It needs to be mounted adjacent to its barrier and at a height that is suitable for all users considering applicable laws and regulations
As a minimum, the electric locking must:
Unsecure side handle controlled with the option to control secure side handle
Accepts standardised high security keyed cylinders with the option of thumb turn exit or escape hardware
Be Deadbolt and anti-friction bolt deadlock when door closes

Have patented keys and cylinder mechanism for maximum protection against unauthorised duplication. Six pin tumblers plus a force-controlled sidebar with false gate position
The associated doors, gates and frames must be of suitable construction
12/24VDC fail safe/fail secure options

### 5.5 Power Supply Unit

All security related components must be connected to the UPS power supplies, to ensure continuity of operation throughout any power outages. The size and rating of these power supplies will be dependent upon the type, quantity and power consumption of electronic locking installed
The units must be installed within secure locations to deter tampering and people gaining unauthorised access to secure areas
Ideally, the units should be installed adjacent to the AACS control equipment, which will make on-going service and maintenance more efficient
electronic locking will also normally require separate
Power Supply Units and Backup Battery Units
Compatible with local grid mains power sources
12VDC or 24VDC, rated at an amperage suitable for the electronic locking installed
Individual fused lock outputs to protect the Power Supply Unit
Metal cabinets with a lid secured by a key operated lock
Tamperproof cabinet with a tamper alarm switches
Linked to the power supply via a centralised UPS system
Have visual indicators for power loss

### 5.6 LV Switchgear Specification

#### 5.6.1 Environmental Conditions

Below requirements are applicable for all units within scope.

Where no specific environment details are mentioned, the following limits apply for the scope of work:

Internal, minimum temperature 5°C

Internal, maximum temperature 40°C

External, minimum temperature 0°C

External, maximum temperature 40°C

Internal, relative humidity 5% - 95%

External, relative humidity 5% - 95%

Noise limit ≤56 dB(A)@1m

Altitude >1000m (Nairobi is at 1750m)

### 5.6.2 General

Provide assemblies:

of approved manufacture as detailed further herein
of overall dimensions suitable for the space allocated
designed to facilitate easy access to and removal of component parts and to facilitate the undertaking of a thermograph survey of all joints and terminations without the need to isolate any parts or circuits.
constructed and containing equipment to the approval of the local Electricity Distributor and Electricity Retailer
incorporating main protective devices with fusing or tripping characteristics which are co-ordinated with other protection devices of the Electricity Distributor and other protective devices on the line and load sides of the device.

## 5.7 Compliance

### 5.7.1 Manufacturer

Assemblies shall be supplied by an approved, experienced manufacturer.

**Quality Assurance:** The design, testing and manufacture of the switchboards shall be carried out under the control of a licensed and accredited Quality Assurance System.

### 5.7.2 Clearances

Check on site as well as latest copies of Architectural and Structural Drawings to determine space available for assemblies including allowance for access during installation. Ensure that each assembly is designed so that it can be satisfactorily installed and that all necessary clearances are provided for satisfactory maintenance and operation of equipment after installation. If necessary, the equipment shall comprise a number of cubicles for assembly on site.

### 5.7.3 Diversity Factors

Each individual circuit and busbar system shall be capable of carrying its full rated current as nominated.

Where busbar ratings are not nominated the rated diversity factor of each assembly shall be in accordance with the requirements of Clause 5.4 of EN 61439.1 with all spaces filled by circuits rated at 90% of the aggregate of the maximum spaces ratings.

### 5.7.4 Forms of Separation

The form of separation for each assembly shall be as noted in the schedules and/or on the drawings.

Insulation of cables and busbars and the insulated housing of switchgear shall not be considered as separation, unless specifically nominated in the form of separation.

### 5.7.5 Perspective Short Circuit Current

The short circuit protection and short circuit strength of each assembly shall be suitable to withstand the thermal and dynamic stresses of the short circuit capacity specified herein. Ratings indicated are RMS values for one second duration.

### 5.7.6 Rating

The assembly and equipment shall be rated to the current carrying capacity, enclosure, operating temperature, maximum prospective fault current and other classifications as specified or shown.

### 5.7.7 Cascading

The principle of cascading using fault current limiting circuit breakers shall be used throughout the installation. All circuit breakers shall be of the same manufacture. Select in accordance with manufacturer's recommendations.

Certificate: Provide a certificate from the circuit breaker manufacturer which shall state that the manufacturer guarantees that the circuit breakers as installed in the installation will operate satisfactorily at the specified supply system fault level.

### 5.7.8 Degree of Protection

Provide a degree of protection in accordance with EN 60529 for switchboard assemblies for internally located IP41 and externally located assemblies IP65.

This degree of protection permits adequate ventilation of the assembly and prevents entry of small sized particles.

Cable entries into switchboards shall not void the specified degree of protection.

### 5.7.9 Switchboard Shop Drawings

Drawings shall be in the format specified herein and show the following information and shall be included on each Switchboard shop drawing submittal for Engineers review:
Manufacturer's name and type of any standard equipment
The general arrangement of equipment
Full details of cabinet construction and dimensions
Vertical sections through each compartment indicating equipment and busbar arrangements
Label Detail Sheet
Build Notes sheet, outlining the Construction method of each switchboard including metalwork, modular design specification, busbar construction
Parts List Sheet to include

Section Identification columns
Part No.
Part Description
The method of supporting busbars and equipment
A description of all materials to be used
Clearances between live parts, and live parts and earth
Busbar dimensions and ratings
Internal wiring sizes and ratings
The size and wording of labels
Wiring diagrams and schematics of instrument protection and control circuits
Front elevation
Sheet metal details
Finishing process details
Weights of assemblies heavier than 500 kg for structural co-ordination purposes
Calculations where PTTA assemblies are being adopted
Calculations verifying the maximum internal temperature ratings will not be exceeded
Details of
Compliance with EN 61439.1
Maximum fault withstand ability
IP rating to EN 60529

## 5.8 Construction

### 5.8.1 Material

Material for cubicle construction shall be mild steel unless other materials, e.g. stainless steel are specified on drawings or schedules. Panels shall be furniture grade sheet.

Thickness shall be adequate to prevent distortion and to withstand the effect of faults. Minimum thickness shall generally be:

2.0mm sheet steel construction for freestanding base-mounted cubicles, fitted with doors attached with lift off pintle hinges.
Where approved, small wall mounted enclosures may be fabricated from 1.6 mm thick sheet steel
The assembly shall allow for thermal imaging of the internal busbar

### 5.8.2 Cabinet Construction

Cabinets shall have:
The switchgear assembly, its circuits and switching devices shall be fit for purpose and be able to continuously carry their required maximum currents. The switchgear assembly shall have natural cooling and be designed for an upper limit ambient temperature of 40°C with a daily average of 35°C, which is considered to be normal service conditions. If compliance with these normal service conditions requires that the free air current rating of a switching device

needs de-rating, then the de-rated current rating of the switching device shall still be sufficient to continuously support the required designed load current. A permanent notice shall be attached to the cubicles of de-rated switching devices stating that the switching device has been de-rated due to thermal restrictions.
Forced ventilation of the compartments within the electrical assembly to comply with the above is not accepted
Sheet steel construction fitted with doors attached with lift off pintle hinges
Edges concealed by folding
Suitable means of securing the complete assembly to the building structure
Provide removable eyebolts for lifting cubicles
Flush fronted type with only toggles, handles, indicators, dials and like equipment for operational use protruding through the front panel
Single core cables arranged such that they do not pass through individual holes in ferrous metal enabling eddy currents to be established
Sets of cabling for incoming or outgoing circuits grouped together to minimise the magnetic field strength generated
Outgoing cables arranged so they do not pass through busbar chambers
A maximum height of 2250 mm
Adequate space for outgoing wiring having consideration for the types of cables entering and leaving the assembly
Cable entries and/or gland plates, sized to suit the cables and installation requirements
Have gland plates of insulating material (bakelite or similar approved)
Sealed cut outs for busbar and cabling installation where cabinets are extendable
Natural ventilation by means of louvered vents in the upper and lower sections, backed with fine bronze wire mesh for switchboards larger than 0.3m3 in volume. All vent locations shall encourage natural ventilation to limit temperature rise within the ambient conditions
The Form shall follow the directions given in Annex B of IEC/EN61439. Separation by the use of the integral housing of a device, e.g. a moduled case circuit breaker as stated in sub-clause 12.8 in IEC/EN61439-0 is not accepted.
In other words, functional units >125A shall be installed in separate and clearly defined compartments, whereby subassemblies e.g. SE DECO busbar system is not acceptable.
Live conductive parts inside switchgear assemblies, which are accessible during normal operation and/or maintenance with front doors open or during installation of spare compartments, shall be shrouded and have an ingress protection of at least IP 20.
Terminals of equipment, which are installed on a compartment door and which can be live when the door is opened, shall be shrouded to a degree of protection of at least IP 20.
Hen a removable (plug-in and draw-out) unit has been removed from the assembly, the live parts inside the fixed breaker chassis shall be shrouded with a degree of protection of at least IP 20.
Assemblies shall be provided with a durable, one-line, mimic diagram on the front, indicating

the busbar circuit and the specific function of the different compartments.
The positioning of the low-voltage switchgear shall allow for a minimum of 700mm access and service clearance from the front of the assembly. The distance shall be measured from the handle of the functional unit (breakers, load switch etc.).
Doors shall (where required):
Be fabricated from 2 mm, minimum, folded sheet steel
Have a heavy duty tumbler type lock complete with two keys per cabinet which are common to all switchboard locks installed. A standard lock coding shall be adopted
Be secured in the closed position by means of two, minimum, large diameter, captive, knurled, cylindrical head screws for doors providing access to busbar and wiring components only
Have folded metal stiffeners and bracing to achieve rigidity and prevent warping or sagging
Have flush mounted escutcheons for recessed switchboard enclosures
Have chromium plated lift off pintle type hinges
Have latching bars on doors larger than one metre high
Have suitable lifting handles on doors larger than one metre high
Be sized so that the weight of any door does not exceed 20 kg
Be fitted with circuit schedules on the inside of the door for fuse and circuit breaker distribution switchboards which shall be typewritten and placed in transparent non- flammable pockets.
Be fitted with braided earthing straps in instances where equipment is fitted to doors
Removable panels, escutcheons and cover plates shall:
be fabricated from 2 mm, minimum, folded sheet steel
be not larger than one metre in height or width, and in no case exceed 0.6 m2 in area
be provided with two "D" lifting handles
incorporate cut outs which:
expose only toggles, handles, indicators, dials and similar items
are adequately stiffened where long cut outs are provided for equipment groups
outgoing cables arranged so they do not pass through busbar chambers
contain proprietary plastic inserts or painted metal covers over unused openings
be provided with locating pins or hangers on the switchboard able to retain the panel in place when all fixings are released.
Dustproof Seals shall:
Dustproof seals consisting of a substantial moulded neoprene rubber strip held in a channel formed around the perimeter shall be provided for doors or removable panels and covers. Escutcheon panels need not be provided with seals.
Ventilation Louvres shall:
Provide ventilation louvres with internal brass mesh screens to prevent entry of insects.
Painting shall:
Cubicles shall be painted internally and externally
Internal Colour: White.
External Colour: TBC
All steel work shall be thoroughly degreased and surface smoothed, treated with rust proofing

primer and undercoat. Finish with two coats of semi-gloss acrylic lacquer or equal.

### 5.8.3 Busbars

Provide busbar system within the assembly, extending from the termination of the incoming unit to the line side of protection equipment for outgoing circuits.
Internal busbars shall:
The main busbars shall be rated for the nominal current over the entire length of the assembly and shall not be rated lower than the incoming switching device and/or the Bus-coupler (comprising the automatically operated breaker + the manually operated isolator) located between two busbar systems.
comply with EN 61439.1 and EN 61439.2
be sized for a maximum temperature rise in accordance with requirements set out in Table 6 of EN 61439-1
be manufactured from high conductivity hard drawn copper bar with radial edges
be of sufficient cross sectional area to supply the capacity of the assembly plus
20% when all equipment spaces are filled
be of minimum size 25 mm x 4 mm except for tee offs to miniature circuit breakers
be arranged for miniature circuit breakers so that a multi pole circuit breaker can be replaced with single pole breakers without disturbing the three phase busbar assembly
have neutral busbars of the same current rating and size as the phase busbars.
have neutral busbars installed with the phase busbars to reduce eddy current heating of adjacent ferrous materials
be provided for all connections carrying 100A or above
be arranged so that all joints, terminations and fixings are fully accessible
supports and spacings shall be in compliance with type tests certificates
have fully lapped joints linished, coated with acid free petroleum jelly and bolted together with passivated zinc plated steel bolts, washers, nuts and locknuts
Tighten bolts to Copper Development Association recommendation with a tension wrench.
be arranged for future extensions to adjacent assemblies where required
have a removable section where mounting current transformers so that transformers may be removed or replaced without disturbing the remainder of the assembly
be supported on synthetic resin moulded type insulators, panels and cleats. Bobbin insulators secured through the busbar are not acceptable
be air insulated between phases.
be identified as follows:
L1 phase : brown
L2 phase : black
L3 phase : grey
Neutral : blue
have PVC dipped insulation, two coats, for three phase busbar assemblies rated up to 250

amps for connection to miniature circuit breakers.
Main and secondary earth busbars shall be not less than 25mm x 5mm solid hard drawn copper and secondary earth busbars shall be provided in all cable compartments for direct bonding of cable armouring
The main earth bar shall be continuous along the full length of the switchgear assembly as shall secondary earth busbars be continuous through the full height of cable compartments.
Covers to busbar chambers shall be fitted with screw-fixed trafolyte labels, coloured red and engraved with 6mm high letters as follows: "DANGER 415 VOLT BUSBARS".

### 5.8.4 Neutralizing

Where indicated in the drawings / schedules the switchgear manufacturer shall provide neutralizing facilities as detailed below.

The neutralizing link shall be located in a separate compartment adjacent to the incoming functional unit or within the main incoming functional unit compartments where all live terminals are fully shrouded over the complete face area of that cubicle. One side of the neutralizing link shall be solidly bolted to the main earthing busbar and the other side to an extension of the main neutral busbar.

The end of the neutral link connected to the neutral bar shall be slotted such that the link can be swung away from the earth bar connections without removing the link from the neutral bar or removing the bolt from the freed end.

The location of the neutralizing link shall be clearly identified on the compartment door by means of labels as detailed elsewhere in this specification.

### 5.8.5 Safety Measures

Where wiring for controls, etc., to an assembly is connected to a circuit originating and supplied from an external source, care shall be taken to ensure safety of personnel by:
Ensuring that signal voltage is not above extra low voltage
Terminating external signal cables at a clearly labelled insulated terminal strip with insulating cover
If it is not possible to use an extra low voltage signal, then in addition to safety measure noted above, the incoming signal shall be isolated by a set of contacts on the switchboard main isolator, or a warning label (red letters/white background) shall be fixed adjacent to main isolator reading:
"DANGER THIS SWITCH DOES NOT ISOLATE POWER TO CONTROL CIRCUIT..... ORIGINATING AT ....." All bolts, screws and nuts shall:
have metric threads
have hexagonal shaped heads
be of non-ferrous metal, or alternatively passivated zinc plated
be fitted with flat and spring washers
be chromium plated where exposed to view.

Self-tapping screws and pop rivets will not be accepted.
Non-metallic bolts and screws may only be used to secure internal non-metallic segregation barriers.

### 5.8.6 Labelling

A typed Circuit Schedule shall be provided in a suitable holder either inside the switchboard door when doors are fitted or adjacent to the switchboard.
**Information:** Circuit schedules shall identify equipment, number of items and relevant room identification codes.
Label and identify cubicles and equipment to approval with appropriate engraved labels to indicate function and/or designation as follows:
adjacent every item on the front of the assembly
indicating the position of equipment which is concealed from view behind panels and doors
indicating the function of main controls, submain controls, relays, fault current limiters, links, contactors, relays, starters and switches
indicating the current rating of fuses for fault current limiters and the equipment protected by the fault current limiter
indicating the settings of adjustable tripping characteristics of circuit breakers
positioned on the rear of main controls and submain controls of back connected assemblies so that the control can be identified from the rear
identified in the form of a numeral for each single pole of sub circuit controls, including each pole of multi pole controls
located on each assembly and indicate:
the assembly reference number as directed
supply mains, number, size and type
the origin of supply mains
the designed prospective fault level applicable
fixed onto the coverplate in front of fault current limiters which are mounted behind the coverplate and displaying the wording 'Fault Current Limiters Behind Panel'
indicate on/off and other positions of all controls, switches, isolators and circuit breakers unless clearly indicated on the equipment
where provision is made for the mounting of future equipment, labelling shall be fixed in position and shall indicate the circuit number and maximum rating
for sub circuit circuit breakers to which frequent access is required for switching and testing purposes, e.g., light circuits, security lights, emergency lights, etc., indicating the purpose of the circuit breaker
for circuit breakers which are locked in the on position to prevent unauthorised operation, e.g., security circuits, clocks, fire alarms, etc., indicating the purpose of the circuit breaker together with the additional wording 'Do Not Switch Off'
Labels shall be arranged so that they can be readily replaced by fixing with two, minimum,

chromium plated or stainless steel screws, secured by spring washers or nuts or by drilling and tapping sheet metal. Self-tapping screws are not acceptable.
A line diagram (SLD) for major assemblies and mount diagram in a glazed frame and fix adjacent to assembly, location to approval.
Provide a label fixed to the front of the main switchboard indicating:
the switchboard manufacturer
designed service conditions
weight
safety instructions, where applicable
all information required by EN 60439

## 5.9 Equipment

### 5.9.1 Miniature Circuit Breaker (MCB's)

All circuit breakers outlined herein shall be of the same manufacture throughout the installation. They shall be selected where possible to fully discriminate and cascade and offer fault current limiting features in the range. Approved manufacturers are Schneider Miniature circuit breakers (MCB's) shall incorporate the following features:
arc interrupting device
inverse time current characteristic
lockable in both the on and off position and trip to operate when breaker is locked on
positive contact indication of the phase conductor
thermal and magnetic tripping mechanism
non welding contacts
comply with EN 60947.2 and IEC 60898.1
be interchangeable for single and multi-pole units where used on final subcircuits
unless specified in the Switchboard Schedules, be of a selected Type (C or D) to suit the load application (starting load and operating load) and meet fault loop impedance requirements
have an interrupting capacity adequate for the maximum prospective fault to which they are subjected and not less than 10 kA in accordance with EN 60947.2
where the fault level exceeds the rated breaking capacity of the device and protection is provided by enhanced discrimination and cascading from an upstream device, i.e. MCCB
provide a label at each assembly to indicate 'In the event of an MCB trip the device shall be replaced'
MCBs shall, in addition to ON and OFF positions have an intermediate tripped position or a tripped indicator flag and the mechanism shall be of the trip free type.

### 5.9.2 Residual Current Devices (RCB(O))'s

All circuit breakers outlined herein shall be of the same manufacture throughout the installation. They shall be selected where possible to fully discriminate and cascade and offer fault current limiting features in the range. Approved manufacturers are Schneider Residual Current Devices (RCB(O)'s) shall incorporate the following features:

be provided on nominated final sub circuits
be rated for 30 mA operation
be integrated with a miniature circuit breaker with over current and short circuit current protection
be arranged within the switchboard so that the test button is accessible without the need to remove covers
comply with IEC 61008 and IEC 61009
not trip on power failure
recognise and not trip where dc leakage currents are present.

### 5.9.3 Moulded case circuit breakers (MCCB's)

All circuit breakers outlined herein shall be of the same manufacture throughout the installation. They shall be selected where possible to fully discriminate and cascade and offer fault current limiting features in the range. Approved manufacturers are Schneider Moulded case circuit breakers (MCCB's) shall be plug in base type and shall incorporate the following features:
DIN-rail mounted breakers shall be fixed, circuit breakers ≤630A shall be plug-in and circuit breakers ≥800A shall be fully with-drawable (draw-out).
Switchgear assemblies shall have an internal separation equal to Form 4a according to IEC/EN 61439-1 for functional units >125A and minimum Form 2b for DIN-rail mounted functional units ≤125A.
All breakers >125A shall not be fitted with thermomagnetic release (TMD), but with digital protection relays e.g. Micrologic
incorporate similar features as listed for miniature circuit breakers
be provided with extension rotary handles at the face of the panels
comply with EN 60947.2.
be rated at a minimum breaking capacity greater than the design prospective fault level as indicated in the Switchboard Schedules or switchboard single line drawings
include electronic trip units, Micriologic 5 series
plug in MCCBs shall be interlocked such that it shall not be possible to remove a plug in MCCB from its plug in base without first switching the MCCB to the OFF position
On all 4 pole devices the neutral (N) pole shall be of an early make late break design, such that abnormal transient voltages cannot occur between phase and neutral lines during opening and closing operations.

### 5.9.4 Air circuit breakers (ACB's)

All circuit breakers outlined herein shall be of the same manufacture throughout the installation. They shall be selected where possible to fully discriminate and cascade and offer fault current limiting features in the range. Approved manufacturers are Schneider Air circuit breakers (ACB's) shall incorporate the following features:

Comply with the requirements of EN 60947.2
be rated at a minimum breaking capacity greater than the design prospective fault level as indicated in the Switchboard Schedules or switchboard single line drawings
include integral electronic trip units, Micrologic 5 Series and above), incorporating the following minimum features:
integral digital ammeters showing the per phase current including neutral on 4 pole devices
three phase bar graph display of % load per phase
earth fault
90% and 100% current local indicator and auxiliary contacts for remote alarm monitoring
be arranged for cubicle mounting, horizontal installation and withdrawal with self- aligning primary and secondary contacts
incorporate digital ammeters displaying all phase currents
have automatic shutters interlocked with the breaker carriage and ensure coverage of the primary conductors when withdrawn
have an operating mechanism designed to close manually and electrically via charged springs such that the contact speed is independent of the operator, and be free to open immediately the trip coil is energised
be provided with mechanically operated, visual indication of the switch position by means of a direct linkage from the main contact movement, indicator shall show green for off and red for on
have electrically or manually driven spring charging mechanisms fitted with manual charging override. Charging mechanisms shall have energy storage to permit one close and one open operation before recharging
be fitted with an operations counter to mechanically record the number of operations
have anti pump logic to prevent logic failure should an open and close signal be given simultaneously
have manual trip facilities fitted with means for locking in the trip position
have provision for remote electrical open and close
be capable of being fully isolated without opening the cubicle door
have a test position in which the main circuits of the circuit breaker body are isolated and the secondary circuits remain connected
be equipped with auxiliary arcing contacts to limit the main contact damage during operation
be designed such that contacts may be rapidly replaced
be provided with one circuit breaker withdrawing trolley, located in the switchroom
be suitable for electrical and mechanical interlocking
be provided with automatic busbar shutters
be provided with safety interlocks such that the ACB:
cannot be withdrawn until tripped to the off position
cannot be racked into the cubicle whilst in the on position or with charged springs
cannot be operated during racking

Position cannot be changed without the use of the correct racking lever and mechanism.
ACB's on 4 pole models the neutral (N) pole shall be of an early make late break design, such that abnormal transient voltages cannot occur between phase and neutral lines during opening and closing operations.
be provided with a means to prevent the following incorrect operation in service:
Slow closing or opening of the contacts
Hand closure, if springs fail
Release of charged springs whilst the contacts are closed.
be provided with a means of slow closing the circuit breaker for inspection, and adjustment when disconnected. Supply a set of tools, necessary for installation, servicing, and removal for each switchboard.

### 5.9.5 Automatic Transfer Switches

All automatic transfer switches shall operate on the following basis:
The transfer mechanism shall be electrically operated with all parts in positive contact at all times. Manual operation shall be available with provision for readily disengaging the gear motor/s when so operated.
The changeover switch shall be suitably fault and current rated.
Provide mechanical and electrical interlocking so that a paralleled position is not possible when under electrical operation. It shall not be possible for load circuits to be connected to normal and alternate sources simultaneously, regardless of whether the switch is electrically or manually operated or if any part should malfunction.
The changeover switch shall be so designed that either feed could be worked on while the other supplies the load without the need to expose live parts. Separate incoming supply terminal sets shall be provided for this purpose.
Transfer switches shall contain two devices.
Automatic circuit breakers shall be used where the Auto Transfer Switch (ATS) is also required to provide downstream protection.
The (LV) ATS shall be able to perform "break before make" transfer from Source A to Source B and vice versa.
Provide Source A and alternate Source B voltage supply sensing:
phase failure (3 phase unit or one per phase)
3 phase under voltage, adjustable 415 V -25% calibrated +0.5% repeatable and labelled with settings (set to –10%)
3 phase over voltage, adjustable 415 V +25% calibrated +0.5% repeatable and labelled with settings (set to +10%)
frequency tolerance, adjustable 50Hz ± 1% calibrated +0.5% repeatable and labelled with settings
Sense supply availability via HRC fuses and phase failure relays.
Install the following LED type lamps (with lamp testing facility)

Supply A Available (red/white/blue indicator locally)
Supply B Available (red/white/blue indicator locally)
Connected to Supply A (green indicator locally)
Connected to Supply B (green indicator locally)
The ATS shall provide output indication of the following to the Building BMS monitoring system, as a minimum:
Status of mains supply
Status of alternate supply
Position of circuit breakers (Open/Closed/Tripped)
Provide a stabilisation timer adjustable from 10 seconds to 20 minutes to delay the return to normal supply. Settings shall be co-ordinated with downstream and upstream transfer switches, UPS, etc., to ensure that downstream devices do not transfer to alternate supply prior to upstream unless specifically required to do so. Stabilisation timer shall be provided with an override to allow for operation of the ATS to be inhibited by an external load control system.
Note: ATS control must be in automatic control for normal supply to alternate supply transfer and automatic for alternate supply to normal supply return.
All ATS sequences shall be factory simulated using actual hardware and bench testing apparatus to simulate and verify correct logic operation.
Software simulation shall be undertaken during switchboard factory and site acceptance tests.
Provide two adjustable time delay functions each of 0-10 seconds duration in the off position when the load is disconnected upon transfer from either:
normal supply to alternate supply or
alternate supply to normal supply
The circuit breakers shall be rated as specified and have pole arrangements as shown on the drawings.
All accessories and equipment shall be front accessible for ease of maintenance or removal.
Components of the operating mechanism shall be either fully insulated or electrically dead.
The transfer mechanism shall be energised only during transfer.
Components of linkages and handles in operating mechanisms shall be ruggedly constructed and
All ATS's shall have the ability to provide the following Source transfer mode arrangement configurations:
Source Seeking Mode:
In the event of loss of Source A, the ATS automatically transfers to its alternative Source B supply. The ATS will stay on Source B supply (regardless of Source A supply status) until manual intervention by an operator. A manual push button shall be provided to initiate return to mains supply (only if available).
Preferred Source:
In the event of loss of Source A, The ATS automatically transfers to its alternative Source B supply. Upon return of the Source A supply the ATS shall automatically return to Source A from

Source B, following elapse of mains restoration timers. No manual intervention required.
A push-button type test switch shall be provided to simulate normal source failure.
A push-button type test switch shall be provided to simulate alternative source failure.

### 5.9.6 Surge Suppression (SPD)

The surge suppression system will be designed by the lighting protection specialist. The board manufacture will allow for the liaising with the lightning protection specialist to obtain the specific type f surge protection device required:
The surge protection system incorporates the following features:
capable of withstanding surges to ANSI C62.41 Categories A, B and C
rated to 70 kA
transverse and common mode protection
fitted with local indication visible on the front of the switchboard
fitted with voltage free contacts for transmission of remote alarm
independent certification of performance.
The system operating conditions shall be 415 V AC, 50 Hz, 3 phase, neutral and earth. Each system shall incorporate 70 kA transient voltage surge suppressers between each phase and earth, each phase and neutral and neutral and earth.
Each LV Switchboard shall come fitted with a Type 1 + Type 2 Combined Class I + Class II Surge Suppression Device in compliance with this specification, Dehn 951-405 DV MTNS 255 FM or approved equivalent. The status of this device shall be monitored and presented to the BMS via the switchboard integral I/O and network connection.
SPD shall be tested to the following performance parameters:
Maximum continuous operating voltage shall be 280VAC Line to Neutral. Voltage Protection Level (Up) shall not exceed 850V when tested to Class II at 5kA per IEC 61643-11
Provide suitable surge diverters, to all switchboards, on each phase of the switchboards, incorporating the following features:
SPD shall be annunciated via front mechanical or LED indicator, visible on the front of the switchboard
fitted with voltage free contacts for transmission of remote alarm. Alarm relay with contacts rated to at least 230VAC and 0.5A
Marking shall be consistent with IEC 61643-1.

## 6. Construction and Installation

### 6.1 Construction products

Any products covered IEEE technical standards, be accompanied by a Declaration of Performance (DoP).

### 6.2 Cabling

All cables shall fully comply with International standards or local East African Cables. All cables and wires shall be on strain-relief
All cabling systems and all cables shall always be mounted fully horizontally or fully vertically
For connecting vibrating objects the Contractor shall use flexible cables with flexible core wires. The transit from solid core to flexible core cables shall be made in a junction box or a local power switch box.
If a vibrating device has more cables connected, the use of spiral hose is required.
Connections between a solid core wire and a flexible core wire shall be done with screw wire terminals for cores from 1.5mm2 to 6mm2. Larger cables shall be connected with connection blocks for crimping wire terminals (so called "cable shoes").
All control wiring to be provided with wire numbering.
Terminals that shall be exposed to temperatures over 40°C shall be heat resistant, locally connected with rubber mantled cables.
All cable transits from one kind to the other shall have clear indication labels on both sides of the transit.
Cable transits going in or out a junction box shall be made with cable glands.
All cables with flexible core wires shall be connected by use of crimping wire terminals (so called "cable shoes").
It is allowed to connect cables with connecting terminals in junction boxes.
All power cables, data cables and control cables shall consist of Low Smoke, Zero Halogen cables.
Functional integrity related cables shall have their own dedicated cable routings.
All other cables can be combined in cable trays, using dividers for separating the systems in different compartments.

### 6.3 IP-Class

Items with a required IP-class shall be equipped with cable glands for cable entries, to maintain the required IP-class.

All mounting materials and other small materials used for a component must be designed not to lower the IP-class of that component.

### 6.4 Soundproof Transits

All acoustic properties of walls/ceilings/floors shall be used as a standard for the requirements of transits. No transit shall lower the acoustic properties of that specific equipment.

All soundproof transits are part of this scope of work.

### 6.5 Waterproof Transits

All locations where cables/ducts enter or leave the building shall be made in waterproof transits. All watertight transits shall be closed by a Specialist Contractor.

The container throughputs have to equipped with proper glands by the use of Roxtec, Hilt or equal.

## 7. Operating Instruction to Owner

The Contractor shall instruct the Owners staff how to make or carry out necessary maintenance and how to operate each system.
For the delivered equipment, the Contractor shall provide the Owner with three copies of complete operating and maintenance instructions for equipment at the time of delivery of the equipment. Equipment will be rejected unless accompanied by instructions.
Instructions shall be bound in a suitable loose-leaf booklet or binder, and shall include;
prints of the following drawings
schedules of equipment installed
general layout
wiring diagram of control panels
non-dimensional layout, showing location of all electrical devices
Operation instructions, including start-up and shutdown procedure
Maintenance instructions, including preventive maintenance instructions for components of the equipment
Lubricating instruction and recommended cycle of lubrication
Complete parts list, showing manufacturer's name and catalogue number
Complete list of recommended spare parts for 2 years of operation with price list for each item of equipment.
The Contractor shall prepare a draft operating and maintenance manual for discussion with the Consultant prior to finalizing the documents.
Time reservation for operating instructions shall be:
5 days of 8 hours for Contractor

## 8. Warranties

The Contractor shall include in his offer spare parts and special tools for maintenance sufficient to cover proper maintenance of the entire works for a period of one year starting from the acceptance date. The manufacturer shall guarantee the availability of spare parts for a minimum period of 10 years.

The Contractor shall provide a detailed description of the required maintenance work during the first 10 years of operation. Contractor shall include in his quotation a detailed proposal for a maintenance contract, which includes for all required maintenance work as described.

The proposal shall include, but not be limited to;

Detailed description of the maintenance works required
Description of the local service organization.

All systems shall be warranted during twelve months after the commissioning by the Contractor with a maximum of eighteen months after delivery ex-works whichever is the sooner.

## 9. Execution

### 9.1 Erection

The Contractor is responsible for delivery on site in coordination with the Fit-out contractor
Any parts of the LV Switchgear damaged during transportation to site shall be corrected at no extra cost to the satisfaction of the Engineer.

### 9.2 Factory Testing

All major main switchboards shall be tested in accordance with the applicable parts of EN 61439 for low voltage switchgear. All instrumentation and controls functions shall be tested to prove their correct operation. The set points for adjustable devices, such as sensing relays, shall be recorded on test results and additionally marked within the switchboard, with adjustment points sealed to prevent movement and unauthorised tampering.
Calibrated instruments shall be used for all tests.
Results of all tests including dielectric strength, and the instruments used to conduct tests, shall be recorded and a copy provided within the operation and maintenance manual. Where initial tests are unsuccessful, the results of these tests together with the corrective measures taken shall also be provided. All test results shall be signed and dated.
Upon completion of construction of the main switchboard and Authority inspections, where required, and prior to the switchboard being shipped to site, arrange for pre-delivery inspections of the switchboard at the factory.
Proposed commissioning test schedules and protocols shall be submitted for approval in conjunction with shop drawings. Protocols shall be fully detailed and include, but not be limited to, schedules in tabulated format covering:
proposed calibrated and where permissible non calibrated, instruments to be used and the tests for which each shall be used
functioning of all switchgear to confirm correct and uninhibited operations over all phases
injection tests for all meters with 0%, 50% and 100% of full scale readings
confirmation of all derived metered values, such as hours run, kWh, Power Factor, kVA, etc
set points for all adjustable devices such as sensing relays, timers and the like
function of all control circuits with all inputs and outputs for simulation listed, detailing the specified response and with space for recording the actual response
functioning of all monitoring points provided either for immediate or future connection to internal or external systems
other functional requirements where specified
space on each page for signature and date of witness tests
Factory testing of controls shall be accomplished using a purpose made and labelled test panel with all required inputs simulated by the operation of switches, and all required outputs indicated by lamps, or an equal arrangement as approved.

Factory testing shall include the demonstration of monitoring systems specified as part of this contract, in conjunction with metering, controls and function testing detailed above. Once testing has been completed, factory test results shall be verified and submitted for approval. Following that approval, a witness test shall be arranged with the Engineer. One week's notice should be allowed for the arrangement of witness testing.

**9.3 Site Testing**

Upon completion of the installation, complete testing of all switchboard controls with all internal and external interfaces and controls connected and operational to confirm their functionality. Retest any functions requiring rewiring adjustment or modification.
Co-ordinate with other trades and arrange for all trades to be present to verify the operations of all external controls and monitoring.
Submit signed test results in an approved format confirming the completion of these test, prior to arranging witness testing by the Engineer.

**9.4 Thermographic Survey**

Arrange for a thermographic survey of all busbar, equipment and cable joints and connections within the major purpose switchboards by an approved independent thermographic survey company prior to practical completion and also prior to the expiry of the defects liability period.

The dates of the survey shall be agreed and shall be conducted when electrical supply and loads are connected, i.e., during normal operation periods of the building with all available and building load connected and whilst under maximum load.

Record the results of each survey and submit a detailed report including ambient temperature, loads, photographs and thermograms for each item being surveyed. Rectify all joints and connections indicated as requiring attention and undertake new thermograms to prove the effectiveness of the remedial work prior to submitting final results.

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# TRANSFORMER & POWER CONDITIONING EQUIPMENT

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## 1. Environmental Conditions

Below requirements are applicable for all units within scope.

Where no specific environment details are mentioned, the following limits apply for the scope of work:

Internal, minimum temperature 5°C
Internal, maximum temperature 35°C
External, minimum temperature 0°C
External, maximum temperature 40°C
Internal, relative humidity 5% - 95%
External, relative humidity 5% - 95%
Noise limit ≤56 dB(A)@1m
Altitude >1000m (Nairobi is at 1750m)

## 2. 1.0 MVA, 11.0/0.415kV, Dry Type Transformer Specifications

The transformer must be rated for continuous operation at the specified ratings, on any tapping position, under service conditions as defined within this specification, without exceeding the specified temperature rise limits. The transformer must be capable to delivering full rated power, without any derating or limitation, in its enclosure (where provided) or in the specified installation conditions.

| **Parameter** | | **Unit** | **Requirement** |
|---|---|---|---|
| 1 | Type of Transformer | | Dry Type |
| 2 | Rated power (ANAN) | kVA | 1000 |
| 3 | Type of cooling | - | ANAN<br>100% continuous |
| 4 | Number of phases | - | 3 |
| 5 | Rated nominal voltage (MEDIUM side) | kV | 11.0 |
| 6 | Primary supply voltage variation | % | □6 |
| 7 | Rated nominal voltage (LV side) | kV | 0.415 |
| 8 | Secondary supply voltage variation | % | □□ |

| Parameter | | Unit | Requirement |
|---|---|---|---|
| 9 | System frequency | Hz | 50 |
| 10 | Winding Connections | | |
| | i. Primary | | Delta |
| | ii. Secondary | | Star |
| | iii. Vector Group | | Dyn11 |
| 11 | Impedance voltage (at120°C and nominal position) | % | 8 |
| 12 | High Voltage Winding (AL) | | |
| | Rated short duration AC withstand voltage | kVrms | 28 or higher |
| | Lighting impulse withstand voltage | kVpeak | 95 or higher |
| 13 | Low Voltage Winding (AL) | | |
| | Rated short duration AC withstand voltage | kVrms | 3 |
| 14 | Neutral conductor rating | Amps | Full load phase to neutral current |
| 15 | Maximum supply source fault contribution (at MEDIUM winding terminals) | MVA | 350 |
| 16 | No load losses (AN) stated in IEC 60067-11:2004 | kW | <3.8 |
| 17 | Load losses (AN) at 120°C and nominal position* stated in IEC 60067-11:2004 | kW | <22 |
| 18 | Impedance tolerance | | |

| Parameter | | Unit | Requirement |
|---|---|---|---|
| | Project Engineer tapping | ± % | ± 10% of declared value |
| | other tapping | ± % | ± 15% of declared value |
| 19 | Ability to withstand short circuit | | For specified system fault currents in accordance with the requirements specified in IEC 60076-5 |
| 20 | Maximum insulation system temperature | °C | 155 (F) |
| 21 | Average winding temperature rise at rated current | K | 100 |
| 22 | Installation location | - | Indoor |
| 23 | Transformer type by enclosure | - | dry type complete with<br>IP31 metal enclosure (except the bottom: IP21):<br>2 lifting lugs for transformer and enclosure assembly.<br>1 Earthing point on enclosure. Access to MEDIUM tapping by removing a bolted panel.<br>Enclosure final colour RAL9002 |
| 24 | Enclosure provided by | - | - |
| 35 | Enclosure degree of protection | - | IP 31 |
| 26 | Enclosure paint colour | - | - |
| 27 | MEDIUM connection to system | - | Insulated cable |
| 28 | Details of MEDIUM connection | - | 3C,95mm2, XLPE |
| 29 | LV connection to system | - | Busbar flange shall be provided by the transformer Contractor. The |

| Parameter | | Unit | Requirement |
|---|---|---|---|
| | | | connection shall be coordinated with busbar Contractor |
| 30 | Transformer climate class | - | C2 |
| 31 | Transformer environmental class | - | E2 |
| 32 | Transformer fire behaviour class | - | F1 |
| 33 | Tap Changing Facilities | | Yes |
| | Type of tap changer | | Off load |
| | Tap changer operation | | Manual crank |
| | Tapping winding | | MEDIUM |
| | Number of tap positions | | 5 |
| | Nominal tap | | 3 |
| | Tapping voltage range | % | + 5, - 5 of nominal voltage |
| | Tapping step | % | ± 2.5 of nominal voltage |
| 34 | Method of earthing | | |
| | LV winding | - | Solidly earthed neutral |
| 35 | Sound level | dB (A) | ≤56 " @1 meter |
| 36 | Temperature monitoring facilities required | - | Yes |
| 37 | Arrangement for bolting to floor | - | Required |
| 38 | Lifting lugs | - | Required |
| 39 | Base support structure | - | Swivel wheels (90° in horizontal plane) Ak,Ao |

| Parameter | | Unit | Requirement |
|---|---|---|---|
| 40 | Efficiency Class | - | |

## 2.1 Transformer Design

### 2.1.1 General Design Requirements

Materials and components must be selected to ensure safe and reliable operation for the specified transformer life of 25 years, with minimum inspection and maintenance.
Power transformers must be designed to:
Withstand the forces and stresses associated with lifting, jacking, transport and erection so that there are no cracks in the welds, leakage from or permanent deformation to any part of the transformer due to such forces and stresses
Have adequate overfluxing (V/f) capabilities to withstand both continuous and temporary over- voltages
Work in parallel with one other transformer, so that the transformers will not cause resonance at fundamental power frequency and harmonics
Have sound power levels for the transformer, with coolers attached, on all ratings below the levels as specified in the applicable IEC Standard; and
Demonstrate the incorporation of modern design, insulation processing, and control/monitoring technology.

### 2.1.2 Core and Coils Assembly Requirements

The transformers(s) shall be three-phase encapsulated winding dry-type transformers, with natural air- cooling (AN) and for indoor installation. They shall be of the double wound core type with fully insulated windings.
A recognised Domain refinement process shall be used to reduce the cross fluxing losses in the transformer core.
Core excitation shall be kept below 1.7T.
Construction of the core shall prevent excessive temperatures occurring at the centre of core limbs.
The framework, clamping arrangement and general structure of the core of each transformer shall be of a robust construction and shall be able to withstand the degree of shocks which may occur during transport, installation movement and service under normal conditions.
The assembled core shall result in a rigid structure, with the clamping pressure of the press evenly distributed, and adjusted to minimize the noise and vibration coming from the transformer when placed into operation.
The magnetic circuit shall be build using high quality, low-loss, non-aging, cold rolled, grain-

oriented silicone steel laminations, having excellent magnetic properties and especially designed for core use. The core laminations shall be insulted from each other with a material having high-inter- lamination insulation resistance and also capable of withstanding pressure, mechanical vibration, thermal changes and temperatures which may occur under the most severe operating conditions.
The joints between limbs and yoke, in the laminated magnetic circuit shall be interleaved and mitred to adapt the flux pattern to the preferred magnetic direction.
The core clamping frame shall be equipped with lifting lugs strong enough to enable the finished transformer to be safety lifted, complete with all accessories etc. in place.
The flux density in the magnetic circuit, based on the minimum cross-section of the steel in the core, shall not exceed 1.65 Tesla at rated frequency and rated no-load voltage.

### 2.1.3 Windings

MV/LV windings shall comprise either copper or aluminium. Winding shall be foil type windings sheet windings or insulated round or square section windings/insulated square section windings, to minimize oscillations due to lightning and impulse voltages. The enamel coating used, which also forms the turn-to turn insulation, shall be suitable to be used for an insulation system with thermal class H (max. temperature 180 degree C).
The transformer shall be insulated using a mixture of epoxy resins and quartz powders to make the transformer moisture proof, suitable for tropical applications, flame resistant and self-extinguishing. Transformer winding shall have Fire Behaviour Class F1. Furthermore, this will ensure a high level of short circuit withstand and avoid the possibility of any cracks caused by mechanical stresses due to temperature variations, or sudden load peaks.
All windings must be wound in the same sense of direction and be adequately braced against the forces arising under system fault conditions. The winding assembly must be pre-shrunk during construction so that shrinkage during the life of the transformer shall be negligible.
Where continuously transposed cable (CTC) is used, its individual strands must not make inadvertent contact. This condition must be verified before completing the winding ends and with the windings under pressure.
Soft soldering must not be used for joining or connecting leads. Joints may be silver soldered, brazed or welded. Bolted joints carrying current must use "Belleville" or similar washers to maintain contact pressure.
The connection arrangements must be clearly shown on the transformer rating plate, connection diagram plate and additional plates detailing procedure for access to transformer link box.

### 2.1.4 Mechanical Construction

The core, windings, framework, clamping arrangements and general structure of the transformers when assembled shall form a rigid construction entirely unaffected by short circuit

conditions, transport or ordinary handling during installation, inspection and repair. Transformer to be supplied with IP31 metal enclosure (except the bottom: IP21):

2 lifting lugs for transformer and enclosure assembly.
1 Earthing point on enclosure.
Access to MEDIUM tapping by removing a bolted panel.
Enclosure final colour RAL9002

### 2.1.5 Cable Boxes

Provide cable boxes for the termination of MV and LV connecting cables. They shall be air insulated and of adequate size for dressing and shaping cables cores as noted on the drawings. Confirm final cable sizes and entry details at time of ordering and installation.

Provide a 3 pole cable box suitable for a heat shrink terminal sleeving kit to receive up to two off 500mm² XLPE cables per phase for MV terminations. MV cables shall be bottom entry.

Provide a 4-pole cable box suitable to receive up to two 6300A busway for LV terminations busway shall be top entry.

Ensure adequate frames are provided to allow support of the MV cable and LV busway at the respective termination locations.

Cable terminations shall be adequate for both copper and aluminium cables.

The terminal bushings and spacings between phases and earth with lugs fitted shall be in accordance with the appropriate IEC Standard. Any special fittings or materials necessary to achieve satisfactory clearances shall be supplied and fitted by the transformer manufacturer.

The neutral terminal of windings rated from 1000 volts shall be enclosed in a cable box separately from the phase terminals.

The minimum distance between the gland plates of air insulated cable boxes and the centre line of the terminal bushings shall be 550 mm.

Provide:

Compressor glands for all cables other than lead sheathed
Armour clamps for all armoured cables
Non-ferrous gland plates for single core cables
An engraved plate fixed to the outside of each cable box to permanently display the physical arrangement of the terminals together with their markings.
Provide adequate space to mount an Earth Fault CT within the transformer enclosure.

### 2.1.6 Rating and Labelling

Rating plates shall be of stainless steel and conform to IEC60076. The details shall be black embossed letters on a silver background and shall remain clearly legible for a minimum of 25 years when exposed to the weather.

Provide labels to indicate danger at both MV and LV sides of transformer enclosure at the access doors.

All other labelling shall be clearly labelled with non tarnishable cast or engraved label of approved size, wording and design, clearly indicating the function and/or circuit designation of the component concerned and securely fixed.

Where laminated plastic labels are adopted, the face shall be white with black machine engraved lettering. In certain instances for safety purposes, danger and fire services labels shall have a red face with white lettering. Edges shall be bevelled.

Generally, equipment identification shall adopt 5mm high letters. All lettering and numbers shall be in metric SI units.

### 2.1.7 Overload Protection

Provide a thermometer connected to Resistance Temperature Detectors (RTD) sensors in each phase winding to measure the winding temperature. Measure in degrees Celsius with a range 0 to 120oC with instantaneous and maximum temperature indication.

Thermometer shall provide a remote alarm signal when winding temperature reaches a user set temperature (below the maximum winding temperature).

Thermometer shall provide a remote alarm signal to protection relays located at upstream MV switchboard when maximum winding temperature is reached.

Remote alarm signals shall be provided via volt free contacts in terminal strips in the control panel. Also provide a separate remote alarm signal via High Level Interface to the BMS.

### 2.1.8 Noise Level and Interference

Transformers shall operate over the full range of voltage and loading without exceeding the standard sound levels specified in IEC60076.

Transformers shall not produce any emission likely to cause interference with communication equipment. When operated at voltages up to 10% above normal system rating transformers shall be substantially free from partial discharge in either internal or external insulation likely to cause interference with communications systems.

### 2.1.9 Control Panel

A control panel shall be provided for the power transformer. Control panel shall be segregated from the remainder of the transformer by a sheet steel housing. Provide within control panel housing the following:

Fuses/MCCBs for protection of control and alarm circuits
Display of winding temperature (viewable without opening housing)

Audible alarm horn and mute button
Transformer door interlock signals from MV and LV Switchboards
Terminal strip for remote alarm signals to MV protection system
Terminal strip for High Level Interface to BMS
Control panel and equipment shall be suitable for power supply at 230V AC.

## 2.2 Construction and Installation

### 2.2.1 Construction products

Any products covered by harmonised European Standards (hENs) or European Technical Assessments (ETAs) shall comply with those standards, be accompanied by a Declaration of Performance (DoP) and be CE marked.

### 2.2.2 Cabling & Busbar Connection

All cables shall fully comply with International standards or East African Cables. All cables and wires shall be on strain-relief
All cabling systems and all cables shall always be mounted fully horizontally or fully vertically
For connecting vibrating objects the Contractor shall use flexible cables with flexible core wires. The transit from solid core to flexible core cables shall be made in a junction box or a local power switch box.
If a vibrating device has more cables connected, the use of spiral hose is required.
Connections between a solid core wire and a flexible core wire shall be done with screw wire terminals for cores from 1.5mm2 to 6mm2. Larger cables shall be connected with connection blocks for crimping wire terminals (so called "cable shoes").
All control wiring to be provided with wire numbering.
Terminals that shall be exposed to temperatures over 40°C shall be heat resistant, locally connected with rubber mantled cables.
All cable transits from one kind to the other shall have clear indication labels on both sides of the transit.
Cable transits going in or out a junction box shall be made with cable glands.
All cables with flexible core wires shall be connected by use of crimping wire terminals (so called
"cable shoes").
It is allowed to connect cables with connecting terminals in junction boxes.
All power cables, data cables and control cables shall consist of Low Smoke, Zero Halogen cables.
Functional integrity related cables shall have their own dedicated cable routings.
All other cables can be combined in cable trays, using dividers for separating the systems in different compartments.
All 800KVA Transformers, LV terminals shall be connected to their downstream MBP panel via

XLPE/PVC/PVC LSZH cable connections. All 800KVA Transformers shall be fitted with cable termination box bottom entry and top exit to facilitate the connection of the primary and secondary cables.
Protection degree at least IP41.

### 2.2.3 IP-Class

Items with a required IP-class shall be equipped with Aluminum plate and cable glands for cable entries, to maintain the required IP-class.

All mounting materials and other small materials used for a component must be designed not to lower the IP-class of that component.

### 2.2.4 Soundproof Transits

All acoustic properties of walls/ceilings/floors shall be used as a standard for the requirements of transits. No transit shall lower the acoustic properties of that specific equipment.

All soundproof transits are part of this scope of work.

### 2.2.5 Waterproof Transits

All locations where cables/ducts enter or leave the building shall be made in waterproof transits. All watertight transits shall be closed by a Specialist Contractor.

The container throughputs have to equipped with proper glands by the use of Roxtec, Hilt or equal.

## 3. Power Conditioning Equipment

This will be an active voltage conditioner protection of the network from the utility voltage sags and surge correction. This will be inverter-based system that will protect sensitive Data Center loads from voltage disturbances. The equipment shall provide fast, accurate overvoltage and undervoltage correction as well as continuous voltage regulation and load voltage compensation. In the event of overload, the equipment shall have internal by-pass that in the event of an overload or internal fault condition, will ensure the load is continually supplied from the utility.

### 3.1 Functional description

GeneraL

The AVC shall be designed for indoor installation with ambient temperatures from 32°F - 104°F (0 - 40°C) and enclosure rating shall be NEMA1 (NEMA2 with optional Roof Kit).
The AVC shall be designed for operation at an altitude of up to (2000 m) without derating. Please check section 1.6 for more information on this

### 3.1.1 Input characteristics

| | |
|---|---|
| Nominal rating | 1000 KVA |
| Application voltage | 220, 415 V, 50Hz |
| Maximum continuous supply | 110% |
| Frequency tolerance | ±5% |
| Power system | 3-wire plus ground input (grounded wye source 4- wire system |
| Outage control ride through | 600ms |

### 3.1.2 Output characteristics

| | |
|---|---|
| Voltage: | To match nominal input voltage (220, 415 V) |
| Equivalent series impedance Equivalent series impedance: | <4%<br>< 4% (model specific) |
| Displacement Power Factor Displacement power factor: | 0lagging to 0.9 leading 0 lagging to 0.9 leading |
| Crest factor Crest factor: | 3.0<br>3.0 |

## 4. Operating Instruction to Owner

The Contractor shall instruct the Owners staff how to make carry out necessary maintenance and how to operate each system.

For the delivered equipment, the Contractor shall provide the Owner with a comprehensive systems manual to the Employer. This electronic manual will provide the Employer with a searchable reference of all as- built drawings, specifications, O&M manuals, final commissioning reports, and other important documentation.

The Contractor shall provide the Main Contractor all PDF/electronic files to populate an electronic Systems Manual. This Systems Manual shall include O&M's, final as-built drawings and specifications no later than three months following the Certificate of Substantial

Completion, or as approved by the IX PM on exception basis only. The CxA shall review the System Manual and verify that it complies to the project requirements.

The electronic information shall include but not limited to:

Complete operating and maintenance instructions for equipment at the time of delivery of the equipment.
prints of the following drawings
schedules of equipment installed
general layout
wiring diagram of control panels
non-dimensional layout, showing location of all electrical devices
Operation instructions, including start-up and shutdown procedure
Maintenance instructions, including preventive maintenance instructions for components of the equipment
Lubricating instruction and recommended cycle of lubrication
Complete parts list, showing manufacturer's name and catalogue number
Complete list of recommended spare parts for 2 years of operation with price list for each item of equipment.
The Contractor shall prepare a draft operating and maintenance manual for discussion with the Consultant prior to finalizing the documents.
Time reservation for operating instructions shall be: 5 days of 8 hours for Contractor
Transformers

## 5. Warranties

The Contractor shall include in his offer spare parts and special tools for maintenance sufficient to cover proper maintenance of the entire works for a period of one year starting from the acceptance date. The manufacturer shall guarantee the availability of spare parts for a minimum period of 10 years.

The Contractor shall provide a detailed description of the required maintenance work during the first 10 years of operation. Contractor shall include in his quotation a detailed proposal for a maintenance contract, which includes for all required maintenance work as described.

The proposal shall include, but not be limited to;

Detailed description of the maintenance works required
Description of the local service organization.
All systems shall be warranted during twelve months after the commissioning by the Contractor with a maximum of eighteen months after delivery ex-works whichever is the sooner.

## 6. Execution

### 6.1 Erection

The Contractor is responsible for delivery on site in coordination with the Fit-out contractor
Any parts of the Transformers damaged during transportation to site shall be corrected at no extra cost to the satisfaction of the Engineer.

### 6.2 Inspection and Testing

To prove compliance with the specification and the guaranteed performance, routine tests must be carried out on the transformers as listed in applicable IEC Standards, except for the additions and amendments listed below.

All components of the transformers must be duly tested in accordance with relevant applicable IEC standards.

All auxiliary items must be fitted and functional for the tests. All external components and fittings that are likely to affect performance of the transformer during the test or during operation will be in place while the test is conducted. The Engineer reserves the right to defer the commencement of any specified tests if this requirement is not met.

The Contractor must prepare a detailed test program not less than two months prior to the start of test, listing all routine tests in the chronological order to be carried out.

All tests will be made at an approved laboratory, agreed with the Engineer during tender. All test reports must be forwarded to the Engineer for approval and acceptance. The tests will be considered as completed only after an approval and acceptance of test results by the Engineer in writing. A list of the tests to be conducted on the power transformers is given below.

Factory test results must be approved and accepted by the Engineer prior to dispatch of equipment from manufacturer's works.

### 6.3 Type Tests

Type tests are intended to prove the soundness of design of the equipment and their suitability for operation under the conditions detailed in the specifications. Type tests must be carried out before the delivery of the equipment. A certified test report, detailing the results of such tests along with the procedures followed, must be provided to the Engineer. These tests must have been applied to equipment of identical design with that offered, or on an equipment of a similar design, which does not differ from that offered in a way that might influence the properties to be checked by the type test
Where such tests have already been performed, copies of type test reports that qualify for the exemption from conducting these tests must be provided with the tender
As a minimum the following type tests will have been conducted on a transformer with similar design:
Temperature-rise test

Lightning impulse test
Dielectric type test
As a minimum the following type tests will have been conducted on a tap changer with similar design:
Short circuit current test
Mechanical endurance
Dielectric tests
Mechanical load test

**6.4 Routine Tests**

As a minimum the following routine tests will be conducted on the transformer;
Measurement of winding resistance
Measurement of voltage-ratio and check of phase displacement
Measurement of short-circuit impedance and load loss
Measurement of no-load loss and current
Separate source AC withstand voltage test
Induced AC withstand voltage test
Measurement of insulation resistances: windings to earth, between windings, core to earth, core to frame and frame to earth, at 1 minute and 10 minutes after application of the dc voltage
2.5 kV applied voltage test to the core, the frame and the tank, in each case with the other components earthed
Measurement of no-load losses, no-load currents, harmonic content and oscillograph of no-load voltage waveform at 100%, 105%, and 110% rated voltage
Measurement of impedance voltages and load losses at >75% load currents on all tappings, except that guaranteed tap positions must be tested at >95% load current (winding temperature, determined by DC resistance, to be measured at the start and end of this test series AND after each guaranteed tap position is tested)
Measurements of zero phase sequence impedances at maximum and minimum tap
– The zero sequence impedances must be tested in five configurations with a series of test currents of 5%, 10%, 25%, 50%, 75%, and 100% of the rated current
Measurement of insulation resistance of auxiliary wiring
Functional and performance tests on all accessories

**6.5 Special Tests**

Following special tests will be conducted on the transformers unless specifically agreed for exclusion by the Engineer.
Determination of capacitance windings-to-earth and between windings.
Determination of transient voltage transfer characteristics
Measurement of zero sequence impedance on three phase transformers

Short-circuit withstand tests.
Partial discharge test
Determination of sound levels
Measurement of harmonics of the no-load current.
Partial discharge tests.
Tests to prove compliance with stated climate, environment and fire behaviour classes.
Where required, these tests are normally requested on one transformer of a batch of similar transformers.

**6.6 Site Tests**

Pre-commissioning tests:
After the assembly of the transformer at site the following tests must be performed to verify the unit has not been damaged during transport and that it has been erected correctly:
Voltage ratio on all tappings.
Vector group phase displacement.
Measurement of winding resistance on all tappings.
Measurement of magnetising currents on all tappings.
Measurement of power factor and capacitance between all windings and between all windings to earth.
Insulation resistance measurement (the type of instrument and measurement voltage must be recorded)
all windings to earth;
between windings;
between core to frame;
between core to earth;
between frame to earth;
current transformer windings to earth;
between current transformer windings;
control cabling; and
auxiliary power cabling.
Check of protective earthing connections.
Bushing turrets.
Tap changer and motor drive.
Cubicles.
Control cabling.
Auxiliary power cabling.
Calibration and functional checks of all monitoring and protection equipment, instruments and gauges.
Operation test of supervisory equipment.
Commissioning tests:
The following tests and inspection must be made before commissioning a transformer:

Visual inspection
Verify and adjust if required
cubicles and their cleanliness
touch up painting
protective earthing
neutral earthing
line and bus connections; and air clearances.
Energisation tests:
The following tests and inspection must be made before energising a transformer
The transformer must be left unloaded for at least 24 hours after energisation
The transformer must be carefully inspected, especially the temperature indicators and monitoring equipment
Any sign of abnormality must be reported to and witnessed by the Engineer.

# UPS SYSTEM

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## 1. Standard specifications

### 1.1 Quality assurance

Contractor is required to have Manufacturer Qualification as per:

ISO 9001;

ISO 14001.

### 1.2 System to be tested per level

| System | L1 Factory Testing (per System) | L3 Start-up Witness Testing | L4 Functional Performance Testing | L5 Integrated Systems Testing |
|---|---|---|---|---|
| All UPS System | YES | YES | YES | YES |

### 1.3 Standards and regulations

The following codes and standards are applicable:

Electrical Installations and Regulations

The contractor shall comply with the rules and regulations of the IEC, EN and Kenya Government Regulations.

IEC 60529 : Protection index envelopes (IP)

EN IEC 61439-1 : Low-voltage switchgear and control gear assemblies

EN IEC 61439-2 : Low-voltage switchgear and control gear assemblies.

IEC 60950-1 : Information technology equipment – Safety – Part 1:General requirements.

IEC 60529 : Degrees of protection provided by enclosures (IP Code)

IEC 61951-2 : Secondary cells and ba0tteries containing alkaline or other non-acid electrolytes - Portable sealed rechargeable single cells - Part 2: Nickel-metal hydride.

IEC 62040-1 : Uninterruptible power systems (UPS) - Part 1: General and safety requirements for UPS.

IEC 62040-2 : Uninterruptible power systems (UPS) - Part 2: Electromagnetic compatibility (EMC) requirements.

IEC 62040-3: : Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements.

VFI-SS-111 classification according to IEC 62040-3

Where no appropriate standard are available, tests shall be carried out in accordance with the manufacturer's standard practice, which shall be subject to approval by the Client and the Consultant.

**1.4 Environmental Conditions**

Below requirements are applicable for all units within scope.

Where no specific environment details are mentioned, the following limits apply for the scope of work:

Internal, minimum temperature 5°C

Internal, maximum temperature 40°C

External, minimum temperature 0°C

External, maximum temperature 40°C

Internal, relative humidity 5% - 95%

External, relative humidity 5% - 95%

Noise limit ≤56 dB(A)@1m

**1.5 General Description**

All UPS system shall be designed to supply high quality AC electric power to single and three phase equipment.
The UPS system shall comprise and include the following as a minimum:
IGBT static rectifier/charger
Static inverter
Independent on board oscillators
Output filtering
Instrumentation monitoring and control functions
Valve regulated lead-acid (VRLA) with pure lead positive plate batteries
Battery modules circuit breakers (complete with earth leakage protection).
Battery modules enclosures.
Standard battery housing (HB) solution, VO (flame retardant) will only be offered when this the Contractors standard option
Battery management system / Data logger
CAN Communication System
Redundant fans for the UPS
Static switch (synchronous bypass facility).
Internal Maintenance bypass facility.
System Control for:
Control
Instrumentation
Alarms

### 1.6 Electrical Performance

AC Uninterruptible Power Supply (UPS) units, and energy storage system, shall comply with the technical and performance criteria specified herein and as nominated in the Schedules. The UPS system shall provide continuous alternating current power supply to the connected load in the event of supply power failure.

#### 1.6.1 Modularity

The UPS shall be of modular design and construction, consisting of independent 50 kW power converter sections.

Each UPS shall also allow for easy maintenance and system growth of modules without disrupting the entire UPS system.

Each power module shall allow easy front accessibility for maintenance or system growth. Each module shall exhibit independent fault tolerance to other modules and shall allow for continuous system operation.

The UPS internal design shall allow for the selection of any one of the 50/60kW power module sections for, as part of an optional internal N+1 redundancy level.

In an inverter module fault scenario, each module shall be electrically and mechanically protected from the faulted unit and that the faulted unit shall not influence other modules or system operations. Each 50/60 kW power converter section shall incorporate the ability to rapidly isolate the failed section from the input, output, and DC buses, whilst maintaining uninterrupted supply to the critical load.

Two main redundant power supplies shall also be provided for main logic circuits and interface signals of the UPS. These power supplies shall have multiple channels, each with their own overcurrent protection to provide fault containment. Each channel shall have tripped indicators to allow for rapid diagnostics and repair by on-site service personnel. UPS control power shall be monitored by the UPS's internal and optional external monitoring system.

Each 50/60kW UPS power module shall contain redundant cooling fans to take in ambient air through filtered inlets on the front of the UPS. The loss of a fan in any or all of the 50/60kW UPS power modules shall not cause a derating of the ambient operating temperature of the UPS. Each 50/60 kW section shall contain two cooling fans and shall operate normally with the failure of any one section fans. Fans shall be monitored by the UPS's internal and optional external monitoring system for operation and speed.

#### 1.6.2 Scalability

The UPS must be scalable up to the maximum 600kW capacity.

Tenderer shall provide documentation and technical mythology for staging the upgrade of additional modules whilst maintaining the entire UPS system online as part of the tender submission.

### 1.6.3 Input and Output Harmonic Content

The input THDi and THDv shall be equal to or less than 5% while simultaneously providing conditioned power to the UPS output bus, and charging the batteries under steady-state operating conditions on mains power or the standby generation system. The 5% maximum THDi and THDv shall be held while supporting loads of both a linear or non-linear type, from 10% to 100% of the UPS capacity. The 5% maximum THDi and THDv shall be accomplished with no additional filters, magnetic devices, or other components.

The UPS Contractor shall provide equipment to measure and verify compliance during factory and site testing that the harmonic content of the input and output current and voltage waveform complies with this specification.

When the UPS is being supplied by the mains or generator, voltage notching occurring during rectifier commutation shall:

not exceed the harmonic distortion limits specified

have a maximum depth not exceeding 20% of the fundamental

have peak amplitudes at the end of the voltage notch not exceeding 20% of the fundamental.

### 1.6.4 Electromagnetic Interference

All UPS equipment shall be effectively screened against the emission of electromagnetic interference as defined in IEC 62040-2.

### 1.6.5 Swing Load

The UPS shall be capable of accepting a step load of 0% to 100% or vice versa, or any combination in- between within one cycle whilst simultaneously providing conditioned power to the UPS output bus within defined limits.

### 1.6.6 Voltage Adjustment

As a minimum, the equipment shall be suitable for operation at both 400/230 and 415/240 volts. All necessary facilities shall be provided to adjust the voltage to match the onsite levels at the input and output.Adjustable Frequency Range

The UPS system shall feature an adjustable capture and tracking frequency range (± 0.5 Hz minimum) to 8% of nominal, for synchronising with the power system supply, especially the alternative source, the standby power generation supply.

### 1.6.7 Input Power Factor

The input power factor shall be near unity (>0.99) while supporting loads of both a linear or non-linear type at 100% loading.

At all loading >25% of the UPS capacity, the input power factor shall not be less than 0.97, with no additional filters.

### 1.6.8 Output Power Factor

The UPS output shall not require derating under the following load power factor parameters

Resistive loads, where power factor of unity

0.9 leading to 0.8 lagging

For loads exhibiting power factors outside this range, the following derating shall apply:

5% derating of the UPS shall apply for 0.7 PF lagging.

10% derating of the UPS shall apply for 0.6 PF lagging.

15% derating of the UPS shall apply for 0.5 PF lagging.

20% derating of the UPS shall apply for a range of 0.4 to 0.1 PF lagging.

### 1.6.9 Input Current Limit

The UPS Input converter shall control and limit the input current draw from upstream supply source (utility or generator) to the following:

less than 115% of the UPS output rated current whenever the system is in normal operation and operating at 100% or less of UPS capacity, whilst in (Battery) recharge mode.

less than 130% of the UPS output rated current whenever the system is in normal operation.

## 1.7 System Operating Requirements

### 1.7.1 Function

The UPS system shall isolate the load from any mains power transient or longer term disturbance in voltage or frequency, and shall supply conditioned power to the load for the specified period of time after input supply failure.

The input rectifier and output inverter shall be capable of full battery recharge while simultaneously providing 100% regulated power to the load bus for all line and load defined conditions.

In both normal operation and battery operation, the output inverter shall create an output voltage independent of the mains input voltage.

Input voltage anomalies such as brown-outs, spikes, surges, sags, and outages shall not affect the amplitude or sinusoidal nature of the recreated output voltage sine wave of the output inverter.

### 1.7.2 Modes of Operation Normal:

The main rectifier shall operate in an on-line manner to continuously regulate and supply power to the critical load. The input rectifier and output inverter shall be capable of full battery recharge while simultaneously providing 100% regulated power to the load bus for all line and defined conditions.

**Recharge:**

Upon restoration of the mains power or the standby generator system, the input rectifier and output inverter shall simultaneously recharge the battery and continue to provide 100% regulated power to the UPS output bus.

**Battery:**

Upon mains power or the standby generator system input failure or any out of tolerance condition as defined by this specification of the electrical AC input source, the UPS output bus shall continue being supplied by the main inverter, which shall derive its power from the battery system.

There shall be no interruption of power to the UPS output bus during both transitions to battery operation and from battery to normal operation.

**Static Bypass:**

The static bypass shall be used to provide an uninterrupted transfer of the UPS output bus from the Inverter output to the bypass source.

This transfer, along with its retransfer, shall take place with no-break, no power interruption to the UPS output bus.

No-break, no power interruption transfers shall also occur in the event of extreme overload conditions, inverter output voltage out of tolerance conditions or if manually commanded by the operator. This transfer shall be an automatic function with the exception of an operator initiated transfer.

The UPS shall automatically return to normal operation when the overload or out of tolerance condition is cleared manually initiated transfers to and from static bypass shall be initiated through the UPS control panel interface.

**Maintenance Bypass:**

The UPS system shall have an external maintenance bypass to electrically isolate the UPS for routine maintenance and service. The external maintenance bypass shall completely isolate both the UPS(s) input and output connections. The electrical contractor shall install the external maintenance bypass, however the UPS Contractor shall advise during tender if there are any dependencies or specific components required to achieve this functionality. The UPS Contractor shall coordinate on site to ensure correct commissioning.

**Load Bank:**

The UPS system shall have the functionality to plug in an external load bank on the UPS output switchboard to test the UPS system offline to 100% capacity.

**Supplied Complete:**

All components and accessories including programming required for a fully operational system as described in this specification shall be supplied as part of the UPS at no additional cost.

### 1.7.3 Battery Recharge Current Limit

The UPS shall be capable of limiting the energy sourced from the mains.

As a default setting, the battery charge energy shall be set to 100% of its nominal value. When signalled by a dry contact (such as from an emergency generator), the UPS shall be capable of limiting the battery charge energy taken from the mains.

Value selectable selection shall be made from the UPS touch screen user interface.

### 1.7.4 Overload Capability

The output inverters shall be capable of 240% sub-cycle for short circuit clearing.

Steady state overload conditions, of up to 200% of system capacity, shall be sustained by the inverter for 60 seconds in normal operation.

In battery operation the inverter shall be capable of sustaining 150% of system capacity for 30 seconds.

Should overloads persist past the outlined time limitation, the critical load shall be switched to the automatic static bypass output of the UPS, without loss of supply to downstream load.

### 1.7.5 Soft Start Facility

On power up of the system, during power protection modes, or the reinstatement of supply to the system while power for the connected load is derived from the battery via the inverter, the UPS shall feature a controlled walk-in input current (soft-start) facility. The Soft-Start facility shall be capable of limiting the input current from 0 to 100% of the nominal input current with no magnetizing inrush currents over a default 10 second period (with settings ranging from 1 second through 60 seconds).

Soft-start function shall be linear operation, not a step function.

### 1.7.6 Normal Operation

The UPS system/module shall derive AC power from the input source and supply DC power to its inverter while simultaneously float charging the energy storage to which it is connected.

The UPS system shall supply uninterrupted AC power on all voltage disturbances over the entire range in input rating. The UPS will offer continuous output power at all load characteristics up to the maximum full rated output of the UPS.

The UPS output shall remain synchronised with the incoming automatic bypass supply whether from mains or standby generator source, provided the supply is within the limits nominated within Schedules. Arrangements that do not track specific supply types such as standby generator as a matter of course are not acceptable.

## 1.8 Construction

### 1.8.1 Requirements

The UPS shall be self-contained and be capable of safe, unattended operation. The equipment shall comprise the following:

Rectifier/Battery Charger
Inverter.
Batteries and associated stands or enclosures.
DC Batteries switchgear and switchboards.
Synchronous Static Bypass Switch.
All necessary associated equipment, protection devices and controls including isolating switches, circuit breakers, instruments, alarms and displays.

### 1.8.2 Service and Repairs

All components shall be easily replaced. Controls shall be solid state type mounted on plug-in circuit cards.

Control system shall include a self-diagnostic facility and display and facilities shall be provided for remote indication of status and alarms.

### 1.8.3 Labelling

Provide traffolyte label rating plate mounted on the enclosure to IEC 62040.3 As a minimum the rating plate shall include:

Manufacturer's Name
Model and Serial Number
Input voltage, current, power, frequency, number of phases
Rated output voltage, current, power, frequency, power factor, number of phases

### 1.8.4 Housing

Equipment shall be housed within a floor mounted free-standing rack. Access to all equipment and terminals shall be by means of hinged doors or removable panels.

**Access:**

All installation, testing and maintenance shall be available by means of front access only, preferably via hinged, lockable doors to the client's standards.

**Busbar Entry:**

The UPS Contractor shall install (at factory) busway flange connection, free issued by the electrical contractor/busbar manufacturer, for input and output connections in the top of the cabinet. UPS Contractor to coordinate with electrical contractor.

**Safety:**

Provide insulating shrouds and internal barriers to permit safe access for setpoint adjustments, testing and limited maintenance with equipment live.

### 1.8.5 Corrosion Protection

Protect all equipment including frame and cubicle metalwork against the effects of corrosion.

### 1.8.6 Cubicle Ventilation

To maintain UPS cooling, provide air inlet louvres and ventilation fans. The number of fans shall be such that the failure of one will not cause the system to shut down. Provide vents for cooling air inlet through low level louvred openings in cabinet.

### 1.8.7 Over-temperature Protection

Protect equipment against overheating due to excessive ambient temperature or failure of cooling fans. The load shall be automatically transferred to static bypass in case of over-temperature. Temperature sensors shall be fitted to all critical equipment. All temperature sensors readings and alarms shall be visible on the existing building management system, UPS Contractor shall allow for all components to facilitate this interface in an open protocol.

### 1.8.8 Circuit Protection

Provide over-current protection at the following locations:

Rectifier input
Inverter input.
Inverter output.
Static switch input.
Unit output.

### 1.8.9 Terminations

All terminations shall be pre-drilled during manufacturer ready for connection of cable lugs on terminal plates. Coordinate with Electrical Contractor as to the required busway sizes.

All connections shall be in copper unless otherwise specified. Confirm cable and entry details prior to manufacture.

### 1.8.10 Monitoring

Provide facilities, test points or sensors on the UPS equipment to enable:

Monitoring of waveforms to facilitate testing and fault finding
Measurement of critical voltages
Measurement of hot spot temperatures
Measurement and monitoring of other critical parameters.

## 1.9 Rectifier, Inverter/Charger

### 1.9.1 Requirements

The UPS shall comprise solid state, high reliability, sealed components to provide regulated DC power to start and run the inverter unit and charge batteries.

### 1.9.2 Features

The unit shall incorporate:
Input circuit breaker
Soft start feature which limits inrush current at switch on to the normal maximum input current
Fast acting fuses to protect power semiconductors except where circuit breaker provides adequate protection
Automatic voltage regulation within limits acceptable to inverter input and to maintain battery in a charged condition
Rated to supply full system output via inverter and simultaneously charge batteries after full emergency discharge period
Battery charging current shall be adjustable in the range 1/10 to 1/15 of rated discharge current or otherwise as recommended by battery manufacturer
Current limiting to prevent damage in case of low battery volts or short circuit
Incorporate an IGBT, fully controlled rectifier bridge.
Output filter to limit ripple current into battery to 3% peak to peak of charging current
Monitoring of DC output arranged to transfer inverter to battery and switch off rectifier/charger if output is not within tolerance
Battery charge current inhibit, signalled by closing of a remote set of voltage free contacts connected to terminals provided in unit to limit UPS input current when the standby generator system is supplying the unit.

## 1.10 Inverter

### 1.10.1 Requirements

Be a solid state device capable of accepting the output of the rectifier/charger or battery and providing rated AC output within the limits already specified.
Have an output frequency normally synchronised with the AC supply. If the AC supply is outside the specified performance limits, the UPS shall be free running and shall remain in this state until the AC supply has returned within these tolerances. It shall be possible to manually switch the UPS to a free running condition. Special provision shall be made to allow the inverter to track the less stable frequency of the standby generation system.

### 1.10.2 Features

The inverter shall incorporate:

The UPS output inverters shall continuously recreate the UPS output voltage wave form by converting the DC bus voltage to AC voltage through a set of IGBT driven bi- directional power converters. In both normal operation and battery operation, the output inverters shall create an output voltage independent of the mains input voltage. Input voltage anomalies such as brown- outs, spikes, surges, sags, and outages, shall not affect the amplitude or sinusoidal nature of the recreated output voltage sine wave of the output inverters.

**Overload Capability:** The output power converters shall be capable of 240% sub- cycle for short circuit clearing. Steady state overload conditions, of up to 200% of system capacity, shall be sustained by the inverter for 60 seconds in normal operation. In battery operation the inverter shall be capable of sustaining 150% of system capacity for 30 seconds. Should overloads persist past the outlined time limitation, the critical load shall be switched to the automatic static bypass output of the UPS, without interruption of supply to critical load.

**Module Isolation:** Automatic positive physical bus isolation in the event of an inverter malfunction. Each 50 kW inverter section shall operate as an independent unit regardless of operational state of other inverters.

**Fusing:** Each modular inverter shall have high speed time and energy coordinated fusing to provide fault isolation between inverters. A fault within an individual inverter shall not cause a cascading failure of any other inverter connected to the critical bus of the UPS.

**Battery Protection:** The UPS inverter shall be provided with monitoring and control circuits to limit the level of discharge on the battery system. The UPS logic and control circuits shall monitor the discharge constant, and automatically adjust shutdown level to 1.75 volts per cell for any discharge expected to last longer than approximately 60 minutes.

## 1.11 Static Bypass

### 1.11.1 Requirements

The UPS shall comprise a Silicon Controlled Rectifier static switch (SCR type) with a continuous duty rating of 125% of the UPS output rating. Each set of SCRs shall be protected with time and energy coordinated fuses to limit the I2T to a value less than the I2T rating of the SCR.

### 1.11.2 Features

The static Switch shall incorporate:

Synchronous no break transfer of load from inverter output to bypass supply, and in the reverse direction, automatically or by manual control.

Automatic no break transfer to bypass if load current exceeds safe overload rating of inverter.

Automatic no break transfer to bypass in the event of inverter malfunction.

Protection to inhibit transfer in either automatic or manual mode if voltages and phase angles of inverter output and bypass supply differ to a degree which would cause system output to

deviate beyond specified limits
Automatic no break transfer of load from bypass to inverter output when inverter output and system load are within normal operating limits, after transfer to bypass has been initiated by an abnormal condition.
The inverter shall never be in parallel with main supply for more than one second.
Back-feed protection detection and protection to IEC 62040.1.1
**Overloads:** The static bypass switch shall be rated and capable of handling continuous overloads equal to or less than 125% of the rated system output current. For instantaneous overloads caused by inrush current from magnetic devices, or short circuit conditions, the static bypass shall be capable of sustaining overloads of 1000% of system capacity for periods of up to 500 milliseconds.

## 1.12 Instrumentation and Controls

### 1.12.1 Requirements

The UPS shall be supplied with a microprocessor based control system monitor. The panel shall be on the front surface of the cabinet and shall not be obscured by doors or secondary viewing windows. All of the controls, meters, alarms and indicators for operation of the UPS system shall be on this panel and shall be accessible without opening doors or panels. The controls shall be simple to operate and indications and alarms shall be easy to read and interpret. The control panel shall be a coloured LCD display with keypad or touch screen and menu with prompt commands.

### 1.12.2 Features

This panel shall incorporate:
Mimic diagram of system with visual indication of state of Project Engineer components
Alarm conditions displayed until reset after condition has gone
Audible alarm with mute facility to signal any abnormal condition
Provision for connection to the existing building management system over an open protocol
Controls shall include:
Start/stop; Manual
Control of synchronous bypass
Load disconnect
Alarm reset

### 1.12.3 Metering

The UPS control panel there shall provide for control and indicating of all variables and parameters relevant to its operation. The following functions (as a minimum requirement) shall be metered:
Mains on
Rectifier on
Load on inverter

Load on bypass (synchronous or maintenance)
Input, output and internal bypass
Current (each phase, high, low and average)
Voltage (each phase, high, low and average)
Frequency (high, low and average)
Power factor (each phase, high, low and average)
Crest factor (each phase, high, low and average)
THDi (each phase, high, low and average)
THDv (each phase, high, low and average)
Apparent Power (each phase, high, low and average)
Real Power (each phase, high, low and average)
System efficiency
Battery
Estimated charge time
Current charge/discharge
Voltage (current reading, high, low)
Temperature (current reading, high, low)
Autonomy remaining;

### 1.12.4 Alarms

Alarms shall be visible when active from the control panel. The alarm log shall show each entry with corresponding date, time stamp and level of criticality. The following minimum set of alarm messages shall be available to depict the status of the UPS:

Mains input supply out of tolerance
Input / Output Overloads
Emergency off
Fault indication for each main component
Load on bypass
Inverter/bypass supply not synchronised
Battery
Stop imminent (battery near minimum)
Discharging
Grounding Error
Discharged/UPS shutdown
Over-current
Under-voltage
Over-voltage
DC string Isolators and Circuit breaker(s) status (open/close/trip)
Over-temperature
Fan failure(s)
Output voltage outside tolerance

### 1.12.5 Battery Protection

Automatic protection of battery against over discharge, irrespective of system load shall be provided. The cut-off voltage at which the UPS is automatically shut down shall be programmable as a function of the discharge rate.

### 1.12.6 Alarm Log

Alarm conditions shall be logged in a non-volatile or battery backed memory in sequential order with clear indication of date, time and condition. The logged data, up to memory limit (minimum 500 events), shall be retrievable at any time. As a minimum the alarm log shall include:

Number of hours the unit has supplied the load
Number of time the critical load has been saved
The last outage date, time and duration
The total outage time
The number of battery discharges, last discharge date, time and duration.

### 1.12.7 Fault Diagnostics

The UPS system shall have facilities to enable rapid diagnosis of any fault within the system. It shall be achieved by a comprehensive number of alarm messages, indicators or codes which are referenced in the maintenance manual with suggested actions to rectify or trace the fault.

There shall be in the order of 100 separate messages, indicators or codes for this purpose, which shall be easily referenced to in the Maintenance Manual. It shall be possible to work on the UPS equipment in safety with the UPS on bypass. There shall be a positive means of ensuring the system remains on bypass.

As well as the above, each control card shall be complete with diagnostic LED indicators which provide information as to the mode of operation the card is in.

### 1.12.8 Battery Discharge Test Facilities

The system shall have the facility to periodically discharge and test the batteries. The system shall adjust rectifier output for a preset period so that the major load is supplied by the batteries. Battery discharge tests shall be manually operated. Test results shall be automatically logged.

### 1.12.9 Temperature Sensors

Temperature sensors shall be mounted amongst critical equipment within the UPS equipment to monitor their temperature. An alarm shall be raised on the Control System Monitor if any component exceeds the manufacturer's maximum recommended operating temperature.

### 1.12.10 Requirements

Provide a battery bank comprising of high performance valve regulated lead-acid (VRLA) monobloc type with pure lead positive plate, maintenance free batteries, for the minimum required autonomy time of 5 minutes at end of life. The residual capacity at the end of life shall be at least 80% of the initial capacity. The batteries shall be provided by 2 different batter

The battery shall comply with the IEC 60896 'Stationary lead-acid batteries' part 21 & 22 and designed for 12 year life – or as 'long life' provided with a 5+5 year pro rata service life warranty. In other words the capacity of the battery shall be 100% at the 5TH year and drop to 80%, which is end of life within the remaining 5 years.

Battery performance shall be based at an nominal operating temperature of 20° Celsius The battery system shall incorporate the following features:

High impact resistant plastic containers
Standard battery housing (HB), VO (flame retardant) will only be offered when this the Contractors standard option
Self-regulating pressure relief vents
Low resistance, corrosion proof inter-cell connections
Flexible lifting handles
Matched lead calcium plates
Labels on each battery stating date of manufacture/date of putting into service
Cell voltage measurement (accurate to 0.5% measurement of reading) and temperature

### 1.12.11 Battery System Configuration

This configuration contains a Battery Breaker Cabinet (BBC)located in the same room as the UPS system. This BBC communicates with the UPS for trip and status signalling. From the BBC, distribution-busbar is used to connect to the battery strings. For the 400A UPS there are X No. battery strings as per manufacturers design. Each battery string is isolated by means of a tap-off box with a DC breaker. In this configuration each string is positioned on a separate frame and positioned under the tap-off

### 1.12.12 Warranty and Guarantees

The battery Contractor shall guarantee to replace any faulty batteries at no charge for a period as per the 5+5 year warranty commencing from Date of Practical Completion.

After the 5+5 year warranty period a pro-rated warranty period shall be included up to the end of life.

The Contractor shall hold spare batteries for the life of the equipment (minimum 20yrs) and shall provide replacement costs in line with present rates plus inflation. A written statement from the battery manufacturer or Contractor, specific to this project shall be provided to support these warranties and guarantee provisions.

### 1.12.13 Shrouds

Insulating shrouds shall be acid resistant and cover all exposed electrical connections. The shrouds shall also allow all gases evolved from the batteries to safely escape into the atmosphere.

The shrouds shall also allow cell voltage readings with multimeter voltage probes without the need for the shroud to be removed.

### 1.12.14 Racks

Battery bank shall be complete with multi-tier rack stand maximum, arranged for easy testing and replacement of batteries and designed to suit space allowed.

The installation shall be as follows:

Access is only from one side
Battery locations sequentially numbered and labelled
Acid resistant, powder coated finish, bolted steel panel and frame construction
Capable of supporting the batteries without excessive deflection or deformation (no more than 3mm)
Designed to spread load on floor with special base to distribute load over slab
The projected area of the base of the cell shall be contained within the rack
Designed to occupy minimum room area
Shall be raised off the floor—(stand provided by UPS Contractor)
Racks are to be appropriately isolated from earth, from that of the site main earthing system.

### 1.12.15 Battery Circuit Breakers String Isolators

To IEC 62485.2

Each battery string shall have its own circuit breaker such that it may be taken offline for maintenance without affecting the remaining battery strings. Battery circuit breakers shall also isolate the battery bank in event of a fault. All protective devices shall be mounted in a prominent position and labelled to approval.

All circuit breakers shall be from the same manufacturer.

The String Isolators shall be supplied by the Electrical Contractor/Busbar manufacturer, and installed above each Battery Rack, within individual Tap-off Boxes, mounted on 4000A DC Busbar system.

The UPS Contractor shall provide all necessary technical information associated with the provision of the String Isolators Circuit Breaker technology, to suit their DC system, to the Electrical Contractor.

Review time shall be provided to review the technical busbar/String Isolator tap-off submittals from the Electrical Contractor, to ensure the system meets the requirements of their DC system.

### 1.12.16 DC Battery Breaker Box, Isolator Switchboard

Provide all necessary DC isolator switchboards located within the battery room to protect the individual paralleled battery strings.

The Battery Breaker Box's (BBB's) shall be supplied by the Electrical Contractor/Switchboard manufacturer, and installed within each UPS Switchroom, as described on layout drawings.

The UPS Contractor shall provide all necessary technical information associated with the provision of the BBB Switchboard technology, to suit their DC system, to the Electrical Contractor/Switchboard manufacturer.

Review time shall be provided to review the technical BBB Switchboard submittals from the Electrical Contractor, to ensure the system meets the requirements of their DC system.

### 1.12.17 Battery Monitoring System

The UPS System shall be capable of incorporating a BMS but shall not require a BMS system for operation. The UPS system will be supplied with a battery monitoring system which will consist of the following:

BMS BACS Webmanager
BACS Modules Sensor
BACS Measuring Cables
BACS Bus Cables.
BUS Splitter (Optional).
BACS BUS Repeater (Optional).

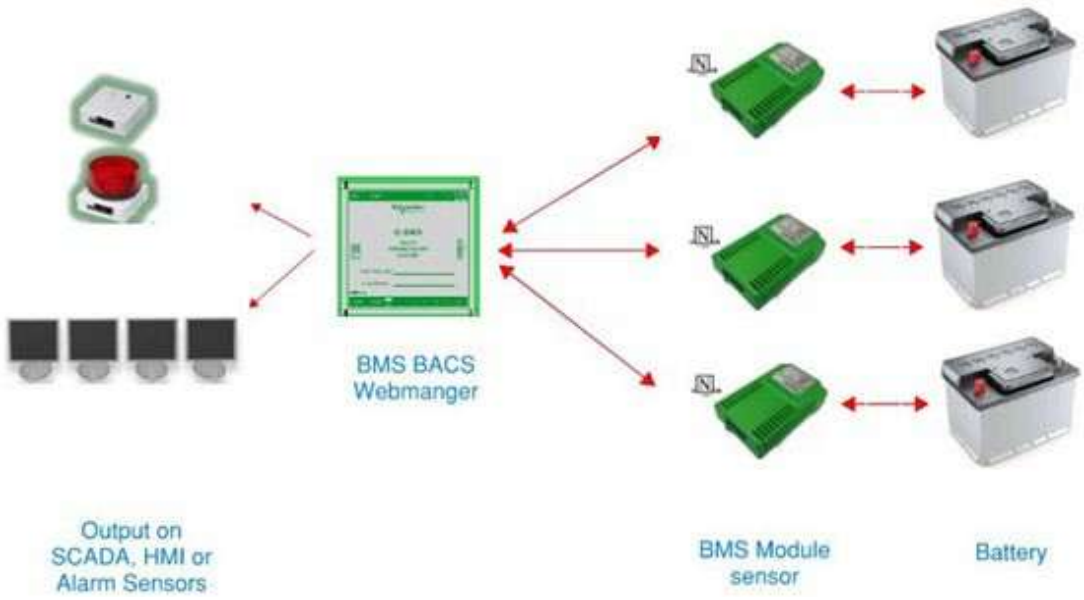



*Figure 1: Schematic of BMS Network System.*

The battery sensor module is attached to each battery. The sensor is connected to the BACS webmaager to allow for viewing and integration of the system

The BMS Module Sensor shall be connected to BMS BACS Webmanger using RS-232 interface communication link. The BMS BACS Webmanger output can be connected to LAN Network to allow for integration with SCADA or SNMP management systems or other network programs.

The system shall allow for additional devices to be connected to the BMS BACS webmanger for example temperature or humadity sensors.

It shall be possible to analyses the information collected from the BMS via SCADA, HMI, SNMP Management System or other network program.

The BMS system shall have a 12V/3A (UPS Protected) power supply.

## 2. Construction and Installation

### 2.1 Construction products

All construction products supplied or employed to complete the electrical installation shall conform to the requirements of the Construction Products Regulation (CPR) and the Construction Products Directive (CPD).

### 2.2 Cabling

All cables shall fully comply with International standards and carry a third party approval certification by BASEC, LPCB or HAR.

**All cables shall Comply with the Construction Products Regulations (CPR). The minimum accepted category shall be CCA. All cables shall carry a CE mark along with a formal Declaration of Performance (DOP) verifying compliance.**

All cables and wires shall be on strain-relief
All cabling systems and all cables shall always be mounted fully horizontally or fully vertically
For connecting vibrating objects the Contractor shall use flexible cables with flexible core wires. The transit from solid core to flexible core cables shall be made in a junction box or a local power switch box.
If a vibrating device has more cables connected, the use of spiral hose is required.
Connections between a solid core wire and a flexible core wire shall be done with screw wire terminals for cores from 1.5mm2 to 6mm2. Larger cables shall be connected with connection blocks for crimping wire terminals (so called "cable shoes").
All control wiring to be provided with wire numbering.
Terminals that shall be exposed to temperatures over 40°C shall be heat resistant, locally connected with rubber mantled cables.
All cable transits from one kind to the other shall have clear indication labels on both sides of the transit.
Cable transits going in or out a junction box shall be made with cable glands.
All cables with flexible core wires shall be connected by use of crimping wire terminals (so

called
“cable shoes”).
It is allowed to connect cables with connecting terminals in junction boxes.
All power cables, data cables and control cables shall consist of Low Smoke, Zero Halogen cables.
Functional integrity related cables shall have their own dedicated cable routings.
All other cables can be combined in cable trays, using dividers for separating the systems in different compartments.

### 2.3 IP-Class

Items with a required IP-class shall be equipped with cable glands for cable entries, to maintain the required IP-class.

All mounting materials and other small materials used for a component must be designed not to lower the IP-class of that component.

### 2.4 Wall, Floor and Roof Penetrations

All systems that pass-through walls, ceiling and/or floors must be finished by Contractor in a way that the total acoustic, water- and fire-resistant value of that wall/ceiling/floor shall not be lowered in any way.

All requirements also count for unused holes or transits, placed during the works. All transits through walls and/or floors for electrical services must be realized with the same resistance classes as that specific wall.

### 2.5 Fire Resistant Transits

When cable conduits pass through wall penetrations, these penetrations shall be made fire resistant according to that walls fire resistance class. All transits shall be provided with fire resistant foam, which shall be frothing at high temperatures. All transits shall be indicated with a sticker on the fire-resistant material.

This sticker shall be provided with a unique code.

All fire-resistant transits shall be closed by a specialist Contractor. As a part of the “as built” drawing set, a transit log shall be provided. All transits shall be described in a transit log, including:

A certificate of compliancy to all relevant standards
All unique codes, as indicated on the stickers near all transits
The fire resistance per transit
The exact location of all transits
A picture of each transit
A signature for approval of the specialist Contractor
The log shall also be used for keeping modifications after completion.

### 2.6 Soundproof Transits

All acoustic properties of walls/ceilings/floors shall be used as a standard for the requirements of transits. No transit shall lower the acoustic properties of that specific equipment.

All soundproof transits are part of this scope of work.

### 2.7 Waterproof Transits

All locations where cables/ducts enter or leave the building shall be made in waterproof transits. All watertight transits shall be closed by a Specialist Contractor.

The container throughputs have to equipped with proper glands by the use of Roxtec, Hilt or equal.

## 3. Operating Instruction to Owner

The Contractor shall instruct the Owners staff how to make carry out necessary maintenance and how to operate each system.

For the delivered equipment, the Contractor shall provide the Owner with three copies of complete operating and maintenance instructions for equipment at the time of delivery of the equipment. Equipment will be rejected unless accompanied by instructions.

Instructions shall be bound in a suitable loose-leaf booklet or binder, and shall include;

prints of the following drawings
- schedules of equipment installed
- general layout
- wiring diagram of control panels
- non-dimensional layout, showing location of all electrical devices

Operation instructions, including start-up and shutdown procedure

Maintenance instructions, including preventive maintenance instructions for components of the equipment

Lubricating instruction and recommended cycle of lubrication

Complete parts list, showing manufacturer's name and catalogue number

Complete list of recommended spare parts for 2 years of operation with price list for each item of equipment.

The Contractor shall prepare a draft operating and maintenance manual for discussion with the Consultant prior to finalizing the documents.

Time reservation for operating instructions shall be:

5 days of 8 hours for Contractor

## 4. Warranties

The Contractor shall include in his offer spare parts and special tools for maintenance sufficient to cover proper maintenance of the entire works for a period of one year starting from the acceptance date. The manufacturer shall guarantee the availability of spare parts for a minimum period of 10 years.

The Contractor shall provide a detailed description of the required maintenance work during the first 10 years of operation. Contractor shall include in his quotation a detailed proposal for a maintenance contract, which includes for all required maintenance work as described.

The proposal shall include, but not be limited to;

Detailed description of the maintenance works required
Description of the local service organization.
All systems shall be warranted during twelve months after the commissioning by the Contractor with a maximum of eighteen months after delivery ex-works whichever is the sooner.

## 5. Execution

### 5.1 Erection

The Contractor is responsible for delivery on site in coordination with the Fit-out contractor
Any parts of the UPS system damaged during transportation to site shall be corrected at no extra cost to the satisfaction of the Engineer.

### 5.2 Factory Acceptance Testing

The UPS system shall be tested prior to its being shipped from the factory.
Copies of the proposed detailed test sheets shall be submitted for approval prior to factory testing being carried out.
Load and performance tests shall be carried out at power factor between 0.8 and unity and the power factor shall be recorded.
Factory testing shall include, but not be limited to:
A general inspection of the equipment to check its compliance with the specified requirements
A minimum four hour full load test
Load test for minimum of 8 hours at full rated load over a range of power factors. Typically, 1 hours at 0.8 lagging, 1 hours at 0.9 lagging, 1 hours at 0.9 leading, 1 hour at 0.8 leading and 4 hours at unity.
Determination of frequency and voltage regulation under the following instantaneous load changes:
no load at 100%
100% rated load to no load.
Determination of System efficiencies under the following instantaneous load changes:
0%,10%, 20%,30%, 50%, 75, and 100% load versus each mode of operation (in all modes of operation, and each UPS efficiency mode)
Operation of all protective circuits and devices together with verification of the settings of relevant sensors.
Insulation resistances and high voltage tests.
Functional tests of all controls, indicators and alarms including set points.
Output Voltage and Frequency recorded graphically to show transient response under all operating conditions and with battery connected. Input and output currents and power

factor shall be recorded simultaneously. Tests shall include:
Main supply on and off
Bypass effected automatically by simulated component failure
Bypass effected manually
5% to 100% load step within one cycle
50% to 100% load step with balanced load
100% to 125% load step with balanced load
50% to 100% load step with one phase 30% unbalanced
100% to 125% load step with one phase 30% unbalanced
150% overload (the option of a type test certificate may be provided for this test)
Output Voltage Harmonic: content under no-load and 100% load conditions
Angular Displacement of output phase voltages at 100% load and 50% unbalanced load.
Battery Voltage shall be measured under all of the above conditions.
**Exceptions:** By prior agreement, where the standard factory tests of the manufacturer do not include all of the above, those tests not carried out during the factory test may be carried out on site. UPS Contractor to advise during tender.
The results of routine tests shall be recorded on the manufacturers standard test sheets, copies of which shall be provided for approval and amended if necessary as a result of review.
Measurements, including power consumption, electrical output, internal component temperatures and the parameters specified shall be recorded at intervals not exceeding one half hour during load testing.
The Contractor shall not cause to be delivered to site any equipment that does not meet the specified requirements, subject to correction for any differences between the factory test ambient and the specified site conditions.

### 5.3 Site Testing

All UPS's shall be retested on site to insure their reliability after shipment. Coordinate with electrical contractor.

Oscillographs or similar capture method shall be used to record voltage waveforms and all transients for inclusions in the reports.

The instruments used during site tests shall include the following:

digital storage oscilloscope with recording facility for all tests (or similar approved digital capture method)

digital voltmeter, accurate to 0.1% on DC range
instrument for the measurement of prospective short circuit current (IMPSC)
mains harmonic analyser per phase and neutral
mains power demand analyser
line disturbance analyser
sound power level meter
permanent battery data logger
**Labour and Equipment:**

Supply the necessary facilities, labour, apparatus and instruments, properly calibrated, required for carrying out the tests, and give the nominated stakeholders 2 weeks' notice of tests.

Utilising load bank as specified carry out site tests after installation is complete and before final connection of load. Tests shall be carried out with battery bank installed.

The UPS Contractor shall supply the required load bank(s). The Electrical Contractor shall connect up the provided load banks and temporary cabling for commissioning.

**Individual UPS Module Tests:**

Site acceptance tests shall include the following:
a check on the operation of all alarms, indications, meters and controls
a check on the functional operation of the UPS including operation under mains failure and return, and transfer to static bypass and return.
Specific tests required include, but are not limited to:
Synchronisation test (UPS to mains and standby generator power)
AC Input failure test (mains and standby generator power)
AC input return test (mains and standby generator power including upstream ATS co-ordination)
Transfer test
Full load tests:
a check on the compatibility of the UPS System operating at no load, 50% load and full load with supply from the standby power generation system and from the mains (two hours minimum at 100% on each of mains and generator supply)
measurement of the harmonic distortion of the input and output voltage and current waveforms caused by the UPS at no load, 50% load and full load, and measured at the distribution switchboard under supply from the standby power generation system and from the mains.
Balanced load test
Rated stored energy time:
conduct this test as part of a continuous test at full kW rated load concurrently with a simulated input supply failure
use a battery data logger for testing of battery discharge during site load tests to verify individual energy storage cell condition and performance
prove the duration of energy storage supply at full load
Rated restore stored energy time
Restart test (mains and standby generator power)
Output voltage test
Frequency variation test, including transient performance tests for:
0 - 100% system load step (simulating return from bypass and step load application)
0 - 50% system load
50% - 100% system load
100% - 5% system load

(under both mains and standby generator power)
Transfer to automatic bypass on full rated system load, 50% rated system load and 5% rated system load.
Prove each remote monitoring point from origin to monitoring station. End to end cable proving is not acceptable.
Operation of Energy Storage isolator/s on load
RFI interference and conducted noise tests
Environmental tests.
Vibration and shock tests.
UPS efficiency test
Unbalanced load test.
Charger ripple current test.
Short circuit test.
Short circuit protection device test.
Periodic output voltage variation test.
Harmonic components test.
Earth fault test.
Audible noise test.
On site ventilation test

# MV SWITCHGEAR

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## 1. Standard specifications

### 1.1 Quality assurance

Contractor is required to have Manufacturer Qualification as per:

ISO 9001;
ISO 14001.

### 1.2 System to be tested per level

| System | L1 Factory Testing (per System) | L3 Start-up Witness Testing | L4 Functional Performance Testing | L5 Integrated Systems Testing |
|---|---|---|---|---|
| All MV Switchgear | YES | YES | YES | YES |

### 1.3 Standards and regulations

The following codes and standards are applicable:
Electrical Installations and Regulations
The contractor shall comply with the rules and regulations of the IEC, EN and Kenya Government Regulations.

IEC 60044-1 : Current transformers
IEC 60044-8 : Electronic current transformer (for LCPT)
IEC 60044-2 : Voltage transformers
IEC 60255 : Measurement and protection relays
IEC 60265-1 : High voltage switches
IEC 60282-2 : High voltage fuses
IEC 60470 : High voltage AC contactors
IEC 60529 : Protection index envelopes (IP)
IEC 60598 : VPIS for voltage present indicator
IEC 60801 : Control-monitoring
IEC 62271-1 (60694) : Common clause for high voltage switchboards
IEC 62271-100 (60056) : High voltage AC circuit breakers
IEC 62271-102 (60129) : Switch and earthing switch to CA
IEC 62271-200 (60298) : High voltage switchgear in metallic enclosures
IEC 60950-1 :Information technology equipment – Safety – Part 1: General requirements
EN-IEC 61936-1 – : Power installation exceeding 1 kV AC part 1, common rules
IEC 60947 : Low voltage switchgear and control gear;

EN 50110 : Operation of electrical installations
EN IEC 61439-1 : Low-voltage switchgear and control gear assemblies.
EN-IEC 61936-1 : Power installation exceeding 1 kV AC part 1, common rules
Where no appropriate standard is available, tests shall be carried out in accordance with the manufacturer's standard practice, which shall be subject to approval by the Client and the Consultant.

**1.4 Environmental Conditions**

Below requirements are applicable for all units within scope.

Where no specific environment details are mentioned, theed following limits apply for the scope of work:

Internal, minimum temperature 5°C
Internal, maximum temperature 40°C
External, minimum temperature 0°C
External, maximum temperature 40°C
Internal, relative humidity 5% - 95%
External, relative humidity 5% - 95%
Noise limit ≤56 dB(A)@1m
Altitude >1000m (Nairobi is at 1750m)

**1.5 Equipment Integration with EMS System**

All MV Equipment shall be provided with a high level interface for direct integration to the site wide EMS monitoring system. The interface shall be Modbus TCP/IP and shall communicate directly over the site wide Ethernet IP network. The manufacturer shall be responsible for any pre-programming of data registers or objects and shall submit a technical document with all data points available and their respective addresses complete with any offsets required for the correct value interpretation in the case of Modbus.

The manufacturer shall provide site commissioning assistance with the EMS integration specialist to ensure seamless integration with the site wide monitoring system.

Each unit shall incorporate integrated controls including:

a micro processor controller and auxiliary equipment necessary for the satisfactory operation of the system; a high level interface (HLI), compliant with Modbus over IP protocol.

**1.6 MEDIUM Voltage Switchgear Specifications**

The MV switchgear shall be designed and manufactured in accordance with the single line diagram and meet the following performance requirements:

| Item | Parameter | Requirement |
|---|---|---|
| 1 | Type | MV Switchgear Panel (Modular design) |
| 2 | Installation Location | Indoor |
| 3 | Service Voltage | 11 kV |
| 4 | Rated Voltage | 17.5 kV |
| 5 | System type | 3 phase, 3 wire |
| 6 | Supply frequency | 50 Hz |
| 7 | Insulation level | 50 kV rms, 1 min |
| 8 | Rated lightning impulse withstand | 125 kV peak |
| 9 | Short time withstand current | 25 kA, 3 sec |
| 10 | Peak making current | >63 kA |
| 11 | Cable Entry | Bottom Entry |
| 12 | Internal Arc Classification (IAC) IEC 62271- 200 | AFLR (4 sides, free standing) |
| 13 | IP rating (Minimum) | |
| | Enclosure | IP 4X |
| | Between Compartments | IP2XC |
| 14 | Busbars | |
| Item | Parameter | Requirement |
| | Rated current | 630 A |
| | Material | Hard-drawn, high-conductivity, electrolytic or superior grade copper of adequate cross section |

| | | |
|---|---|---|
| | Insulating Medium | SF6, within a lifetime sealed gas chamber |
| | Extensible | NA |
| 15 | Functional devices | |
| | | Spring motor charge circuit |
| 15.2 | Mechanical operation counter (non-resettable) | Yes, for each Circuit Breaker and Cable Isolator Switch |
| 15.3 | Circuit Breakers and Cable Switches | |
| | Current Rating | 630 |
| | Quantity | As per SLD |
| | Current Interruption Medium | SF6 Gas or Vacuum bottles |
| 15.4 | Control Circuit | |
| | Trip Coil | Yes |
| | Closing Coil | Yes |
| | Power Supply | 230Vac<br>Provided by Fitout contractor (UPS-Backed) |
| 15.5 | Operating Mechanism | |
| | Type | Motor operating, fast acting, stored-energy mechanism |
| | Power Supply | Integral 48 V DC Power Supply Unit provided as part of the Switchgear<br>230Vac (ups backed) supply to be provided by Fit- out Contractor |
| | Anti-pumping feature | Yes, for both electrical and manual operation |

| | | |
|---|---|---|
| | Mechanical endurance – number of close and open operations | Minimum of 2,000 operations at rated short circuit current |
| | Operating Cycle | O - 0.3s - CO - 15s - CO |
| 15.4 | Position indication | For each Circuit Breaker and Cable Switch |
| | Positions | |
| | Open | Mechanical and Electrical indication |
| | Closed | Mechanical and Electrical indication |
| | Earthed | Mechanical and Electrical indication |
| | Closing Spring status (charged/ discharged) | Mechanical indication |
| | Types | |
| | Mechanical | Yes (Open and Close) for each position indicated above. |
| | Electrical | Two potential-free contacts, rated for 48 V DC, 2 A for each position indicated above. |
| 15.5 | Cable Terminations | To suit copper cables |
| | Number of cores | 3 phase single core cables |
| 15.6 | Earth Switches | Provide two for all breakers and one per switch. |
| | Position | On the cable side of functional devices (circuit breakers and cable switches) |
| | Busbar | On the busbar side of circuit breakers |
| | Type | Lockable and integral |
| | Operation | Manual |

| | | |
|---|---|---|
| 15.7 | Mechanical Endurance - number of close and open operations | 2,000 operations |
| | Maximum manual static effort to operate | 150 N |
| | Padlocking system | Provide – Capable of locking in the open or closed position. |
| | Voltage Presence Indicating System (VPIS) | Yes, for each Circuit Breaker and Cable Isolator Switch, installed on each phase of incoming and outgoing feeders. Including the provision of test points and phase indication. |
| | Type | Capacitive |
| | Indication | Neon bulbs (interchangeable and removable for test purposes). With bulb test switch. |
| 15.8 | Phase Sequence Checking | Provide connection points |
| | Phase Concordance Unit | Provide |
| 15.9 | Functional Interlocks | |
| | Mechanical Interlock Devices | Direct acting |
| | Padlocking facilities | Provide for all doors, operating buttons and levers |
| 15.10 | Fault Current Indicator (Short Circuit and Earth Fault) | |
| | Visual Indication (identify the phase on which the fault current was detected) | Yes |
| | Output Contacts | Yes |

| | | |
|---|---|---|
| | Type | Potential-free |
| | Rating | 48 V DC, 2 A |
| | Functions | Over Current (NO) |
| | | Earth fault (NO) |
| 15.11 | Current Transformers | One installed on each of the three phases & as per SLD |
| 15.12 | Voltage Transformers | One installed on each bus section for each of the three phases &as per SLD |
| 15.7 | Control Circuits | |
| | Supply Source | 230Vac<br>Provided by Fitout contractor (dual UPS-Backed) |
| | DC equipment continuous withstand capability | 70% to 115% of nominal DC voltage |
| | Separation and electrical isolation between circuits | Close Circuit |
| | | Trip Circuit |

## 1.7 MV Switchgear Design

### 1.7.1 General Design Requirements

MV switchgear shall constitute all MV devices including, but not limited to, busbars, circuit breakers, and earth switches.
MV switchgear shall be designed, constructed and tested in accordance with IEC 62271 (whole series).
MV Switchgear shall meet all Internal Arc Classification (IAC) criteria as proven by test in accordance with IEC 62271-200 - Annex A.
Each switchgear compartment shall be provided with a means for extracting arc products and eliminating moisture pockets.
The switchgear operational and arc-extinguishing mechanism shall be designed to achieve the design life with limited dielectric and thermal stresses on the installation.
Switchgear elements shall be physically arranged within the enclosure such that the operation

of any live item can only be performed with compartment doors closed.
The design life for MEDIUM switchgear shall be a minimum of 30 years, with normal wear and tear, and recommended operation and maintenance. Contractor to set out in their offering, maintenance and support and guarantee for future availability for replacement/ spare parts.

### 1.7.2 Switchgear Construction

Panels shall be equipped with the following and as described herein:
Cable earthing facility
Spring charged indicators.
Motor mechanism and stored energy manual operating mechanism (for all functional devices)
Open/close push button.
Local/remote selector switch
Lifetime sealed SF6 chamber (where SF6 is utilised as the insulating medium)
SF6 gas pressure indicator with facility for remote indication (where SF6 is utilised as the insulating medium)
Air filled rear cable box suitable for bottom entry plug in cable connection.
Mechanical operation counter.
Phase connected/live indicators (voltage indicator lamps).
Comprehensive mechanical interlocks.
Padlocking facilities for doors, operating buttons and levers.
Full remote control facilities (for all functional devices) as outlined in the Power Topology Functional Description
Contractor to design and supply the arc flash duct.
Switchgear to be provided with all required operating tools + tool holder Provide one of each of the following additional accessories at handover:
Phase indication concordance unit
Protection relay test unit

### 1.7.3 Busbars

Busbars shall be hard-drawn, high-conductivity (HDHC), electrolytic or superior grade copper of adequate cross section and supported by post insulators.
The main busbars shall have the same current rating throughout the length of the switchboard.
Horizontal and vertical busbars shall have epoxy moulded insulation.
Busbars and connections shall be so arranged and supported such that under no circumstances, including short-circuit conditions, can the clearance between:
live metal and earth or earthed metal work; or
the live conductors of different phases, be less than the minimum clearances specified in relevant applicable IEC Standards.

Busbars and feeder connections shall be provided with phase colour coding at all connections and ends to identify the phase. Phase identification shall be using non-flammable material.
Busbars shall be rated for the higher of:
maximum possible power flow on any feeder connected to busbar;
nominal rating of circuit breaker; or
nominal rating of cable switch.
All feeder connections shall be rated for the higher of:
maximum possible power flow on the feeder;
nominal rating of circuit breaker;
nominal rating of cable switch; or
nominal rating of cable.
The busbars and connections to equipment shall maintain adequate flexibility to allow for thermal expansion and contraction.
All sections of each busbar shall be of an equivalent rating.
Busbars shall be connected to the elements of the high voltage system by means of branches.
All busbar contacts and connections shall be electro-tinned or silver plated.
Sliding or rolling surfaces other than stainless or hardened components shall be zinc electro-plated and passivated.

### 1.7.4 Cable Termination

All cable terminations shall:
be rated for the nominal and peak impulse voltages and short time fault rating; and
be rated for the nominal current of the relevant Switchgear functional device as a minimum.
Cable termination shall be by plug in, elbow type;
Cable boxes shall be of the air insulated type and suitable for connecting the cables which rise vertically from the base of the unit;
It shall not be possible to close the circuit main switch with the cable compartment cover removed;
The cable compartment shall be type tested to withstand internal arc faults;
Where plug in type surge arrestors are used, provision shall be made for the inclusion of surge arrestors within the cable termination;
Cable terminations shall be provided with a means of supporting cables which enter/ exit the Switchgear;
Cable terminations provided shall be sized to allow adequate space for trifurcation of three-core cables within the Switchgear enclosure.

### 1.7.5 Control Circuits

All Control Circuits shall be arranged to facilitate external connections and to provide appropriate isolating points for circuit checking and fault finding. Isolations shall be possible in the form of slide- disconnect link terminals;

Each slide-disconnect link terminal shall have a specific designation and shall be easily identified for the designated purpose;

All DC supplies shall be brought to a common terminal group in each local control panel. The terminals shall be easily and safely accessible from floor level;

The Contractor shall provide individual MCBs for each functional unit (circuit breakers and cable switches) to provide all DC power required by the components of the functional unit.

### 1.7.6 Fittings and Joints

Only proprietary brands of bus fittings shall be used;
All bus fittings shall be free from sharp edges and corners to minimise possible corona effects;
All types of clamps used shall be suitable for carrying their rated normal and short time currents;
No hot spot shall be formed at cable connections and joints. This shall be achieved without the need for regular maintenance, such as periodic tightening due to thermal cyclic effect or short circuit forces, or cleaning of chemical by-products;
A suitable oxide-inhibiting, corrosion-resistant type electrical jointing compound shall be used for all current carrying joints and connections to inhibit galvanic corrosion between contact surfaces;
Clamps shall be of the same material as the relevant conductor, or a material suitable for their purpose without giving rise to corrosion;
The contact surfaces of non-plated aluminium and copper shall be free from oxide prior to tinning and making connections;
Air and moisture shall be excluded from the joint through the use of approved grease joint compound;
All copper-to-copper connections shall be made with bronze connectors;
Only 316 grade stainless steel bolts and compatible grade stainless steel nuts, washers and spring washers shall be used for bolted connections;
Fastener tension shall be maintained by either wave or belleville spring washers without the need for periodic re-tightening or maintenance;
All lugs shall be of the sealed type;
If snap off bolts are used in the jointing process then the standard of finish applied to snap off bolts shall be approved by the independent tester before bolts are covered with insulation.

### 1.7.7 Earth Bar

The Switchgear shall have an earthing bar running along the whole length of the switchboard longitudinally, allowing for future expansion of the switchboard.
The earthing bars for each of the panels making up the switchboard shall be interconnected by a set of copper bars and shall be connectable outside the switchboard and extend over its full width.
The earthing bar shall be sized/rated for the higher of:
25 mm x 6 mm;
the size adequate to carry maximum earth fault current that the switchgear and busbar are rated to withstand; or
the size required to conduct any injection tests on the high voltage system.
The earthing bar shall be suitable for connection to a substation earth bar at least at two independent points.
The earthing bar shall be arranged to provide connection to the main earthing bar of the substation without dismantling any of the bars.
The earthing of cables shall only be possible when the switch is open.
Earthing switches shall be capable of operating with a short circuit making capacity to withstand the fault level applicable at that location.
All metallic parts of each panel shall be connected to the main earth bar.
All earthing devices must either be capable of being viewed so that visible indication of earthing is given or indicating devices must be positively linked to earth switch operating mechanism.
Provide facilities for earthing of busbars.
Provide details of mechanical interlocking function to ensure the earth switch cannot be closed without the switch being open.
Provide a pad locking system to lock the earthing switch in the open or closed position.

### 1.7.8 Switchgear Enclosure

The Switchgear shall be fully assembled and tested before leaving the factory.
The Switchgear shall have an earthing bar running along the whole length of the switchboard longitudinally
The enclosure shall have full segregation between all low voltage and high voltage compartments.
It shall not be possible to access any MEDIUM compartment from a LV compartment, under any operating conditions.
Access to any live parts of the system shall be prevented at all times, including under fault conditions, by means of design or use of interlocking devices.
It shall not be possible to bypass interlocks that prevent access to live parts.
Any feature that allows bypassing of the interlocks shall be subject to approval in writing of Superintendent. Where the Superintendent does not approve a particular feature, the feature

shall be permanently disabled.
Entry for control and instrumentation cables to each low voltage compartment shall be possible via segregated and fully enclosed cable ducts from underneath each separate unit.
To minimise the effects of electro-magnetic interference, adequate clearance shall be maintained between:
power cables, control cables and communication cables; and
power cables and control cable trays

### 1.7.9 Functional Devices

**Circuit Breakers and Cable Switches:**

The circuit breakers shall:
use SF6 gas or vacuum bottles as the current interruption medium, as detailed previously;
require only minimum maintenance and shall provide a high level of electrical endurance;
be interlocked with the power circuit disconnector so that the disconnector cannot be open unless the circuit breaker is open;
be equipped with a fast-acting stored energy type operating mechanism as well as a motor mechanism.
The position of the circuit breaker contacts shall be clearly indicated by the operating mechanism.

**Earth Switches:**

All Earth Switches shall:
have a rated short-circuit making current equal to the rated peak withstand current
be designed and so placed that the operation of earth switches does not pose any risk to operator safety
The earth switch mechanisms shall be designed so that, in the event of failure of the operating mechanism, the earth arms shall not swing from the open position into the closed position under the action of counterweights or springs and similarly if the device is closed it shall not swing into the open position
be of identical performance and characteristics
be closed and opened from the front of the Switchgear
be provided with an inspection window to check the physical contacts of the earth switch to ascertain its position; and
have mechanical indicating devices positively linked to the earth switch operating mechanism.
The earthing blade shall be fitted with a means of directly connecting to the substation earthing grid via a dedicated, fully rated earth connection. The earth switch shall connect the earthed equipment to this earth blade.
The manual operating mechanism shall not be located higher than 1200 mm above ground level.

### 1.7.10 Functional Interlocks

**Switch Interlocks:**

Switch operational interlocks shall be as follows:
the switch can only be closed if the earthing switch is open
the earthing switch can be closed only if the switch is open
the access panel for connection can be opened only if the earthing switch is closed
remotely – if the operation of the switchgear is selected to local
locally – if the operation of the switchgear is selected to remote
for a low gas lockout condition, for gas insulated switchgear
the device can only be closed if the earthing switch associated with the circuit and the bus earth switch (if bus earth switch is provided) is open; and
padlock facilities as follows:
doors closed
switching device is in open position
earthing switch closed

**Circuit Breaker Interlocks:**

Circuit breaker operational interlocks shall be as follows:
the circuit breaker can only be closed if the earthing switch is open
earthing switch can only be closed when the circuit breaker is in the open
the access panel for connection can be opened only if the earthing switch is closed
if the trip circuit associated with the circuit breaker is faulty
if closing spring is not charged
remotely – if the operation of the switchgear is selected to local
locally – if the operation of the switchgear is selected to remote
for a low gas lockout condition, for gas insulated switchgear
the device can only be closed if the earthing switch associated with the circuit and the bus earth switch (if bus earth switch is provided) is open
padlock facilities as follows:
doors closed
switching device is in open position
earthing switch closed

**Earth Switch Interlocks:**

Earth switch operation shall be interlocked such that:
an earth switch can only be closed when the associated cable switch/ circuit breaker is open
an earth switch shall be prevented from being closed onto a live bus
an earth switch shall be prevented from being closed if the associated cable switch/ circuit breaker is NOT open; and
the access panel for the MV cable termination compartment can be opened only if the earthing switch is closed.

### 1.7.11 Auxiliary Equipment

Relays and controls shall be mounted at the front of the switchgear, in the top compartment together with protection relays
Control wiring shall be LSOH insulated having a minimum cross sectional area of 1.5 mm², except for bus wiring and CT secondary wiring which will have a minimum area of 2.5 mm². The cable shall be rated at 105°C.
Not more than two wires shall be connected to any one terminal, one wire at each side.
Wiring across door hinges shall be protected against mechanical damage. Main and auxiliary circuit cables within an enclosure shall be segregated.

### 1.7.12 Instrument Transformers

Instrument transformers, namely current transformers (CT) are required for both protection schemes and operational measurement within the MV electrical power network.
Instrument transformers provided shall be suitable for their application in a main electricity distribution environment. The instrument transformers are to conform to the latest applicable IEC Standards:
IEC 60044.1 Current Transformers Current transformers (CTs) shall be as follows:
ring type CTs shall be bushing mounted and comply with IEC 60185. CTs shall be accessible safely without de-energising the main busbars
CTs shall be provided as shown on the single line diagram.
protection class of CTs shall be as shown below or other to be checked with engineer for approval and shall have a rated burden suitable for operation of the self-powered protection relay.

**Insulation:**

Instrument transformers shall have necessary insulation as per the above Standards and in no case less than the highest voltages expected in the specific application.
Instrument transformers shall be cast resin insulated, completely sealed, solid insulated type. Oil insulated instrument transformers will not be accepted.

**General Requirements:**

Multiple ratios shall be achieved by reconnection of secondary windings taps only. Ratio changes shall not be achieved by reconnection of primary windings.
Where multiple ratio, multi tap, multi core instrument transformers are provided, all testing associated with the instrument transformers shall be undertaken for each core, winding and tap.
The instrument transformers shall be provided with necessary number of cores and windings with performances and classes of precision suited to the functional requirements of the devices connected to them.
The specified performance of the instrument transformers shall be obtained without recourse to compensation devices or ancillaries for calibration.

The instrument transformers shall have same short circuit withstand capability as that of any other high voltage elements at the point of connection of the instrument transformer.
Polarity markings shall be provided on primary and secondary terminals of all instrument transformers and fixed on the instrument transformers so that it may be easily read without requiring disconnection of the instrument transformer.
Secondary terminal markings shall be provided for each tap and each secondary winding. Each secondary tap including any test taps shall have their own individual terminal marking.
All secondary terminations including connections from all taps, cores and test taps shall be brought out in the corresponding switchgear low voltage compartment. The termination of the instrument transformers shall, as a minimum, be in the low voltage compartment where the secondary devices are located and shall be arranged to be easily accessible from floor level.
All secondary connections shall use slide-disconnect link test terminals to enable testing of protection and metering devices without removing any wires from terminals. The CT links should be arranged to fall to closed.
All MEDIUM instrument transformers, applied to a MEDIUM switchboard, shall be of identical technology in terms of insulation and principle of operation.
All instrument transformers shall be arranged so that it is possible to conduct primary injection of the instrument transformers without requiring removal of the transformers. Connections for conducting primary injection testing shall be suitable for testing of instrument transformers to their full rating. All such provisions shall be clearly identified and instructions for testing shall be provided.

**Current Transformers:**

Current transformers (CTs) shall be provided as shown on the single line diagram and meet the following performance requirements:

| **Parameter** | **Requirement General** |
|---|---|
| Standard | IEC 60044.1 |
| Insulation | Solid, (rated for 24kV) |
| **Protection (OC & EF)** | |
| CT Ratio | as per SLD |
| Burden | as per SLD Class As per SLD |
| **Metering** | |
| CT Ratio | As per SLD |
| Burden | As per SLD Class As per SLD |

CTs for all feeders (incoming, bus tie or outgoing) shall be located on the cable side of the associated circuit breakers and on the circuit breaker side of the associated earth-switch. CTs for all feeders shall be arranged to allow access for maintenance and repairs without requiring a busbar outage.
The minimum rated burden for each CT core and winding shall allow for the burden of connected secondary circuits and devices, plus an additional device, with similar burden.

**CT Primary Circuit Requirements:**

The continuous thermal rating of the primary of the current transformer shall be greater than 120 % of the primary current at highest ratio connection of the current transformer.
Where multi-core CTs are provided, the design shall be such that a burden change on any one core does not affect the performance of the other cores.
Each CT shall have the necessary number of cores as required from the intended applications. As a minimum, the number of cores and their performance shall meet the requirements as below.
For all CT cores applied to MEDIUM busbar protection, the specifications and ratios of CT cores in incomer feeder, outgoing feeder and bus-coupler shall be identical.
Arrangement and order of the cores shall be based on the principle of overlapping protection zones.
Primary terminals shall have polarity markings P1 and P2.
The polarity markings for various circuits shall be arranged as below:
For incoming feeder to a MEDIUM busbar, P1 located adjacent the MEDIUM circuit breaker;
For outgoing feeder from a MEDIUM busbar, P1 located adjacent the MEDIUM circuit breaker;
For bus-coupler, P1 terminal located adjacent the MEDIUM busbar, with P2 terminal located adjacent the bus-coupler circuit breaker; and
For transformer neutral, P1 terminal located remote from the transformer bushing for externally mounted neutral current transformers.
Cores shall be numbered sequentially according to their location relative to primary polarity P1 and P2 with the core closest to P1 identified as Core 1.

**CT Secondary Circuit Requirements:**

The nominal secondary rating of all current transformers shall be as nominated on SLD's unless otherwise indicated.
The thermal rating current of the secondary circuit of the current transformer shall be 10 Amps in any connection configuration.
The secondary short-time withstand capability shall be at least equivalent to that of the primary.
The actual CT ratio for connection shall be confirmed with Engineer before commissioning. All pre- commissioning and commissioning tests shall be based on this selected ratio. Testing on all actual and derived ratios and shall be performed during factory acceptance testing and shall be performed for each CT provided.
Secondary circuit shall have polarity marking and shall use xS1, xS2, xS3 and xS4. Where utilised, test taps shall have polarity markings xT1, xT2. 'x' represents the core number.
CT secondary circuits for each three phase CT combination shall be normally connected in a star configuration. The common star point shall be formed on terminal blocks in each low voltage compartment. For the protection CTs, the secondary terminals that are towards the device to be protected shall be connected as the star point. For the metering CTs, the S1 terminals shall be connected as the star point.

Each CT secondary circuit shall be earthed at only one point in each associated low voltage compartment. Where multiple CTs are connected in parallel in a protection scheme, the secondary circuit will be earthed at only one point adjacent the protection device.

### 1.7.13 Metering, Protection & Control Requirements

Each circuit breaker shall be equipped with a DC powered electronic protection relay unit with adjustable over-current and earth fault protection. The protection functions shall be provided as detailed on single line diagram.

**General Requirements:**

Minimum requirements for protection and control systems are listed below:

The protection and control equipment shall be capable of reliable operation within a frequency range of 44.5 Hz to 52 Hz for the MEDIUM System and shall be designed for operation at a system frequency of 50 Hz.

All new protection and control devices or schemes shall make use of proven microprocessor technology.

The protection and control devices shall have self-diagnostic features in the form of "internal device failure".

All processes within any protection and control devices shall be continuously supervised and alarms for non-healthiness of the units shall be connected to a terminal strip.

On the detection of an internal malfunction within a device, the device shall block itself to prevent mal-operation or a circuit breaker trip.

The self-diagnostic outputs shall use hard-wired fail-safe contacts to indicate unit failure and problems.

### 1.7.14 Electrical Insulation Requirements

The Table below details the electrical and insulation requirements with which all protection and control equipment shall comply:

| No. | Characteristics | Specifications |
|---|---|---|
| 1 | Supply interruptions and ripple | All static equipment or static sub-assemblies within non-static equipment shall comply with IEC 60255- 11 and be unaffected by the following disturbances to the DC auxiliary supply: |
| | | To IEC 60255-11 Interruptions of duration 10ms |
| | | To IEC 60255-11 AC component of 5% rated value |
| 2 | Insulation (routine test) | To IEC 60255 |
| | | 2.0kV rms for 1 minute or |
| | | 2.5kV rms for 1 second. |
| 3 | Insulation (type test) | |
| 3.1 | Rated insulation | 500 V |
| 3.2 | Dielectric test voltage series | B |
| 3.3 | Dielectric test voltage for open contacts | 2.0 kV rms |
| 3.4 | Insulation resistance test | 1.0 kV rms |
| 3.5 | Creepage and clearance distances to tables | IV and V |
| 3.6 | Impulse voltage tests | 5 kV peak |
| 4 | Electromagnetic compatibility (type test) | |
| 4.1 | 1MHZ burst test to IEC 60255-22-1 | Class III (2.5 kV) |

| | | |
|---|---|---|
| 4.2 | Electrostatic discharge to IEC 60255- 22-2<br>with covers on | Class III (4 kV) |
| 4.3 | Radiated electro-magnetic field to IEC 60255-22-3 but with frequency range 20 MHz to 1,000 MHz | Class III (10 V/m) |
| 4.4 | Radiated electro-magnetic field to fast transient test to IEC 60255-22-4 | Class IV (4 kV) |
| 4.5 | Data ports for permanent connection | The insulation class (2.0 kV rms preferred) and electromagnetic compatibility class of port(s). |

### 1.7.15 Labelling

Provide labels for every panel, pilot lamp, push button, switch, relay and all indicating equipment. Labels shall be as follows:
circuit title labels shall be of the plastic laminate type with black letters on a white background
standard instruction and identification labels shall be either aluminium, plastic laminate or stove enamelled screen printed type with black letters on a white background
warning labels of the permanent self-adhesive type shall be attached to all removable covers behind, which are situated live high voltage connections and where such connections are the main busbars, an additional label inscribed "busbars" shall be fitted.
for each complete assembly, a purchaser's nameplate should be included giving the following information:
Purchaser's name
Order number
Manufacturer's name
Item tag number
Year of manufacture
Rating information such as voltage, current, frequency, short circuit, insulation level, impulse level.
IP rating
identification labels shall be attached to each removable cover/door of the switchboard to

identify an internal CT/VT turns ratio, class and rating.

## 2. Construction and Installation

### 2.1 Construction products

All construction products supplied or employed to complete the electrical installation shall conform to the requirements of the Construction Products Regulation (CPR) and the Construction Products Directive (CPD).

### 2.2 Cabling

All cables shall fully comply with International standards.

**All cables shall Comply with the Construction Products Regulations (CPR). The minimum accepted category shall be CCA. All cables shall carry a CE mark along with a formal Declaration of Performance (DOP) verifying compliance.**

All cables and wires shall be on strain-relief
All cabling systems and all cables shall always be mounted fully horizontally or fully vertically
For connecting vibrating objects the Contractor shall use flexible cables with flexible core wires. The transit from solid core to flexible core cables shall be made in a junction box or a local power switch box.
If a vibrating device has more cables connected, the use of spiral hose is required.
Connections between a solid core wire and a flexible core wire shall be done with screw wire terminals for cores from 1.5mm2 to 6mm2. Larger cables shall be connected with connection blocks for crimping wire terminals (so called "cable shoes").
All control wiring to be provided with wire numbering.
Terminals that shall be exposed to temperatures over 40°C shall be heat resistant, locally connected with rubber mantled cables.
All cable transits from one kind to the other shall have clear indication labels on both sides of the transit.
Cable transits going in or out a junction box shall be made with cable glands.
All cables with flexible core wires shall be connected by use of crimping wire terminals (so called
"cable shoes").
It is allowed to connect cables with connecting terminals in junction boxes.
All power cables, data cables and control cables shall consist of Low Smoke, Zero Halogen cables.
Functional integrity related cables shall have their own dedicated cable routings.
All other cables can be combined in cable trays, using dividers for separating the systems in different compartments.

## 2.3 IP-Class

Items with a required IP-class shall be equipped with cable glands for cable entries, to maintain the required IP-class.

All mounting materials and other small materials used for a component must be designed not to lower the IP-class of that component.

## 2.4 Wall, Floor and Roof Penetrations

All systems that pass-through walls, ceiling and/or floors must be finished by Contractor in a way that the total acoustic, water- and fire-resistant value of that wall/ceiling/floor shall not be lowered in any way.

All requirements also count for unused holes or transits, placed during the works. All transits through walls and/or floors for electrical services must be realized with the same resistance classes as that specific wall.

## 2.5 Fire Resistant Transits

When cable conduits pass through wall penetrations, these penetrations shall be made fire resistant according to that walls fire resistance class. All transits shall be provided with fire resistant foam, which shall be frothing at high temperatures. All transits shall be indicated with a sticker on the fire-resistant material.

This sticker shall be provided with a unique code.

All fire-resistant transits shall be closed by a specialist Contractor. As a part of the "as built" drawing set, a transit log shall be provided. All transits shall be described in a transit log, including:

A certificate of compliancy to all relevant standards
All unique codes, as indicated on the stickers near all transits
The fire resistance per transit
The exact location of all transits
A picture of each transit
A signature for approval of the specialist Contractor
The log shall also be used for keeping modifications after completion.

## 2.6 Soundproof Transits

All acoustic properties of walls/ceilings/floors shall be used as a standard for the requirements of transits. No transit shall lower the acoustic properties of that specific equipment.

All soundproof transits are part of this scope of work.

### 2.7 Waterproof Transits

All locations where cables/ducts enter or leave the building shall be made in waterproof transits. All watertight transits shall be closed by a Specialist Contractor.

The container throughputs have to equipped with proper glands by the use of Roxtec, Hilt or equal.

## 3. Operating Instruction to Owner

The Contractor shall instruct the Owners staff how to make carry out necessary maintenance and how to operate each system.
For the delivered equipment, the Contractor shall provide the Owner with three copies of complete operating and maintenance instructions for equipment at the time of delivery of the equipment. Equipment will be rejected unless accompanied by instructions.
Instructions shall be bound in a suitable loose-leaf booklet or binder, and shall include;
prints of the following drawings
schedules of equipment installed
general layout
wiring diagram of control panels
non-dimensional layout, showing location of all electrical devices
Operation instructions, including start-up and shutdown procedure
Maintenance instructions, including preventive maintenance instructions for components of the equipment
Lubricating instruction and recommended cycle of lubrication
Complete parts list, showing manufacturer's name and catalogue number
Complete list of recommended spare parts for 2 years of operation with price list for each item of equipment.
The Contractor shall prepare a draft operating and maintenance manual for discussion with the Consultant prior to finalizing the documents.
Time reservation for operating instructions shall be:
5 days of 8 hours for Contractor MV Switchgear

## 4. Warranties

The Contractor shall include in his offer spare parts and special tools for maintenance sufficient to cover proper maintenance of the entire works for a period of one year starting from the acceptance date. The manufacturer shall guarantee the availability of spare parts for a minimum period of 10 years.

The Contractor shall provide a detailed description of the required maintenance work during the first 10 years of operation. Contractor shall include in his quotation a detailed proposal for a maintenance contract, which includes for all required maintenance work as described. The proposal shall include, but not be limited to;

Detailed description of the maintenance works required
Description of the local service organization.
All systems shall be warranted during twelve months after the commissioning by the Contractor with a maximum of eighteen months after delivery ex-works whichever is the sooner.

## 5. Execution

### 5.1 Erection

The Contractor is responsible for delivery on site and installation.
Any parts of the MV Switchgear damaged during transportation to site shall be corrected at no extra cost to the satisfaction of the Engineer.

### 5.2 Type tests

The MV switchgear assembly (including all functional devices) shall have previously undergone type testing in accordance with;

IEC 62271.100
IEC 62271.200
Test certificates shall be provided.

The switchgear Contractor shall present the following type of testing certificates:

Impulse dielectric withstand test
Dielectric withstand at power frequency test
Overheating test
Admissible short time current withstand test
Mechanical operation test
Degree of protection check
Electromagnetic compatibility check (EMC test)
Switchgear device breaking capacity check
Switchgear device making capacity check

### 5.3 Routine Factory Tests

Each item of MV switchgear supplied shall undergo routine testing at the manufacturer's works in accordance with;
IEC 62271.100
IEC 62271.200
IEC 60044.1 (Current Transformers)
IEC 60044.2 (Voltage Transformers)
Copies of all test documentation shall be provided prior to shipping of the equipment. The following tests shall be carried out at the factory tests;
Dielectric withstand at power frequency test
Mechanical operation test

Relay and low voltage auxiliary functional test
Checking of protection relays and settings
Functional testing of devices
Checking of conformity with drawings and diagrams.
All instrumentation and controls functions shall be tested to prove their correct operation. The set points for adjustable devices, such as sensing relays, shall be recorded on test results and additionally marked within the switchboard, with adjustment points sealed to prevent movement and unauthorised tampering. Calibrated instruments shall be used for all tests. Results of all tests including dielectric strength, and the instruments used to conduct tests, shall be recorded and a copy provided within the operation and maintenance manual. Where initial tests are unsuccessful, the results of these tests together with the corrective measures taken shall also be provided. All test results shall be signed and dated.
Upon completion of construction of the Medium Voltage Switchgear inspections, where required, and prior to the switchboard being shipped to site, arrange for pre-delivery inspections of the switchgear at the factory.
Proposed commissioning test schedules and protocols shall be submitted for approval in conjunction with shop drawings. Protocols shall be fully detailed and include, but not be limited to, schedules in tabulated format covering:
proposed calibrated and where permissible non calibrated, instruments to be used and the tests for which each shall be used
functioning of all switchgear to confirm correct and uninhibited operations over all phases
injection tests for all protection with 0%, 50% and 100% of full scale readings
confirmation of all derived metered values, such as, kWh, Power Factor, kVA, etc
set points for all adjustable devices such as sensing relays, timers and the like
function of all control circuits with all inputs and outputs for simulation listed, detailing the specified response and with space for recording the actual response
functioning of all monitoring points provided either for immediate or future connection to internal or external systems
other functional requirements where specified
space on each page for signature and date of witness tests
Factory testing of controls shall be accomplished using a purpose made and labelled test panel with all required inputs simulated by the operation of switches, and all required outputs indicated by lamps, or an equal arrangement as approved.
Factory testing shall include the demonstration of monitoring systems specified as part of this contract, in conjunction with metering, controls and function testing detailed above.
Once testing has been completed, factory test results shall be verified and submitted for approval. Following that approval a witness test shall be arranged with the Superintendents Representative. One week's notice should be allowed for the arrangement of witness testing.

# GENERATOR & FUEL SYSTEM

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# 1. Diesel supply systems

## 1.1 Systems

**Diesel supply systems**

## 1.2 System performance: Design of petrol and diesel supply systems

### 1.2.1 Filling Point

Product- Diesel
75mm fitting
50mm high level float set
pad mountable, open construction pumpset with weatherproof and lockable fill box with 7 gallon spill containment sump and weatherproof and lockable control box
Quick disconnect hose coupling with dust plug
Inlet shutoff valve
Check valve
Outlet shutoff valve
Line purging valve
Spill sump drain valve
High capacity transfer pump 500 L/min
Automatic controller, described below
Ground stud

**Controller Includes:**

High level floatset for installation in 2" tank fitting minimum
Tank Full visual alarm
High Level visual alarm
Tank Leak alarm
Audible alarm horn activated by alarms above
Power Available indicator
Control Power On-Off switch
Pump Start/Stop push-buttons
Top-off/hose drain mode push-button
Pump starter
Type 3R control enclosure (fuel oil version)

### 1.2.2 Self Bunded Fuel Storage Tank

Designed to UL, NFPA Standards
Baffled Internally
White colour
6mm Steel Self Bunded double wall construction

Galvanized lifting lugs
Set of statutory signage
Lockable Inspection/fitting chamber with gas filled hinge support
1x 32mm fill port with filter
1x40mm supply port
2x50 mm return port
1x Air Breather Vents
2x Anodized dipstick
Coating: Epoxy coated at in- and outside and corrosion protected by active cathode protection system.

Earthing: Must be connected to the building's earthing system by a non-corrosive method.

### 1.2.3 Fire Responses:

At a confirmed fire in a generator module, the fuel line to that generator module shall be automatically closed by a fusible link valve.

### 1.2.4 Bulk Tank Level Signaling:

The Fuel System Contractor shall provide multiple status signals:

Actual fuel level (%) (Analog signal per each Bulk tank)

Level fuel storage (low/low) (Dry contact signal) System shall switch to taking Diesel from another Bulk tank, or starts transferring Diesel

Level fuel storage (low) (Dry contact signal)

Level fuel storage (high) (Dry contact signal)

Level fuel storage (high/high) (Dry contact signal) Alarm to upper layer system, start transfer of Diesel to another Bulk tank

### 1.2.5 Fuel Pumps

Each pump section consists of:

Suction header
Distribution header
Diesel pump 50 L/min
Valves
Non return valves
Filters
Flow transmitters
Pressure differential transmitter

Connection Type:
Double walled steel pipes
Diesel Pump:
Type: Frequency controlled
With local override (bypass) switch: "Off" / "Auto" / "100% on", suitable for the situation and preventing water hammer in pipelines.
Frequency controller shall not be integrated in the pumps. These are required to be separated.
Overheating contact or pump failure contact must be included.
It's allowed to measure current in the Fuel Control Panel and to base a malfunction on this parameter.
The follow signals (alarm/status) must be available for upper layer system:
Status pumps (on/off).
Failure pump A.
Failure pump B.
Status valves (open/close).
Vacuum system leak detection.
Status by-pass valves.
Filter pressure difference.
The signaling to an upper layer system shall be provided. These contacts must be made available in the Diesel Pump room or implemented in a communication protocol approved by the Employer

### 1.2.6 Fuel Polishing System

To prevent the diesel fuel from degrading in performance the fuel supply system shall be equipped with a common fuel polishing system, suitable for the size of the bulk tanks.
The system shall comply with the following minimum requirements:
Fuel conditioning against the development of bacteria, algae, and eliminates the build-up of water in the storage tanks
Centrifugal filtering process
Recirculation filtering process
99,6% removal of the water
Fuel Cleaning particles down to 10 microns
The follow signals (alarm/status) must be available for upper layer system:
General alarm
Service filter alarm
Water in fuel alarm
The alarm contacts of the system shall be signaled to the Fuel Control Panel. This control panel will communicate this with the upper layer system. The signaling to an upper layer system shall be done by the General Contractor.

Time settings when fuel shall be purified can be programmed in the Fuel Control Panel.

### 1.2.7 Fuel Control Panel:

It shall be hard wired to receive power and control system from upstream Master Control Panel and control all functions of the Fuel system

### 1.2.8 Supply pipelines:

Steel pipes and fittings for liquid fuels

### 1.2.9 Electrostatic protection:

In accordance with EI Model Code of Safe Practice Part 21 Guidelines for the control of hazards arising from static electricity.

## 1.3 System performance

**Design of petrol and diesel supply systems**

Design: Complete the design of the petrol/ diesel supply system.
Location of tank: Above ground.
Leak detection: Class I to BS EN 13160-2.
Pipelines
Suction systems: Select pipelines that can withstand the external forces due to atmospheric pressure without collapsing.
Pressure systems: Select pipelines that can withstand maximum pressure fluctuations without bursting.
Requirement: Submit proposals including detailed design drawings, technical information, calculations and manufacturers' literature.

## 1.4 Products

**Steel pipes and fittings for liquid fuels**

Pipes
Standard: To BS EN 14125.
Class: Class 1.
Temperature class: Class T2.
Protection: Secondary containment.

## 2. Generator and enclosure

**Products**

**Generator and enclosure**

### 2.1 Standards

ISO 3046: Reciprocating internal combustion engines - Performance, Declarations of power, fuel and lubricating oil consumptions, and test methods.
ISO 8528: Reciprocating internal combustion engine driven alternating current generating sets (Parts 1 to 13).
ISO 8178: Reciprocating internal combustion engines –Exhaust emission measurement
ISO 13850: Safety of machinery – Emergency stop function – Principles for design.
IEC 60034 (Parts 1, 2-1, 5, 8, 9, 11, 15, 18-1 and 22): Rotating electrical machines.
IEC 60204 (All parts): Safety of machinery – Electrical equipment of machines.
IEC 60502-4: Power cables with extruded insulation and their accessories for rated voltages from 1 kV (U m = 1,2 kV) up to 30 kV (U m = 36 kV) – Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (U m = 7,2 kV) up to 30 kV (U m = 37 kV).
IEC 60529: Degrees of protection provided by enclosures (IP Code).
IEC 60947 (All Parts): Low-voltage switchgear and control gear.
IEC TR 61000-5-2: Electromagnetic compatibility (EMC) Part 5: Installation and mitigation guidelines Section 2
IEC TR 61000-6-2: Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments
IEC TR 61000-6-4: Electromagnetic compatibility (EMC). Part 6-4: Generic standards. Emission standard for industrial environments
IEC/TR 61439 (All parts): Low-voltage switchgear and control gear assemblies.

### 2.2 Electrical:

| | |
|---|---|
| Engine and Alternator Power: | **As stated in Bills of quantities** |
| Overload requirements: | None are required Derating |
| factors: | None are allowed |
| Installation altitude: | **1800m above sea level** |
| Power factor: | 0,8 inductive to 0,96 capacitive |
| Voltage: | 415V with variable output Voltage setting +/- 5% |
| Speed: | 1500RPM |

| | |
|---|---|
| Frequency: | 50Hz |
| Earthing: | TN-S |
| Start delay: | 10 seconds (programmable) |
| Start-up time: | 9 seconds (maximum) |
| Load step capability: | 0 - 60% minimum |
| Rating: | Prime Power |
| G-class: | G3 |
| Engine: | Emission optimized |
| Alternator: | 2/3 Pitch Xd'' |

Note: Short circuit current of 2,5*INominal / 3 seconds must be possible for inrush of M-works components.

| | |
|---|---|
| Synchronization: | Included |
| Parallel operations: | Included |
| THDi on output: | Under **8%** |

Split Board: To include 1No. 800A incomer and 3No. 800A outgoers.
Cable from generator to split board: Included
Cable from split board to paralleling panel: Excluded.
Trapped key interlock: Included
Generator control panel: Included
Fire detection system inside the enclosure: Included
Fire suppression system inside the enclosure:
Portable fire extinguishers: 2No.
Water mist fire suppression system
Each generator module shall be sprinkler protected using a dedicated double interlock pre-action sprinkler system
A pre-action ICV valve shall be installed outside of the module (by others) connected to steel piping that shall be reticulated from the valve to inside the module. Upright sprinkler heads shall be installed onto the sprinkler branch pipes inside the module.
The sprinkler design for the generator module shall be in accordance with NFPA 750. The table below provides the design parameters for the sprinkler system inside the generator module:
The generator contractor is responsible for the design and installation of the sprinkler system inside the module and to terminate the sprinkler piping at the outside of the enclosure. The generator contractor shall provide a groove coupling with an end cap at the outside of the enclosure.

Security systems (CCTV & Access control) of enclosure: Included
Lighting for the enclosure: Included
Surge protection (external of the enclosure): Included
Lightning protection (external of the enclosure) : Included
Earthing (external of the enclosure): Included
Cable Containment: Included

**2.3 Mechanical:**
Exhaust pipe and silencer: Included
Front build radiator: Included
Roof transit for exhaust: Included
Intake and output damper & attenuator: Included
Fuel system day-tank including pipes, valves to genset, outgoing pumps: Included (8hrs minimum)
Thermal fusible link systems & closing valve: Included

**2.4 Automation:**
Generator control panel (GCP) including auxiliary system control These GCP panels shall:
Monitor the generator in general
Control and monitor the enclosure ventilation
Control and monitor the fuel day tank
Monitoring of the fuel leak detection system
Monitor and calculate the generator fuel consumption
Status relays: Included
Energy measurement: Included
Cabling (Power and control): Included

**2.5 Generator housing:**
Enclosure
Be a purpose-built steel enclosure with a 40 year life span, rust proofed and paint finish to withstand the most recent ASRHAE conditions for the project location. The enclosure shall be fully insulated to R-value 3.7.
The enclosure shall be provided with a durable paint finish, based on a RAL colour, Power coating min 50µm. The minimum IP rating for the complete enclosure shall be IP65
The enclosure shall not have a fire rating.
Sound insulation is required to provide a maximum Sound pressure level of 85 dB at 1m around the enclosure.
The enclosure structural frame shall incorporate lifting eyes, and shall be constructed with a suitable base to allow for rolling the enclosure and to maneuver the enclosure into position.
The enclosure shall incorporate a steel based frame with height adjusters (suitable for adjusting for a slope of 1%), and shall have a horizontal steel strut welded to the outside of the enclosure for mounting lighting fixtures.

To have a steel perforated plate at all doors for mounting of (future) access controls equipment (e.g. card readers)
All doors into the enclosure shall be provided with internal door release and shall have the provision for security access. Door shall be provided with Level 2 door seals, Chrome plated steel exterior handles, and Stainless steel exterior hinges. If double door is provided, passive door shall be fixed with espagnole and active door provided with mechanical lock and door handles on both sides with door closer. Doors shall be equipped with viewing window of 300mm x 300mm (minimum).
Doors shall be sized to allow for equipment replacement.
Have the option to mount cables to the outside of the enclosure.
Have OEM-approved watertight transits, suitable for all pre-installed and later installed connections (cables, busbar and if needed also Chilled Water pipeworks, Sprinkler, gaseous extinguishing, etc.
Watertight transits shall only be made through the enclosure sidewalls. There shall not be any transit through the roof of the enclosure.
Watertight transits such as Roxtec, MCT, Hauff Technic or similar.
The floor of the enclosure shall be constructed as a liquid tight bund to contain the volume of all hazardous fluids in the enclosure. Openings in the bund area shall be avoided.
If any equipment that requires maintenance is to be installed on the roof of the enclosure, then roof needs to be accessible via ladder. Safety measures need to be considered for maintenance of the equipment. The access on the roof and safety measures needs to comply to the local law/regulations. Any required provisions are in supplier's scope.
Roof drainage system shall be provided with gutters and downspouts to the floor level of the enclosure.
Façade grilles shall be rainwater resistant. Rainwater defence performance shall be demonstrated.
Opening and penetrations: As required
Vertical exhaust air channel: As required
Metal frame for exhaust chimney: As required
Room air exhaust enclosure: As required
Fixing, fitting and bracketry: As required

# BUSBAR TRUNKING & TAP OFF

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## 1. Standard specifications

### 1.1 Quality assurance

Contractor is required to have Manufacturer Qualification as per:

ISO 9001;
ISO 14001.

### 1.2 System to be tested per level

| System | L1 Factory Testing (per System) | L3 Start-up Witness Testing | L4 Functional Performance Testing | L5 Integrated Systems Testing |
|---|---|---|---|---|
| All Busbar | YES | YES | YES | YES |

### 1.3 Standards and regulations

The following codes and standards are applicable:
Electrical Installations and Regulations
The contractor shall comply with the rules and regulations of the IEC, EN and Civil Defense Dept. and all local Municipal and Statutory Authorities having jurisdiction over the installation.
IEC 60529 : Protection index envelopes (IP)
EN IEC 61439-1 : Low-voltage switchgear and control gear assemblies
EN IEC 61439-2 : Low-voltage switchgear and control gear assemblies.
EN IEC 61439-6 : Low-voltage switchgear and control gear assemblies, Busbar Trunking Systems
IEC 60950-1 : Information technology equipment – Safety – Part 1: General requirements.
EN-IEC 60754-1 – Test on gases evolved during combustion of materials from cables.
Where no appropriate standard are available, tests shall be carried out in accordance with the manufacturer's standard practice, which shall be subject to approval by the Client and the Consultant.

### 1.4 Environmental Conditions

The mechanical and electrical design of the switchgear shall be based on the following conditions and requirements:
The design shall be based on site and service conditions as specified hereinafter, i.e. ambient temperature: maximum 40°C, daily average of 35°C.
The temperature-rise limits given in Table 6 of IEC 61439-1 shall not be exceeded when the assembly is fully loaded in accordance with the diversity factors as given in Table H.2.
The distribution board shall be designed for indoor installation in a ventilated room.
It shall satisfy EMC withstand requirements. It shall be designed for use in a type A environment according to standard IEC 61439-1. In particular treatment of functional volumes shall ensure that sensitive circuits are separated from power conductors.

The Busbar trunking system shall comply with EN 61439-1/6. Type-test certificates according to the above-mentioned standards must be available. Verified by testing.
The panel-builder shall be ISO 9001 certified and shall provide the certificate.In normal operating conditions, the switchboard shall have a minimum protection degree of IP 41 according to IEC 60529.
Altitude >1000m (Nairobi is at 1750m)

### 1.5 General Description

This specification covers the electrical characteristics and general requirements for a continuous open channel, low voltage busbar/busway system.
The system shall be designed primarily for overhead power distribution of electrical power.
System shall be designed to be installed at critical distribution points to power specific loads, servers, and workstations.
Loads fed from plug-in/tap off boxes, shall be added or removed without shutting down the busbar.
The busbar should be compulsorily hot swappable and compulsorily should be an open channel busbar system which is continuous access and allows plugin units/tap off boxes to be inserted and removed anywhere along its length.
Once installed, the completed system will provide a manageable, economical means for power distribution and communications.
The Busbar system shall comprise and include the following as a minimum:
Busbar trunking in TN-S circuits shall be five core. The PE conductor shall be PER (PE Reinforced).
Protection degree at least IP55.
Contractor Busbar trunking will be always responsible for the phase sequence.
Busbar trunking colour RAL9001
IEC 61439-1/9, Verified by testing.
Short circuit capacity to be derived from short circuit calculation.
The busbar trunking housing shall be non-ventilated and at least of 1.5 mm thick for protection against dust accumulation and mechanical damage. The enclosure shall be of hot dip galvanized and pre-painted sheet steel.

## 2. Busbar Construction

### 2.1 General

The Busbar trunking shall be verified by testing in accordance with IEC 61439-1/6.

All short-circuit withstand strength and temperature-rise limits tests shall be certified by an independent test authority and performed with switchgear installed in real conditions.

Horizontal runs of busbar trunking system shall be supported by hangers at every 3 meters. Vertical runs of busbar trunking system shall be supported by hangers not more than 4m apart.

The lengths provided on the project shall be as recommended and selected by the manufacturer to meet the project requirements.

The lengths shall be available in lengths up to 4 meters with option to extend.

The top of the busbar shall have a slot running the length of the busbar to provide attachment points for installation of the busbar.

The hangers provided with the system should not in any way interfere with the tap off installation.

Various hangers need to be available for different type of installations to meet individual site needs.

The bottom of the busbar shall have a continuous opening to accept the tap off boxes. This opening shall pass the UL and IEC hypothetical finger probe test. The entire opening with the exception of the small area for the joint coupling, shall be available for plug- in/tap off unit insertion.

Housing: The busbar housing sections shall be constructed of extruded aluminum and provide 100% rated system earth path that meets IEC61439-6 standard. Steel housings shall not be permitted.

The housing shall have a means of containing the smart cabling along its length when required.

Conductors: All conductors for amperage ratings up to 1250A shall be made of 99.9% pure aluminium . All conductors sized to handle 100% of the busbar rating under continuous operation up to the maximum ambient temperature. The conductors shall be electrically isolated from the housing.

Shall be capable of carrying rated current continuously up to an ambient temperature of 40°c.

Isolated earth: An isolated earth is to be supplied if shown on the drawings. This is required for the system where earth isolation is required, such as systems with heavy microprocessor-based loads or large computer-based installations.

Oversized neutral for systems with non-linear loads. The additional capacity prevents overloading caused by zero sequence harmonic currents –available options are:

160A – 200% Oversized Neutral

250A – 170% Oversized Neutral

400A – 150% Oversized Neutral

630A – 125% Oversized Neutral

Insulators: Internal conductor shall be electrically isolated from the housing using full length individual insulator of IEC and UL certified halogen free, non-flammable thermoplastic. The insulation must have excellent dielectric strength and is impact resistant.

### 2.2 Connections

The design of the switchboard will be such that it will be possible to enter the power cables or busbars trunkings by the top and bottom without modifying busbar location or switchboard height.

Conductors shall be of hard drawn 99% purity aluminium.

The insulation used on the busbar shall be class"B" polyester material rated at 130°C and halogen free.

Both ends of aluminium conductors shall be fitted with bimetal copper/aluminium laminate riders, electrically welded.

### 2.3 Installation/Commissioning

The manufacturer shall provide all recommendations concerning transport and site acceptance.

### 2.4 Protection of Persons/Ergonomics

All live parts placed directly behind the end or rear removable panels or presenting a risk of accidental contact shall be covered with insulating obstacles made of self- extinguishable halogen-free material.

### 2.5 Operation/Maintenance

The Contractor shall dispose of the necessary proximity to make available personnel and parts required for intervention.

The manufacturer shall provide the suitable procedures and can, if necessary, provide his logistic assistance.

The Contractor undertakes to propose spare parts for a lifetime of 10 years as from the time of end of marketing.

## 3. Battery Tap-off Boxes (String Isolators)

### 3.1 Battery Circuit Breakers String Isolators

To IEC 62485.2

Each battery string shall have its own circuit breaker such that it may be taken offline for maintenance without affecting the remaining battery strings. Battery circuit breakers shall also

isolate the battery bank in event of a fault. All protective devices shall be mounted in a prominent position and labelled to approval.

All circuit breakers shall be from the same manufacturer.

The String Isolators shall be supplied by the Electrical Contractor/Busbar manufacturer, and installed above each Battery Rack, within individual Tap-off Boxes, mounted on 1000A DC Busbar system.

The UPS Contractor shall provide all necessary technical information and assistance to allow the Busbar Contractor to select the required associated with the provision of the String Isolators Circuit Breaker technology, to suit their DC system, to the Electrical Contractor.

Review time shall be provided to review the technical busbar/String Isolator tap-off submittals from the Electrical Contractor, to ensure the system meets the requirements of their DC system.

### 3.2 MCCB Devices within Tap-off

Moulded case circuit breakers (MCCB's) shall be plug in base type and shall incorporate the following features:
incorporate similar features as listed for miniature circuit breakers
be provided with extension rotary handles at the face of the panels
comply with EN 60947.2.
be rated at a minimum breaking capacity greater than the design prospective fault level as indicated in the Switchboard Schedules or switchboard single line drawings
include trip units
plug in MCCBs shall be interlocked such that it shall not be possible to remove a plug in MCCB from its plug in base without first switching the MCCB to the OFF position
On all DC devices shall be 4 pole devices

### 3.3 Tap-off System Monitoring

All devices within the Tap-off Units shall be equipped with the communication function via a prewired connection system and a Modbus network interface.

Refer to Figure 1 below.

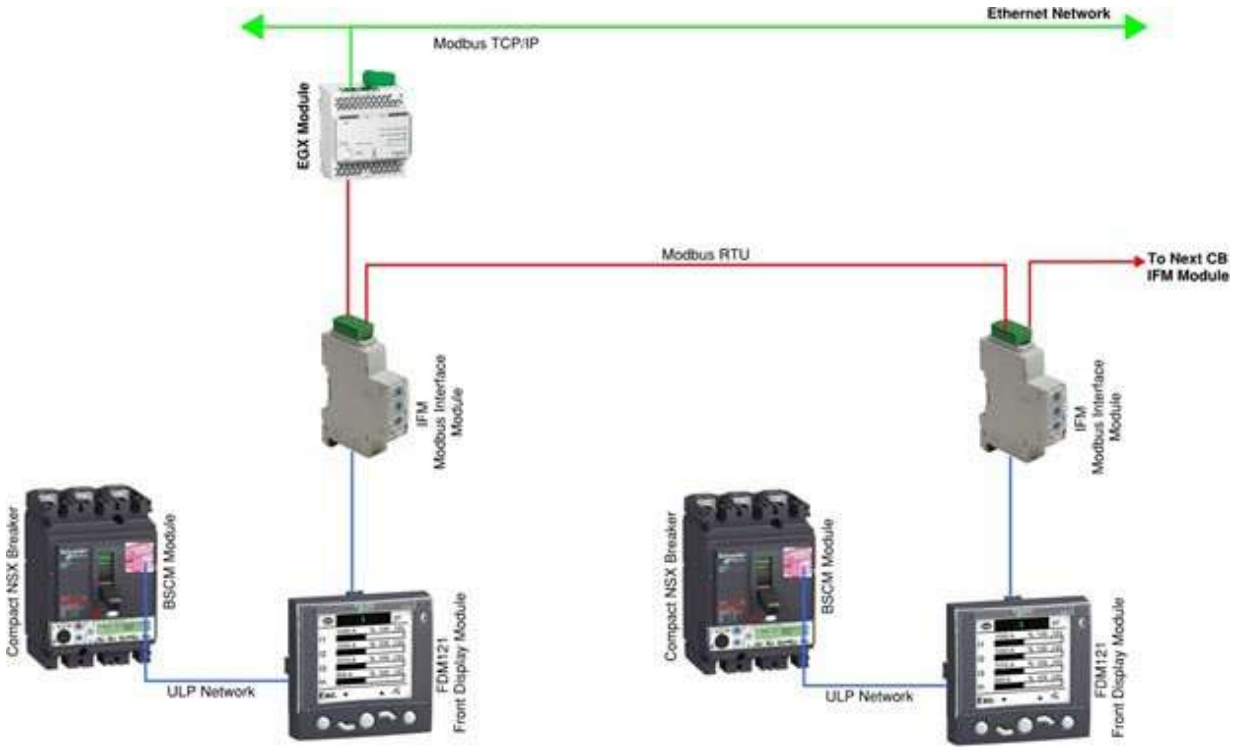



*Figure 2*

The following functional levels are accessed on MCCBs devices (with trip units)

Communication of status indications;
Using the BSCM module, the following information is accessed:
ON/OFF position (O/F)
trip indication (SD)
fault-trip indication (SDE)
Communication of measurements;
Access to all available measurement information including on the Micrologic trip unit:
instantaneous values
demand values
maximeters/minimeters
energy metering (if available)
demand current and power
power quality (if available)
Communication of operating assistance
protection and alarm settings
time-stamped histories
event tables
maintenance indicators Construction and Installation

### 3.4 Construction products

All construction products supplied or employed to complete the electrical installation shall conform to the requirements of the Construction Products Regulation (CPR) and the Construction Products Directive (CPD).

### 3.5 Cabling

All cables shall fully comply with international standards.

**All cables shall Comply with the Construction Products Regulations (CPR). The minimum accepted category shall be CCA. All cables shall carry a CE mark along with a formal Declaration of Performance (DOP) verifying compliance.**

All cables and wires shall be on strain-relief
All cabling systems and all cables shall always be mounted fully horizontally or fully vertically
For connecting vibrating objects the Contractor shall use flexible cables with flexible core wires. The transit from solid core to flexible core cables shall be made in a junction box or a local power switch box.
If a vibrating device has more cables connected, the use of spiral hose is required.
Connections between a solid core wire and a flexible core wire shall be done with screw wire terminals for cores from 1.5mm2 to 6mm2. Larger cables shall be connected with connection blocks for crimping wire terminals (so called "cable shoes").
All control wiring to be provided with wire numbering.
Terminals that shall be exposed to temperatures over 40°C shall be heat resistant, locally connected with rubber mantled cables.
All cable transits from one kind to the other shall have clear indication labels on both sides of the transit.
Cable transits going in or out a junction box shall be made with cable glands.
All cables with flexible core wires shall be connected by use of crimping wire terminals (so called "cable shoes").
It is allowed to connect cables with connecting terminals in junction boxes.
All power cables, data cables and control cables shall consist of Low Smoke, Zero Halogen cables.
Functional integrity related cables shall have their own dedicated cable routings.
All other cables can be combined in cable trays, using dividers for separating the systems in different compartments.

### 3.6 IP-Class

Items with a required IP-class shall be equipped with cable glands for cable entries, to maintain the required IP-class.
All mounting materials and other small materials used for a component must be designed not to lower the IP-class of that component.

### 3.7 Wall, Floor and Roof Penetrations

All systems that pass-through walls, ceiling and/or floors must be finished by Contractor in a way that the total acoustic, water- and fire-resistant value of that wall/ceiling/floor shall not be lowered in any way.

All requirements also count for unused holes or transits, placed during the works. All transits through walls and/or floors for electrical services must be realized with the same resistance classes as that specific wall.

### 3.8 Fire Resistant Transits

When cable conduits pass through wall penetrations, these penetrations shall be made fire resistant according to that walls fire resistance class. All transits shall be provided with fire resistant foam, which shall be frothing at high temperatures. All transits shall be indicated with a sticker on the fire-resistant material.

This sticker shall be provided with a unique code.

All fire-resistant transits shall be closed by a specialist Contractor. As a part of the "as built" drawing set, a transit log shall be provided. All transits shall be described in a transit log, including:

A certificate of compliancy to all relevant standards
All unique codes, as indicated on the stickers near all transits
The fire resistance per transit
The exact location of all transits
A picture of each transit
A signature for approval of the specialist Contractor
The log shall also be used for keeping modifications after completion.

### 3.9 Soundproof Transits

All acoustic properties of walls/ceilings/floors shall be used as a standard for the requirements of transits. No transit shall lower the acoustic properties of that specific equipment.

All soundproof transits are part of this scope of work.

### 3.10 Waterproof Transits

All locations where cables/ducts enter or leave the building shall be made in waterproof transits. All watertight transits shall be closed by a Specialist Contractor.

The container throughputs have to equipped with proper glands by the use of Roxtec, Hilt or equal.

## 4. Operating Instruction to Owner

The Contractor shall instruct the Owners staff how to make carry out necessary maintenance and how to operate each system.

For the delivered equipment, the Contractor shall provide the Owner with three copies of complete operating and maintenance instructions for equipment at the time of delivery of the equipment. Equipment will be rejected unless accompanied by instructions.

Instructions shall be bound in a suitable loose-leaf booklet or binder, and shall include;

prints of the following drawings

schedules of equipment installed

general layout

wiring diagram of control panels

non-dimensional layout, showing location of all electrical devices

Operation instructions, including start-up and shutdown procedure

Maintenance instructions, including preventive maintenance instructions for components of the equipment

Lubricating instruction and recommended cycle of lubrication

Complete parts list, showing manufacturer's name and catalogue number

Complete list of recommended spare parts for 2 years of operation with price list for each item of equipment.

The Contractor shall prepare a draft operating and maintenance manual for discussion with the Consultant prior to finalizing the documents.

Time reservation for operating instructions shall be:

5 days of 8 hours for Contractor

## 5. Warranties

The Contractor shall include in his offer spare parts and special tools for maintenance sufficient to cover proper maintenance of the entire works for a period of one year starting from the acceptance date. The manufacturer shall guarantee the availability of spare parts for a minimum period of 10 years.

The Contractor shall provide a detailed description of the required maintenance work during the first 10 years of operation. Contractor shall include in his quotation a detailed proposal for a maintenance contract, which includes for all required maintenance work as described.

The proposal shall include, but not be limited to;

Detailed description of the maintenance works required

Description of the local service organization.

All systems shall be warranted during twelve months after the commissioning by the Contractor with a maximum of eighteen months after delivery ex-works whichever is the sooner.

## 6. Execution

### 6.1 Erection

The Contractor is responsible for delivery on site in coordination with the Fit-out contractor

Any parts of the UPS system damaged during transportation to site shall be corrected at no extra cost to the satisfaction of the Engineer.

### 6.2 Factory Acceptance Testing

The Busbar system shall be tested prior to its being shipped from the factory. Copies of the proposed detailed test sheets shall be submitted for approval prior to factory testing being carried out.

Load and performance tests shall be carried out at power factor between 0.8 and unity and the power factor shall be recorded.

### 6.3 Site Testing

All Busbar shall be retested on site to insure their reliability after shipment. Coordinate with electrical contractor.

# WHITE SPACE CONTAINMENT

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## 1. SUMMARY

A pre-engineered and fully integrated system specifically designed for medium to large data center applications. The solution should combine all the best-in-class equipment inside a single enclosure that ensures the successful operation of data center.

This section highlights the specifications for one module (PoD) as required by the user. A total of 2 pods of similar design are required inside the data centre

## 2. TECHNICAL SPECIFICATIONS

A single and fully enclosed infrastructure solution for data centers that are assembled at installation site and balances the capacity, space utilization, availability, and efficiency in data center practices. The solution has features such as precision cooling, power management, monitoring and control technologies, and provisions to integrate fire suppression in an enclosed system. The commissioning of the complete system takes only few weeks after installation to be fully operating. An overview of the complete architecture of the solution should be as below:

| **Parameter** | | **Specification** |
|---|---|---|
| Size | Corridor width | 1200 mm |
| | Machine external dimensions (L × W) | 8800 mm × 3400 mm (bare unit) |
| Overall key indicators | Density | Average density |
| | Power architecture | Centralized power supply |
| | Cooling architecture | Air cooled DX based row cooling units, independent cooling modules (6 Quantity) |
| | Structured cabling | Column header network wiring closet |
| | Fire architecture | External fire, third party mapping provision |
| | Total number of U-bit single module | 840U (single rack 42 U, including the network rack) |
| | Redundant power supply | 2 N |
| | Average power consumption of a single rack | 5 kW |

| Parameter | | Specification |
|---|---|---|
| | IT power consumption single module | 100 kW |
| | Single refrigeration module | 35 kW |
| | Altitude | < 1000 m (air conditioning derating > 1000 m) |
| | Mounting | Raised floor/ground installation |
| Voltage standard | Voltage | 380 VAC to 415 VAC (±10%), 3 N |
| | Frequency | 50 Hz/60 Hz |
| Color | | RAL7021 |

## 3. SUBMITTALS

Submittals are provided with the proposal and include dimensional/installation, electrical connections data, and circuit drawings.

## 4. WARRANTY

A warranty against defects in component and defects in manufacturing is provided with the system.

## 5. QUALITY ASSURANCE

The system is designed and manufactured in compliance with world class quality standards. The complete architecture of the solution is ISO 9001 certified.

## 6. PRODUCT DESCRIPTION

The complete data center system architecture is a structured assembly of the following pre-engineered components inside a single housing.

**Enclosure:** Access doors (includes power distribution, remote monitoring system, network switch), cable trunking passages, and roof top.

**Equipment:** Server and network racks, precision air conditioning units, and control panel.

The process of on-site assembling and on-site installation of system is easy.

### 6.1 Enclosure

The enclosure assembly is pre-designed with high grade aluminum components that are durable yet light in weight. The access door and roof enable the isolation of the hot and cold

aisles and the linkage opening function. Control access must be allowed only to authorized personnel. A bridge from the door frame is required to achieve the connection between the enclosure management functions and the capacity of the network rack to the circuit.

**a) Access Doors**

The access door enclosure as double lead sliding door made of toughened glass construction and a frame housing on all four sides. The sliding arrangement of the doors is semi-automatic. Wherein the opening of the doors is done manually whereas the closing of the doors is done automatically through a motor, gear, and a guide rail mechanism.

The sealing mechanism of doors is through electrically charged with magnetic strips, which is a part of the access control feature for the complete system. The doors function as a part of containment for the separation of cold aisle and hot aisle that facilitates efficient air movement through the server racks.

The access door frame has housing for power distribution terminals of the containment, utility/CRAC power distribution, hardware for remote monitoring system, NVR, network switch so 100% usable white space is provisioned.

**b) Cable Management Passages**

There is provision of self-organization and channelizing arrangement of power cabling and control cabling connections from the power distribution terminals (built in door frame) to the designated terminals. There is a cable management passage located on the top of the racks that are prefabricated from the factory. Each cable management passage is pre-designed to fit conveniently with the cable entry passage inside the rack. The cable management passage facilitates in easy identification and replacement of the cables, troubleshooting, future expansion provisions, and organized cable management for the complete system.

**c) Roof Top Plate**

The roof top plate is a made of toughened glass enclosed in a frame structure pivoted at one side. The other side has a mechanism for automatic opening of the roof operated by the controller. The opening of the roof top plate facilitates the airflow movement from the rooms across the servers inside the system that only occurs automatically in the event of a power failure, or the entire air conditioning system shuts down. The automatic opening is designed to integrate with room fire suppression system in the event of fire to allow the fire suppression gas to flow into the containment. The roof top has various accessories installed such as the dome camera, smoke sensor.

**6.2 Equipment**

The equipment primarily signifies the operational aspects of the solution to enable a specific application. This application comprises of the architectural framework of the servers, cooling system, and UPS system. These systems work together to achieve the desired operational objectives with the highest combined efficiency and to maintain a 100% uptime.

**a) Server and Network Racks**

The racks are designed as an ideal utility for 19 in. rack mounted hardware, including servers, voice, data, internet, and other network equipment. A maximum of 16 racks of 600 mm × 1100 mm × 2100 mm (W × D × H) dimension will be accommodated in the solution configuration and a maximum of 4 racks with dimensions of 800 mm × 1100 mm × 2100 mm (W × D × H) will be accommodated in the solution configuration. Each rack can accommodate a server density of 5 kW and combined racks of all the servers in the pod can accommodate a maximum server density of 100 kW.

Each server or network rack includes 2 N ready soft busway system, individual monitoring module, cable management passage, LED lighting, temperature/humidity/door sensor all prefabricated from factory that reduce complexity and time of on-site installation.

**i. Power Distribution System**

Power distribution system is provided to accommodate 19 in. rack mounted hardware. The power distribution system contributes zero footprint in the door frame system in the DC integrated system and provides precise power supply to the all the components within the system. It is a 2 N ready power distribution system and facilitates connection between the end terminal devices through busway system built-in on each rack. The soft busway system facilitates zero cable connection between each rack and is connected using flexible connectors with integrated thermistor for monitoring purpose. The soft busway system is prefabricated on server or network racks directly from factory to reduce complexity of on-site installation of separate busway system.

**ii. Rack Power Distribution System**

The server or network racks have rack mounted PDU, with locking socket (without the need of propriety power cord). The color chassis enables to differentiate between A and B sources and is provided with a minimum of 5 years warranty.

**iii. Monitoring Module**

The server or network racks are provided with individual monitoring module mounted on the top plate of the racks. This monitoring module is the monitoring gateway for each rack to gather monitoring points such as soft busway temperatures, power distribution to rack PDUs, rack environment sensor data, rack lighting control, rack access control, roof top detection, and reserves for future management capabilities. Each monitoring module of the rack is linked through the soft busway system and is consolidated by the centralized containment monitoring system for remote monitoring and control. This eliminates the need to monitor cable connections during on-site installation.

**b) Precision Air Conditioning Units**

The solution should be equipped with the latest precision cooling technology which are placed within the row of the racks and are designed to deliver high efficiency and availability. Itis compact in size to perfectly fit in the changing infrastructure cooling environment. It is ideally suited for rack level cooling and specifically designed for high return air temperatures

to optimize air distribution and maximize efficiency. These features help to achieve both cost savings and energy related savings.

The refrigeration circuit incorporates a high efficiency brushless DC compressor with a crankcase heater, safety valve, filter drier, moisture indicating sight glass, liquid line solenoid valve, and electronic expansion valve.

The compressor uses R410A refrigerant based brushless DC type with variable capacity operation from 30% to 100%, The compressor has a suction gas cooled motor, vibration isolators, internal thermal overloads, manual reset high pressure switch, low pressure and high-pressure transducer, and crankcase heater.

The unit has copper tubes evaporator coil of with hydrophilic coated aluminum fins and a condensate drain pan. The diameter of evaporator coil is 7 mm, rows of coil, and face areas is 1.27 $m^2$ and unit has 3 rows of coil. The hydrophilic coating provides superior water carryover resistance.

The Electronic Expansion Valve (EEV) controls the mass flow of the refrigerant within the refrigerant circuits with high speed and high precision. It is suitable for use as an expansion device in refrigerant circuits with brushless DC compressor, with green refrigerants (that is R410A). The electronic expansion valve provides better control over superheating at the outlet of the evaporator, simultaneously ensures that the liquid must never fill the compressor.

**i. Fan Section**

The unit comprises of eight EC fans. The fan speed is variable and is regulated automatically by the highly intelligent controller through all modes of operation. The EC fans pull air through the coil and are located on the front side of the unit. The EC fan has the characteristics of high efficiency, energy saving, space saving, and hot swappable.

**ii. Rack and Frame**

The exterior steel panels are custom powder coated to protect against corrosion. The wall side panels are separated by the 15 mm, 1.75 $lb/ft^3$ insulation from the airstream. The unit is provided with leveling feet. The perforated inlet and outlet panels have 75% open area for better circulation of the air through the unit.

**iii. Air Filtration**

The unit is equipped with two air filters rated G4 following EU4 that are located within the rack and are accessible from the rear of the unit with filter clog alarm.

**iv. Refrigerant**

The unit is suitable for operation with R410A refrigerant.

**v. Operational Logic for Precision Air Conditioner (PAC) Units**

The row cooling system senses and delivers the exact amount of conditioned air required by each server rack that provides the most optimum cooling performance as the cooling output quickly adapts to the demands of each rack with a built-in load sensing operation logic. Based on the field input devices, the unit operates on a proactive approach to maintain the desired air conditions even during load fluctuations.

A minimum of 4 temperature (T) sensors and a minimum of 4 humidity (H) sensors are provided for temperature and humidity reading at rack level for each cooling unit (for temperature sensing logic).

Share and use monitoring remote temperature and humidity sensor (3 temperature and humidity sensors at front of rack and 1 temperature and humidity sensor at back of rack) to perform optimize thermal control over the thermal teamwork.

Each value, temperature, and humidity can independently be enabled for controlling the cooling output.

Differential sensors are mounted in the calibrated holes which modulate the cooling capacity and airflow. (For pressure sensing logic).

The average or the highest value is calculated in accordance with the number of enabled sensors.

**c) Control Panel**

The system is mounted with a high end technologically advanced control panel which has a 15 inch panel mounted and 95 inch door display for viewing the operations and the performance of the entire system. The local display helps administrators or the concerned facility managers by presenting information to achieve the operational objectives of the application.

The controller has capabilities which displays the detailed working of every component working some of which are mentioned below:

**Thermograph:** Indicates the temperature conditions of the air in both the cold aisle and the hot aisle at the top, bottom, and central locations of each rack. This gives insights of the detailed working of the precision air conditioning system.

**IT Load Profile:** Describes the present usage of each rack and compares it with the maximum available capacity for each rack to provide the actual loading percentage as per the current load demands.

**System Alarms:** A detailed real time alarms and warnings list is populated and categorized based on the level of criticality with a historical storage of 500 alarms in the web browser interface and the urgencies to be addressed priority wise.

**Power Usage Effectiveness (PUE):** Specifies the real time PUE of the entire data center infrastructure by capturing the efficiency of the complete system.

**95 in. Door Display:** Acts as the sliding door for access and displays all details from the control panel which includes device management, alarm management, power consumption management, statistical analysis, security management, device monitoring, system management, power consumption analysis, environment information, and alarm information.

### 6.3 Accessories

**a) Lighting Switch/System**

The lighting switch is positioned on the door frame at the entrance to the system which assists in the manual operation of the LED lights inside the system. The switch also functions as an emergency activation of lights in the case of detection of any critical alarms which require immediate attention.

**b) Sound and Alarm Lights**

The sound alarms for critical warnings are coupled with multicolored LED lights (minimum red, blue, and white colors) inside the system that describes the nature of the alarm with the color of the lights. Red color lights blinking in the system indicates that the alarm is of a critical nature and needs an immediate response from the user. These alarms and lights assist in rapid action to address any issues when the entire system is under a visual inspection by on-site personnel.

**c) Remote Monitoring System**

The monitoring system enables the remote supervision of the entire system over the using a single individual system monitoring. The remote monitoring kit comprises of the entire monitoring architecture. The device is mounted inside the door frame enclosure assembly, providing 100% usable white space. There is provision for an access controller feature connected to the remote monitoring kit which comprises of an access card and a door opening function.

The remote monitoring system has the following features:

Monitoring and management of IT device through IPMI2.0.

Remote monitoring, controlling, managing infrastructures (power, cooling, and environment).

Teamwork management of cooling unit for CRAC units via supply, return, and remote sensor control algorithms.

Provision for real time alarm and alarm notification by email/SMS.

Alarm event actions (Automation).

Data record and event log.

Requests only single IP address and offers RJ45 port for sensor plug and play.

Support IPC <= 4 ways and door access management.

Support asset management and warranty reminder.

User authorization management.

System access management.

Real time CCTV 24/7 recording and playback.

Playback video recording via even log screen at the actual even happening time.

Fully integrated within door access, CCTV, and environmental monitoring system with build in interrelated respond and function to backup each other and to trigger recording and door opening due to any pre-set alarm.

**d) Temperature and Humidity Sensor**

IRM-S02TH temperature and humidity sensors must be positioned within the closed rack door frame assembly of the system. The standard temperature and humidity sensors should be uniformly mounted on both sides of the inner channel in the rack to ensure the accuracy of measurement throughout the enclosed channel. Each server or network rack has 3 temperature and humidity sensors at the front and 1 temperature and humidity sensor at the back. The proper positioning of sensors allows accuracy in thermograph image and optimize performance of thermal control algorithm. The sensor supports MODBUS protocol through RJ45 port in RS485 mode to configure and collect data. The LCD display panel displays sensor address, temperature, and humidity data in real time. The temperature and humidity status are displayed by turns every 2 seconds. When the temperature data is outside the configured data range or the sensor fails, the alarm indicator flashes. When the temperature data is in the range of the configured data, the alarm indicator extinguishes.

**e) Water leak detection system**

The water leak detection system must be a complete monitoring system that reports the presence of water and other conductive liquids. When a conductive liquid encounters the sensing cable, the proposed solution should:

Generate an audible alarm sounds.

Display the distance to the leak on the LCD display and via the web user interface.

Provide alarm notifications via Modbus/BACnet/SNMP/SMTP when configured.

The system determines the location of water on the detection cable and reports the distance from the controller, in feet or meters. Within seconds of detection, the measurement should flash on the display panel, allowing one to take prompt action to correct the leak and prevent damage. To ensure proper protection, the system should continuously monitors operation, signaling system normal, leak detected and cable fault.

The leak detection controller should monitor up to at least 10,000 feet (3048m) of leak detection cable and should have an LCD touch screen that allows the user to configure, monitor, locate, and acknowledge leaks from the front panel. It should also have below key features:

Monitor up to 10,000 feet of conductive fluid sensing cable

Create up to 10 interactive leak detection reference maps

Single compact package that contains a touch screen LCD display

The Leak Detection Cable should have accurate sensing abilities and the ability to read and report the exact position of the leak. Must be made of rugged durable materials resist corrosion and abrasion for long cable life. After a leak is corrected, the cable should shed

liquid quickly for an easy return to normal conditions. The Leak Detection Cable must have the following key features:

Detects any conductive fluid

Patented design helps eliminate false alarms

Quick dry / quick reset

Plenum rated – CL2P

Designed for open areas and to encapsulate areas of concern

Non-conductive polymer construction

Thermally bonded polymer-coated carrier

Highly flexible

Resists bends and kinks

Available in standard lengths with pre-installed end connectors

Helps eliminate false alarms

Strong, durable cable

**f) Infrared Sensor**

Infrared sensor must be positioned inside the system as a part of the motion detection system. The mounting of the infrared sensors is predetermined with the proper mounting of the base and connection wiring provisions provided at the top part of the system in the channels supporting the roof top plate.

**g) Swipe Card Reader**

Either the swipe card reader or the door opening button can be mounted. The swipe card reader allows authenticated access only to the system for the designated personnel. The swipe card reader or the door opening button have the same location of installation and overlapping fitment provisions.

**h) Fingerprint Scanner**

The fingerprint scanner mechanism allows access to enter the containment system only to a selected group of authorized personnel. This scanner is linked to the remote monitoring system to provide the user with full authority to grant or restrict access to the containment based on the criticality of any threatening condition for the system.

The scanner has identification and authorization confirmation functions. It supports Wiegand 26 output and RS485. The features of the scanner should be as below:

| Parameter | Specification |
|---|---|
| Dimension (L × W × D) | 155 mm × 52 mm × 39 mm (±5%) |
| Weight | 0.2 kg (±5%) |
| Working voltage | 12 VDC (±5%) |
| Working current | 300 mA (±5%) |
| ID card frequency | 125 kHz (±5%) |
| IC card frequency | 13.56 MHz (±5%) |
| Reading distance | 50 mm to 100 mm (without other same products interferences) |
| ESD parameter | Air discharge ±8 kV |
| Keypad keys | 12 (Quantity) |

| Status | Indicator |
|---|---|
| Standby | Blue LED light ON |
| Scan the fingerprint | Green LED light ON |
| Illegal fingerprint | Buzzer beeps thrice, red LED and blue LED blinks twice |
| Legal fingerprint | Buzzer beeps once, red LED and blue LED blinks twice |
| Swipe card | Buzzer beeps once, red LED and blue LED blinks once |

## 7. Particular Specifications for DCIM

| **Data Center Infrastructure Management (DCIM) Software Requirements** | | |
|---|---|---|
| **Category** | **Req #** | **Requirement** |
| **General** | | **General Requirements** |
| | G-01 | Support deployment directly on a physical server or as a VMware; Linux KVM or Microsoft Hyper-V virtual appliance |
| | G-02 | System backup shall be automatically be created and pushed to remote storage |
| **Models Library** | | **Built-in comprehensive list of data center equipment manufacturers and models.** |
| | ML-01 | Models Library: Ability to import and synchronize updates to the library |
| | ML-02 | Models Library: Updated monthly with new models by the DCIM Vendor |
| | ML-03 | Models Library: Ability to manage a comprehensive list of data center equipment manufacturers and models and associated attributes including 1. Make 2. Model number, 3. Asset class type, 4. Mounting type, 5. Physical dimensions, 6. RU height, 7. Weight, 8. Front image, 9. Rear image, 10. Data port specifications, 11. Power supply specifications. 12. Airflow direction 13. Server CPU, RAM, Disk details. |
| | ML-04 | Models Library: Ability to add, clone and edit models from the user interface |
| | ML-05 | Models Library: Ability to add new assets with the items characteristics automatically populated. (i.e. the number of data and power ports shall be shown on a new item created from a model in the library and other server specifications like CPU, RAM and Disk size) |
| | ML-06 | Models Library: Ability to develop a company standard library such that only models that are in the company |

| | | |
|---|---|---|
| | | standard library are available for users to select from when adding a new asset |
| | ML-07 | Models Library: Ability to use provided or customize images. Port placement shall be identifiable on the images |
| | ML-08 | Equipment Template Library with pre-defined templates for rack, floor-mounted devices, servers, switches, routers, Rack PDUs, RPPs, PDUs, UPSs, CRAC, HVAC, floor tiles… etc. |
| | ML-09 | Models Library: Ability to define and manage rules for models such that a model specification can automatically change when deployed in different locations |
| **Asset Import** | | **Tools to make integration of existing data easier.** |
| | AI-01 | Asset Import: Ability to track and manage all data center assets including: Cabinets, racks, devices, network equipment, cable plant patch panels, UPS, floor PDU, RPP, panel boards, electrical busways, electrical outlets, rack PDUs, CRAC units, and environmental probes |
| | AI-02 | Asset Import: Import to any field in the database (data mapping) |
| | AI-03 | Asset Import: Conduct validation on each row independently from other rows such that good rows are imported and invalid ones are not. Generate a new import file with all invalid rows |
| | AI-04 | Asset Import: Rename the items names |
| | AI-06 | Asset Import: Import Asset details including custom fields, data ports and connections, power ports and connections and structures cabling, Panel Breaker schedules and data center locations |
| **Asset Management** | | **Ability to know what you have. Store detailed information about your assets and configurations., Easily import, add** |

| | | |
|---|---|---|
| | | **or change information with automated and built-in tools and libraries.** |
| | AM-01 | Asset Management: Add new assets to the database based on the models defined within the library |
| | AM-02 | Asset Management: Clone a single item, single cabinet, multiple items, or multiple cabinets at once |
| | AM-03 | Asset Management: Bulk update the asset information via GUI and import within the database |
| | AM-04 | Asset Management: Track 1. Cabinet assignment, 2. RU position assignment, 3. Asset dimensions, 4. Asset weight, 5. Detailed asset front and rear images |
| | AM-05 | Asset Management: Track asset-related data including: 1. Make, 2. Model, 3. Asset tag (barcode), 4. Serial number, 5. Purchase date, 6. Purchase price |
| | AM-06 | Asset Management: Track asset-related maintenance information include: 1. SLA, 2. Maintenance contract, 3. Maintenance contract start date, 4. Maintenance contract end date |
| | AM-07 | Asset Management: Create unlimited number of user-defined custom fields. Field type shall include pick list, multi-select pick list, Boolean, date and text area. |
| | AM-08 | Asset Management: Ability to lay out the UI for the user defined custom fields and arrange them in sub-tabs and panels with customizable titles. Use drag and drop to arrange the fields in the panel and to size and move the panels. |
| | AM-09 | Asset Management: Store and ability to launce to external links to documents and 3rd-party applications using file, http, telnet and other links |
| | AM-10 | Asset Management: Move items between racks without need for re-provisioning via GUI and bulk import |

| | | |
|---|---|---|
| | AM-11 | Asset Management: Track and manage software applications installed on all device types (physical, blade, virtual) including tracking the application administrator, application user department/owner, and application criticality |
| | AM-12 | Asset Management: Create and manage configuration of data ports including network, SAN, and other data ports |
| | AM-13 | Asset Management: Assign port names, color codes, VLANs, MAC, and IP addresses |
| | AM-14 | Asset Management: Track port physical attributes such as port connector type, protocol, and speed |
| | AM-15 | Asset Management: Create and manage configuration of power supplies including power supply names, color codes, connector type, nameplate Watts, nameplate Amps, budgeted Watts, budgeted Amps, and power factor |
| **Search** | | **Asset database search capabilities** |
| | SE-01 | Search: Ability to search and filter to locate an asset or circuit |
| | SE-02 | Search: Ability to export search results |
| | SE-03 | Search: Ability to limit search criteria based on asset or circuit attributes |
| | SE-04 | Search: Ability to combine search criteria and use operators such as OR, AND, >, >=, <, <= and =. Ability to search on exact match, contains, begins with, ends with |
| | SE-05 | Search: Ability to customize the search results table: re-order columns, sort, change column width, show or hide columns |
| | SE-06 | Search: Ability to save the customization and filter parameters in to named views that can be retrieved by name and shared with other users |

| | | |
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| | SE-07 | Search: Ability to search and locate the best location (cabinet and U position) for an asset, utilizing available space, cooling, network and power capacity to optimize capacity utilization and avoid stranded capacity |
| | SE-08 | Search: Ability to search and locate an IT device to perform power control |
| **Visualization** | | **Know where your assets are. View your entire floor map and drill down on individual assets. Easily search and filter the information you want to view.** |
| | VI-01 | Floor Plan Management: Ability to import and export an unlimited number of AutoCAD and Visio drawings representing the floor layouts for different sites or rooms |
| | VI-02 | Floor Plan Management: Ability to configure a floor map, a bird's eye view of the room layout including row, POD, rack, door (enclosure, cabinet), environmental sensors, IT devices with association to the individual PDU outlets |
| | VI-03 | Floor Plan Management: Ability to render the floor layout in both 2D and 3D view |
| | VI-04 | Floor Plan Management: Ability to link floor map objects to a database |
| | VI-05 | Floor Plan Management: Ability to drill down from the floor map view to show the elevation of rows and racks |
| | VI-06 | Floor Plan Management: Ability to drill down from the floor map view to show individual racks and contents |
| | VI-07 | Floor Plan Management: Color code floor plan objects based on consumption and capacity criteria such as RU space, weight, temperature, humidity, budgeted power, and real-time power |

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| | VI-13 | Floor Plan Management: Set threshold on the color-coded Floor Plan Reports that indicate the status based on real-time measured values and events for available RU space vs. configurable thresholds, occupied space vs. configurable thresholds, cabinet capacity, weight per cabinet, weight capacity per cabinet, static load per cabinet, max temperature per cabinet fronts/rears, measured amps per cabinet, budgeted power per cabinet, and a health map |
| | VI-08 | Floor Plan Management: Color-code floor plan objects and cabinet contents based on the values for a choosen field such as status, model, customer, type, function, etc as well as custom fields |
| | VI-09 | Floor Plan Management: Export the complete or filtered data center inventory into a delimited file (.csv) |
| | VI-10 | Floor Plan Management: Ability to recognize the layers from the imported drawing and toggle each layer on or off and save the layer state |
| | VI-11 | Floor Plan Management: Ability to select one or more layers that depict a cable tray and render it at a given elevation above the cabinets or under the raised floor. |
| | VI-12 | Floor Plan Management: Ability to download the the Floor Layout to AutoCAD format (.dwg), edit it to update changes and re-import |
| | VI-13 | Asset Views: Ability to search on any standard or custom item field and render the results in the 3D view by making the cabinets translucent and showing the only the cabinet contents that match the search criteria |
| | VI-14 | Asset Views: Ability to save one or more set of search parameters into named views for later retrievable. Ability to search such view with other users |
| | VI-15 | Asset Views: Show cable plant and electrical connectivity between floor objects |

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| | VI-16 | Asset Views: Have a user configurable time lapse video to show hourly, daily, and monthly temperature or pressure readings, represented as a thermal map view, similar to radar weather maps |
| | VI-17 | Asset Views: Visualize the thermal map on three planes - top, middle, and bottom of rack |
| | VI-18 | Cabinet elevations: Ability to view multiple cabinet elevations in one view based on multiple criteria including physical adjacent (row), user-defined logical grouping of cabinets, and cabinet RU usage. |
| | VI-19 | Power Circuit Views: Summary view of a given cabinet including budgeted power, heat output, total weight, items in cabinet, available RUs, and largest contiguous RUs |
| | VI-20 | Power Circuit Views: Summary view of the types of ports, total number of ports, and total number of available ports for a given port type |
| | VI-21 | Power Circuit Views: Summary view of connection path information including inlet/outlet, power path connections, amps (r/b/m), and source |
| | VI-22 | Power Circuit Views: Summary view of the power source including the number of breaker poles, the rated/budgeted/measured amps at the power outlet, the origination source, and sub-panel name |
| **Connectivity Management** | | **Map and easily view the power chain all the way from the server up to the power bank** |
| | CM-01 | Data Connectivity: Visually build data circuits between any combination of devices, network equipment, and patch panels including all hops in a single circuit |
| | CM-02 | Data Connectivity: Intelligence to allow and disallow connections based on fixed compatibility requirements such as connector types, protocols, and speeds. |

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| | CM-03 | Data Connectivity: Set connections based on user-defined criteria such as color codes, groupings, and VLANs |
| | CM-04 | Data Connectivity: Distinguish all ports that are in use or ports that do not match the connectivity criteria |
| | CM-05 | Data Connectivity: Manage structured cabling (copper and fiber patch panels) within sites and between sites |
| | CM-06 | Data Connectivity: When displaying a data circuit terminating on a switch, allow to trace through the uplink port(s) to the upstream switch or router |
| | CM-07 | Data and Power Connectivity: Display the circuits in the 3D visualization to visualize the relationship between items |
| | CM-08 | Power Connectivity: Visually build power circuits between power supplies, rack PDU sockets, and electrical outlets |
| | CM-09 | Power Connectivity: Intelligence to allow and disallow connections based on the availability of budgeted power through the entire power chain upstream to the UPS |
| | CM-10 | Power Connectivity: Intelligence to allow and disallow connections based on the ratings of connectors and breakers through the entire power chain upstream to the UPS |
| | CM-11 | Power Connectivity: Intelligence to allow and disallow connections based on fixed compatibility requirements such as power and data connectors |
| | CM-12 | Power Connectivity: Visually trace power circuits including all hops in the power chain |
| | CM-13 | Power Connectivity: Alert the user as to where the bottleneck is in the power chain in the event a circuit cannot be built due to lack of available budgeted power |
| | CM-14 | Power Connectivity: Generate a list of equipment that would be impacted if the selected piece of equipment, e.g. a Floor PDU, Panel or breaker |

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| **Power Management** | | **Easily visualize and manage power.** |
| | PM-01 | Powerchain: Ability to manage all nodes in the power chain including: UPS, PDU, RPP, panel board, busways, circuit breakers, electrical outlets, rack PDUs, rack PDU breakers/fuses, rack PDU sockets |
| | | Powerchain: Ability to manage all nodes in the power chain for Direct Current systems including: DC Power Plant, BDCBB, BDFB, Fuse Alarm Panels and Rack Invertors |
| | PM-02 | Powerchain: Ability to visualize the power path in a graphical diagram, including associated values at each node in the power path including budgeted and measured power |
| | PM-03 | Powerchain: Ability to manage 3-phase power along all nodes in the power chain using various 3-phase conventions including L1/L2/L3, A/B/C, and color codes |
| | PM-04 | Panel Boards: Ability to configure AC and DC panel boards with any number of circuit breaker pole positions using all international conventions including odd/even and sequential |
| | PM-05 | UPS: Ability to create UPS banks and gang multiple UPS units into a single UPS bank |
| | PM-06 | UPS: Ability to define redundancy level within UPS bank |
| | PM-07 | PDU: Ability to track various PDU configurations including PDU with multiple panel boards, PDU with RPPs, PDU with busways. |
| | PM-08 | DC Power: Ability to configure DC Power plants with multiple rectifiers, battery strings and output panels |
| | PM-09 | DC Power: Ability to calculate output power from rectifier based on individual Rectifier capacity, Rectifiers redundancy and allowing for battery charging capacity |
| | PM-10 | DC Power: Ability to calculate estimated Battery Run Time based on the number of battery strings, battery model |

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| | | and specifications, battery age and present load on the plant |
| | PM-11 | Rack PDU: Ability to track various rack PDU configurations, define socket types, and branch circuit breakers/fuses. |
| | PM-12 | PDU: Ability to track capacity: nameplate, budgeted and measured usage for the entire PDU and each individual branch circuit. |
| | PM-13 | PDU: Ability to make configuration updates in bulk including PDU rescanning, decommissioning and maintenance. |
| | PM-14 | PDU: Ability to roll back or restore PDU configurations in bulk |
| | PM-15 | PDU: Ability to change PDU administrator passwords in bulk |
| | PM-16 | PDU: Ability to automatically discover PDUs |
| | PM-17 | PDU: Ability to automatically discover a range of PDUs |
| | PM-18 | PDU: Polling path redundancy |
| | PM-19 | Power Path Report: Ability to provide information on systems dependent on a specified ATS/UPS/PDU/Power Strip |
| | PM-20 | Power Report: Ability to track and report current power costs and associated costs by platform, application or business unit which is useful for bill-back |
| | PM-21 | Power Report: Remote capability for graceful OS shutdown in event of an emergency |
| | PM-22 | Power Report: Remote power supply outlet control (on/off) |
| | PM-23 | Traps: Ability to set a trap receiver |
| | PM-24 | Traps: Ability to forward traps to another system |

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| **Network Management** | | **Ability to see and search for network capacity at multiple points in your network chain** |
| | NM-01 | Network Management: Ability to track various configurations including: 1. stackable switches, 2. chassis and blade switches, and 3. network equipment, 4. SAN switches |
| | NM-02 | Network Management: Ability to assign VLANs to network switches |
| | NM-03 | Network Management: Ability to assign one or more IP addresses to a port of a server. Ability to assign IP addresses on multiple ports of a server. Ability to assign the same IP to multiple ports of a server to achieve teaming or bonding. |
| | NM-04 | Network Management: Ability to assign IP subnets to VLANs |
| | NM-05 | Network Management: Ability to create and manage IP subnets |
| | NM-06 | Network Management: Ability to create and manage pools of static IP addresses using an intelligent IP address calculator |
| | NM-07 | Network Management: Ability to assign subnet names, subnet suffix, and color codes to IP subnets |
| | NM-08 | Network Management: Ability to assign IP addresses from pool of available IP addresses to device ports using pre-defined subnets. |
| **Real-time Monitoring** | | **Tools to ensure uptime and availability** |
| | RT-01 | Real-time Monitoring: Display real-time monitoring in a unified view |
| | RT-02 | Real-time Monitoring: Capability to create customized dashboards for event viewing (site, rack, asset power consumption at port level) |

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| | RT-03 | Real-time Monitoring: Define and monitor for thresholds violations on inlet current, unbalanced current %, rack pdu breaker state change, rack PDU breaker current, temperature, humidity, and rack power load. |
| | RT-04 | Real-time Monitoring: Enable user-defined polling intervals |
| | RT-05 | Real-time Monitoring: Poll data center devices using SNMP v3 protocol |
| | RT-06 | Real-time Monitoring: Poll power consumption, temperature, humidity, airflow, pressure, contact closures, door locks, water, and smoke continuously based user-defined intervals and store historical results in the database |
| | RT-07 | Real-time Monitoring: Poll UPS, PDU, Remote Power Panels (RPPs), Busways, CRAC, BCMs, and environmental sensors to capture instantaneous data |
| | RT-08 | Real-time Monitoring: Identify hot spots |
| | RT-09 | Real-time Monitoring: Maintain and reference historical environmental data indefinitely |
| | RT-10 | Real-time Monitoring: Collect data for watts, amps, voltage, watt hours, power factor, carbon footprint, cost, airflow, air pressure, humidity, temperature. This data shall be collected at the inlet, outlet, phase, and breaker |
| | RT-11 | Real-time Monitoring: Circuit capacity and utilization |
| | RT-12 | Real-time Monitoring: Thermal & Energy Analytics |
| | RT-13 | Real-time Monitoring: Ability to receive event notifications via http delivery. |
| | RT-14 | Real-time monitoring: Ability for managed PDUS to respond to SNMPv3 Informs, acknowledging their receipt. |
| | RT-15 | Monitor for events(if supported by Traps from your Rack PDUs) including: |

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| | | 1. Server Reachable (Not Reachable, Not Reachable Clear) |
| | | 2. Inlet Over/Under Peak Current (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Sensor Unavailable Clear) |
| | | 3. Inlet Over/Under Unbalanced Current (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 4. Inlet Over/Under Active Power (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 5. Inlet Over/Under Apparent Power (Critical, Warning, Critical Clear, Warning Clear, Unavailable, Unavailable Clear) |
| | | 6. Inlet Over/Under Power Factor (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 7. Inlet Over/Under Frequency (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 8. Inlet Over/Under Phase Angle (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 9. Inlet Over/Under Residual Current (Critical, Warning, Critical Clear, Warning Clear) |
| | | 10. Power Quality (Critical, Warning, Critical Clear, Warning Clear) |
| | | 11. Inlet Over/Under Voltage Line (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 12. Outlet Over/Under Peak Current (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |

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| | | 13. Outlet Over/Under Unbalanced Current (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 14. Outlet Over/Under Active Power (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 15. Outlet Over/Under Apparent Power (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 16. Outlet Over/Under Power Factor (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 17. Outlet Over/Under Phase Angle (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 18. Outlet Over/Under Voltage Line (Critical, Warning, Critical Clear, Warning Clear, Unavailable Clear) |
| | | 19. Outlet Power State (Unavailable, Off, On, Unavailable Clear, Off Clear, On Clear) |
| | | 20. Circuit Breaker Peak Current (Critical, Warning, Unavailable, Critical Clear, Warning Clear, Unavailable Clear) |
| **Workflow and Change Management** | | **Tool to manage, monitor and report on change requests** |
| | WF-01 | Change Management: Generate requests to add, move or change assets and connections |
| | WF-02 | Change Management: Ability to review, reject, or approve requests |
| | WF-03 | Change Management: Generate work orders (tickets), assign to users, reserve space, define due dates, track status, and keep an audit trail |

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| | WF-04 | Change Management: Generate e-mail notifications for every state change in the change management process |
| | WF-05 | Change Management: Produce reports of changes and work order status |
| | WF-06 | Change Management: Integrate with third party ticketing systems to import tickets, assign work orders, and track status updates |
| **Integration** | | **Ability to leverage existing tools. Open web services APIs provide workflow efficiencies** |
| | I-01 | Integration: APIs to enable integration with third-party change management and ticketing systems |
| | I-02 | Integration: Integration with third-party systems to allow it to read and query the database using ODBC views |
| | I-03 | Integration: Integration with CMDB systems to provide asset Item create, read, update and delete |
| | I-04 | Integration: Web Services API that enables integrations with 3rd party systems and allow them to created, read, update and delete on various objects in the database |
| | I-05 | Integration: Web Services API that enables power control and reading of events |
| **Dashboards** | | **Built-in chart views** |
| | RD-01 | Dashboards: Ability to view pre-defined key performance indicator (KPI) charts displaying information on the status of the enterprise health, asset inventory, space, power, cooling and connectivity within the data center |
| | RD-02 | Dashboards: Ability to choose which KPIs to display on their own dashboard view. The information to view must be aligned with their permission set |
| | RD-03 | Dashboards: The pre-defined KPI charts shall include: |

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| | RD-04 | 1. Count of device, number of items, % of used racks, % of active power, PUE, Average Active Power, and Average Inlet Temperature |
| | RD-05 | 2. Asset Inventory KPIs shall include charts for Items Added per Week, Item Age, and the breakdown of Items by Type |
| | RD-06 | 3. Capacity KPIs shall include charts for Number of Used vs Open Rack/Chassis Slots, Top Customers/Racks, Floor Space Usage, Fragmentation |
| | RD-07 | 4. Power Status KPI charts shall include a budget power consumed |
| | RD-08 | 5. Cooling KPI Charts shall include cooling capacity, ASHRAE conformance, Inlet Temperature/Humidity |
| | RD-09 | 6. Connectivity KPI Charts shall include used vs. open network/data ports, top racks with open ports by connector, report of data circuits by number of hops, and connected items by power supply or redundancy. |
| | RD-10 | Dashboard: Set of pre-configured dashboard widgets |
| | RD-11 | Dashboard: Ability to create personal dashboard pages and copy any number of widgets to it and save with the preferred parameters |
| | RD-12 | Dashboard: Ability to share dashboards with other users or set some dashboards in a list of favorites |
| | RD-13 | Widget: Ability to create own custom widgets within the DCIM using HTML |
| | RD-14 | Widget: Ability to use SQL commands to query ODBC tables and displays results in a report |
| | RD-15 | Widget: Downloadable library of custom widgets that can report on virtually any data within the system |
| | RD-16 | Widget: Ability to drilldown on details of widget data and filter based on columns of the additional detail. In addition to filtering, ability to sort, group and re-order |

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| | | columns. When grouping, ability to count, sum, or calculate min, max, and average for each group |
| | RD-17 | Widget: Ability to drill down to obtain detail information about a specific widget display |
| | RD-18 | Widget: Ability to include one or more widgets in a report that can be automatically generated and sent via email on a set reoccurring schedule |
| | RD-19 | Reports: Ability to generate reports from all dashboard widgets, print to PDF, and export reports to Excel |
| | RD-20 | Reports: Ability to generate custom reports |
| **Standard PDU Reports** | | **Software shall be able to support the following standard report templates out-of-box** |
| | SR-01 | Health Map: Used as a base to color code and display racks based on event severity. If the rack itself, or any PDUs or sensors contained in the rack have warning or critical active events, the rack is shown as warning (yellow) or critical (red) level |
| | SR-02 | Active Events: Displays the 10 highest severity and active events in a list |
| | SR-03 | Power/Energy Report: Reports and charts that show: |
| | | 1. Active Power (W) |
| | | 2. Current (amp) |
| | | 3. IT Energy (kWh) |
| | | 4. CO2 Footprint (CO2 Kg) |
| | | 5. IT Energy Cost ($ or other currency) |
| | | 6. Total Energy Including Cooling (kWh) |
| | | 7. Total Energy Cost Including Cooling ($ or other currency) |

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| | SR-04 | Environmental Conditions Report |
| | | 1. Temperature Charts showing Outlet and outlet temperature as well as Outside Air Temperature |
| | | 2. Humidity Charts including Outlet Humidity (%), Outlet Humidity (%), and Outside Air Humidity (%) |
| | | 3. Air Flow and Pressure Charts including Air Flow (m/s) and Air Pressure (Pa) |
| | SR-05 | Rack Failover Report: Shows which racks may completely lose power when one of the two redundant power sources fails or is turned off for maintenance. Simulates a failover situation, and indicates a prediction for your rack's highest utilization percentage. |
| | SR-06 | Device Chart: Displays a default setting of average active power over the past 24 hours |
| | SR-07 | Capacity Forecast Chart: Tracks maximum active power of a data center. Based on the capacity settings, the chart displays how many days of supply remain before your data center reaches capacity, or it will indicate that you have adequate capacity |
| | SR-08 | Capacity Gauge: Shows how much power a selected node of your data center has consumed over a specified time period. The gauge shows a tick mark for minimum, maximum and average power consumed during the time period. The dial points to the real time active power reading. |
| | SR-09 | Cooling Utilization: Cooling charts enable you to compare your data center's sensor readings against industry recommendations - ASHRAE 2011 |
| | SR-10 | PUE Trend Chart: Allows you to see how your data center's PUE has changed over a time period you select. Either daily or monthly calculations may be used. The length of the trend depends on how much data Sunbird's DCIM Monitoring has collected, as well as your selection. |

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| | SR-11 | Facilities Chart: Electrical Utilization - The Facilities chart widget enables you to display active power or energy readings for one or more facilities objects, such as a CRAC, floor PDU, floor UPS, power panel, or standalone meter, in your data center. |
| | SR-12 | Rack PDU Energy Trends including Active Power, IT Energy, Line Current, and Circuit Breaker Current |
| | SR-13 | Rack IT Devices: A list of all devices that are connected to one or more outlets or circuits. Devices that have associated circuits display the current and active power of the circuit. The outlets associated with each device display beneath the IT device. There is a checkbox for each outlet, to select it for power control operations. Each outlet shows a Trend chart showing the active power trend. |
| | SR-14 | PDU Elements: A list of all outlets in the rack, or all outlets on the PDU, respectively |
| | SR-15 | Rack Energy and Environmental Trends: Shows Energy and Environmental Trends, the first and last data points in the trend and the minimum and maximum values in the trend. Environmental, temperature and humidity charts are shown one per sensor |
| | SR-16 | Rack PDU Readings: Power readings for the PDU |
| | SR-17 | Cab (Rack) Detail Report: Displays either a text-based or visual representation of the cabinet elevations for the cabinets. Includes additional cabinet details such as the make, model, size, weight, and so on |
| | SR-18 | Cab (Rack) Resource Report: Information on cabinets and the resources that are associated with them such as power ports, network equipment reports, comm ports, and so on |
| | SR-19 | Items (Inventory) Report: A list of all items being maintained. Additionally, information specific to each item, such as the item type, function, administrator, etc. is |

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| | | captured in this report. This report can be filtered to display information based on criteria you specify |
| | SR-20 | Item Details Report: Displays either text-based representations of items or, when available, images of the items being managed. Includes additional device details such as the make, model, etc. |
| | SR-21 | Power and Network Connections Report: View connection information for all cabinets (All Connections in Cabinets Report) or specific types of connectors that are connected to specific items (What Connects to an Item Report) |
| | SR-22 | Applications Report: A list of the applications installed on the servers that are being managed. Ability to view the report by application or by server |
| | SR-23 | Power Report - View power data for all cabinets being managed |
| **Capacity Views** | | **Tools to determine capacity at every point in the network/power chain.** |
| | CV-01 | Capacity: Summary view of a given cabinet including budgeted power, heat output, total weight, items in cabinet, available RUs, and largest contiguous RUs |
| | CV-02 | Capacity: Summary view of the types of ports, total number of ports, and total number of available ports for a given port type |
| | CV-03 | Capacity: Summary view of connection path information including Outlet/outlet, power path connections, amps (r/b/m), and source |
| | CV-04 | Capacity: Summary view of the power source including the number of breaker poles, the rated/budgeted/measured amps at the power outlet, the origination source, and sub-panel name |

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| **Audit Trails / Logging** | | **Protection of your data center. Ensure only the right people have the access they need. Enable logging to ensure audit trails are available for compliance and tracking.** |
| | AT-01 | Log: Ability to log all asset related changes for auditing purposes |
| | AT-02 | Log: Log is filterable, sortable, searchable |
| **User Security and Access** | | **Tools to ensure only the right people have the access they need** |
| | US-01 | System Administrative Access: Ability to support administrative access through a web browser |
| | US-02 | Role-based Permissions: Ability to provide for global and local role-based permissions for location, cabinet, chassis down to a single asset, including: |
| | | 1. Site Administrator |
| | | 2. Administrator |
| | | 3. Gatekeeper |
| | | 4. Operator |
| | | 5. Viewer |
| | | 6. Manage Library |
| | | 7. Bulk Import |
| | | 8. Request Bypass |
| | | 9. Manage IP Address |
| | | 10. Data Circuit Manager |
| | | 11. Power Circuit Manager |
| | | 12. Power Control |
| | | 13. Create Analytics |

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| | | 14. Create Dashboards |
| | | 15. Create Event Notifications |
| | | 16. Event Manager |
| | | |
| | US-3 | User Accounts: No limit to the number of user accounts that can be created. Each of these accounts shall have their own unique login user name and password |
| | US-4 | User Groups: The system shall support user groups to organize users within the DCIM system |
| | US-5 | Local and Remote Authorization: The system shall provide Lightweight Directory Access Protocol (LDAP) and Active Directory (AD) support |
| | US-6 | Authentication and Encryption: The system shall allow configuration to restrict web interface and SSH access by IP address |
| | US-7 | Defaults: Ability to configure default preferences for location, dashboard and measurements |
| **Cabinet and Containment Security** | | **Electronic access control** |
| | CCS-1 | Electronic access control via RFID cards and card readers. |
| | CCS-2 | Electronic card readers can be decommissioned and recommissioned |
| | CCS-3 | Electronic cards can be activated, deactivated and reassigned to users |
| | CCS-4 | PDUs with door sensors: Door and door sensors are automatically created and mapped to the PDU |
| | CCS-5 | Centralized door control rights and privileges |

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| | CCS-6 | Ability to manually lock/unlock doors |
| | CCS-7 | Reporting on status and audit |
| **Implementation Services** | | **Service offerings to ensure fast implementation** |
| | IM-01 | Services: Software install, setup and configuration |
| | IM-02 | Services: Proof of Concept setup, testing, and user acceptance |
| | IM-03 | Services: Asset and Connection Audit |
| | IM-04 | Services: Data Migration |
| | IM-05 | Services: Turn-Key Service |
| **Licensing** | | **Explain licensing and maintenance models** |
| | LI-01 | Licensing: based on cabinets and monitored devices |
| | LI-02 | Licensing: No license restrictions or limitations on users, sites or floor space |
| | LI-03 | Licensing: No license fee for a non-production or test system |
| | LI-04 | Licensing: Perpetual licenses |
| | LI-05 | Licensing: Availability of software updates, maintenance patches and upgrades |
| **Technical Support** | | **Ongoing support and training options** |
| | TS-01 | Support: Telephone, email, remote, and on-site support |
| | TS-02 | Support: Ability to request solution enhancements |
| | TS-03 | Training: Training and webinar availability |
| | TS-04 | User Group: Availability for participation |
| | TS-05 | Online support portal with the ability to manage tickets, free training videos and customer forum |

# PARTICULAR MECHANICAL INSTALLATION SPECIFICATION

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# 1. Technical Equipment Data Sheets

## 1.1 Ventilation Fans

### A. Supply/ Extract fans

Notes:
Each fan to have Suction and discharge side attenuator to be included on fan.
Each fan must have its own isolator.
Each fan Fans to be selected mid curve and at low noise.
Each fan Fans to have variable speed drives.
Each fan is to be complete with mounting arrangements, anti-vibration pads, non-return damper and flanges
Each fan to have its own proprietary controller and shall be able to communicate with each other. On the loss of 1 No. fan, the other fan will ramp up to meet the commissioned flowrate.
The communications with the BMS will be via Modbus RTU for monitoring only.
Fan with a 300Pa Static, shall have the following Duct Fan:
Duct Fan with EC Motor with the following accessories: 2x Flexible connection, Back Draught Damper, Vib-Isolation mounts.
Controls to be supplied by fan manufacturer and shall utilise a 5-step Controller.

Table 1.3

| **Unit Ref** | **Level** | **Type** | **Air volume supply(m3/h)** | **Supplier** | **Quantity** |
|---|---|---|---|---|---|
| SF- GF-01 | GF | Supply fan | 40 | Sodeca/Systemair or approved equivalent | 1 |
| | | | | | |
| EF- GF-01 | GF | Extraction fan | 40 | Sodeca/Systemair or approved equivalent | |

**1.2 Motorized Fire Smoke Damper Control Panel**

Intelligent Smoke & Fire Damper Control System

The contractor shall provide a complete motorized fire smoke damper installation to ensure that all duct penetrations passing through fire barriers are provided with a motorized fire smoke damper.

Solid state PC based addressable damper control & monitoring system c/w UPS and utilizing LonWorks® technology. Graphical user interface at PC provides control and continuous monitoring of smoke/fire, smoke, fire and balanced smoke extract dampers. System is flexible in terms of wiring, building strategies, number of dampers and number of inputs/outputs to/from the system. Unlimited wiring distances, via network extender kits.

Guaranteed input response time of < 10s on a fully laden 512 damper system to meet the new draft BS EN 12101-9. System is fully compliance tested to EN 55011:1999 + A2: 2002 and EN 61000- 6-1: 2001 and CE approved.

The system shall accommodate the following damper interfaces:-

SFDI – Smoke/Fire Damper Interface (motorized spring return fail safe smoke/fire dampers)
SDI – Smoke Damper Interface (motorized on/off smoke dampers)
FDI – Fire Damper Interface (manual spring return fail safe fire dampers)
3PDI – 3 Position Damper Interface (3 position motorized spring return fail safe smoke dampers)
HDI – 300ºC for 1 hour applications available for all interfaces. Contractor: Safegard or equal and approved

**1.3 Fire Dampers**

General Notes
All ductwork which penetrates a fire barrier will be provided with suitably rated fire smoke addressable dampers.
As required by European Law through the Construction Products Regulation (EU) No 305/2011, all fire dampers installed on or after 1st September 2012 must be CE marked.
The products must meet the requirements described in EN 15650:2010 to achieve CE certification.
All fire dampers must comply with local regulations
All fire dampers must be classified according to EN 13501-3:2005 and tested according to EN 1366-2:1999. As required by the CE mark, performance of the damper in these tests must be clearly displayed on the product.
Dampers tested to any standard other than EN 1366-2:1999 will not be acceptable. Examples of unacceptable testing standards include BS 476 Part 20-24: 1987, UL 555, UL 555C, UL 555S and ISO 10294-1: 1996.
All fire dampers for this project shall have achieved a performance rating of EI 120 (ve-ho) S (traditionally stated as EIS 120) when tested to EN1366-2:1999.

A copy of the test certificate and physical samples of the product must be submitted to the engineer for inspection and approval.
As stated in EN1366-2:1999:
"Fire dampers which are to be installed in both horizontal and vertical constructions shall be tested in both orientations" (Clause 6.3.2)
"A test result obtained for a fire damper installed within a structural opening is only applicable to other fire dampers installed in the same orientation as that tested" (Clause 13.2)
"A test result obtained for a fire damper installed onto the face of a wall or floor is only applicable to fire dampers installed onto the face of a separating element in the same orientation as that tested" (Clause 13.3)
"Determination of leakage at ambient temperature. Undertake this test prior to the fire test" (Clause 10.3)
"The leakage through the fire damper shall not exceed 200m3/hr/m2 (corrected to 20°C)" @300Pa (Clause 11)
"If smoke leakage is required, an additional fire damper, representing the smallest size, shall satisfy the smoke leakage criteria when tested to the procedure described in 10.3" (Clause 13.1) Only products that have passed these tests will be accepted.
The total enclosed precise movement opposed blade drive shall be positioned outside of the airstream for protection against damage, shall be hard wearing and free running.
The actuator damper connection shall be by means of a drive interface mechanism which is independent of the ductwork.
Fire and smoke dampers with appropriate control actuators shall have spring fail-safe control actuators with 24V/230V supply and shall be activated by a local fire alarm detector.
All fire and smoke dampers shall be tested to EN 1366-1 and shall be in compliance with EN 13501-3.
Fire and smoke dampers shall be SFD-EN range as supplied by Safegard or equal and approved.
Fire dampers shall be of proprietary manufacture and constructed from a corrosion resistant material such as stainless steel, or be galvanized or otherwise treated to minimize corrosion.
The dampers shall be housed in a rigid frame of proprietary manufacture, corrosion resistant casing which shall not distort under fire conditions.
Each fire damper casing shall be clearly marked with a permanent indicated of the correct fixing attitude of the damper, the direction of air flow and the side at which access or maintenance openings shall be located.
Fire dampers shall be located in such a position and be of a type that facilitates manual testing and re-setting.
Fire dampers which are supported only by the ductwork in which they are located, or by combustible battens, frames or other methods that do not provide the fire resistance required are not acceptable.

Fire dampers provided in fire resistant ceilings shall be adequately supported either by the ceiling or from the structural soffit. It is not acceptable to form an opening, install a diffuser or grille and fit a fire damper above, if the gap between the ceiling opening and the fire damper does not achieve the fire resistance.
Fire dampers shall be fitted with a suitably sized access door to facilitate manual testing.
Fire dampers shall be provided complete with installation frames. The contractor shall provide details of fixings and supports to the Engineer for approval.
No duct lining or flexible ductwork shall be installed within 1.0 metres of a fire damper.
All fire dampers will provide a level of protection to match that of the fire barrier in which it is to be installed.
120 minute fire barrier – FD to be EI(120ve,ho)S
The data hall floor grilles shall be heavy duty type floor grilles suitable for installation in a raised floor. The structural loading of grille shall be same as raised floor tiles. Edge frames shall be provided with mitred corners suitable for pedestal mounting. Height between pedestal face and face of grille to be selected with permanently factory fitted shims as necessary.
The data hall floor grilles will be a brushed Aluminium finish.
The data hall floor grilles will be TROX AFG type or equal and approved by Consultant.

**1.4 Schedule of Staircase Smoke Exhaust Vents**

The building's fire escape staircase in the Main Data Centre building need pneumatic actuated smoke vents to ensure these staircores can be kept clear of smoke in an emergency. This requires a control panel for each staircase to be located on the Ground Floor of the stairs, just inside the staircase. All vents must be rated for 1 hours @ 400°C or classified as F400-90 and must have a free area equal to 1.0 m². For Building NB02, all vents are located externally on the roof. All staircases must have a ground floor vent to allow bottom to top venting of the stair cases to achieve a smoke free stairs.

The smoke vents should also be equipped with a motorised opening motor to allow the vents to be used as stairwell ventilation. Using a Thermostat located on the uppermost floor landing, the roof vents and the ground floor vents shall open when the stairwell temperature reaches 30°C (adjustable), and close when this temperature reduces to 25°C (adjustable). This control feature shall be incorporated into the purpose built control panel to be located on the Ground floor.

**General**

Each vent must have its own isolator.
Each vent is to be made of galvanised steel with bases insulated with 20mm insulation.
Size of AOV Vent to accommodate 1.0 m² of free area located on the roof. This requires a smoke AOV dimension as follows:
Size of Smoke Vent Make-up damper to accommodate 1.0 m² of free area located on the Ground floor. This requires a vent dimension as follows:

| | | |
|---|---|---|
| Staircore 1: | Ground Floor | 500 x 500mm x1 No. |

A pneumatic AOV incorporating a one time activation through a Fire Alarm activation shall be used for all three Stairwell vent systems. In case of a fire, the CO2 cylinder will open the vent.
For the roof mounted AOVs, builder's upstand to be sized to match the vent. This will be no greater
than 1380 x 1200mm.
All vents to conform to EN 12101-2

**1.5 Grilles**

**Notes:**

All supply diffusers to be complete with insulated plenum and opposed blade volume control dampers.

All grilles to be factory painted to R.A.L. colour of Architects choice.

All grille submittals to be issued to Engineer for approval/comment prior to order. For quantities, refer to ventilation layouts.

Manufacturer: Trox or equal and approved by Consultant

**1.6 Battery Room Extract Fans**

**Notes:**

2 No. Fans in Duty/Duty arrangement
Suction and discharge side attenuator to be included on fan.
Each fan must have its own isolator.
All fans to be selected mid curve and at low noise.
All fans to have variable speed drives.
Each fan is to be complete with mounting arrangements, anti-vibration pads, non-return damper and flanges
Each fan to have its own proprietary controller and shall be able to communicate with each other. On the loss of 1 No. fan, the other fan will ramp up to meet the commissioned flowrate.

The communications with the BMS will be via Modbus RTU for monitoring only. Duct Fans 0.5 m³/s and 300Pa
All Fans with the 0.5 m³/s (1,800 m³/h) and 300Pa Static, shall have the following Duct Fan: Duct Fan with EC Motor with the following accessories: 2x Flexible connection, Back Draught Damper, Vib-Isolation mounts.
Controls to be supplied by fan manufacturer and shall utilise a 5-step Controller. Manufacturer: Sodeca, Flaktwoods or equal and approved.

**1.7 Drip Trays**

Stainless steel condensate drip trays shall be provided below all CRAC units in the raised access floor. Leak detection will be provided in the complete drip tray installation.

Stainless steel condensate drip trays shall be provided below each split cooling unit located in office area comms room. Leak detection will be provided in each drip tray.

**1.8 Fire Extinguishers**

Portable fire extinguishers will be placed in buildings and at all levels as shown on the Consultant Fire Services layouts. Fire Extinguishers will be installed and be in accordance with IS291. Where possible CO2 extinguishers to be used. Dry Powder exit extinguishers are not permitted.

**1.9 VRF System**

**VRF Controls**

The following control items will be required. General
All air-conditioned rooms are to be provided with a wall mounted controllers (1 for each indoor unit) as part of the controls package and mounted 1.6m above finished floor away from direct sunlight and sources of heat. A Central intelligent touch screen controller to be provided for all the indoor units. The heat recovery units will also be controlled through the central controller.
Control Package:
The air conditioning system shall be provided with a fully automatic controls package. The controls system shall comprise of remote wall mounted LCD controllers with full function capabilities including, but not limited to:
24 hour, 7-day timer, on/off Selection for auto/heat/cool/dry Temperature set point Air discharge setting.
Self-diagnostics, defrost mode display Room temperature sensor.
The facility shall be such to enable one (1) or more units to be controlled by one (1) wall mounted controller. A central controller shall be also supplied and shall have functions including but not limited to
Central control
Operation schedule setting Group formation Fault indication Stop / start Fan speed

Temperature setting
Each floor's central controller must have the facility to interface with the BMS system (
A building fabric protection system shall be installed to maintain a suitable temperature within the building while un-occupied (i.e. above 8□C). This system shall bring on the A/C units until the temperature within the space rises above 14□C
Notes:
All units are to run on latest environmentally friendly refrigerant gas.
All external units are to be inverter controlled
Appropriate correction factors to be applied to the outdoor unit capacities, i.e. taking into account the vertical distance between the indoor and outdoor units as well as the length of refrigerant pipework required.
The contractor shall provide dedicated tray for the refrigerant pipework and controls cabling.
The contractor shall supply and install all interconnecting control wiring.
The contractor shall provide a complete condensate system (complete with condensate pumps where necessary). The condensate system shall tie into soils pipework via a tundish and trap to detail.
The A/C system contractor shall select the external condensers allowing for a maximum loading of 100% on the outdoor unit.
All indoor units to be selected on high sensible function, with a minimum off coil temperature of 12oC.
All indoor units shall be selected to achieve the required cooling and heating at low speed.
All indoor units shall be selected to achieve NR25 in Boardrooms and meeting rooms and NR30 in office areas.
A hard wired wall mounted controller will be allowed for each air conditioning unit for pricing purposes. The successful contractor shall liaise with Consultant Engineer for potential master / slave grouping of units in the open plan space prior to procurement. The maximum amount of units controlled from 1 controller will be 2 No.
All indoor VRF Units shall be selected to operate on mid speed and set accordingly during commissioning.
All ducted indoor VRF units shall have EC motors installed for energy efficient operation
The refrigeration contractor and ALL their associated engineering technicians MUST be F-Gas certified and registered in order to carry out refrigeration works. All relevant certificates must be included in the clients safety file. Consultant reserve the right to request said certificates prior to project procurement and remove any non-compliant contractors from the tendering process.
**Manufacturer:** Toshiba or Daikin

## 2. General Requirements

### 2.1 Record Drawings and O&M Manuals

The Contractor shall provide complete record drawings and O & M Manuals in sufficient detail to enable the Employer to carry out proper maintenance. To facilitate submission of record drawings, the Contractor shall keep on site a complete set of all drawings used on the Contract Works, on which he shall mark alterations to the designs shown thereon as such alterations are carried out. THIS PROCEDURE SHALL BE STRICTLY ADHERED TO.

Three prints shall be supplied of each drawing in addition to a soft copy via cloud software containing all drawings in an AutoCAD Format.

Three complete sets of Operating and Maintenance Manuals and record drawings shall be supplied to enable the Employer to operate and maintain the systems correctly. The manuals must therefore contain all necessary technical information on each item of equipment and the associated components which have been used to assemble and construct the system(s).

In addition, manuals for each system must contain information on the design intent of the system, commissioning and testing results and reports of how the components of the system are adjusted to achieve the design intent, line diagrams to show how the system is arranged in the building giving the location of all equipment and components, its control system, how the system must be set in the normal operating mode and in the event of any emergency, routine check that must be made and a list of spares which should be kept and a list of any special tools which may be required.

The manuals must be prepared in such a way that an Engineer without any previous knowledge of the Project may use them to operate and maintain the system.

### 2.2 Contents of Manual

The Operating and Maintenance Manual shall be specific in respect of the complete Contract Works and shall include the following sections.

Section 1 Description
Section 2 Plant and Engineering Systems
Section 3 Automatic Control Systems
Section 4 Operating and Maintenance Procedures
Section 5 Commissioning and Testing

**Section 1** – Description

This section shall comprise of:

A detailed description of each building services system.

General description of all plant and equipment.

A detailed description of the automatic control system.

Design data for the system and for each item of plant which affects the performance of the system.

**Section 2 -** Plant and Engineering Systems. This section shall comprise of:
Detailed technical information as published.
Manufacturers drawings (where applicable) showing all components of the plant item with each component number in accordance with the parts list.
Parts list for each item of plant.
Name plate details for each plant item.
Manufacturers' addresses and telephone numbers.
Complete instructions for ordering replacement parts in a manner that will prevent errors or misunderstanding including order number for each plant.
Installation instructions as provided by manufacturer.
Details of pipework and ductwork materials.
Colour coding identification schedule for each building services system.
**Section 3** - Automatic Controls System
This section shall comprise of:
Wiring diagrams of control panels and external wiring from panel to control etc.
A line diagram showing positions of all sensors (i.e. humidistats, thermostats, pressure stats, controllers and control operators).
Parts list for each different type of control device.
Manufacturers' addresses and telephone numbers.
Complete instructions for ordering replacement parts in a manner that will prevent errors or misunderstanding, including order number for each component item.
Installation instructions as provided by manufacturers.
Section 4 - Operating and Maintenance Procedures This section shall comprise of:
A step-by-step method of starting, operating and shutting down a system and how this affects other systems. The procedure for an emergency shut-down.
A list of routine checks that should be made and the frequency of the checks.
A comprehensive schedule of routine maintenance based on Manufacturer's recommendations for items of plant etc. This program should state clearly what work should be done each day, week, month, year or given number of hours.
A list of tools and keys which will be required in the operation and maintenance of the systems.
Fault finding procedures.

**Section 5** - Commissioning and Test Report

The report for each system shall contain a record of all the parameters which affect the performance of the system at the time of commissioning. A similar report shall be prepared for tests which have been made. The report shall be comprehensive and shall contain a record of the settings of all valves and controls and any other adjustable components so that the system may be reset to the commissioned state by reference to the report.

### 2.3 Commissioning Specification

The specialist commissioning contractor shall undertake the following works to ensure they have an accurate record and condition of the various installations.

Review tender drawings to ensure adequate facility to commission mechanical services installation
Inspect systems to ensure they can be commissioned safely and efficiently
Inspection of piping systems including chilled, condenser, heating and domestic hot & cold-water systems.
Inspection of ductwork systems.
On completion of the above a written report of each inspection shall be furnished within 24 hours of site survey. All site visits shall be coordinated prior to the actual inspection.

The specialist commissioning contractor shall undertake the following works on completion of inspection and issuing of report.

Measurement of airflow and static pressures
Measurement of chilled/heating water flows and pressures
Measurement of domestic water services in any existing systems that are affected by New or Renovated areas. Systems to be confirmed by the Main Contractor.
All Commissioning will be carried out in accordance with the following codes, and best practice:

CIBSE series W for water distribution systems.
CIBSE series A for air distribution systems.
CIBSE series C for Automatic controls.
BSRIA Application Guide 2/89 for water systems
BSRIA Application Guide 3/89 for air systems.
Commissioning contractor to issue sample pre-commissioning and commissioning test sheets for review by mechanical contractor, electrical contractor, main contractor and design team.

Commissioning contractor to issue commissioning method statements for each type of system 4 weeks before commissioning of the first system is due to start for approval by consultant engineer and commissioning manager.

During the commissioning period the Commissioning specialist shall provide a regular punch list (snag list) in a master punch list format that lists the items needing correction on a system by system basis, corrective action needed, date submitted and each date checked ( if more than once) and the date item was corrected.

The Commissioning specialist shall inspect the operation of the facility once per quarter after handover of the facility to offer assistance with any questions regarding maintenance procedures, for a period of one year.

The Commissioning specialist shall be in attendance for pressure testing of the building, fire alarm testing and smoke exhaust systems.

The Commissioning specialist shall issue verification of proper 65performance test of treatment rooms requiring specified 65performance.

In general terms the commissioning specialist shall undertake the following elements of work:

Commission Air Handling Units / Exhaust systems and verify operation is as per design specifications.
Commission Domestic Water services installation, including hot, cold and mains water services.

**Air systems**

The Commissioning specialist shall undertake the following elements for the air systems:
Test and Balance the system components to obtain optimum conditions in each conditioned space in the building. Initial criteria will be to adjust all components to within +10/- 0% of design airflow for supply systems and –10/+0 % for return or exhaust systems.
Final adjustments shall be made to achieve proper pressurization in all critical areas.
A Commissioning test pack, including a report shall be issued to the Main Contractor and Consultant. The test pack shall contain a reduced set of project drawings illustrating the location of each test point listed in the Test and Balance Report, fan performance test sheet, fan curve marked up with actual performance and air balance results.
Balancing specialist shall provide regular punchlist (snag list) in a master punchlist format that lists the items needing correction on a system by system basis, corrective action needed, date submitted and each date checked ( if more than once) and the date item was corrected.
As part of the Commissioning specialists pre-commissioning works:
Carry out pre-commissioning checks in accordance with CIBSE Code 'A' and BSRIA guide AG3/89.2.
Inspect all fan scrolls and remove objects or debris.
Inspect all coils and remove debris or obstructions.
Check the MEDIUMAC systems are installed to the design.
Verify that volume control dampers , fire dampers are properly located, installed correctly and functional.
Verify that supply, return, exhaust and transfer grilles, registers, diffusers, terminal units with controls and filters are installed properly.
Verify that air handling systems, units, duct systems and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc. are correctly blanked and/or sealed to eliminate by-pass or leakage of air.
Prior to systems Start-up, verify that new pre-filters and final filters are installed on all air handling units, fan coil units and return air grilles where applicable.
Check fans for rotation. Confirm that when fans are operating at full load, fans are free from vibration, proper fan rotation and belt tension and confirm elements in motor starters are of

proper size and rating.
Measure and record supply outlets prior to fan or damper adjustment (Initial scan). Issue to report to the Commissioning Manager to confirm the system can be balanced (fan flow 110%, no false indexes).
Carry out air balance as described in BSRIA application guide AG3/89.
Preliminary balancing may be done prior to completion of all systems, however, final balancing must be done with systems completely installed and operating.
Measure and record final total supply air through a pitot tube traverse and record static pressure at traverse point.
All main supply air ducts shall be traversed, using pitot tube and manometer. The manometer shall be calibrated to read two significant figures in all velocity pressure ranges. The intent of this operation is to measure by traverse the total air quantity supplied by the fan and to verify the distribution of air to zones.
Measure and record motor amperage, fan static, filter and coil pressure drops, RPM etc.
Measure final static pressures across each significant system component under full load condition.
Recirculation ventilation systems shall be set-up with the supply system in the maximum mode, adjust minimum outside air damper to design through pilot tube traverse or other approved method of measurement. Verify that any fan tracking, outside air measurement controls etc. are functional and maintaining minimum outside air at various airflow rates other than maximum flow. Outside air quantity shall be –0/+10%.
After completion of testing measure the air handling unit static profile and record all final static's, amperages, rpm, airflows, etc.
As part of the Commissioning specialist ventilation and pressurization verification, they shall undertake the following works:
Balance each supply and return as noted above.
Check and/or adjust pressure relationships so that each positive pressure and each negative pressure area is at least 2.5 pa (.01") (if possible with design airflow) e.g. Positive or negative as appropriate.
Record room pressures / air flow movements on room layout drawing.
Issue test packs for each system commissioned. Provide listing of all air pressure / direction of flow in sensitive areas with confirmation that the pressures and / or airflows are correct to design.
Demonstrate commissioned system to the Services Engineer.
Demonstrate system to Consultant and Client representatives.
Water Circulating Systems
The Commissioning specialist shall undertake the following elements for the water systems, as part of the Commissioning specialists pre-commissioning works:
Check system compiles with CIBSE code W and BSRIA AG89/2.
Verify pump alignment and rotation.

Open all valves to full open position, set control mixing valves to full flow through systems components and verify that the mechanical contractor has cleaned all strainers.
Verify water-circulating systems shall be full and free of air; expansion tanks are set for proper water level; and air vents are installed at high points of systems and operating freely.
The commissioning specialist shall then undertake the following:
With all chilled water valves calling for full cooling and with isolation valves verified 100% open, record pump flow and head. Report any under-performance.
Proportional balance water flows to BSRIA application guide A89/2.
Test and record pump performance at design flowrates.
Record pump motor amperage on each phase and voltage after completion of testing and balancing.
Test and record pressure drops and temperature drops through chiller.
Re-verify pump flow, head and pressures.
Measure and record final motor amps, heater sizes and name plate data.
Mark settings of balancing valves and record all data after completing the flow readings and coil adjustments.
Determine the pump speed control pressure differential setpoint if system is variable volume.
Issue test packs for each system commissioned.
Demonstrate commissioned system to the Services Engineer.
Demonstrate system to Consultant and Client representatives.
The following elements of works shall be undertaken by the Commissioning specialist for the Heating Coils:
Measure and record entering and leaving air dry bulb temperature with electronic thermometers accurate to 0.5□C.
Measure and recordentering and leaving water temperature with electronic thermometers accurate to 0.5□C.
All piping systems shall be completely filled and vented, and all strainers cleaned prior to balancing. The Contractor shall inspect the strainers for verification of system cleanliness.
The following elements of works shall be undertaken by the Commissioning specialist for the Domestic Systems:
Set design flowrates at return HWS commissioning sets.
Check water flow at each tap is correct (hot or cold), flow not excessive.
Hot water temperature is correct and time from turning tap on to 40□C is within specified limit.
Domestic water system to be commissioned as per HTM04-01.
BMS specialist commissioning activities.
The Commissioning specialist shall be in attendance when the controls specialist is undertaking the following elements in relation to controls installation:
Verify that control components are installed in accordance with project requirements and are functional, including electrical interlocks, damper sequences, air and water resets, fire and

freeze stats, temperature/humidity sensors and high and low limit switches. Each device shall be tested for proper operation in conjunction with the temperature controls contractor. A checklist of each device shall be prepared by the BMS specialist and utilized for the testing procedure.
Verify that static pressure controllers are calibrated. Calibrate/adjust variable frequency drives as required to maintain a stable static pressure.
Verify that controlling instruments are calibrated and set for designed operating conditions
Verify all thermostats set at design setpoint.
Measure and record dry and wet bulb temperatures at each thermostat.
Check and set operating temperatures of heat exchangers to design requirements.
Checkset operating temperaturesof chillersand boilers as noted on the drawings/specifications for system operation.
Verify that controls computer graphics are functional and indicate correct measurement of each indicated device as shown on the graphics screen for each system. This verification will be performed in conjunction with the temperature controls personnel.

**Deliverables**

The Commissioning specialist is required to issue an overall Commissioning Test Pack for all aspects of a system being completed. This should incorporate Mechanical testing, Electrical Testing, Loop Checking, Water and Air balancing, system control and aspects of monitoring.
The system breakdown shall follow a format of systems as laid out in the attached typical Hospital Commissioning Tracking Matrix and system commissioning completion dates shall be reflected on the Matrix as shown on the final agreed commissioning program issued by the respective contractors completing the contract for handover.
The commissioning test pack should start with identifying the system, and each of the boundaries which will be incorporated in the system from all disciplines which will be needed to support that system as a standalone system which will allow the system to be demonstrated with minimal amount of simulation.
Each of the disciplines required to support the system being commissioned shall be listed in the commissioning test pack and their boundaries identifies.
The test pack should be made up of 5 main sections after the index.
Functional Description: Functional Description shall indicate, at a minimum, system description, a summary of mechanical tests against design requirements, electrical tests against design requirements, Control of system against design requirements and flow rates where applicable. These requirements are as a minimum and does not limit additional information for been submitted to Consultant Limited for inclusion in the Commissioning Test pack sections prior to developing the commissioning test packs for final use.
Pre-commissioning Results: Pre-Commissioning Results shall be further broken down by discipline included in the initial breakdown of requirements to support the system. These

discipline sections shall include all original copies of the pre-commissioning results and tests completed for the respective system or support utility for that system.
Commissioning Results: Commissioning Results shall be further broken down by discipline included in the initial breakdown of requirements to support the system. These discipline sections shall include all original copies of the commissioning results and tests completed for the respective system or support utility for that system.
Summary: Summary shall be a Paragraphed summary by the lead commissioning contractor for the system indicating the performance of the system at commissioning against expectations. This section should reference previous section giving details of items and works required to bring the system to its completed and fully commissioned state.
Deviations from original requirements shall be a list of items deviated from the original commissioning plan for the system
Commissioning packs to be issued to Consultant for approval prior to utilisation. Measuring Equipment / Record of Information

In certain cases, where specified by the Engineers, any electronic test equipment used must be witness calibrated each day against the standard U-tube equipment.

**Water Balance**

Record the following design requirements for all pumps and pump motors from the approved shop drawings:
Water quantity litres per second
Total head meters of water, kPa
Pump speed rpm
Impeller size
Motor Power
Volts, phases, hertz and amps at design conditions
Record the following data from all pumps and pump motors installed at the project:-
Manufacturer, model and size
Impeller size
Motor power, RPM, volts, phase, hertz and full load current
Motor starter and heaters size
Equipment location
All pumps and piping systems shall be completely balanced by the adjustment of control devices to obtain the flow quantities indicated on the design drawings, Balancing shall be done with all controls set for full-flow through coils. All the automatic throttling valves shall be in full- open position.
Record the following test data for all pump motors installed at the project:
Pump speed - RPM
Total head at shut-off or dead-end discharge – meters of water, kPa (Plot this value on pump

curve as a verification of impeller size)
Suction, discharge and total head at final adjusted flow – meters of water, kPa
Balance the water flow through the boilers, chillers, reheat coils, air handling units, convectors, close control units, etc., in accordance with design requirements.
For all orifice plates record the pipe size, orifice make/size, flow factor, required differential pressure, final differential pressure and calculated final flow quantity.
For all 69enture type, flow tube, pitot tube or other flow measuring devices, record the pipe size, manufacturer and size of device, the direct reading or the differential pressure, and calculated final flow.
Flow shall be balanced through all equipment and coils by means of pressure drop. Where Manufacturer's curves are supplied by the Engineers, the readings shall be marked on these curves. Readings shall be taken on calibrated test gauges. Submit curves with the final report. Upon completion of balancing, adjust all differential bypass.

Submit single line diagrams of all pipework systems indicating all plant items. Data sheets shall list all equipment by the same numbers as diagrams.

**Air Balance**

All fan systems shall be operated for as long a time as will be necessary to test air flow from all openings, make all necessary damper and other adjustments until even distribution shall be obtained throughout the various systems, in air quantities required at each outlet or inlet as shown. Balance all air systems to obtain design air quantities at the least static pressure.

Record the following design requirements for all fans and fan motors from the approved shop drawings.

Air quantities litres per second
Approximate fan speed rpm
Fan static pressure mm of water, Pa (total or external)
Maximum tip speed meters per second
Outlet velocity meters per second
Fan brake kilowatt
Motor kilowatt
Volts, phases, hertz & amps at design conditions.
Record the following data from all fans and fan motors installed at the project.
Manufacturer, model and size
Motor power, rpm, volts, phase, hertz and full load current
Motor starter and heater size
Equipment location.
All fans and duct systems shall be completely balanced by the adjustment of sheaves, variable speed motors, dampers, registers and other volume and diverting control devices, to obtain the air quantities indicated on the design drawings. Outside air and return air

modulating dampers shall be adjusted to admit the specified quantities of air under all cycles of operation. All final adjusted air quantities shall be within +10% of the design requirements.

Record the following test data for all fans and fan motors installed at the project at final balanced conditions.

Fan speed rpm
Fan static pressure mm of water, Pa (external and total)
Static pressure drops across all filters, coils and eliminators in the supply fan casings,
Motor operating amps
Actual voltage
Fan air quantity as required above
Calculated brake power kW
Submit single line diagrams of all duct systems indicating all terminal outlets identified by number. Data sheets shall list all such outlets denoted by the same numbers, including the outlet size, location and air quantity. Submit this data for all supply, return and extract air systems.

Outside air, spill air and return air dampers shall be so adjusted that the respective fans shall deliver the correct air quantity at all damper positions. Record and submit the outside, return and mixed air temperatures for both cycles after final adjustments.

Where specified by the Engineers, noise level measurements shall take place to check the operation of specific pieces of mechanical and ventilation equipment in order to determine if this equipment meets the requirements laid down in the specifications and data submissions, or produces excessive noise in occupied areas of the building.

**Witnessing**

On receipt of the commissioning data the engineers will carry out witnessing tests in the presence of the Mechanical Contractor. Witnessing must be requested by the Contractor to the Engineers in sufficient time so that systems may be validated within 10 days of completion of commissioning of each individual system. Should these test results be outside the tolerance band then the system must be re-commissioned. The additional expense on engineer's time for repeat witnessing shall be borne by the Mechanical Contractor.

The Commissioning contractor shall provide for a second witness testing by the client representative on final handover.

**Cleaning of Ducting**

All internal surfaces of ducting must be clean on delivery to the site, and must be maintained clean during and after installation. The Mechanical Contractor is responsible for keeping the ducting system clean, free of such, grit, grease etc.; if ducting is found to be unclean then the Mechanical Contractor will be responsible for cleaning out such ductwork and the supply of a

replacement set of filters for that air handling/ducting system.

**Building Air Leakage**

The commissioning contractor shall provide attendance for the building air leakage testing to ensure all ventilation volume control dampers and fire dampers are set in commissioned position after building pressure test.

**Testing Sheet Steel Ducting**

All sheet steel ducting is to be tested in accordance with MEDIUMAC requirements DW/143 current edition. These tests are to be carried out before ducts are insulated and all readings must be recorded and reported.

**Equipment Commissioned by Vendor**

Boilers shall be commissioned in accordance with CIBSE Series B.

Automatic Controls shall be commissioned in accordance with CIBSE Series C.

All refrigeration equipment shall be commissioned in accordance with CIBSE Series R.

**2.4 Presentation Indexing System**

Each volume shall be numbered and shall be divided into sections using an appropriate numbering system.

Paper Sizes

The manual will contain manufacturer's literature which will be different sizes. Large pages will be folded and small pages will be fitted in plastic pockets with a reinforced edge punched for filing in A4 lever arch files. the page size shall be standardised for all volumes using A4 paper (210 x 297mm) with four holes punched centrally in the longer side 80mm apart.

Diagrams shall be prepared on A4 or A3 (297 x 420mm) paper.

**Section Dividers**

Stiff cardboard section dividers with extended tabs shall be used; these shall be SUMMIT Ring Book Guides or equivalent.

**Files for Manual**

A4 lever arch files with rigid plastic-coated covers shall be used which shall be EMGEE or equivalent. Inlaid lettering on the front cover shall indicate the title, i.e. Operating and Maintenance Manual, the Name of the Project and Volume Number. A label shall be fitted in the window on the spine of the file listing its contents.

The Trade Contractor is advised that all Record Drawings and O & M Manuals in the form described herein must be handed over to the Engineer prior to the issue of a Practical Completion Certificate for the Trade Contract Works.

Failure to issue these Record Drawings and O & M Manuals will also defer the issue of the Practical Completion Certificate until such time as they are received.

If the Trade Contractor fails to issue such documentation on time, then the Engineer will have the right to engage such other third parties to prepare these Record Drawings and O & M Manuals and any resultant cost incurred by him shall be borne and set against the Contract.

**Plant Room Schedules and Schematics**

The Contractor shall provide fully detailed diagrams of each of the specific mechanical systems showing the function of all isolating and regulating valves, numbered in accordance with the identity labelling of components. These shall be framed and under glass and placed on the wall of each plant room area adjacent to the items concerned.

**Identification of services and plant**

All piped and ducted services shall be labelled clearly with colour coded bands which identifies content, function, destination, temperature, source of supply and flow direction.

All plant items including MCC's, boilers, pumps, valves, sensors shall be clearly labelled with white traffolite labels.

**Thermal insulation of services**

All pipework shall be insulated in accordance with BS 5422.

All supply ductwork shall be insulated in accordance with BS 5422.

Insulation type shall be glass fibre pre-formed sections; foil wrapped with self-adhesive overlap. Pipework services in concealed spaces other than voids and risers shall be insulated with class 'O'

Armaflex. All external pipework and supply ductwork shall be cladded. All pipework in plant rooms shall be

# CRAC UNITS

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## 1. Particular Specification for Power Room Air conditioning

### 1.1 High Performance Split Air-Conditioner

The Scope of Work covers the supply, installation, commissioning and warranty of High-Performance Split air-conditioner and services provided for the same.

### 1.2 Design Requirements

The environmental control system will be a High performance factory assembled split air-conditioning unit. It will be ceiling mounted, optimized for maximum cooling capacity and high Airflow rate to match sensible load in power room . This units should be designed for service from the front of the unit.

The Air-cooled High Performance Split AC unit shall be designed as per following conditions:

| | |
|---|---|
| Inside Design condition | 27 Deg C ±2 Deg C and Max 50% RH |
| Ambient air design temperature | 35 Deg C |
| Actual Capacity | As per Bills of Quantities |
| Filters Efficiency | 90% efficiency down to 10 Microns. |
| Type of load | High sensible heat load (Sensible heat factor above 0.90) |

### 1.3 Submittals

Submittals will be provided with the proposal and will include: Dimensional/installation, refrigerant – hydraulic and electrical connections data, and circuit drawings.

### 1.4 Warranty

The system will be provided with a warranty against defects in material and workmanship.

### 1.5 Quality Assurance

The system will be designed and manufactured according to world-class quality standards. The manufacturer should be ISO 9001 certified.

## 2. PRODUCT

### 2.1 Cooling Circuit

The refrigeration system shall consist of a R407C/R410A based Scroll compressor, hydrophilic coated evaporator coil, condenser coil, thermostatic expansion valve (Capillary Tube type

expansion device is not acceptable) and filter drier. The compressor should have a suction gas cooled motor, vibration isolators, internal thermal overloads, manual reset high pressure switch, low pressure and high-pressure transducer.

**2.2 Fan section**

The unit will be equipped with a direct drive electronically commutated radical fan with high efficiency and high reliability. The unit are designed with draw-thru airflow having fans in downstream of the coil.

**2.3 Cabinet and Frame**

The exterior steel panels will be custom powder coated to protect against corrosion. The wall constructed side, bottom and rear panels separated with insulation from the airstream. The unit should be provided with perforated inlet and outlet panels and same should have more than 65% open area.

**2.4 Air Filtration**

The unit will be equipped with one set of HDPE air-filter having filtration efficiency of 90% down to 10 micron and same to be located within the cabinet and accessible from the front of the unit. The filter can be washed repeatedly.

**2.5 Air Cooled Condenser**

The condenser should be with fan modulation kit. Condenser should be able to work -5 deg C to 45 deg C ambient temperature without tripping. The condenser frame will be made up of a sturdy G.I. structure. The protection level of the outdoor unit will be IP54. The air-cooled condenser coil is constructed of mechanically expanded copper tubes in enhanced surface aluminium fin with Hydrophilic coating.

**2.6 Unit Controls**

Microprocessor Controller

Unit should be controlled by intelligent control board. The control board should be microprocessor based. The controller should allow setting and monitoring of the room parameters.

The controller allows setting and monitoring of the following space parameters:

Return Temperature set-point
Actual Room temperature
Indoor Fan speed Range
Mode of Operation
Unit Number
Active Alarm

Example of available warnings / alarms:

Power fail
High Return temperature
Loss of airflow
Compressor Low Pressure
Compressor High Pressure
High discharge temperature
etc
Following features will be incorporated in the controller:

Sequencing and auto-rotation of units upto 8 numbers in connection.
Fault Failure Switch in sequence
Automatic restart will be provided after a power failure.
Displays versions:

The unit should be provided with corded remote controller with LCD screen and keypad. It will

provide multiple-level password protection to prevent unauthorized operation effectively. The operation time of components should be available through the menu. A led indication in case of the 'Warning' or 'Alarm' event. The screen will display the current temperature, unit output status (Cooling, fan, free cooling), unit mode (Single, lead, standby), unit operation status (Running, standby, locked), alarm information, and current date & time. More detailed operating status and alarm information will be available from the Main Menu screen.

**2.7 Monitoring**

The control board should provide an RS485 port, and the standard protocol will be MODBUS. This should be standard feature of the product

**High Wall Precision Split Unit Specification**

| **Unit Definition** | **Unit** | **Requirements** |
|---|---|---|
| Cooling capacity(total) | kW | 13.3 |
| Cooling capacity(sensible) | kW | 12.1 |
| Net total Cooling capacity | kW | 12.6 |
| Net sensible Cooling capacity | kW | 11.4 |
| Condensing temperature | (0C) | 50 |
| Indoor Sense EER | kW/kW | 2.84 |
| Sound power level | dB | 78.6 |
| Number of refrigerant circuits | | 1 |
| Number of compressors | | 1 |
| Return air temperature DB | (0C) | 24 |
| Return air temperature WB | (0C) | 17 |
| Return air humidity | % | 50 |
| Supply air temperature DB | (0C) | 14 |
| Supply air temperature WB | (0C) | 12.9 |
| Supply air Humidity RH | % | 88.5 |
| Altitude above sea level | m | 1800 |
| Height | mm | 1975 |
| Width | mm | 600 |
| Depth | mm | 500 |

| | | |
|---|---|---|
| weight | kg | 125 |
| Refrigerant | | R410A |
| Power supply | | 400V/3ph/50Hz+N |
| **Fan** | | |
| Number | | 1 |
| Total Air Flow | CMH | 3300 |
| Power consumption | (kW) | 0.73 |
| ESP external static pressure | (Pa) | 0 |
| FLA | A | 4.2 |
| Motor efficiency | % | 89 |
| **Compressor** | | |
| Number | | 1 |
| Type | | Fixed |
| Total Power | (Kw) | 3.28 |
| FLA | A | 9.4 |
| **Condenser** | | |
| Unit type | | DMC 12WA1 |
| Ambient temperature | (0C) | 35 |
| Sound pressure group | | Standard |
| Cond Heat | (kW) | 16.58 |
| Number of condensers | | 1 |
| Weight | Kg | 60 |

| | | |
|---|---|---|
| Currents consumption(per fan) | A | 2.3 |
| Power consumption (per an) | (Kw) | 0.53 |
| Height | mm | 1240 |
| Width | mm | 787 |
| Depth | mm | 352 |
| Outdoor LpA | dB(A) | 61.5 |
| | | |
| **Heater** | | |
| Type | | PTC |
| Stage | | 1-Stage |
| Total Power | (Kw) | 3 |
| FLA | A | 8.9 |
| | | |
| **Connection Details** | | |
| Liquid Qty | | 1 |
| Discharge Qty | | 1 |
| Liquid OD | mm | 12.7 |
| Discharge OD | mm | 16 |
| Humidity Supply OD | mm | 6.35 |
| Drain ID | mm | 19 |
| | | |
| Filter Grade | | Nylon |

# INTELLIGENT COPPER AND FIBER PRE-TERMINATED TRUNKS

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## 1. Patch Cords

All modular equipment cords shall conform to the flowing minimum performance standards:

Be factory assembled and 100% transmission tested with laboratory grade network analyzers for proper performance up to 500MHz

Have a 9th wire and 50 micro-inch plated sensor pin contained in a robust over-molded boot

Have access to the sensor pin at the rear of the boot for testing and mapping purposes

Use modular plugs, which exceed TIA-968-B and IEC 60603-7 specifications, and have 50 micro-inches minimum of gold plating over nickel contacts

Be resistant to corrosion from humidity, extreme temperatures, and airborne contaminants

Be available in standard lengths of 1, 2, 3 and 5 meters with custom lengths available upon request

Be available in Gray and Blue with color matching boots for proper circuit identification

## 2. Controllers and Patch Panels

All termination panels shall facilitate cross-connection and inter-connection using modular patch cords and shall conform to EIA standard, 19-inch relay rack mounting requirements.

Each MCP & DCP should monitor up to 2880 ports and utilize one rack mount space.

When MCP & DCP are combined, should be able to manage up to 65,000 ports

Have redundant power and communication ports for each patch panel.

Accommodate at least 24 ports for each rack mount space (1RMS = 44.5 mm [1.75 in.])

Have rear protective strain relief caps which can be installed onto cable before or after termination

Allow RJ45 interface for connection of Control Bus Cable connections (to G2 Smart Panels and Smart Enclosures)

Support industry standards for T568A or T568B wiring options on each individual outlet

Have modular ports compliant with FCC CFR 47 part 68 subpart F and IEC 60603-7 with 50 micro-inches of gold plating over nickel contacts

Have individual port identification numbers permanently marked on both the front and rear of the panel

MCP should continuously monitor all components in the system and report issues to the management software.

Feature on-panel intelligence and a combination of LEDs and a backlight graphic LCD to guide technicians

Must be certified by Underwriters Laboratories to UL 60950-1, 1st Edition (2003) – Information Technology Equipment. ACA TS 001, A/NZS 3260

Have port monitoring capabilities built into each patch panel for increased density.

Have redundant power and communication ports for each patch panel.

Be made of black painted Steel, in a 24 port configuration

Be available in both flat and angled configurations

Accommodate at least 24 ports for each rack mount space (1RMS = 44.5 mm [1.75 in.])

Feature the Z-MAX™ keystone outlet available in 6A UTP and 6A F/UTP as well as the Cat 6 UTP Max keystone module.

Allow tool-less termination of keystone outlets

Feature robust "intellitab" sensor pads constructed with 30 micro-inches of gold over nickel.

Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity

Have rear protective strain relief caps which can be installed onto cable before or after termination

Allow 110 style punch-down termination or modular S110P4 Plug for connection of Control Bus Cable connections (to analyzer)

Support industry standards for T568A or T568B wiring options on each individual outlet

Have modular ports compliant with FCC CFR 47 part 68 subpart F and IEC 60603-7 with 50 micro-inches of gold plating over nickel contacts

Have individual port identification numbers permanently marked on both the front and rear of the panel

Feature on-panel intelligence and a combination of LEDs and a backlight graphic LCD to guide technicians

Active circuit board on panel must be field serviceable (i.e., allow for replacement without removal of the panel, keystone outlets or patch cords)

Must be certified by Underwriters Laboratories to UL 60950-1, 1st Edition (2003) – Information Technology Equipment. ACA TS 001, A/NZS 3260

### 3. Fiber Enclosures

All interconnect centers, panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.

Be made of black painted steel, in a 48 strand (24 Port) LC configuration.

Have port monitoring capabilities built into each panel for increased density.

Feature compact 1 RMS (43.2mm [1.75 in.]) design

Use duplex LC fiber adapters.

Panels to be pre-loaded with duplex LC adapters to support up to 48 strands of fiber

Incorporate fiber managers to effectively store fiber cable slack in both the front and rear of the enclosure.

Feature on-panel intelligence and a combination of LEDs and a backlight graphic LCD to guide technicians.

Have anchor points for securing fiber cable(s) entering the unit.

Feature robust "intellitab" sensor pads constructed with 30 micro-inches of gold over nickel.

Allow for standard RJ 45 interface for connection of Control Bus Cable connections (to analyzer)

Have one intellitab sensor pad for each fiber pair for connection to an intelligent patching system.

Have labeling that meets or exceeds ANSI/TIA-606-A requirements and also be laser printable.

Be able to mount both 19-inch and 23-inch rack/cabinets.

Must be certified by Underwriters Laboratories to UL 60950-1, 1st Edition (2003) – Information Technology Equipment. ACA TS 001, A/NZS 3260

### 4. Fiber Patch Cords/Pigtails

Fiber equipment cords shall possess the following characteristics:

Be available in standard lengths of 1, 2, 3 and 5 meters with custom lengths available upon request

Feature premium 50/125μm fiber that meets IEEE 802.3ae 10 Gigabit Ethernet requirements as well as IEC 60793-2-10, TIA-492AAAC and TIA-492AAAD specifications for laser bandwidth Differential Modal Delay (DMD) specifications

Have one sensor pin for each duplex connector to connect to an intelligent patching system.

Sensor pins to feature 30 micro-inches of gold over nickel for long term reliability

Have access to the sensor pin at the rear of the sensor clip for test and mapping purposes.

Offer a superior connector polish that meets Telcordia and ISO/IEC specifications for end-face geometry (including radius of curvature, apex offset, and spherical undercut)

Use cable and connectors that are complaint with color coding specifications as listed in ANSI/TIA standards

Utilize precision zirconia ceramic ferrules on connectors

Have LC-SC hybrid versions available

Include dust caps on all assemblies

Be 100% optically tested to meet the following performance specifications:

| Parameter | OM3 | OM4 |
|---|---|---|
| Max. Insertion Loss (dB) | 0.25 (0.10 Typical) | 0.25 (0.10 Typical) |
| Min. Return Loss (dB) | 30 (35 Typical) | 30 (35 Typical) |

Be available in standard lengths of 1, 2, 3 and 5 meters with custom lengths available upon request

Offer a superior connector polish that meets Telcordia and ISO/IEC specifications for end-face geometry (including radius of curvature, apex offset, and spherical undercut)

APC connectivity complies with Telcordia GR-326-CORE

Have one sensor pin for each duplex connector to connect to an intelligent patching system.

Sensor pins to feature 30 micro-inches of gold over nickel for long term reliability

Have access to the sensor pin at the rear of the sensor clip for test and mapping purposes.

Use cable and connectors that are complaint with color coding specifications as listed in ANSI/TIA standards

Utilize precision zirconia ceramic ferrules on connectors

Have SC-LC hybrid versions available

Include dust caps on all assemblies

Be 100% optically tested to meet the following performance specifications:

| **Parameter** | **Singlemode UPC** | **Singlemode APC** |
|---|---|---|
| Max. Insertion Loss (dB) | 0.40 (0.10 Typical) | 0.40 (0.15 Typical) |
| Min. Return Loss (dB) | 55 (60 Typical) | 65 (70 Typical) |

## 5. Automated Infrastructure Management

### 5.1 Master and Distribution Control Panels

Control panels are hardware devices which collect patching status information from intelligent patch panels/fiber enclosures. This information is relayed via the customer's LAN/WAN to a central database.

Control Panels must be compatible with EagleEye Red software and shall have the following key features (but not limited to):

Report patching changes to the central database within 3 seconds in even the largest patch zone configuration

LCD Multi-Functional User Interface

Redundant Ethernet connections (Master only)

Redundant power connections

Monitor up to 120 intelligent patch panels/fiber enclosures

Panel capacity can be expanded using distribution control panels (up to 24 distribution control panels)

Maximum panel capacity of 2880 panels per patch zone

Mounts on standard 19" racks/cabinets

Until shall not exceed 1U rack mount space

Use standard category 5e shielded patch cords or shielded cable to connect to intelligent panels

Provide redundant links to intelligent panels to ensure system reliability

Remote firmware upgrade for Control panel over LAN/WAN

Control panel shall distribute firmware upgrades to connected devices (Distribution panels and intelligent panels)

Control panels shall support Multi-language capability

Control panels shall report error conditions to the central database

Allow for either punch down or RJ45 connection of control bus cables

Supply power to all connected intelligent panels/fiber enclosures

1-year warranty

### 5.2 Supported Topologies

The Control Panels shall be flexible enough to support a variety of customer installation options. These shall include but not limited to:

Cross-connect (panel to panel connections) and Interconnect (switch to panel connections)

Cross-connect and interconnect available for both copper and fiber systems

Single Control Panel can support panels in multiple cabinets/racks

Shall be flexible in terms of port density and be suitable (economically viable) for supporting outlying branch environments accommodating <20 users

Shall be scalable, allowing user to add intelligent panels for future growth

Shall support large data center and office environments (up to 2880 panels per patch zone)

**5.3 Intelligent Patch Panels & Fiber Enclosures**

Intelligent patch panels and fiber enclosures shall have the following key features (but not limited to):

All panels/enclosures shall feature a backlight LCD for work order guidance, patch tracing and other technician guidance capabilities

All panels/enclosures shall feature one Green and one Red LED to provide technician guidance on work orders, patch tracing and other technician guidance capabilities

The active components in all panels/enclosures shall be field repairable and shall not require removal to patch cords, outlets, horizontal cables to accomplish the repair

Mounts to standard 19" rack/cabinet

Copper panels & Fiber enclosures shall be compatible with patch cords and fiber jumpers with external pogo pin contacts. The pogo pins will make contact with sensor pads on intelligent panels/enclosures

Field replacement of active circuit board in intelligent panels/enclosures shall be done with no disruption to any customer circuits

Panels/enclosures shall provide two control bus cable ports (either S110 or RJ45)

Up to five panels may be daisy chained together and connected to a single port on the Master or Distribution Control Panel

Panels/Enclosures can be connected in a redundant link back to the Master or Distribution Control Panel. In the event the control bus cable is disconnected all panels shall remain connected and communicating via the redundant link

Copper panels shall be available in both flat and angled version

Copper panels shall be modular, meaning that outlets can be inserted/removed in/from the panel

Copper panels shall accommodate Category 6, 6A and 7 (TERA) outlets

Copper panels should be compatible with UTP or F/UTP outlets (Category 6 and 6A)

Copper panels shall not exceed 1U rack mount space and accommodate 24 ports

Fiber enclosures shall be offered in LC multimode and singlemode

Fiber enclosures shall be offered for both LC splice/polish or MTP trunks

**5.4 Server/Client Requirements**

The system shall be installed as a virtual machine guest on a customer supplied server. The minimum guest server requirements are as follows:

| Requirement Type | Component and Version |
|---|---|
| Operating System | Windows Server 2012 or 2012R2, Windows Server 2016 or 2019 or Windows 10.64-bit versions only |
| Database | MySQL 8.0.30.0 |
| Web Server | IIS 10 |
| Processor | 6-core |
| Minimum Disk Space | 30 GB minimum |
| Physical Memory | 8 GB |
| Disk I/O Throughput | 125MB/Second |
| Virtual Memory | Minimum: 1.5x Physical Memory |

The specification for client workstations is as follows:

| | |
|---|---|
| Client Applications | Compatible with any major web browser. |

**5.5 Automated Infrastructure Management (AIM) software**

The AIM software shall have the following features/capabilities:

Automated Infrastructure Management (AIM) software shall help better document and manage IT network and devices.

AIM shall be highly visual and intuitive software and provide graphical views of rack, floors drawings and infrastructure node hierarchy.

Shall include on-built multi-tiered network discovery protocols to find all IP based devices and places.

AIM shall provide both physical layer and network device connections are updated automatically and provide an end-to-end circuit trace.

Other tools include analytics to help manage IT capacity and alarm monitoring to detect unauthorized activity or network issues.

**Documentation**

Real-time physical layer documentation and monitoring including discovery of IT devices, interactive floor images, rack elevations and end-to-end circuit traces

**Asset Management**

Real-time database with auto-discovery stores status and location of all cabling and IT assets to minimize troubleshooting time and maximize equipment and rack utilization

**Security**

Software shall detect and records all physical network activity and provides alerts on unauthorized access or modification on physical layer

**Work Orders**

Shall be able to create work orders and assign, direct and track tasks associated with these orders, ensuring accuracy, efficiency and documentation of change activity

**Other Features**

Customized screen view for 24/7 NOC monitoring of network and alarm status

Software shall be HTML5 based and able to integrate with 3rd party applications via an API

AIM shall be available per floor mounted assets (cabinet / rack) or unlimited

AIM shall include free first year support / maintenance free of cost and additional year upon request.

Software implementation services may be carried out by OEM representative

**Authorized Users and Access to AIM Software**

Ability to create users and login security credentials in AIM software

Unlimited concurrent user access to AIM software at no additional cost

Ability to restrict access to certain functions in AIM software based on access level settings

Ability to access AIM software via compatible devices with a compatible web browser and network access

**Database Build Capabilities**

Create cabling devices and ports via Excel file import

Import floor drawings and overlay devices on these images

Create rack/cabinet elevations with both front and back views

Include a wide variety of device graphics with the AIM software

Automatically assign device graphics at time of creation

Capability to automatically assign network device graphics as devices are discovered

Automatically discovery and create network devices

Automatically place discovered network end devices at their proper location in the database

Automatically update the AIM database with patching information from intelligent panels

Automatically detect network device connections/disconnections and update the AIM database accordingly

Easy to use graphical building tool to either build, modify or add-on

Ability to gather item attributes from a variety of sources (derived from system data, manually entered/modified, imported via Excel, discovered via SNMP or other network discovery tools, linked external data source)

**Alerts**

Users shall have the ability to filter alerts based on location, day/time, work order status, IP Address, MAC Address

Alert options shall have the ability to send alert information via email

The AIM system shall also be able to trigger IP cameras to a picture in the area where the fault condition occurs

The AIM system shall also be able to send SNMP commands or traps to network devices or 3rd party applications

The AIM system shall have the ability to run scripts in response to alerts. This may be used for exchange of data with 3rd part software/databases or other user defined applications

User shall have the ability to send alert notification to multiple users. Each user notification shall have the ability to use a unique filter

AIM software shall provide the capability to test connectivity between the AIM software to email server via a one button click. The test shall provide a visual indicator of pass or fail

Users shall have the ability to create/customize scripts for IP camera triggers, SNMP commands and traps and alert scripts

A wide variety of standard alerts shall be available in the AIM system. These include alerts for discovered devices, intelligent patching changes and work orders

**Reports**

A wide variety or standard reports on capacity, assets, work order costs and status and users shall be available

System administrators shall have the ability to restrict report access by report and user

The AIM software shall have the ability to automatically email reports to selected users on a pre-defined schedule

Users shall have the option to view reports via a web browser or generate an Excel file

The AIM software shall offer the ability to filter reports by location, device type or time

**Automated Network Device Discovery & Monitoring**

Provide administrators the ability to enter network discovery information

SNMP discovery compatible with v1, v2c and v3

Automatically discovery and create devices with SNMP enabled

Automatically discover devices without SMP enabled or capability (device information may be limited to IP address, MAC and device name)

Administrators shall have the ability to enter router information to facilitate proper discovery of switches and network end devices

Administrators shall have the ability to configure discovery polling periods for IP ranges or individual devices

AIM software will continue to monitor discovered devices and automatically update connection status

Switch VLAN information shall be automatically populated for each switch port (if available). This information will be available as a port attribute as well as in the circuit diagram in the AIM software

AIM software shall have the ability to tag IP ranges as wired, wireless or switch to help determine device location

A log of all network discovery activity shall be maintained in the AIM software and shall be available via direct viewing in the software and via Excel export

**Master Control Panel (MCP) Management**

AIM software shall provide a dedicated page for configuration/management of Master Control Panels

AIM software shall automatically discover and create all Master Control Panels. These panels along with their attributes shall be displayed in on the Master Control Panel page

Administrators shall have the ability to download new firmware to MCPs via the Master Control Panel page

The Master Control Panel page shall provide debug capabilities for troubleshooting MCP issues

All MCP related events shall be stored in a log. Log shall be viewable from the Master Control Panel page or exportable to an Excel file

**AIM software and hardware shall meet below requirements.**

Technicians can view work order details on MCP and panel LCDs

Technicians can view circuit trace information on the MCP LCD

Patch panels provide LCD which can display patching work order instructions and provide feedback on correct/incorrect patching

Patch cord tracing can be done and displayed on MCP LCD and panel LCDs

Panel LCD displays panel name and can be updated via software if needed

Panel LCD is easier to see vs port level LEDs which can be hidden by patch cords

A single MCP shall manage from 1 to 2880 patch panels

Redundant bus cable connections required for all panels

Redundant power option shall be available on MC

# GAS SUPPRESSION SYSTEM

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## 1. Performance Requirements

### 1.1 Plant

The Works include the provision of the fire suppression system including all equipment and associated ancillaries. The systems shall have as a minimum but not limited to the following:
1 No. central plant system complete with full distribution pipework, manifolds, zone valves, pilot cylinders, high pressure monitoring switches, low pressure monitoring switches, fire resisting cabling, hot dip galvanised coated steel pipework, pneumatic pipework etc feeding the data halls and the MMR rooms per schedule in Section 2.
Gas bottle storage cylinders arrangement
Nozzles (acoustic type) shall be selected to produce low noise and pressure levels below 100dB(A) and be spaced at approximately one per 15m2 (or spacing as certified by Contractor to meet the design requirements). The diffusion of gas should not be hindered by other services obstructions
Vents and pressure relief dampers.
Dedicated Fire System Monitoring & Control panel system including control wiring from all fire system components. Include Repeater Panels at exits.
Dedicated specialist manifold panels
Remote LED indicator units for activated device indication, with location grid
All distribution pipework and the like shall be sized for the ultimate system design capacities and flow rates.
The design life of the installation and equipment shall be 20 years of normal operational life within the limitations which relate to this project.
The Contractor shall supply and install a proprietary support system including all fixings, supports, hangers, flexible connections etc. as required to provide a complete system.
The Contractor shall detail design, size, select, supply, install and commission the following systems, as described in the drawings and technical specifications. The part of the site shall be protected using a gas suppression system. The gas used shall be INERGEN.
The installation shall comprise all components necessary to provide a complete and fully operational detection and gaseous suppression system in accordance with guidance from an appropriate regulatory body (e.g. NFPA, BFPSA, BS, ISO etc.).
The system shall be capable of achieving the extinguishing concentration within the required discharge period. The level of concentration shall be maintained within the protected enclosure for a minimum of 10 minutes.
Automatic detectors (VESDA) shall be provided in all areas of the protected enclosure. Refer to the Electrical design schematics and layouts for requirements relating to automatic detection.
Coincident operation of two detectors shall be required for the initiation of a gas release signal. Coincident operation may be achieved either by receipt of alarms from two detectors on separate circuits or, where it is possible to individually identify each detector in alarm, by the receipt of two individual alarms of fire. On receipt of an alarm of fire, the automatic fire

detection and alarm system shall initiate signals to close all ventilation dampers, shut down the ventilating system and, where practical, cut off power supplies to the equipment affected, as required. Please note that CRAC units will always run to destruction (i.e. they never shut down even in fire alarm mode)
The system shall incorporate a variable gas release delay of 30 seconds. The delay period shall be sufficient to allow the fans in the central ventilation system (i.e. humidity control system) to shut down completely and for personnel to evacuate the protected enclosure.
Controls shall be provided outside the main entry door to the protected enclosure to enable the gas system to be set to a manual only mode of operation.
Changeover facilities shall be restricted to authorised persons by, for instance, use of a key switch.
A control for manual release of gas shall be provided at the main entry door to the enclosure. The manual release facilities shall be suitably protected against inadvertent operation and shall require two actions, such as lifting of a protective flap and breaking a frangible element.
Status indicator panels shall be provided at all entrances to the protected enclosure to indicate the status of the system including:

| Mode | Colour Indication |
|---|---|
| Automatic | Amber |
| Manual | Green |
| System Discharged | Red |

A gas discharge sounder shall be provided in the protected enclosure to warn personnel of an impending gas discharge. The sounder shall have a sound distinctive from any other in the location and shall be

initiated following coincident operation of the detection system and prior to the release of gas.

All ductwork openings in the protected enclosure shall be fitted with automatic, tight shut off dampers. Dampers shall be closed on receipt of a confirmed fire alarm signal. Shutter blades shall be held open by bolt and solenoid. The solenoids shall be energized after receipt of two separate signals from smoke/flame detectors.

A pressure relief vent shall be provided to vent the excess pressure caused by the gas discharge. The vent shall be able to vent both negative and positive pressures for halocarbon systems. The relief vent shall close as the pressure subsides to hold the extinguishing agent concentration within the protected enclosure. The vent shall be discharged to a safe place.

All necessary interfaces between systems shall be provided. The protected enclosure shall be pressure tested to check its integrity.

Signs- Caution signs shall be provided at the manual control point and entrances to the hazard in accordance with appropriate regulations.

The central ventilation system serving the Data Halls will be shut down prior to gas discharge and all dampers closed in order to seal the room. Post gas discharge, the central ventilation system will be utilised for cold smoke extraction. This will be achieved via a fire man's switch (one for each Data Hall) which will be activated for the affected Data Hall by either the Fire Brigade or Client Operations in order to remove cold smoke from the room prior to entering. When the fire man's switch is opened, the dampers associated with that hall will be opened, the AHU supply and return fans on the AHU to maximum speed and the mixing damper on the AHU will be bypassed so that there is full extraction of air to atmosphere and make up air.

**1.2 Specific Standards**

EN 15004-1:2008 Fixed Firefighting Systems - Gas Extinguishing Systems - Part 1: Design, Installation and Maintenance.
ISO 14520 "Gaseous fire-extinguishing systems"
NFPA 2001 "Standard on Clean Agent Fire Extinguishing Systems"

**1.3 Specialist Company**

The system shall be designed, supplied, tested and commissioned by an approved specialist company with extensive experience with the relevant type of system.

**1.4 Design**

The pipework layout and nozzle locations shall be designed by the specialist company.

The specialist contractor shall utilise the working BIM model to accurately measure the dimensions and volumes of all protected spaces including all voids to allow the system to be fully designed and co- ordinate the design of the suppression system with all other services.

The Contractor shall ensure that all doors in protected spaces open outwards and have sufficiently strong door closures to maintain the required room seal during operation.

**1.5 Operation**

Gas will be discharged into the protected space to meet required design concentrations as per EN 15004:2008. The Contractor shall identify 'Standard' and 'High' hazard areas and design the system accordingly.

The system shall be fast acting and shall discharge into the protected spaces within 10 seconds. Discharge pressure shall be less than 40 bar.

### 1.6 Components

The system shall in general comprise of:

Storage Cylinders
Actuation components
Pipework
Acoustic Nozzles
Gas storage pressure in cylinders shall not be greater than 300 bar.

### 1.7 Gas

Gas shall be INERGEN (or approved equal)

The gas used shall have the following properties:

Clear, colourless and low-odour
Clean (i.e. leaves no residue)
Fast acting (discharges within 10 seconds)
Zero Ozone Depletion Potential (ODP)
Atmospheric Lifetime of 1 month or less
Global Warming Potential of 1 or less
Not require monitoring under Kyoto Protocol
Electrically non-conductive
Non-toxic (i.e. safe for personnel)
Simple to refill
Suitable for class A, B and C fires
SNAP – Significant new alternatives policy (US EPA)
Safety Margin greater than 50% (Difference between Class A Design Concentration and NOAEL – No Observable Adverse Effect Level)
20 Year Environmental Warranty
Widely approved by insurers such as LPCB, UL and FM

### 1.8 Room Integrity

The Contractor shall carry out a Room Integrity Test of each protected space. This shall check the space to locate and then properly seal any significant air leaks that could result in a failure of the space to hold the specified extinguishing agent concentration level for the specified holding period.

Leakage shall be quantified by measuring the air flow rate and the developed pressure within the room.

A fan unit shall be fitted into a doorway by means of an adjustable frame and shall be used to pressurise the room by a small amount until it is equivalent to the weight of gas that would be achieved after system discharge.

The contractor shall calculate equivalent leakage area. The room integrity testing shall be an alternative to a full discharge testing of gaseous firefighting systems.

### 1.9 Testing and Commissioning

The completed system shall be fully tested, commissioned and certified by the specialist company.

The Contractor shall carry out a Room Integrity Test of each protected space. This shall check the space to locate and then properly seal any significant air leaks that could result in a failure of the space to hold the specified extinguishing agent concentration level for the specified holding period.

The Contractor shall also include for witness testing, proving to the local Fire Officer, demonstrating to the Employer and demonstrating to the Occupiers the operation of the system.

### 1.10 Materials

Pipework, fittings and supports shall comply with the standards for the system.

### 1.11 House Alarm System

The fire detection and alarm systems installed within enclosures provided with Gas Suppression shall be stand alone to the House Alarm system installed in all other parts of the building.

Activation of the House Alarm System shall not trigger activation of the Gas Suppression System. The Gas Suppression system shall only be triggered by activation (double knock) of devices installed within Gas Suppression enclosures.

### 1.12 Fire Detection and Alarm System

The Contractor will provide, install and terminate cabling to the following devices:

#### 1.1.1 Alarms

Each protected area shall consist of an Automatic Fire Detection System. This system shall operate on a "Double Knock System" i.e. operation of two devices within protected area. Equipment shall be as detailed below.

#### 1.1.2 Detection

##### 1.1.2.1 Fire Detection Control Panel

A fire gas suppression fire control panel in accordance with EN 12094-1 shall be located at each zone. A repeater panel shall be located at each exit.

The control panel fascia shall include but not limited to the following components:

Silence Alarm Switch
Test Evacuate Alarm Switch

Alarm Silenced Lamp
Isolate Remote Signal – Switch and Lamp
System General Fault – Lamp and Buzzer
Buzzer Silence
Power on Lamp
Lamp Test Switch
System Automatic Mode – Lamp
System Manual Mode – Lamp
Manual/Automatic Mode – Push Switch
Isolate Release Circuit – Switch and Lamp
Key Operated Security Switch
Manual Release Unit

#### 1.1.2.2 Detectors

Very Early Smoke Detection Alarm (VESDA) system will be provided in the customer rooms and in the floor voids. Refer to electrical design for further information.

#### 1.1.2.3 Manual Release Units

Manual call points will be clearly identifiable and have a simple method of operation. The method of operation of call points shall be identical throughout the installation.

The call point shall give an audible or visual confirmation within 3s of being operated so that the person operating it is left in no doubt as to the success of the operation.

They shall have normally open (NO) contacts and shall be electrically compatible with the automatic detectors used.

They shall comprise baseplate, insert, cover and be suitable for fixing to standard switch boxes of the flush type or purpose surface mounted type of the same colour. Covers shall be red in colour and of the snap-on type, secured against unauthorized removal. It shall be possible to test the call point without breaking the glass or removing the cover.

All inscriptions shall be permanently made on the cover and not on the glass. They shall utilize frangible elements, the broken pieces of which shall be contained within the cover of the call point.

Call points shall employ acceptable sealed micro switches.

The alarm condition shall be maintained until reset by an authorized person by means of a special tool provided for that purpose.

#### 1.1.2.4 Sounder Strobe Alarm Devices

Audible alarms shall be fully coordinated and shall be clearly distinguishable from other audible warning devices.

One unique sound shall be produced by all fire alarm sounders.

There shall be aural discrimination between the fire alarm sound and all other sources of noise.

Coded fire alarm signals will not be permitted under any circumstances. Alarm signals once started shall be continuous.

Where there are existing sounders, the sounders shall sound similar to the existing units.

Sounders shall be combined with detectors where shown on the drawings. Where combined sounder strobe units are used, both sound and strobe elements shall be fully monitored for failures.

An alarm sounder shall be located close to the fire alarm control panel, which sounds immediately on operation of any detector or call point.

#### 1.1.2.5 Sound Levels

Alarm sound levels shall not be less than 65dB(A) in all accessible areas, except in sleeping areas which shall not be less than 75dB(A), and all levels shall be a minimum of 5dB(A) above any background noise level which occurs for 30s or more.

The maximum alarm sound level in any normally accessible area shall not exceed 120dB(A).

#### 1.1.2.6 Sounders

Dedicated sounders shall be coloured red. Sound output at 1m shall be minimum: Dedicated sounders and sounders/beacons: 95dB

Base sounders: 95dB

#### 1.1.2.7 Beacons

Beacons shall be coloured red and flash at a rate of 30-120 cycles per minute. Beacons shall utilise high intensity LEDs. The operation of all beacons on the system shall be synchronised.

#### 1.1.2.8 Sounder Beacons

Combined sounder beacons shall include sounders on beacons installed on a single base. They shall comply with the requirements of both sounders and beacons

#### 1.1.2.9 House Link Relay

The contractor shall allow for house link relay to interface the Fire Gas Suppression system and the BMS system.

### 1.13 Building Management System (BMS) Interface

The following points shall be made available to the Building Management System (BMS) as a minimum:

Low Pressure
1st knock
2nd knock
The BMS monitors the fire suppressant activated. If the fire suppressant is activated, an alarm will be

raised on the BMS supervisor. If an alarm is indicated, an alarm will be raised on the BMS supervisor.

The Contractor shall provide volt free changeover contacts (24Vdc rating) to provide the signals to the BMS. Others shall provide the cabling and cable terminations to connect the BMS.

The Contractor shall provide attendance when the BMS is under testing and commissioning. The Contractor shall exercise the interfaces provided to allow confirmation that the BMS is fully functional and responds correctly to inputs.

## 2. Testing and Commissioning

### 2.1 General Requirements

#### 2.1.1 Documentation and Certificates

The Contractor shall submit Testing and Commissioning and Performance Testing method statements, data and manuals as required by the Contract Documents and as necessary to allow the Contractor to plan, co-ordinate and implement the associated works as detailed below.

For on-site activities, these shall be separately identified.

The Contractor shall provide all necessary and appropriate documentation to the Contractor to allow him to compile the documentation set out below.

The Contractor shall agree procedures for notices, witnessing, reporting and recording tests with all parties involved including Local Authorities and Statutory Undertakings, prior to the commencement of the works. The Contractor shall provide all necessary and appropriate assistance to the Contractor.

The Contractor shall submit copies of the formal test certificates signed by the Manufacturer and himself no later than 3 days after completion of successful tests.

#### 2.1.2 Instruments and Equipment for Testing

The Contractor shall supply, check, recalibrate whenever necessary and maintain in good working order all instruments and equipment for setting out, measurements, gauging, inspection, commissioning and performance testing whether they are specifically called for or implied by the Contract Documents.

All such instruments and equipment shall be adequate for the purpose and shall satisfy the purposes and accuracies required by the Contract Documents.

All instruments and equipment shall remain the property of the Contractor.

### 2.1.3 Provision of Staff

The Contractor shall provide all necessary staff with the relevant skills and competence for all inspection, testing, commissioning and performance testing.

### 2.1.4 Costs of Tests

The Contractor shall bear the costs for all parts of all tests as described in this Specification.

### 2.1.5 Attendance and Co-operation

The Contractor shall give at least seven days' notice to Client of requirements for the attendance and co- operation by Client Ops and by others.

### 2.1.6 Notice to Client

The Contractor shall give at least seven days' notice to Client of any commissioning or testing to be carried out to enable Client to witness all or any of such tests, etc.

### 2.1.7 Commissioning and Performance Testing Specifications and Manuals

The Contractor shall prepare and submit a set of testing and commissioning specifications and manuals. These shall be prepared in draft for review and comment by the Contractor at least 4 weeks prior to any testing, commissioning and performance testing activities. The manuals shall include, but need not be limited to:
Factory, off-site and on-site testing, commissioning, acceptance testing, demonstrations, Client training and performance testing Method Statements and activity check list
Complete set of proposed test/commission forms, pro formas etc.
The Contractor shall produce this Specification incorporating all necessary data, documents and the like. It is essential that this document represents a comprehensive approach for the complete Works and associated interfaces.
Commissioning Method Statements shall be based on the current Codes of Practice and all applicable Standards. They shall describe the exact method that the Contractor and the Contractor shall adopt to commission an item of equipment. The Method Statements shall be approved by Client prior to any commissioning activity taking place.

### 2.1.8 Commissioning Manual

This document shall provide an updated version of the equipment Commissioning and Performance Testing Specification including a comprehensive set of all testing and commissioning forms, pro formas, certificates and the like, duly completed and witnessed.

Test Certificates, which shall contain the following minimum information:

System Identification
Date of Test

Design Date
Individual Equipment Identifications
Reference Number of Tests
Referenced Test Procedure and/or Method Statement
Reference QA/QC Procedure
The commissioning manuals shall contain the following sections:
Systems Schedules
System Test and Commission Specifications
A record of all tests carried out (including all testing recorded on Test Certificates)
Drawings and diagrams cross-referenced with the test records
Record of instrumentation used, together with current calibration certificates.
At the completion of all testing and commissioning, the Contractor shall provide the completed testing and commissioning manuals in both hard copy, as agreed withClient, and electronic format compatible with Microsoft Word, Excel or as otherwise directed by client.
The electronic transmittal

shall be on read/write CD. Two sets of disks shall be handed over: one Master and one working copy. A strict software configuration control shall be enforced.

### 2.1.9 Inspection and Testing Certificates

#### 2.1.9.1 Supply Works Test Certificates

Works tests certificates shall include, whenever applicable, full information to enable the item tested to be identified, such as project title, Contractor's name, manufacturer's nameplate or serial numbers, the location in the Supply Works and the delivery or batch which the sample represents.

#### 2.1.9.2 Inspection and Testing Records

The Contractor shall maintain records of all inspections, and testing performed to substantiate conformity with the Contract Documents including those carried out by the Contractor and/or third- party testing agencies, together with manufacturers' or Contractors' certificates of test.

All records shall be retained on site and made available to Client on request. On completion of the Works all records shall be handed over to Client unless otherwise directed.

These records shall include, as appropriate, but not be limited to, project title, Contractor's name, the identification of the element, item, batch or lot, the nature and number of the observations and tests, the dates of testing, the name and signature of the person responsible for the testing, the number and type of deficiencies found, and details of any corrective action taken.

Any record, which indicates that any part of the Works inspected or tested does not comply with the Contract Documents, shall be submitted without delay in order that the Contractor's proposals for rectification may be assessed.

#### 2.1.9.3 General Inspection

The Contractor shall test each plant item as specified herein and as required by French Codes and by applicable Insurance Agencies (Please note, Client's insurers is Marsh). Tests shall be witnessed by all required parties and written certification of same furnished to Client. The Contractor shall co- ordinate all testing and commissioning with the Contractor.

Inspections and tests shall be carried out in accordance with specified or approved procedures and the results shall be judged in accordance with the specified Standards or other agreed criteria including criteria defined in the Specification.

#### 2.1.9.4 Statutory Approval Testing

The Contractor shall be responsible for ensuring that all tests and approvals required by Statutory Authorities are duly performed by an approved Insurance Authority and the relevant approval documents issued, free of charge, to the Contractor. The name of the Insurance Authority shall be stated by the Contractor for approval by Client at the time of Tender.

#### 2.1.9.5 Pre-commissioning, Setting to Work

Following the completion of installation, all equipment shall be pre- commissioned, set to work and commissioned. The Contractor shall conduct these tests to ensure the safe and correct setting to work of the equipment supplied under the Contract.
The Contractor shall detail the tests required which shall include but not be limited to the following:
Check all electrical connections to ensure that they are correct
Electrical test records to ensure that the Equipment is safe to operate
Carry out any further electrical tests necessary to ensure the Equipment is in a safe and satisfactory condition to operate
Check operation of all safety devices
Check all pipework connection
Check the installation of valves, mountings, pipe and fittings
Check the installation and connection to field mounted control devices
Check the connection of field mounted control wiring and piping to control equipment, terminals and panels
Check any field cleaning, flushing, hydrostatic and pneumatic testing of the installed equipment
Check lubrication
Check rotation of drives
Check and confirm power consumption of all electrical equipment (e.g. fans, pumps, heaters etc.)
Carry out short running tests on all items sufficient to demonstrate the general operation of the Equipment and the operation of controls, control valves, instruments etc.
Carry out any field testing of the installed works control system and interface with the master

controller and BMS
Tests required by the Insurance Authority and Statutory Authorities
Submit a written report of satisfactory completion for each stage of work

# WATER MIST SYSTEM

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## 1. Component description

The high-pressure water mist system comprises a modular pump unit, modular section valves, nozzles, press fittings and pipes.

### 1.1 Nozzles

high-pressure water mist nozzles are designed to produce a fine mist of water droplets that quickly extinguish fires by cooling the flames and reducing the oxygen supply to the fire. high-pressure water mist nozzles comprise a compression connector (8434-1) made of stainless steel AISI 316L for both 10 mm, 12 mm, and 15 mm OD pipe (subject to nozzle type), a nozzle body with drilled holes or micro nozzles and in the case of automatic nozzles, a thermal release element.

#### 1.1.1 Automatic water mist nozzle

Water mist system with activation based on an individual automatic water mist nozzle that operates when its thermal release element is heated to its thermal rating or above, allowing water mist to discharge over a specified area or volume.

**Thermal release element**

The thermal release is designed to produce and discharge water mist. The glass bulb of the thermal release element contains fluid which expands when exposed to heat. When a rated temperature is reached, the bulb shatters and water flows through the automatic water mist nozzle, forming a uniform water mist spray pattern to control or extinguish fire.

**[Thermal release element]**



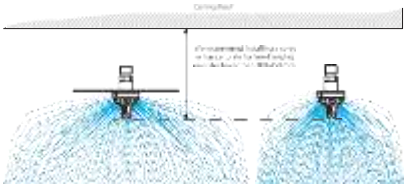
Automatic water mist nozzles are normally used in wet, dry and pre-action systems.

#### 1.1.2 Spray enhancer plate

The spray enhancer plate is designed to support and reinforce the spray pattern of the nozzle in instances where the nozzles are free hanging. The spray enhancer plate has a diameter of ø200 mm, which enables better heat collection and consequently, better activation of the automatic nozzles.

The spray pattern of a free-hanging nozzle has the tendency to lose its shape. To retain its shape, the spray enhancer plate can be installed. The spray enhancer plate creates a vacuum between the nozzle and the plate which elevates and widens the spray pattern.

[Spray enhancer plate]



### 1.1.3 Open water mist nozzle

Water mist system with activation based on an individual open water mist nozzle that operates manually or on detection from a sensor (heat, smoke, or a flame etc), allowing water mist to discharge over a specified area or volume. Open nozzles are normally used in deluge systems.

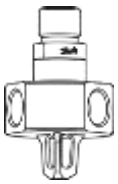
[Open water mist nozzle]



### 1.1.4 Heat release element

Heat release element is designed to discharge and distribute water to the connected water mist nozzle(s) at that very moment where the heat release element is heated to its thermal rating or above. Heat release element can be used with advantage where obstructions extending or suspending from the ceiling will impact the spray pattern of the nozzle. (See section nozzle obstructions)

[Heat release element]

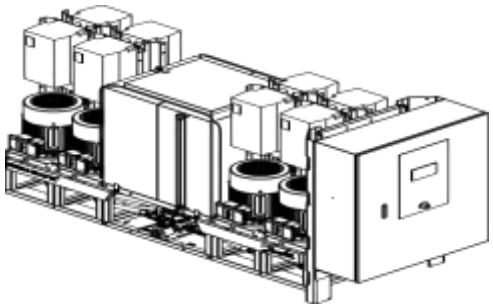


### 1.2 Pump unit

The pump unit is a special engineered part of the high-pressure water mist system for firefighting. In case of a fire, the pressure transmitter module on the pump unit registers a pressure drop on the main trunk line; an activation signal is sent

to the pump unit. Once activated, the pump unit will start up the required pumps to maintain flow and pressure in the system. If the flow demand increases due to the release of more nozzles, additional pumps will automatically start sequentially.

[Pump unit]



### 1.2.1 Pumps start sequence for electrically driven pumps

When the system is activated, only one pump will be started. For systems incorporating more than one pump, the pumps will be started sequentially. Should the flow increase due to the opening of more nozzles, the additional pump(s) will automatically start. Only as many pumps as are necessary to keep the flow and operating pressure constant with the system design will operate. The high-pressure water mist system remains activated until qualified staff or the fire brigade manually shut off the system.

### 1.2.2 Diesel driven pump unit

When the system is activated, all pumps will be started simultaneously. The diesel unit will keep the water flow and pressure constant at the calculated design level. If the flow is too high, the surplus flow will be led to the outlet. The high-pressure water mist system remains activated until qualified staff or the fire brigade manually shut off the system.

### 1.2.3 Pump capacity, power supply requirements and dimensional details

For more information, refer to datasheet or [Electric driven pump unit DIOM manual].

### 1.2.4 Redundant pump

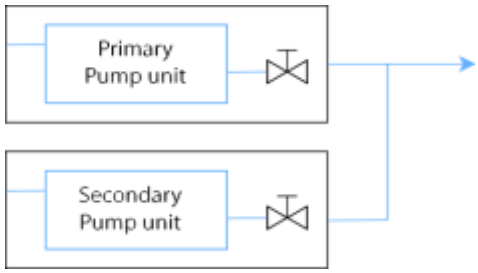
During normal operation, both pump units are connected to the water mist system and the system monitors the pressure. The pressure in the system is maintained by the primary pump unit. If the pressure in the manifold drops below the setpoint for activation (Fire Detection Setpoint) or if a signal for external activation is received, then both pump units will be activated. The primary unit starts the first high-pressure pump without delay and then the remaining high-pressure pumps will start in the set interval.

The secondary pump unit is activated but waits with the start of the first high-pressure pump until the delay has expired, but only if the system pressure is below the system working pressure. Delay for first pump start-up resets when system working pressure is reached. If the primary pump unit cannot maintain the system working pressure, pumps are started from the

secondary unit when the pressure in the system has been below the system working pressure long enough for the first pump start delay having expired. When performing maintenance of a pump unit, that unit can be isolated from the system by closing the high-pressure main valve during the maintenance.

The building will still be protected by the other pump unit.

**[Redundant pump]**




### 1.2.5 Water supply

Pump systems will typically operate between 80 bar and 150 bar with single pump flow rates up to 184 l/min.

#### 1.2.5.1 Pressure and water capacity of town mains

For pumps., directly connected to the town main, a test shall be carried out to show that the un-boosted supply provides a flow rate equal to the maximum demand flow plus 20 %, at a pressure of at least 0,5 bar, as measured at the pump inlet.

#### 1.2.5.2 Excess water

Water return lines from pressure relief valves, test valve and bypass valves are connected to the return manifold or tank on unit. Water return manifold can be connected to reservoir tank or drain. Connection to a reservoir tank or the drain and the drain, must be dimensioned to accommodate the maximum flow of the pump unit, without exceeding the maximum pressure of the return manifold.

Overflow connection to tank on unit can be connected to drain.

Note: All connections to drain must be ventilated. Note: See [datasheet] for maximum pressure.

#### 1.2.5.3 Overheating prevention of water supply.

When the pumps on the pump unit are in operation, energy is supplied to the water pumped through the pumps. If excess water is returned to the tank and if there is no consumption on the system, there is a risk of overheating of the feed water in the tanks (max 50°C degrees). This will damage the high-pressure pumps. To prevent this, the outlet on one regulating valve can be led to drain. This is to ensure the supply of cold feed water to the tank.

Note: The drain must be dimensioned at least according to the maximum flow from the regulating valve, 150 l / min.

Note: All connections to drain must be ventilated.

### 1.2.6 Pump unit components

#### 1.2.6.1 Pressure transmitter module

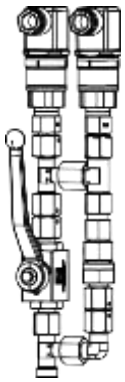
The pressure transmitter module is designed to register and start the pump unit on a pressure drop on the main trunk line in both operation and service mode, i.e., with the main valve closed.

In the event of a pressure drop on the main trunk line, the pressure transmitter of the module will register the drop and send a signal to the UCP of the pump unit. The signal will trigger an acoustic alarm at the pump unit and an alarm at the fire alarm system. This is to alert both personnel onsite and the local fire department or other firefighting body of the pressure drop.

The pressure transmitters have the following function:

Show the current system pressure in the alarm display on the UCP control panel.
Start and stop of pilot pump to maintain the standby pressure.
Activate the high-pressure pumps on rapid drop in the standby pressure.
The pressure transmitter is monitored for wire breaks and short circuits. Broken cables will not cause the pump to start. In the event of a cable break during operation, all high- pressure pumps start up.

[Pressure transmitter module]



#### 1.2.6.2 Tank on unit

The unit tank (tank on pump unit) is designed to establish an air gap between the supply source (public water supply) and the water contained in the water mist system (backflow protection according to standard EN 1717). Its other function is supplying the clean filtered

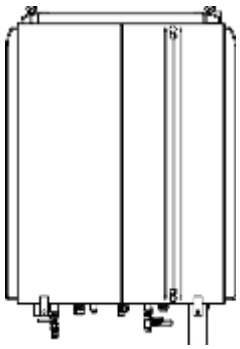
water to the high-pressure pumps and receiving excess water from the pressure regulating valves and safety valve.

The unit tank volume is adapted to the discharge capacity of the SEM-SAFE® pump unit. The unit tank volume is 1200l.

The unit tank level is monitored and controlled by a pressure transmitter. In case the transmitter malfunctions, the unit sends out a common fault. If the system is activated

while the transmitter is out of order, all filling valves will open to fill the tank regardless of the level.

**[Tank on unit]**



### 1.2.6.3 Motor starters

#### 1.2.6.3.1 DOL starting direct-on-line

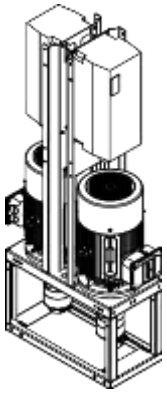
The Direct-On-Line can be used where high starting current is not critical.

#### 1.2.6.3.2 Frequency converter

The frequency converter can be used if there is a need to eliminate the start current of the motor having the best performance with the smallest footprint. As well as gentle operation, improving system reliability.

Caution: Before designing a system with frequency converter, ensure that it complies with the commercial property insurance policies and other official national and local regulations.

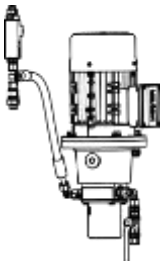
**[Frequency converter]**



### 1.2.6.4 Pilot pump

The pilot pump is designed to maintain a stand-by pressure. To maintain the stand-by pressure, a pressure transmitter controls the start and stop of the pilot pump. If the pilot pump has been running more than 2 times or continuously within 5 minutes (adjusted), an alarm of potential leakage will be trigged.

**[Pilot pump]**



Note: When the high-pressure pumps are running, the pilot pump is prevented from running.

### 1.2.6.5 Manifolds

#### 1.2.6.5.1 Inlet manifold

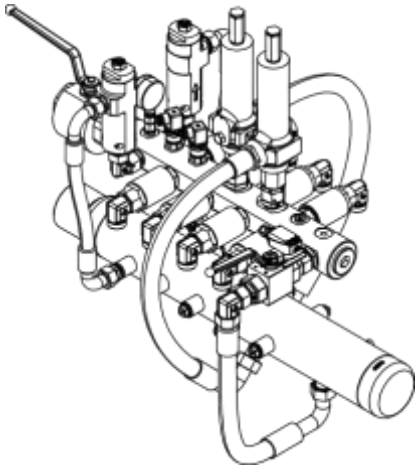
The inlet manifold supplies water to the pilot pump or the high-pressure pumps. The primary function is evenly distributing the supplied water to the high-pressure pumps.

#### 1.2.6.5.2 High-pressure manifold

The high-pressure manifold combines all high-pressure outlets from the pumps to the main shut-off valve and further into the pipe system and to the water mist nozzles.

The main components mounted on the high-pressure manifold are:

[High-pressure manifold]



#### 1.2.6.5.2.1 Main valve

The main valve is used to isolate the pump unit from the pipe system when servicing and maintenance is carried out on the unit. A limit switch is mounted on the main

valve, which indicates whether the main valve is in the fully open position. If the main valve is not in the fully open position, it will issue an alarm.

#### 1.2.6.5.2.2 Test valve

The test valve is used for the following operations and pump start-up during service and maintenance:

Pressure relief of the high-pressure manifold during maintenance and service.
Test of start and stop of pilot pump at pressure drop.
Test of high-pressure pump.

Start of the high-pressure pump when the pressure drops below unit activation set point.
The pressure drop in the system is simulated, with the main valve in closed position.
A limit switch is mounted on the valve, which indicates whether the valve is in closed position.
If the valve is not in closed position, it will issue an alarm.

#### 1.2.6.5.2.3 Alarms for valve position indication

Main and test valve alarms are a common alarm for line break if the main valve is not fully open and if the test valve is not fully closed.

#### 1.2.6.5.2.4 Pressure regulating valves

The purpose of the pressure regulating valve is to maintain the system pressure at the desired level. This is done by leading excess pump capacity back and thereby maintaining desired system pressure.

The pump unit is equipped with up to two pressure regulating valves. The valves are installed on the high-pressure manifold of the high-pressure pump unit.

#### 1.2.6.5.2.5 Safety valves

Up to two safety valves can be installed on the high-pressure manifold of the high- pressure pump unit. The safety valves activate when the system pressure reaches the set point of the safety valve. The set point of the safety valve will determine the system design pressure. When activated, the water is drained back to the tank or return manifold.

The pressure regulating valves and safety valve are pre-set at the factory and this setting must not be changed. All types of service and repairs to the valve must be carried out by a qualified service engineer.

#### 1.2.6.5.3 Return manifold

Water-return lines from pressure regulating valves, test valves and bypass valves and safety valves are collected in a common return manifold to be returned to the water storage tank or drain in one single pipe.

For more information, see datasheet or [Electric driven pump unit design, installation, operation, and maintenance manual].

### 1.2.6.6 Unit control panel (UCP)

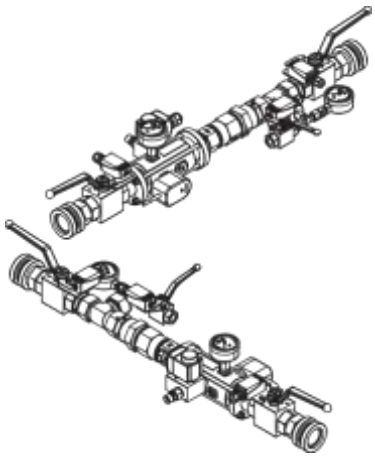
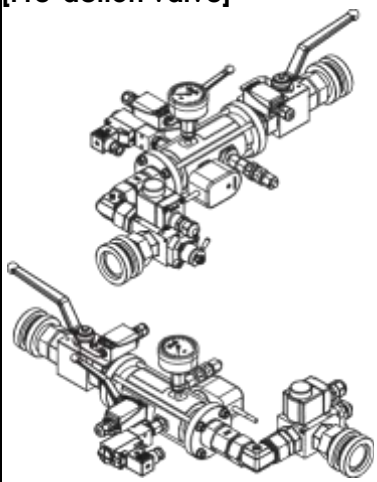
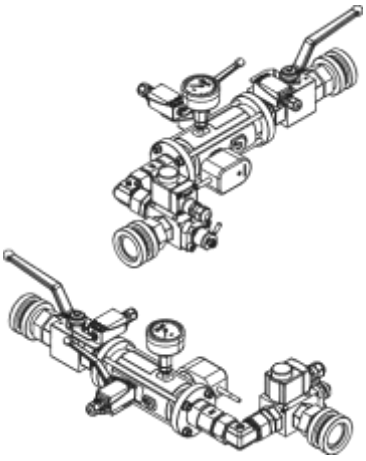
The unit control panel can be specified to be mounted on the pump unit, or for remote installation. The control panel has an ingress protection rating of IP54. For power supply and more information, see datasheet or [Electric driven pump unit design, installation, operation, and maintenance manual].

## 1.3 Section valves

The Section valves are used to separate the individual fire sections. A section valve shall be installed per water mist system or section. The section valves are made of stainless steel (AISI 316). The section valves should be located outside the protected rooms if not stated otherwise in national or local regulations and codes. The section valves' sizing is based on sections' design capacity for the individual section.

section valves are used for the following four different types of high- pressure water mist firefighting systems.

A wet valve for an automatic wet pipe system.
A dry valve for an automatic dry pipe system.
A pre-action valve for an automatic pre-action system.
A deluge valve for a deluge system.

| [Wet valve] | [Pre-action valve] | [Deluge valve] |
| --- | --- | --- |
|  |  |  |

### 1.3.1 Wet valve

The wet valve can comprise a non-return valve, inlet shut-off ball valve, test valve, pressure indicator, flow switch and outlet shut-off ball valve. The inlet and outlet shut- off valves and the test valve are supplied with an electrical limit switch for monitoring the valve position indications.

The wet valve is normally open, i.e. the wet valve is fully open in system stand-by operation mode, and the pipe system is filled with water from the pump unit and downstream to the high-pressure water mist nozzles.

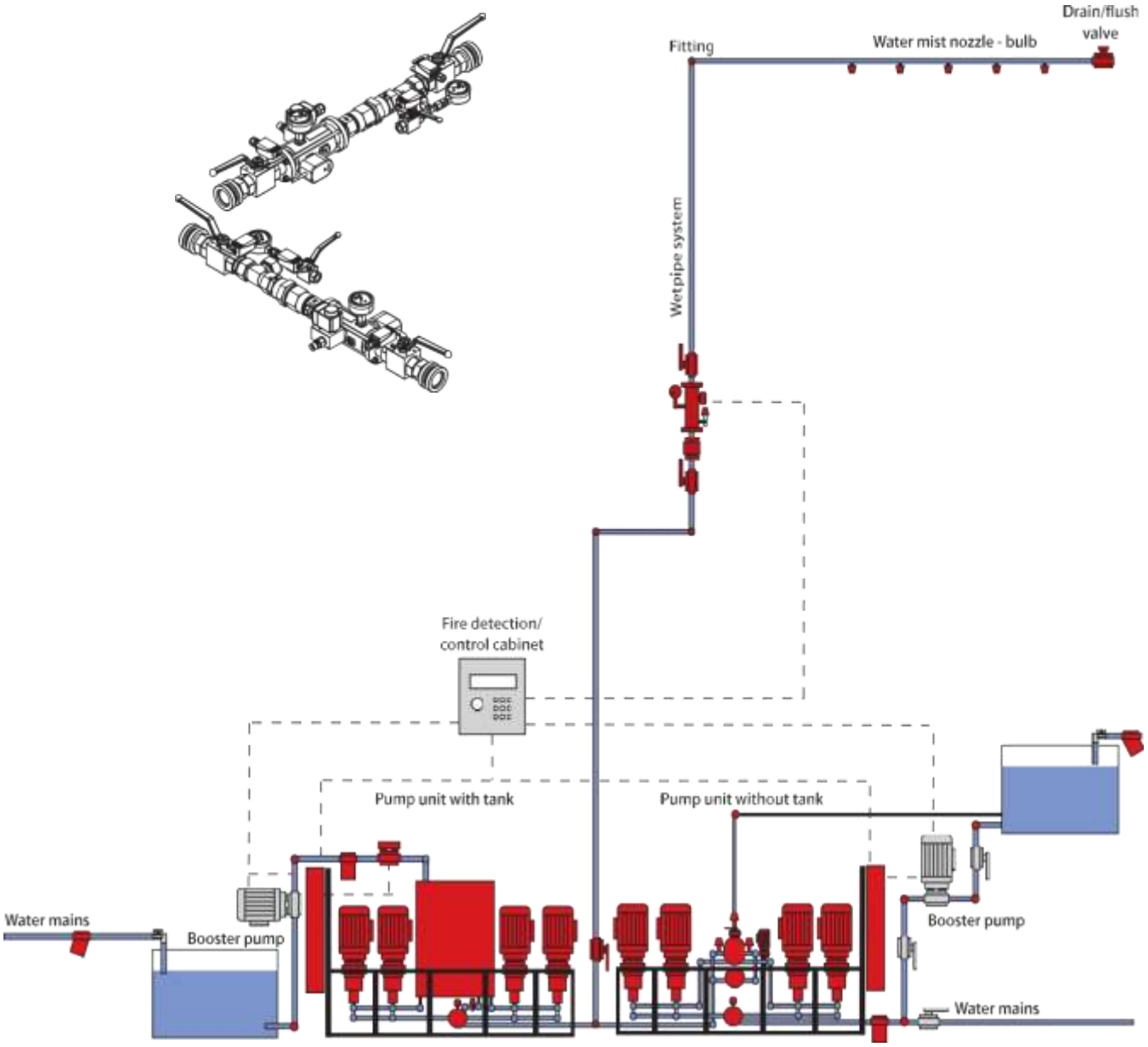
The system is activated when the thermal-sensitive glass bulb in the nozzle bursts and the nozzle opens. This is caused by an increase in the temperature at the nozzle during fire.

Opening of the nozzle creates a pressure drop in the pipe system, which activates the high-pressure water mist pump unit.

The pump unit immediately delivers water under high pressure to the pipe system through the normally open wet valve to the activated high-pressure water mist nozzles located in the fire.

When water flows through the wet valve, the flow switch detects this and a signal from the flow switch can be transferred to the fire alarm panel, showing the exact section affected. In case of a fire, firefighters then know where to direct their attention.

**[Wet valve]**




### 1.3.2 Dry valve

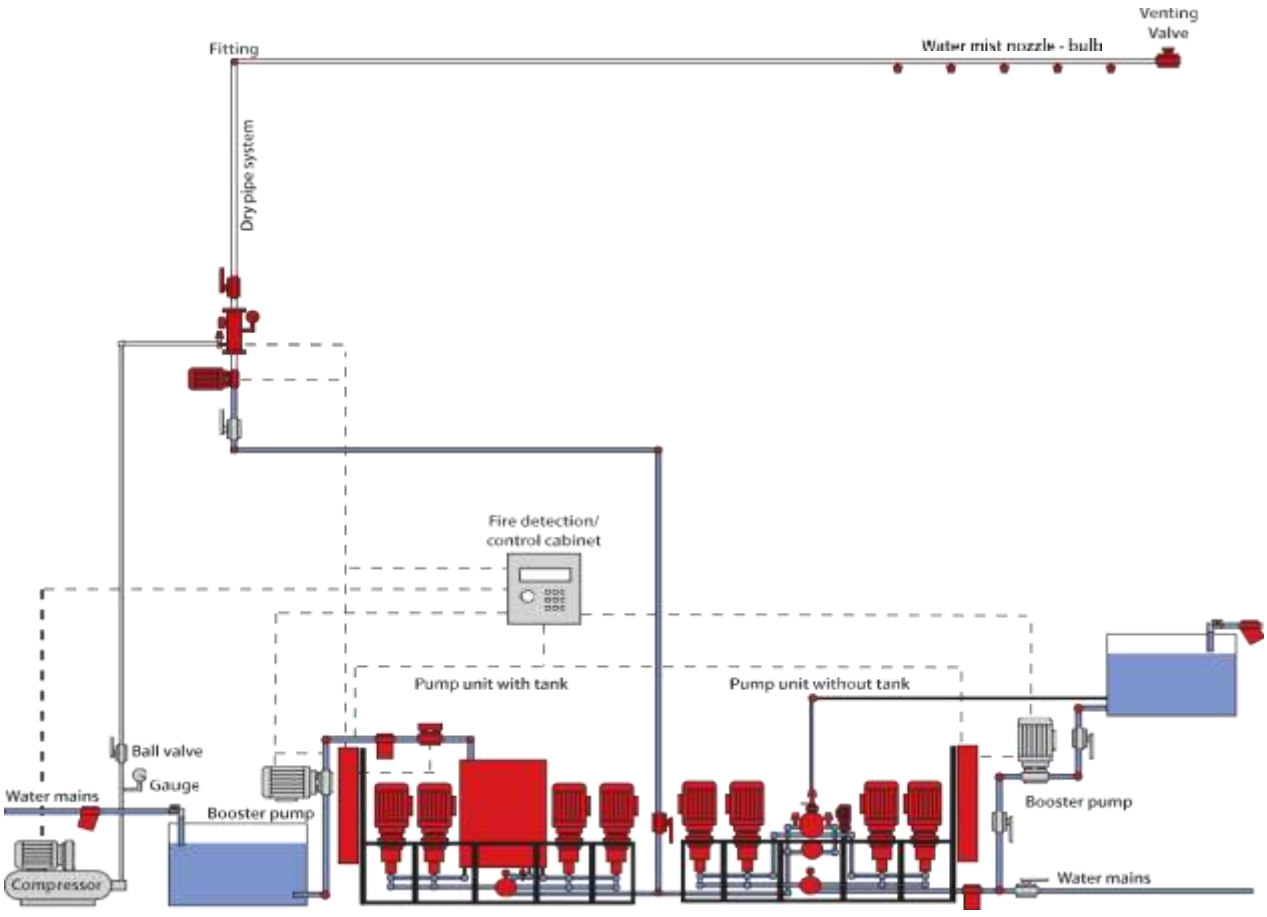
The dry valve is typically used where there is a danger of the water freezing inside the pipes. Dry valves can be used where the room temperature can drop below 4°C. The dry valve is normally closed in system stand-by operation mode. The pipe system from the pump unit to the valve is filled with water and from the dry valve to the nozzle the pipes are filled with compressed air or gas. The air (or gas) pressure is typically 1 to 3 bar.

The compressed air (or gas) in the pipe system opens the dry valve in the event of a pressure drop due to the burst glass bulb in the nozzle. This will activate the flow switch and send a signal to the fire control. The fire control will send a signal to the section valve to release the water.

The dry valve comprises a shut-off ball valve on the inlet, motor-operated ball valve or solenoid operated valve, test valve, pressure indicator, flow switch, and outletshut-off ball valve. The inlet and outlet shut-off valves and the test valve are supplied with an electrical limit switch for monitoring the valve position indications. The dry section valve also contains a pressure switch/transmitter (alarm device) and connection through a non-return valve for compressed air.

Note: If more than one floor is to be protected with a dry pipe system, each floor must have its own section valve. This includes mezzanines, but not balconies.

For more information on the dry valve, please refer to the SEM-SAFE® datasheet or [section valve design, installation, operation, and maintenance manual].



### 1.3.3 Pre-action valve

The pre-action valve is typically used in areas containing high-value equipment or areas which are highly sensitive to the effects of accidental discharge. A pre-action valve works in combination with an automatic fire detection system. The pre-action valve is normally closed in system stand-by operation mode and is operated by a separate detection system.

When the system is in stand-by operation mode, the pipe system is filled with water from the high-pressure pump unit and downstream to the pre-action valve. From the pre-action valve to the water mist nozzles, the pipe system is filled with compressed air (or gas). The compressed air (or gas) fills the pipe system at the pre-action valve.

The air compressor operates from its own pressure regulating device (start/stop pressure switch). The compressed air (or gas) in the pipe system monitors the pipe integrity. The air (or gas) pressure is typically 1 to 3 bar.

The pre-action valve comprises an inlet shut-off ball valve, motor-operated ball valve or solenoid operated valve, test valve, pressure indicator, flow switch, and outlet

shut-off ball valve.

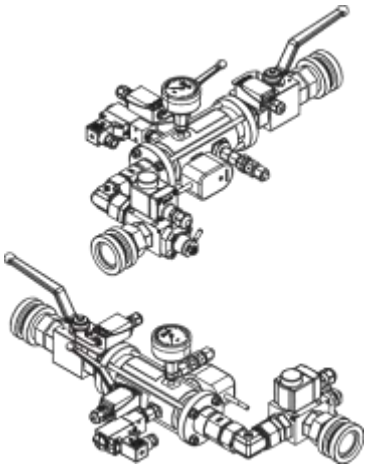
The inlet and outlet shut-off valves and the test valve are supplied with an electrical limit switch for monitoring the valve position indications. The pre-action valve also contains a pressure switch or pressure transmitter (alarm device) and connection through a non-return valve for compressed air.

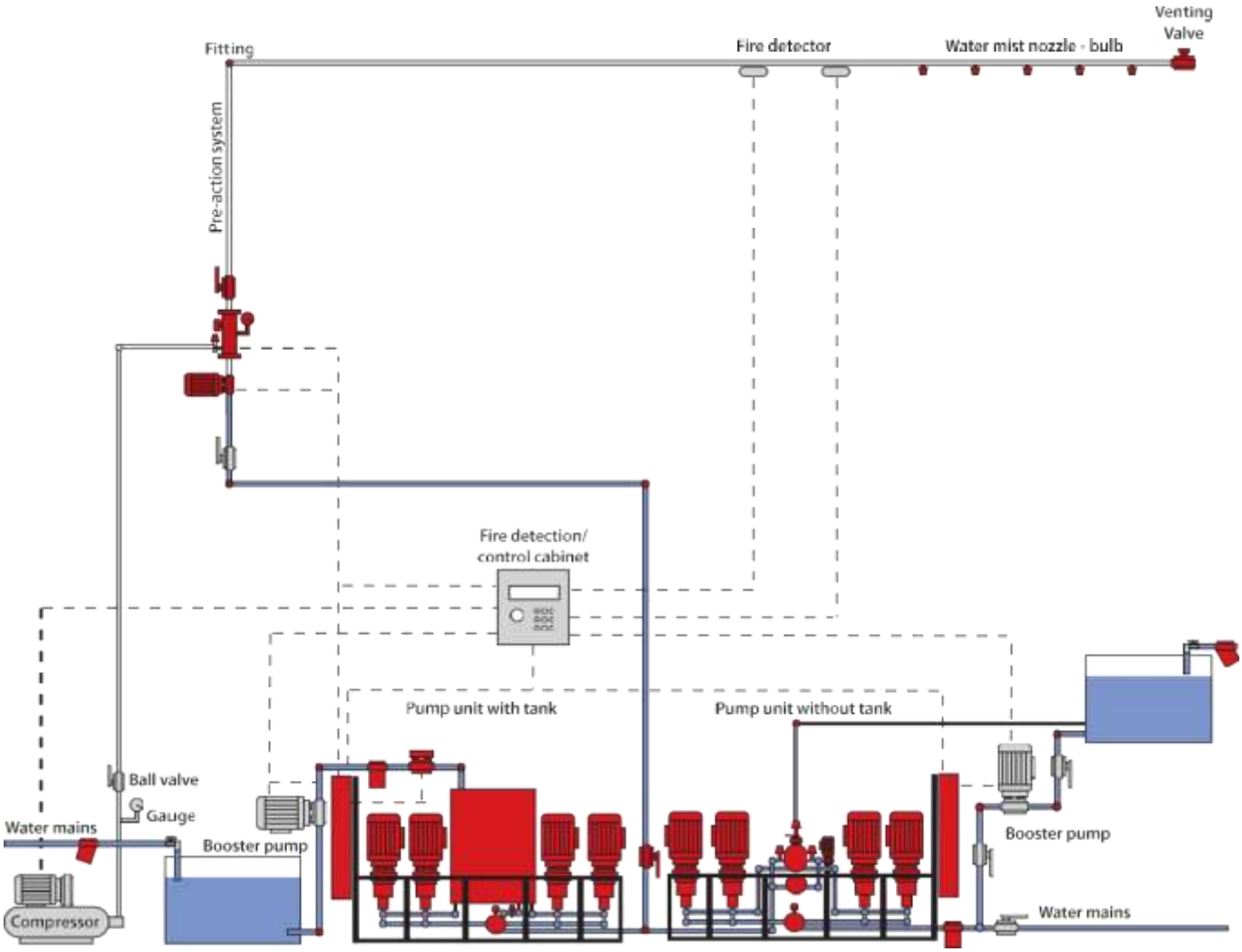
Two things must happen before a pre-action system releases water.

The individual nozzle bulb must burst to allow water to discharge.

The detection system must detect a fire and the valve must open, releasing water into the pipes.

[Pre-action valve]






### 1.3.3.1 Valve in single interlock system

When a fire is detected by a single automatic fire detection system, a signal is sent to open the pre-action section valve, which activates the high-pressure pump unit. The high-

pressure pump unit pressurises the pipe system up to the high-pressure water mist nozzles.

The increase in the temperature in the area will make the thermal-sensitive glass bulb in the nozzle burst. Once burst, the nozzle head(s) will discharge a water mist into the affected area.

### 1.3.3.2 Valve in double interlock system

In a double interlock system, two (double) different kinds of fire detectors need to be activated before the pre-action section valve opens. Once a fire is detected by both (double) automatic fire detection systems, signals are sent to open the pre- action section valve, which activates the high-pressure pump unit. The high-pressure pump unit pressurises the pipe system up to the high-pressure water mist nozzles.

The increase in the temperature in the area will make the thermal-sensitive glass bulb in the nozzle burst. Once burst, the nozzle head(s) will discharge a water mist into the affected area.

**Caution**

Before designing a double interlock system, ensure that it complies with the commercial property insurance regulations and other official regulations.

**The conditions that must be met for the pre-action system to activate.**

If only one condition is triggered, an alarm will be sent to the fire alarm panel, but no water released. The conditions that will trigger an alarm are as follows:

Only one fire detector has been activated.
The nozzle is burst and no or only one fire detector has been activated.
The pressure switch/transmitter (alarm device) has been activated due to a pressure drop (leakage) in the pipe system.
For more information on the pre-action valve, please refer to the SEM-SAFE® datasheet or [section valve design, installation, operation, and maintenance manual].

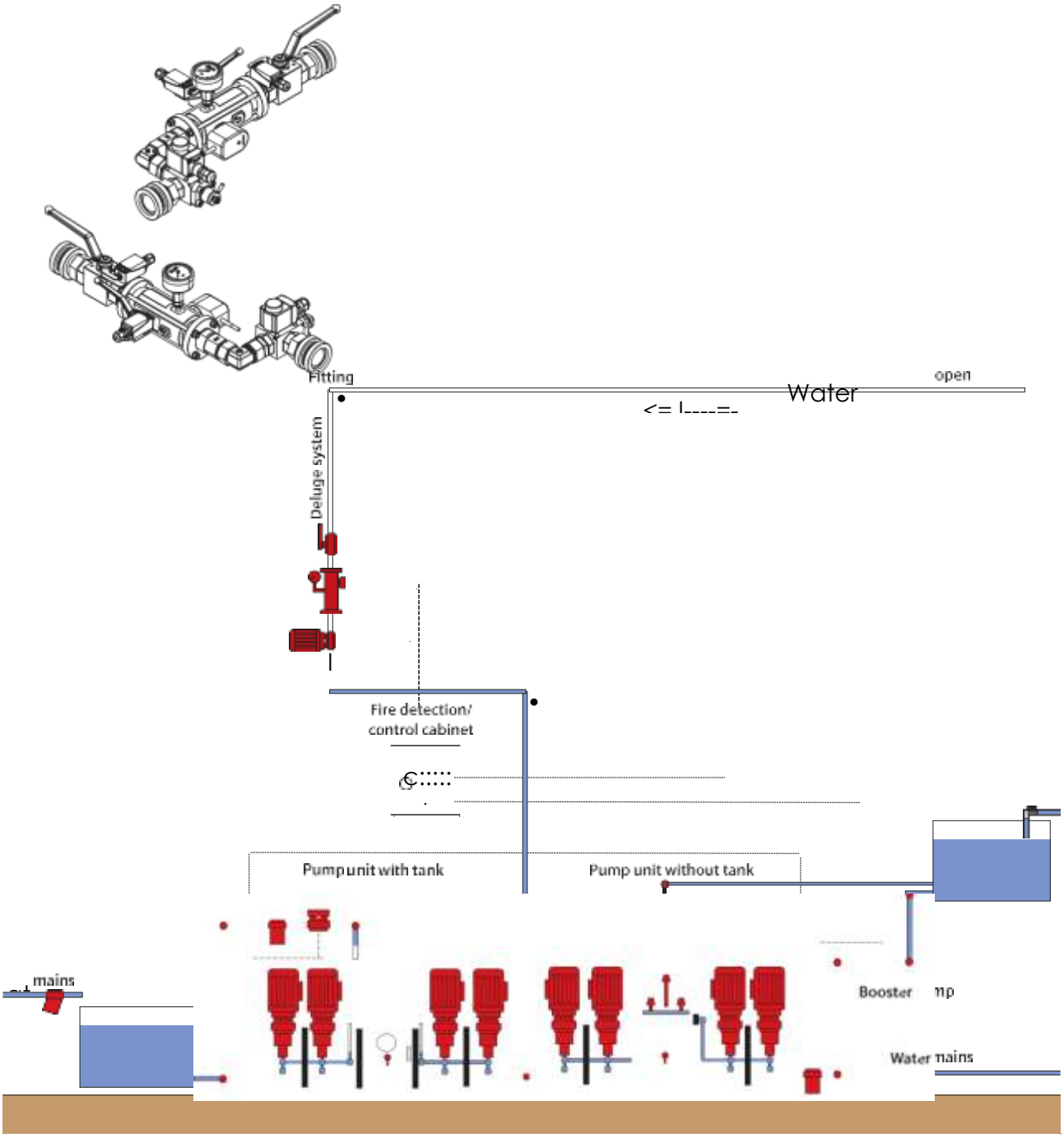
### 1.3.4 Deluge valve

The deluge valve is a dry pipe water mist system with open nozzles. The deluge valve is typically used where more nozzles are released at the same time, for example local application or total flooding systems. A deluge system works in combination with an automatic fire detection system.

The deluge valve is normally closed in system stand-by operation mode. The pipe system from the pump unit and downstream to the normally closed deluge section valve is filled with water. However, the pipe system from the deluge valve downstream to the open high-pressure water mist nozzles is dry without water (or gas).

The deluge valve comprises an inlet shut-off ball valve, motor-operated ball valve or solenoid operated valve, test valve, flow switch, and outlet shut-off ball valve. The inlet and outlet shut-off valves and the test valve are supplied with an electrical limit switch for monitoring the valve position indications.

For more information on the deluge valve, please refer to the SEM-SAFE® datasheet or [section valve design, installation, operation, and maintenance manual].[Deluge valve]




### 1.3.5 Electrically operated section valves

The dry, pre-action and deluge section valves can be supplied as either an electrically operated solenoid valve or as an electrically operated motorized valve. The solenoid section valve is used in systems with a section capacity up to approx. 150 l/min. and a motorized valve is normally used in systems with a section capacity of more than 150 l/min.

The solenoid section valves are directional high-pressure electrically operated solenoid valves with a built-in supplementary manually operated high-pressure bypass valve. The solenoid-

operated section valves normally require a 230VAC or 24 VDC signal for operation. The built-in manually operated high-pressure bypass valve allows the valve to be opened manually in an emergency. The bypass valve is normally closed and "locked" in the closed position.

Motor-operated section valves normally require a 230VAC or 24 VDC signal for operation. The motor driven section valve is normally a high-pressure ball valve, driven by an electric actuator. The motor driven valves can also be emergency operated, by manually operating a built-in actuator override when the actuator is powerless.

### 1.4 Filter

The Filters are intended to be used as a physical barrier that can block or trap debris from entering the High pressure pump unit, Section valves, Nozzles at high flow rates in a fixed firefighting water mist system. The pump unit requires water with no particles larger than 10 microns (10 µ). Thus a 10 µ absolute filter with a Beta value > 5000 must be used. (The Beta value

> 5000 refers to the efficiency of the filter).

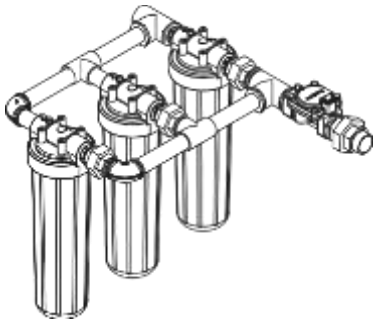
10 µ means that particles of 10 µ or larger in size will be caught by the filter. Absolute filtration means that the fluid is filtered both horizontally and vertically. In comparison, an inferior nominal type of filter will allow particles which are more than 10 µ in length to pass through the filter, as it only filters the fluid according to the diameter of the particles.

A filter with a Beta value of > 5000 catches 99.98% of particles 10 µ or larger.

#### 1.4.1 Big blue filter unit

Big blue filter unit provides a high level of water filtration (10 microns).

[Big blue filter unit]



### 1.4.2 Standard filter unit HF-2-S

The 40" stainless-steel high-pressure filter solution is typically used for larger capacity water mist systems and where the filter inlet pressure exceeds 6 bar. One filter can be used for capacities up to 1000 l/minute.

For more information onFilters, please refer to the SEM-SAFE® datasheet or [filter design, installation, operation, and maintenance manual].

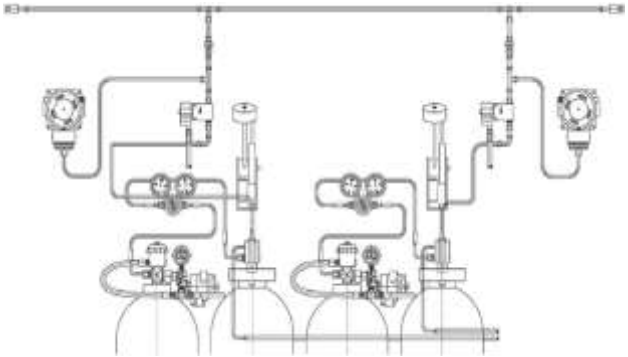
### 1.5 Cylinder

cylinders are to be used as a primary fixed firefighting water mist system for total flooding application in enclosures with volumes not exceeding 260 m³. SEM- SAFE® cylinder-based systems are used for the protection of machinery spaces, combustion turbine enclosures and special hazard machinery spaces.

The cylinders shall be used in open nozzle systems for applications like:

Machinery spaces.
Diesel generators.
Combustion turbines, incl. appropriate devices, such as oil pumps, oil tanks, generators, gear units, drive shafts, and hydraulic units.
The Cylinder based system is designed as a total flooding type system, discharging the water mist within the entire risk volume from all the nozzles installed in the protected enclosure.

**[Cylinder based system]**



### 1.5.1 Field of application

The Cylinder based system can be designed to provide continuous or intermittent flow from the discharge open nozzles working at a design pressure from 45 to 100 bar.

Note: For an intermittent flow system, the water mist discharge is sprayed into the enclosure in a pulsing sequence (e.g., start, 40- second spray, 30- second pause, 15- second spray, 45- second pause, 15 second spray / 45 second pause sequence repeats 19 times for complete discharge). It is normally used to avoid too rapid cooling of the machinery.

The Cylinder based system can be designed for enclosures with or without controlled ventilation shutdown and door closing upon fire detection.

**Note:** For systems designed for enclosures with controlled ventilation shutdown and door closing upon fire detection, during firefighting, the dampers are automatically operated by the extinguishing system to limit ventilation of the protected area.

discharge open nozzles shall be selected considering the enclosure sizes and the respective maximum ceiling heights as well as design recommendations and limitations described in the relevant fire test reports to obtain the same average water mist flux density as demonstrated in the fire tests.

Note: Refer to the fire test summary correspondent to the protected enclosure for the selection of the correct discharge open nozzle.

Where a high level of security and limited downtime is required, it is common practice to equip the system with a reserve charge of both propellant media and extinguishing media (pure water), as well as duplicated nitrogen release units and system regulators.

Note: Cylinder battery banks are referred to as MAIN and RESERVE if redundancy is requested.

### 1.5.2 Discharge duration

The minimum discharge duration of the Cylinder based system listed below, taken from internationally established rules of good practice, constitute a guide for defining the minimum performance requirements of the systems:

### 1.5.3 Machinery Spaces

All hazards included under the scope of this total flooding application shall be protected for a minimum of twice the longest time to extinguish the test fires, the time to shut down process equipment, or 10 minutes, whichever is greater.

### 1.5.4 Combustion turbine enclosures

Combustion turbines included under the scope of this total flooding application shall be protected for a minimum of twice the longest time to extinguish the test fires, turbine rundown time (including the time that the turbine surfaces are above the auto ignition temperature of the lubricating fluid), the time to shut down process equipment, or 10 minutes, whichever is greater.

### 1.5.5 Special hazard machinery spaces

All hazards included under the scope of this total flooding application shall be protected for a minimum of twice the longest time to extinguish the test fires, the time to shut down process equipment, or 10 minutes, whichever is greater.

**Note:** The cylinders' capacity is designed with reference to the defined total protection time depending on the recommended nozzle flow rate, minimum working pressure, and the total number of nozzles installed in the protected enclosure for both the MAIN and RESERVE (if present) cylinder battery banks.

### 1.5.6 Component specification and functional description Cylinder battery bank(s)

Each discharge bank consists as a minimum of 1 x nitrogen cylinder pressurized to 200 bar and 1 x water storage cylinder, nitrogen and water valves, nitrogen release unit(s), system regulator(s) and flexible connection hoses.

**Nitrogen cylinder(s)**

Nitrogen is the medium used as the water mist system propellant and acts as the prime mover of the water. Nitrogen is stored in 80 litre cylinders.

For more information on Cylinders, please refer to the datasheet or [cylinder design, installation, operation, and maintenance manual].

## 1.6 Pipe and fittings

Pipe fittings, also known as pipe connectors, attach one pipe to another to lengthen the run or change the flow direction in a pipe system. The fittings are used to combine, divert, or reduce the flow in the water mist system.

The pipe system is made from stainless steel pipes and fittings to ensure a corrosion- free pipe system. For corrosive circumstances, we recommend using EN10217-7 (ASTM A269)

- 1.4404 (AISI316L) or equivalent. For VdS or FM approved systems 1.4404 (AISI316L) pipe quality is mandatory.

Pipework materials shall be of stainless steel or of at least equivalent quality in respect of corrosion. Pipe wall thickness must be calculated based on the maximum pressure at pressure test, and pipe quality, also considering tolerance from ISO1127.

The sizes of the pipes range from 10.0 mm outer diameter x 1.0 mm wall thickness to a diameter of 60.3 x 5.54 mm. See more in the [pipework calculation] section.

For more information on Pipe and fittings, please refer to the datasheet.

## 1.7 B. Installation

### 1.7.1 Receipt of goods

Upon receipt of the equipment, do the following:

Ensure that order confirmation and package list match.
Ensure that the equipment has not been damaged during transport.

If the number of items on the order and package list do not match or in case of faults and defects in the delivery of the equipment, the project engineer should be notified. All incoming goods shall be directed to the relevant area or agreed storage facility.

## 2. Transportation

### Precautions

The weight of the pump unit is heavy and failure to follow local safety regulations for lifting heavy weights may cause death, personal injury, or property damage.
To guard against injury, wear personal protective equipment such as gloves, safety glasses, and safety shoes and head protection.
Never walk under suspended loads.

### 2.1 Lifting equipment

Always use appropriate lifting equipment with sufficiently safe working load.

### 2.2 Storage

The equipment must be stored in the shipping crate in which it was transported.

The shipping crate must be stored in such a way that it is protected from rain and snow.
Storage humidity: 0-90% R.H.
Storage temperature: 4-40°C.
The shipping crate must not be stacked.

#### 2.2.1 Stainless-steel materials

All stainless-steel materials must be handled and stored in a way that the corrosion rate of the stainless steel will not be reduced.

Storage temperature: -20 to 50 degrees Celsius.
Pipes must be protected from dust and dirt.
Pipe ends must be plugged during storage.
The pipes must be protected from falling objects and any damage.
Stainless steel must not come into contact with unalloyed steel during transport, handling, and storage. This means that all handling tools, all storage racks etc. used for stainless steel need to be made of stainless steel or wood or to be covered with textile, nylon, or similar materials.
Stainless steel is to be stored at a dry and clean place, where it will not be exposed to iron particles, abrasive dust, or welding smoke from unalloyed steel. Protection is also required from material particles from both unalloyed and other stainless steel.

### 2.2.2 Painting

It is not permitted to paint fire safety products except for pipes and fittings. For fire safety pipes and fittings, we recommend using fire-resistant paint.

## 3. Installation

### 3.1 Pre-installation

Inspect the drawings for location of pumps, cylinders, nozzles, and pipe routes:

Ensure that the positions indicated on the drawings for pump units, cylinders, valves, nozzles etc. are not obstructed.

Visually inspect the pipe route with the drawings to ensure both access and positioning can be achieved.

Any deviations from the drawing due to obstructions or coordination clashes shall be reported to the project engineer.

Changes to the design shall be finalised prior to the commencement of the installation and agreed with the client/owner or the authority having jurisdiction.

Nozzle obstruction: The size and distance to obstructions depend on the nozzle type. The information can be found on the data sheets for the specific nozzle.

### 3.2 Pipe work

All piping work may be performed according to EN 13480-4:2017. All pipes shall be carefully inspected for defects before installation.

Pipes or fittings that show defects shall not be used. Any injury to wrapping measurement of the pipe or fittings shall carefully be repaired before installation.

#### 1) Inspection of the pipes.

Pipes or fittings that show defects shall not be used. Always inspect the pipe, ensuring that:

There are no marks, scratches, or dents (> 0.1 mm) in the surface of the pipe.

#### 2) Pipe cutting

Always cut pipe with a cutting machine, manual or automatic, manufactured for the purpose of cutting stainless steel pipe with a cutting guide, for a right angle cut. Burrs inside and out must be removed using a purpose-made de-burring tool. Pipe cutting fluids shall not be used.

#### 3) Pipe cleaning

Immediately following the “bench work”, i.e., the pipe has been cut and/or bent, the pipe shall be thoroughly cleaned internally. Before a pipe can be considered ready for

installation, it should be cleaned as thoroughly as possible to ensure that no foreign matter remains inside and outside the pipe. If the pipe is not cleaned appropriately, contaminants like

weld defects, rough surface dirt, iron particles, scale etc. can cause damage to the nozzles and the pipeline.

**Pipe cleaning methods**

There are more recognized ways to clean pipes. Common methods are:

Cleaning with air.
Cleaning with steam.
Cleaning with water.
Mechanical cleaning.
For pipes we recommend using the pigging method (mechanical cleaning) to clean the pipes.

Note: If the pipes are not cleaned by any recognized methods, the pipes must be flushed. See [Flushing the installation]

We recommend marking the pipes that has been mechanically cleaned, this is to ensure that, cleaned pipes are not mixed with not cleaned pipe during installation.

**The pigging method**

A pipeline pig (polymeric projectile) is shot through the pipes by means of compressed air. The pipeline pig is compressed and forced through the pipeline, cleaning the inner

walls of the pipeline by a brushing action. The brushing action removes particles and other impurities.

The pipes must be cleaned at least twice with a pipeline pig. This is to ensure it is completely free of debris, particles, and other impurities.

### 4) Pipe support

The water mist system shall be supported by structural elements of the building.
The water mist system shall be supported independently of any other equipment that may be present in the building or otherwise accepted.
Pipe support for water mist systems shall be suitable for the hazard
considering the environmental conditions, dynamic and static forces.
Supports shall not be glued, welded, or soldered to the pipe fittings. Where necessary, supports for pipes shall be suitably lined to prevent corrosion and abrasion.
Supports shall be fitted as close as practically possible to each end of line water mist nozzles to ensure that no movement occurs which would recoil heads into the ceiling or loft voids.
At least one pipe support shall be fitted as close as practically possible to a pipe bend.
Pipe support must surround the pipe entirely.
Pipe support must be vertically adjustable to secure a uniform load.
Plastic raw plugs and screw anchors are not allowed.

**Pipe support and spacing**

Pipe supports shall, in accordance with EN 14972-1:2020, be spaced with no greater distance than:

| Maximum spacing of pipe supports for pipes with less than 2.6 mm wall thickness [B] | | |
|---|---|---|
| Nominal diameter [mm] | Horizontal run [m] | Vertical run [m] |
| 12 | 1.2 | 1.8 |
| 16 | 1.5 | 2.1 |
| 22 | 1.8 | 2.4 |
| 25 | 1.8 | 2.4 |
| 30 | 2,4 | 3.0 |
| 38 | 2.4 | 3.0 |
| 42 | 2.4 | 3.0 |
| 54 | 2.7 | 3.0 |
| Maximum spacing of pipe supports for pipes with min. 2.6 mm wall thickness [B] | | |
| Nominal diameter a [mm] | Horizontal run [m] | Vertical run [m] |
| 15 | 1.8 | 2.4 |
| 20 | 2.4 | 3.0 |

a for nominal diameters ≥ 25 mm see EN 128145 ;2015+A1:2019 section 17.2.2.

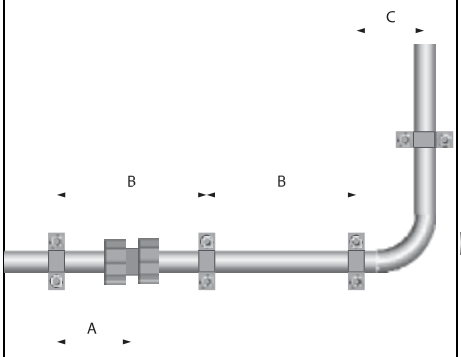
The designer is responsible for conform to the relevant standard.

Any single pipe longer than 1.5m must be fixed with a pipe clamp. For pipe fixation to long straight risers, particularly for high rise buildings, special care needs to be taken when it comes to expansion, which is not subject of this document. Any pipe connection is prohibited inside pipe bending.

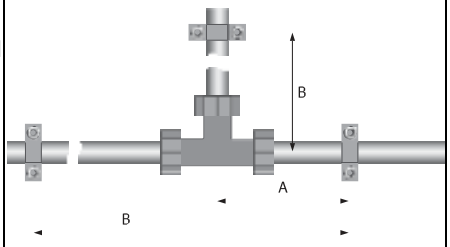
| Nominal diameter [mm] | Distance [A] m | Distance [C] m |
|---|---|---|
| 12 | 0.10 | 0.20 |
| 15 | 0.10 | 0.20 |
| 18 | 0.10 | 0.20 |
| 28 | 0.15 | 0.30 |
| 30 | 0.15 | 0.30 |
| 35 | 0.15 | 0.30 |
| 38 | 0.15 | 0.30 |
| 42 | 0.20 | 0.30 |
| 60.3 | 0.20 | 0.30 |
| 88.9 | 0.20 | 0.30 |
| 114.3 | 0.20 | 0.30 |

We recommend using M10 threaded rod up to 42-mm diameter. For diameters above this, use 12M threaded rod.

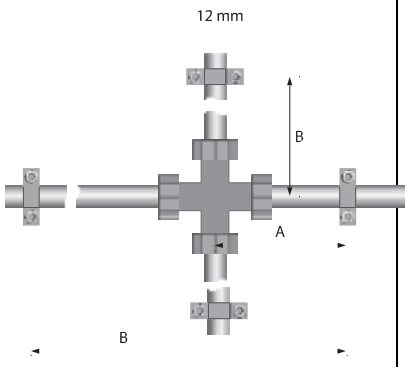
**[Bended pipe, straight pipe]**




**[T – connection]**




**[Distribution blocks]**



**Pipe support and spacing for pipes**

Fittings require a minimum service space of 5 times the diameter of the pipe on both sides of the fitting. The support for Pipes must be installed at least 300 mm away from the fitting. It is necessary that the pipe supports have an appropriate liner to avoid stress corrosion between the stainless- steel pipe and the bearing.

Note: The pipe supports cannot be used for supporting other installations.

Pipe and fitting support are fixed in regular intervals with a maximum distance:

| Maximum spacing of pipe supports for pipes | | |
|---|---|---|
| Nominal diameter [mm] | Horizontal run [m] | Vertical run [m] |
| 12 to 15 | 1.5 | 1.8 |
| 16 to 28 | 1.8 | 2.4 |
| 30 to 60.3 | 2.4 | 3.0 |

### 5) Pipe bending

As a principal rule, the larger the bending radius, the lower the adverse effects on the pipe. For stainless-steel pipes, manual or hydraulically bending machines can be utilized. For pipe size with an outside diameter > 20mm hydraulically powered bending machines should be used.

**pipes**

The stainless steel pipes are welded pipes which are suited for bending. Ensure that the course of the weld is on the centerline of the pipe bend. We recommend using

rotary draw benders. fire safety pipes and fittings may be painted. We recommend using fire-resistant paint.

**Important:** Ovality of the pipe affects the compressive strength of the pipe and must be avoided.

**Important:** fittings must be installed at least 300 mm away from any pipe bends.

**Important:** The pipe must not be deformed or damaged.

**Important:** Flattened bends where the larger diameter is greater than 1.08 times the smallest diameter shall not be permitted (EN 14972 5.3.7.2).

**Press fittings**

A straight pipe length [L] before any fitting of minimum 5 times the pipe diameter should be ensured.

Example: for a OD 30mm pipe, L must be 5 x 30mm = 150 mm as a minimum away from any fitting.

| Dimensions | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] | |
|---|---|---|---|---|---|---|---|
| Outside diameter OD | 12.00 | 15.00 | 30.00 | 38.00 | 54.00 | 60.30 |  |
| Wall thickness WT | 1.00 | 1.00 | 1.60 | 1.60 | 2.20 | 2.50 | |
| Minimum straight length [L] | 60.00 | 75.00 | 150.00 | 190.00 | 270.00 | 301.50 | |

fire safety pipes and fittings may be painted. We recommend using fire- resistant paint.

#### 6) Earth bonding

Grounding must be in accordance with HD 60364 series.

### 3.3 Fittings

Pipe fittings, also known as pipe connectors, attach one pipe to another to lengthen the run or change the flow direction in a pipe system. The fittings are used to combine, divert, or reduce the flow of the water supply.

**Good installation practice**

All fitting work must be carried out in accordance with current regulations and good installation practice. All pipe and fitting work may only be performed by professionals. Always follow the pipe and fitting supplier's installation and safety instructions.

There are many different types of fittings and installation methods that can be used for high-pressure water mist systems.

#### 1) Type of fittings

The following type of fittings can be used:

Threaded fitting.
Sweat fitting.
Crimp fitting.
Clamp fitting.

Flare fitting.
Compression fitting.
Press fittings.
We recommend using press fittings.

**2) Press fittings**

For installation of the fitting, see manual.

### 3.4 Welding

Welding of water mist pipework shall be carried out in such a way that:

All joints are welded continuously.
The inside of the weld does not interfere with the flow of water.
The piping is deburred, and the slag removed.
10% of joints subjected to non-destructive testing.
The professional qualifications of the welder are of crucial importance for the quality of the welding work. To be able to perform quality work, it is recommended that the welder has a certificate for plate or pipe welding according to the welding process EN ISO 14732, EN 287-1, DIN EN ISO 9606 or similar.

### 3.5 Section valves

Install the section valve to the pipework in accordance with the system design. Connect the motorized or solenoid valve activation circuit cabling, power cabling, and alarm circuit interface cabling from the system flow switch, monitored valve switches etc. in accordance with the system design.

It is recommended that all section valves are marked with weatherproof labels which indicate the associated hazard/risk covered by the section valve. For detailed information, see [SEM-SAFE® Section valve design, installation, operation, and maintenance manual].

### 3.6 Filters

For information, seeFilter design, installation, operation, and maintenance manual].

### 3.7 Cylinders

For information, see Cylinder design, installation, operation, and maintenance manual].

### 3.8 High-pressure pump units

Connect the low-pressure domestic feed water supply to a filter unit and to the unit inlet using the appropriate connections in accordance with the system design.

Connect the power supply circuit cabling and alarm circuit interface cabling to the pump unit controller in accordance with the system design.

For detailed information, see Electric driven pump unit design, installation, operation, and maintenance manual].

### 3.9 Fire hose reel

For information, see Fire hose reel cabinet design, installation, operation, and maintenance manual].

### 3.10 Nozzles

high-pressure water mist nozzles must be handled with due care; they must be stored at ambient temperature. Storage as well as any onward shipment is to be made in original packing only. The water mist nozzles must be visually inspected for damage

before installation. Nozzles visibly damaged, dropped, must not be installed. Never install an automatic water mist nozzle if the bulb is cracked or if there is a loss of liquid from the bulb.

The nozzles are designed to be installed in accordance with recognised installation standards. Deviation from the standards or any alteration to the nozzle or cover plate assemblies after they leave the factory including, but not limited to painting, plating, coating, or modification, may render the nozzle inoperative.

Fire protection systems must be designed and installed only by those who are completely familiar with the appropriate standards and codes, and thoroughly experienced in fire protection design, hydraulic calculations, and water mist system installation. Before installation, ensure that the nozzle has the correct K-Factor, temperature rating, and response characteristics.

high-pressure water mist nozzles must be installed after the piping is in place to prevent mechanical damage.

#### 1) Pendant installation

A selection of high-pressure water mist nozzles are designed to be installed pendant.

#### a) Automatic nozzles

If the water mist nozzle is installed on a suspended ceiling, the water mist nozzle must flush with the ceiling. The requirements for the distance between the ceiling/roof and the top of the nozzle are as follows:

Ceiling/roof: Between 75 mm – 150 mm
Combustible suspended ceiling: Not lower than 300 mm
Non-combustible suspended ceiling: Not lower than 450 mm
If the pendant installation of an automatic nozzle is lower than 300/450 mm, we recommend installing a spray enhancer plate.

**b) Open nozzles**

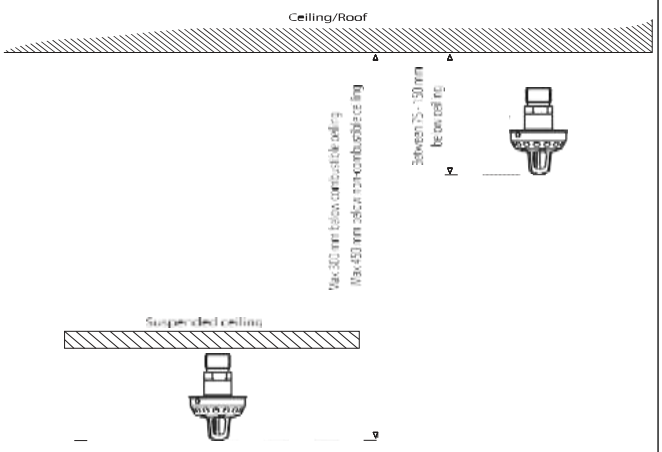
For pendant installation of an open nozzle, the requirements for the distance between the ceiling/roof and the top of the nozzle are as follows:

Ceiling: As close as possible, but not lower than 400 mm

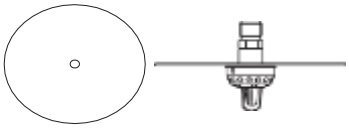
**c) Spray enhancer plate**

A selection of high-pressure water mist nozzles are designed to be installed free-hanging and can advantageously be installed with a spray enhancer plate. Insert the free hanging automatic nozzle through the hole of the spray enhancer plate.

**[Pendent - Automatic nozzle]**




**[Spray enhancer plate]**



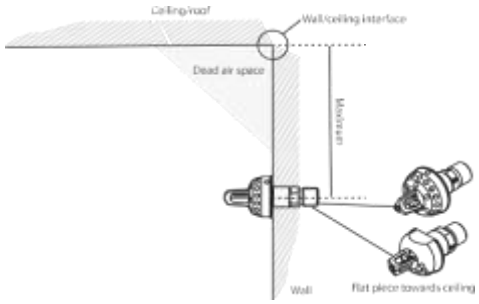
**2) Upright installation**

A selection of high-pressure water mist nozzles are designed to be installed upright. For upright installation of an automatic nozzle, the requirements for the distance between the ceiling/roof and the top of the nozzle are as follows: **[Upright - Automatic nozzle]**

**3) Sidewall installation**

A selection of high-pressure water mist nozzles are intended for installation near a wall/ceiling interface and designed to discharge water outward from the wall. If the water mist nozzle is installed sidewall, the water mist nozzle must flush with the wall.

**[Sidewall nozzle]**



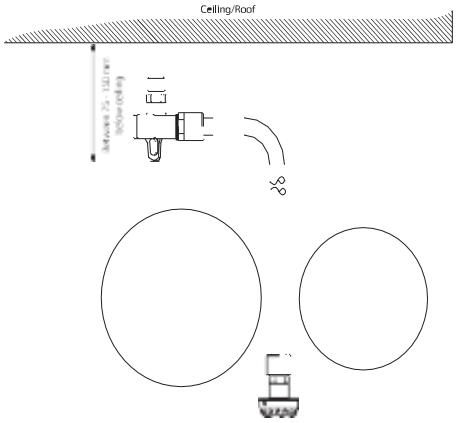

See applicable data sheet for maximum installation below ceiling.

#### 4) Heat release element

The heat release element (valve) must be positioned at the point of heat build-up, and when a required temperature is reached, the bulb of the release element breaks, allowing water to flow through the valve and be discharged through the spray head(s) in the desired location(s).

For installation of the heat release element, the requirements for the distance to the ceiling/ roof and the top of the nozzle are between 75 -150 mm (below ceiling)

**[Heat release element]**




## 4. Commissioning and testing

All commissioning and testing activities shall be documented as per the project requirements. Commissioning procedures, method statements and data recording schedules shall be issued to the client/owner or the authorities having jurisdiction prior to commencing the commissioning for approval.

All system design documentation shall be available prior to commencing the commissioning. Commissioning test shall be witnessed by a representative of the client/ owner or the authorities having jurisdiction.

### 4.1 Pre-commissioning

Before the Fire Safety high-pressure water mist system can be commissioned; the following tasks shall be completed:

All system pipework shall be installed, pressure tested and cleaned in accordance with the test requirements.
All nozzles shall be in place.
Water supplies shall be available in enough quantity to allow commissioning to be completed.
Power supplies shall be available.
**Note:** Certification of safe and tested circuits shall be available for viewing.

Fire detection and controls shall be available.
**Note:** Certification of safe and tested circuits shall be available for viewing.

Pump units shall be in place and adequately secured.
All equipment shall be earthed in compliance with current local standards and regulations.
All relevant "permit to" work actions shall be completed, and site personnel made aware of commissioning in progress.

### 4.2 Flushing the installation

When the installation of the pipe system is complete, it is recommended that the entire system is to be flushed. Flushing should only be carried out with fresh water. Flushing should only be carried out before the nozzles are installed. Each section of the system shall be flushed; therefore, section valves shall be opened. For systems containing several sections, each section shall be flushed independently of the others.

When flushing the pipework, the velocity within the pipe shall generate turbulent flow in the pipe work. The full capacity of the pump unit should be used for flushing for the rise pipes. When flushing branch pipe, the usage of one or two pumps may be necessary. It shall be verified that no dirt is present in the pipework after flushing.

A flushing report shall be filled out and signed by the installer, a copy of the report shall be filed with the commissioning documents.

#### 4.2.1 Venting the pipe installation

**Caution:** Only ventilate one section at a time.

Close the necessary valves to isolate the sections that are not being vented.
Open the necessary valves to isolate the section that needs to be vented.
Mount a hose that complies with the necessary requirements to the bleed valve (SEM-SAFE flushing or venting valve) at the end of the main pipe of the section and lead to drain.

Use one of the high-pressure pumps in the pump unit for venting
Disconnect other pumps in the pump unit.
**Warning:** if more than one pump unit - ensure the other pump units are switched off.

Open the bleed valve (flushing or venting valve) to release the air in the pipes.
**Note:** The installation will then leak at the bleed valve (flushing or venting valve).

Bleed the installation until no more air is released.
**Note:** As the air is released you should hear a faint hissing sound.

Stop the high-pressure pump and switch off the pump unit.
Close the bleed valve.
Close the necessary valves that isolated the section that was vented.
Go to the next section and repeat 1 to 10.

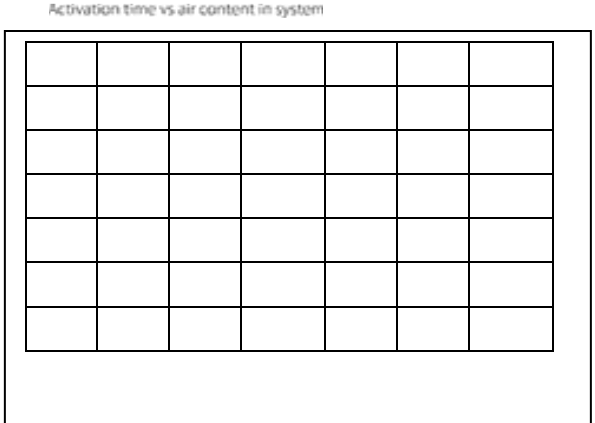
### 4.2.2 Setting the pilot pressure

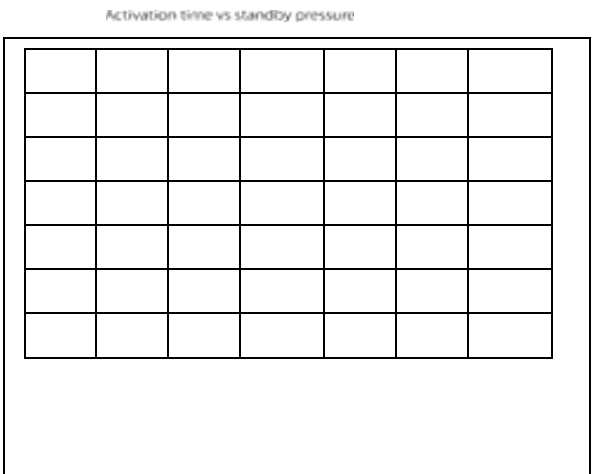
Flushing must be done prior to setting the pilot pressure. To set the pilot pressure, do as follows:

Set the system to standby mode.
Connect the test kit with the appropriate nozzle to the hydraulically most unfavourable nozzle.
Open valve on test kit.
Measure the time from the opening of the test kit valve until full system pressure is reached.
Close valve on test kit and stop the pump unit by activating the emergency stop.
If the measured time is within the acceptable limit, the pilot pressure set is correct.
Disconnect the test kit.
De-pressurise the section unless defined leakage is enabled on the section valves.
Set the system to standby mode.
If the measured time is not within the acceptable limit, consider the factors and make appropriate corrections. When corrections are made, repeat the [Setting the pilot pressure] procedure.

The activation time depends on the following factors

Standby pressure
Air in system.
System size.
Nozzle type (K-Factor).
Distance from fire to bulb
Distance from fire to bulb






### 4.2.3 Pressure test - hydrostatic

All pipe/pipe systems must be hydrostatic tested before putting into service. Parts of the system concealed by walls or ceilings should be pressure tested before the walls or ceilings are erected or closed to ease and rectify leaks.

**Test criteria [EN14972-1 section 8.2]**

The performance of the completed water mist system shall be proven by the following:

The water mist system shall be pressurized 1,5 times the maximum operating pressure for at least 2 h to ensure that no leakage and fault to pipework and components occur.

The temperature change shall be taken into account. Any faults disclosed, such as permanent distortion, rupture, or leakage, shall be corrected and the test shall be repeated. Loss verification can be done by pressure gauge or visibly on the system.

**Note:** Water used to charge the system shall always be potable water passed through a filter (maximum 10 microns).

**Note:** The system must be vented properly before pressure testing with water. Failure to maintain the pressure indicates leakage. The leakage should be located, and appropriate rectification must be carried out. Repeat the pressure test procedure until pressure is maintained for the above-mentioned period.

### 4.2.4 Test procedure

Relieve pressure in all parts of the system to ensure that there is no remaining pressure in the pipes before removing plugs or caps. The static pressure test should be witnessed by relevant authorities and representatives. Ensure that no unauthorised personnel are inside the area where tests are being carried out.

Procedure for pressure test.

1) Calculate the test pressure.

The calculated the test pressure is 1.5 times the maximum operating pressure

2) Start of pressure test.

Examine the installation for visible defects.

3) The installation is leak tested with air.

Connect the compressor and leakage test with 0.5 bar air pressure.

Wait for 10 minutes.

If the pressure holds, continue. If there is a pressure drop, the leakage must be found and repaired before continuing.

4) Flush the installation.

The installation is thoroughly flushed with water through the filter.

The water is filled in one end and flushed out at the other end of the installation.

Continue flushing until the installation is filled with water.

After flushing, leave the installation with the pressure from the water supply.

5) If connected to pump unit - close main valve.

6) Pressure testing to 25% of design pressure.

Connect the filter to the test pump and pump the pressure up to 25% of design pressure.

Wait for 10 minutes.

The installation is inspected for leaks. If there are no leaks and the pressure holds, continue.

7) Pressure testing to design pressure.

The pressure is increased to design pressure with the test pump.

Pay attention, the pressure will rise very quickly.

8) Pressure testing according to the calculated test pressure.

The pressure is increased to the calculated test pressure with the test pump.

Wait for pressure to stabilize

Read the pressure gauge and register.

Wait 2 hours to ensure no leakage

Read the pressure gauge and register.

***Note:** Use a suitable high-pressure test pump to provide the specific test procedure. Do not use high-pressure pumps.

**Inspect the system**

The pressure is dropped below 100 bar and the installation is inspected.

**Ending the test procedure**

The pressure test is approved. The installation is depressurised.

### 4.3 Commissioning

Once it has been established that the system and all its components are complete, the system can be commissioned in accordance with the project requirements and Fire Safety procedures.

The commissioning activities and tests are to verify the system operation in accordance with the project requirements.

The tests are to be carried out to the satisfaction of the commissioning engineer and a representative of the client/owner or the authorities having jurisdiction.

Where commissioning includes third party systems, a representative of each shall verify correct operation of their system.

Commissioning activities shall generally include the following; however, the project specific procedures shall be adhered to:

Test water storage tank filling control.
Test start-up of pump(s) - automatic and manual
Test pump unit fault monitoring, alarms, and indications.
Test pump running alarm and indications.
Test pressure actions and controls.
Test section valve(s) operation, alarms, and indications.
Test pump unit control panel functions, alarms, and indications.
Test associated fire detection and control alarm, indications, and interfaces (if applicable).

**Third party approval and acceptance**

On completion of all commissioning activities and tests, the system shall be demonstrated to the representative of the client/owner or the authorities having jurisdiction. The project handover documentation shall be completed and issued to the client/owner or the authorities having jurisdiction.

Familiarisation with the system is extremely important for the client/owner. Therefore, it is recommended that at least two representatives of the client/owner's site fire and safety team be familiarised with the installed system layout and basic operational and maintenance requirements. A copy of the project operational and maintenance manual shall also be issued with a copy permanently available adjacent to the system pump unit or cylinders.

# MASTER CONTROL PANEL SEQUENCE OF OPERATION

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# 1. General

## 1.1 Used Component Coding

| | | |
|---|---|---|
| MCS | : | Main Control System |
| MCP-1 | : | Main Control Panel 1 |
| MCP-2 | : | Main Control Panel 2 |
| GCP-x | : | Generator Control Panel genset x |
| ECB-x | : | Engine Connection Box |
| MCB | : | Mains Circuit Breaker |
| GCB | : | Generator Circuit Breaker |
| CPU | : | Central Processor Unit |
| LV1 | : | Low Voltage Mains Distribution Board (Green) |
| LV2 | : | Low Voltage Generator Mains Distribution Board (Red) |
| GEN-x | : | Generator 1 & 2 |
| KS 1 | : | Key Switch 1 : Maintenance LV Mains Distribution |
| KS 2 | : | Key Switch 2 : Maintenance LV Generator Distribution |
| KS 3 | : | Key Switch 3 : Release Generator Operation |
| KS 4 | : | Key Switch 4 : terminate +1 configuration in Generator mode |
| KS 5 | : | Key Switch 5 : Release Maintenance in Generator/Emergency mode (uptime) |
| SS 1 | : | Selection Switch release Genset Load Testing On Load bank |
| BL1 | : | Selection Switch Block Main Fuel Tank 1 Out |
| BL2 | : | Selection Switch Block Main Fuel Tank 2 Out |

**1.2 Used Terms and Definitions**

| | | |
|---|---|---|
| Terms | | |
| Genset | : | Generator |
| GCP | : | Generator Control Panel |
| MCP | : | Main Control Panel |
| MCS | : | Main Control System |
| DCC | : | Data Center Rated Power |
| RoCoF | : | Rate Of Change of Frequency |
| | | |
| Definitions | | |
| RTL | : | Ready To Load |
| MCB | : | Mains Circuit Breaker |
| GCB | : | Generator Circuit Breaker |
| HMI | : | Human Machine Interface |
| Power- and Power factor mode | : | Installation running in mains parallel with active power output control and active power factor control. This results in a regulation active controlling the installation to a pre-defined set point value. |
| Load- and VAR sharing mode | : | Installation running in multiple Generator operation active Controlling proportional power output and proportional equal power factor. |
| Synchronization procedure | : | The generator controller is connected to the Alternator Voltage and Bus Bar Voltage. The installation uses these reference voltages for comparing the alternator voltage- and frequency level to the bus bar voltage- and frequency. These values have to be inline while synchronizing. If in line the phase angle difference between the alternator and bus bar is compared, and if this difference is |

| | |
|---|---|
| | minimal and within frame a timer will start. If the timer is completed the closing signal is initiated. |

## 2. Mains and Back-up Power Control System – Functional Description

### 2.1 Interlock between breakers

The control system includes a breaker interlock system

This system is included to prevail the possible closing of the generator breakers in case the mains breaker is closed, and in opposite, to close the Mains Breaker if the Generator breakers are closed. This installation constantly communicates between the different installation parts prevailing the breaker closure at any time.

With this system the genset installation is not able to run in mains parallel / grid connected

### 2.2 Power system Topology

The power system has been designed as a fault tolerant and concurrently maintainable system. Single points of failure have been avoided by:

Redundant power distribution paths;
N+1 redundant capacity components: Generators
Redundant controls, e.g., generator start/stop and circuit breaker sequencing, pump control.
Two generator control panels GCP1&2;
Redundant Main Control System: Existing off MCP1 and MCP2;
Redundant Fuel Storage Tank;
Redundant Fuel Transfer Pumps;
Redundant communication lines;
Physical separation between capacity units;
Physical separation between redundant cable runs.
Note: This excludes the power supply to single corded IT-equipment.

Fault tolerant:

The function of a randomly failed element will be automatically and instantly transferred to one or more redundant elements.

Concurrently maintainable:

The function of an element, scheduled for maintenance, can be transferred to another redundant element by manual intervention.

### 2.3 Gensets

3No. Low Voltage Gensets rated site conditions.

The genset contains the diesel fired engine, alternator, fuel day tank, control system, ventilation system, exhaust system and generator distribution board and is located at the supporting structure of the generator area next to the datacenter.

### 2.4 Main Control System

The installation includes 2 Main Control Panels, MCP1 and MCP2, referred to as Main Control System.

The Main Control System monitors and controls the complete installation, incl. monitoring of the fuel storage system.

### 2.5 Fuel Storage System

The installation is completed with a Fuel storage system, build in 1 container, installed 2 separated fuel tanks with a capacity of approx.

15.000 l each.

### 2.6 Setpoints

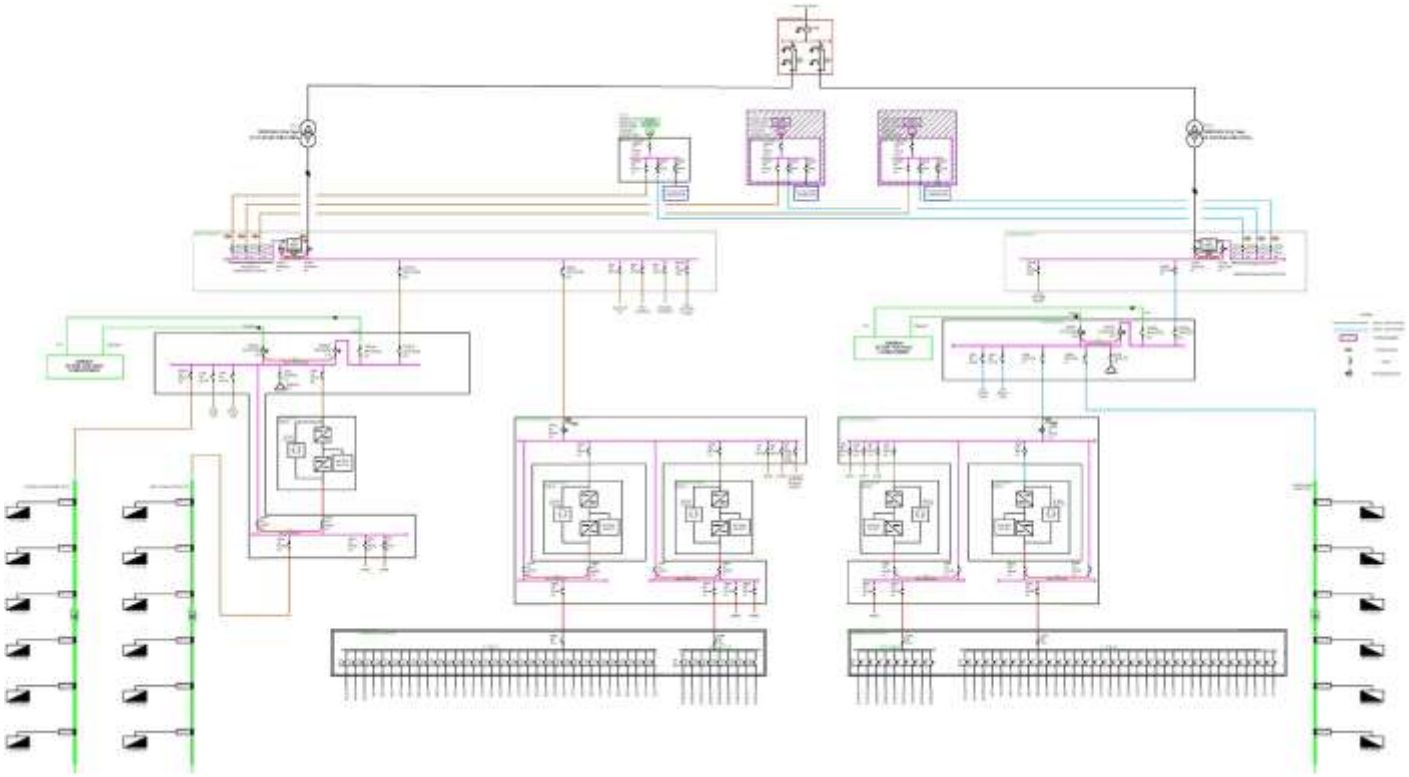
| **Basic Settings** | | | |
|---|---|---|---|
| Basic Manis Voltage | | | |
| Basic Mains frequency | | | |
| **Mains Protection** | | | |
| Mains>V MP | 110 | % | Overvoltage Protection |
| Mains<V MP | 90 | % | Undervoltage Protection |
| Mains<V Del | 2 | S | The delay for mains under and overvoltage protections |
| Mains Avg>V MP | 120 | % | This setpoint defines the trip level for mains overvoltage protection based on 10-minutes moving average of mains phase voltage. This protection is evaluated in each phase and is activated immediately when the moving average value |

| | | | |
|---|---|---|---|
| | | | exceeds limit adjusted by this setpoint. |
| Mains>f | 104 | % | Over frequency protection |
| Mains<f | 96 | % | Under frequency protection |
| Mains f del | 2 | S | The delay for mains under and over frequency protections |
| Mains V unbal | 10 | % | Mains voltage unbalance protection |
| Mains Vunb del | 5 | s | Delay for mains voltage unbalanced alarm |
| Mains I unbal | 50 | % | Mains current asymmetry (unbalance) |
| Mains I unb del | 3 | S | Delay for Mains current asymmetry (unbalance) |
| ROCOF | 1 | Hz/s | Rate of change of frequency (not applicable) |
| Vector shift | 7 | | Maximum vector in mains parallel |
| **Mains Healthy Delay** | | | |
| Mains Healthy | 900 | S | Delay time for mains approval (MAX 3600 sec) |
| **UPS System** | | | |
| Walk in time | 60 | S | Delay time in generator mode |
| Walk in time | 10 | s | Delay time in mains mode |
| **Low Voltage Breaker Mechanical Load** | | | |
| Delay time | 10 | S | Before closing |
| **Cool Down time Genset** | | | |
| Cool down time | 300 | s | Cool down after operation |
| **Set points Synchronization** | | | |

| | | | |
|---|---|---|---|
| | 7 | | Maximum angle mains to generator |
| | 10 | % | Voltage difference between Mains to generator |
| | 1 | s | Minimal time within synch window Mains to generator |
| **Mains Parallel Setpoint** | | | |
| | 80 | % | Base load in mains parallel (not applicable) |

## 2.7 Single Line Installation

**Simplified version**



## 2.8 Image Illustration of MCP Control Panel (Sample



## 3. Basic principles of operations

### 3.1 Low level switching and control philosophy for LV power systems

A redundant master control panel system shall be provided for;
Control starting/stopping of the generator sets/ fuel system, and,
Circuit breaker sequencing and switching.
Both of the above control requirements shall take place under various site operational conditions of the LV power distribution system comprising of the following operational scenarios. There are 40 No different scenarios described below:
Normal operation
Mains failure
Mains return
Maintenance on the LV mains distribution section (Main LV Panel 01)
After maintenance and return to mains operation (Main LV Panel 01)
Failure on LV mains distribution section (Main LV Panel 01) in normal operation
After resolving of the failure LV mains distribution section (Main LV Panel 01)
Maintenance on the LV mains distribution section (Main LV Panel 02)
After maintenance and return to mains operation (Main LV Panel 02
Failure on LV mains distribution section (Main LV Panel 02) in normal operation
After resolving of the failure LV mains distribution section (Main LV Panel 02)
Maintenance on the LV mains distribution section (Main LV Panel 02)
After maintenance and return to mains operation (Main LV Panel 02
Maintenance of LV generator section (Main LV Panel 01)
After maintenance of the LV generator section (Main LV Panel 01)
Failure of the LV Generator section (Main LV Panel 01) during a mains failure (Generator mode)
Return after failure of the LV Generator section (Main LV Panel 01) after a mains failure
Failure of the LV mains distribution section (Main LV Panel 01) during a mains failure
Transfer after Failure LV mains distribution section (Main LV Panel 01) after mains failur
Failure of the LV Generator section (Main LV Panel 01) during mains operation
Return after failure of the LV Generator section (Main LV Panel 01) in mains operation
Maintenance of LV generator section (Main LV Panel 01)
After maintenance of the LV generator section (Main LV Panel 01)
Failure of the LV Generator section (Main LV Panel 02) during a mains failure (Generator mode)
Return after failure of the LV Generator section (Main LV Panel 02) after a mains failure
Failure of the LV mains distribution section (Main LV Panel 02) during a mains failure
Transfer after Failure LV mains distribution section (Main LV Panel 02) after
mains failure
Failure of the LV Generator section (Main LV Panel 02) during mains operation
Return after failure of the LV Generator section (Main LV Panel 02) in mains operation
Mains Breaker Closing LV1 Br.01 or LV2 Br02 Failure after Mains return

Mains Failure and Failure opening mains incomer
Resolving Failure Opening mains incomer LV1 – Br-01 or LV2 – Br.01and mains return
Maintenance LV mains distribution section (Main LV Panel 01) during mains failure (Generator mode)
Ending Maintenance LV mains distribution section (Main LV Panel 01) during mains failure (Generator mode)
Maintenance LV generator distribution section (Main LV Panel 01) during mains failure (Generator mode)
Ending Maintenance LV generator distribution section (Main LV Panel 01) during mains failure (Generator mode)
Maintenance LV mains distribution section (Main LV Panel 02) during mains failure (Generator mode)
Ending Maintenance LV mains distribution section (Main LV Panel 02) during mains failure (Generator mode)
Maintenance LV generator distribution section (Main LV Panel 02) during mains failure (Generator mode)
Ending Maintenance LV generator distribution section (Main LV Panel 02) during mains failure (Generator mode)

### 3.2 Individual operation per installation part, controlled/connected to Main Control System

This section describes the individual operation per installation part.

#### 3.2.1 Genset

The Genset is controlled by a generator control system.

The generator control system handles the following installation parts:

Starting, stopping and monitoring of combustion engine
Controlling and monitoring of the Alternator
Controlling and monitoring of the radiator cooler
Controlling and monitoring of the Generator Circuit Breaker
Controlling and monitoring of the Breaker to Mains Low Voltage Distribution
Controlling and monitoring of the Breaker to Generator Low Voltage Distribution
Controlling and monitoring of the Fuel Day tank
Controlling and monitoring of the Fuel transfer Pumps
Controlling and monitoring of the Battery Chargers + Batteries
The generator control system communicates with the following installation parts:

LV GEN Distribution Board (LVG) (hardwired signals)
Main Control System, Main Control Panels (hardwired signals and communication bus)
BMS (hardwired signals and communication bus)

The standard genset configuration is based upon a single controller per genset. The installation is already redundant by means of N +1 genset, so there is no need for redundancy in the genset controller.

The power supply for the auxiliaries is as following:

Primary source: Auxiliary Power Supply via low voltage connection in LVG distribution board
Secondary source: Data centre Power (Main LV Panel 01 & 02)

### 3.2.2 Main Control System

The Main control system is built with of 2 Main Control Panels.

The Main Control Panels are located in separated dedicated area and the configuration is fully redundant.

The switch over between the units is uninterrupted.

The Mains controller monitors and controls the mains incoming breaker the PLC handles the other Voltage Breakers.

The combination of the PLC and Mains Controller starts and stops the gensets. The Main Control System is limited to the control and monitoring of all emergency operation related installation parts.

The Main Control System monitors the fuel storage system.

*Human –Machine Interfacing:*

The Main Control System has an HMI screen for indication and monitoring proposes.
*Selection Switches:*

(KS1) Maintenance on Main Distribution
(KS2) Maintenance on Generator Distribution
(KS3) Start Installation in Generator operation
(KS4) Release Generator Operation in non-N+1 configuration
(KS5) Release Maintenance operation in Generator/Emergency operation
(if N gensets are on busbar, system will be released to proceed with switching)
(SS1) Genset release for Load test (1-4)
(BL1) Block Fuel storage tank 1
(BL2) Block Fuel storage tank 2
*Push Buttons:*

Reset Button
The Main Control System communicates with the following installation parts:

LV Main Distribution Section (hardwired signals)
LV Generator Distribution Section (hardwired signals)
Generator Control Panel (hardwired signals and communication bus)
BMS (hardwired signals and communication bus)

### 3.2.3 Generator 3-way Distribution Board (LVG-1,2& 3)

Each genset- alternator is connected to a 3-way Low Voltage Distribution Board. This board contains the following breakers:

Incoming breaker from alternator incl. voltage measurements and current transformers
Load bank breaker removable from alternator.
Outgoing feeder to Generator section busbar (Main LV Panel 01)
Outgoing feeder to Generator section busbar (Main LV Panel 02)
The controls of these breakers are handled thru the Generator Control System. The Distribution board communicates with the following installation parts:
Generator Control Panel (hardwired signals)
Main Control System, Main Control Panels (redundant hardwired signals)

### 3.2.4 Low Voltage Main distribution (Main LV Panel 01 & 02)

In the installation two (2) Low Voltage Mains Distribution Boards are independent The Low Voltage Distribution Board has the following typical breakers/connections integrated:

Incoming Mains breaker from AVC Bypass Panel
Incoming Feeders from two (2) Generator 3-way distribution boards
Interlock system between Mains section incomer breaker and Generator section outgoing breaker
Outgoing feeders to Low Voltage IT load
Outgoing feeders to Low Voltage Mechanical load
The following breakers are monitored and controlled by the Main Control System:

Generator section outgoing breaker
Incoming Mains breaker
Incoming Feeders from Generator 3-way distribution board (Monitoring only)
Outgoing feeders to Low Voltage IT load (Monitoring only)
Outgoing feeders to Low Voltage ATS Mechanical load (Monitoring only)
The Distribution board communicates with the following installation parts:

Main Control System, Main Control Panels (hardwired signals)

### 3.2.5 UPS systems

In the installation several UPS systems are integrated providing the power supply for the IT and mechanical loads. The UPS is operating autonomous. When the power supply fails the UPS will disconnect from its power supply and run on battery power. When the incoming power supply restores, the UPS will automatically reconnect to the power supply. In Mains operation the restore time / walk in time will be 10 s

In Generator/ Generator operation the restore time/ walk in time will be 60 s -90s, this to avoid overloading the gensets.

The UPS should be able to detect Generator Operation. The UPS communicates with the following installation parts:

Main Control System, Main Control Panels (hardwired signals)

## 4. Hardware Interfacing

Due to the redundant configuration of the Main Control System all contacts and cabling between Main Control System panels and Low Voltage Distribution panels is to be separate in double configuration. The parts of the system to be interfaced include the following:

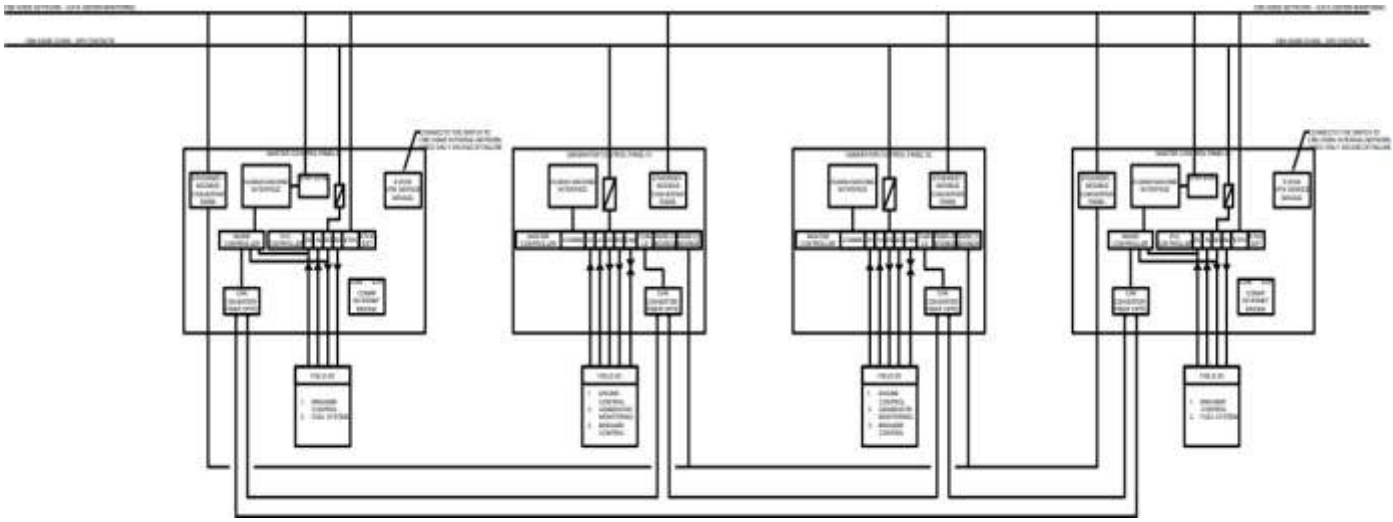
Gensets and 3-Way Generator Distribution LVG-1,2&3
Main Control System MCP1 and MCP2 with Main Distribution Main LV Panel 01 & 02.
Interfacing Main Control System MCP1 and MCP2 with 3-Way Generator Distribution LVG-1 and 2
Interfacing Main Control System MCP1 and MCP2 with UPS system
Interfacing Main Control System MCP1 and MCP2 with Fuel System

## 5. Software Interfacing

### 5.1 Communication Topology

This chapter describes the software interfacing to each module.

The following communication topology is applicable for the installation :



## 5.2 Main Control System

### Overview

Each Main Control Panel has the following hardware on-board which communicates via a dedicated protocol:

### 5.2.1 Managed Network Switch

Used for the internal network of the Main Control Panel.

### 5.2.2 PLC Controller

The PLC system uses the following communication.

DI : Digital Inputs for field components (Mains controller / breaker status / Fuel system) DO : Digital Outputs for field components (Mains controller / Breaker control / Fuel system) AI : Analog inputs for field components (measurement fuel system)

ETH : Onboard (CPU) Ethernet port for communication

ETH2 : Dedicated additional on board Ethernet port for communication with BMS via Modbus TCP-IP

## 5.3 Interfacing Gensets and BMS

### 5.3.1 Genset Controller

The genset controller uses the following comms.

DI : Digital Inputs for field components (Breaker status / Engine Status) DO : Digital Outputs for field components (Breaker control /

Fuel system/ Ventilation) AI : Analog inputs for field components (measurement engine values)

RS485 : Onboard (CPU) Modbus RS485 port for communication

### 5.3.2 Human Machine Interface (HMI)

The HMI touch screen uses the following comms :

CAN or equivalent protocol : Connected to Genset Controller

### 5.3.3 Communication with BMS

The Genset Control System is provided with rs485 to Modbus tcp-ip converter.

The communication between the gensets and the BMS is based upon Modbus TCP-IP communication.

Each converter receives its own IP address in line with the Network. The BMS communicates directly via an Modbus TCP/IP converter with the controller. The information is based upon read only, no control from the Modbus is possible.

### 5.4 Communication between Main Control System and Genset

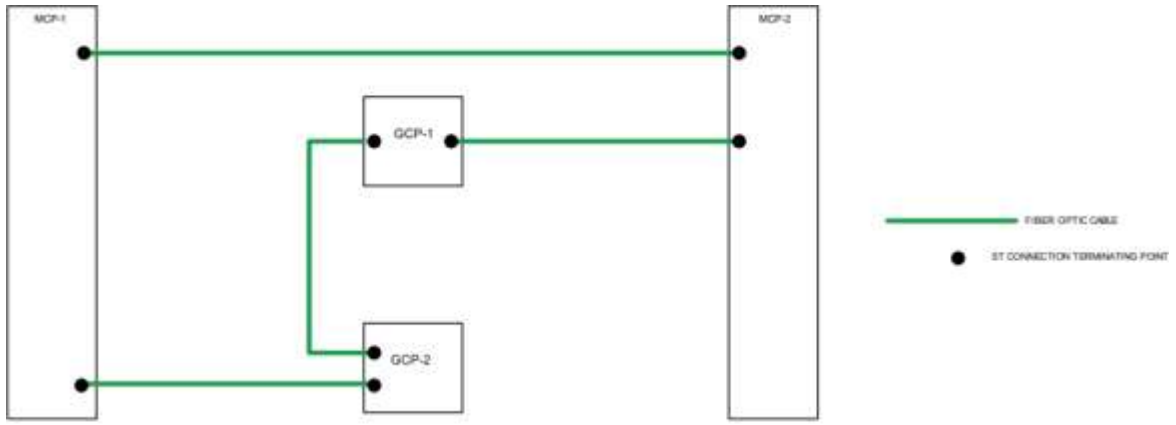
### Interfacing Gensets and Main Control System MCP1 and MCP2

The communication between the gensets and the main control system is to be based upon CAN bus or equivalent via fiber-optics communication. The fiber-optics communication has a redundant ring system mode with two separated fiber-optics communication lines.

This bus provides information regarding load sharing and synchronizing.

If a failure occurs in the redundant ring occurs an alarm is automatically generated via the dedicated module.

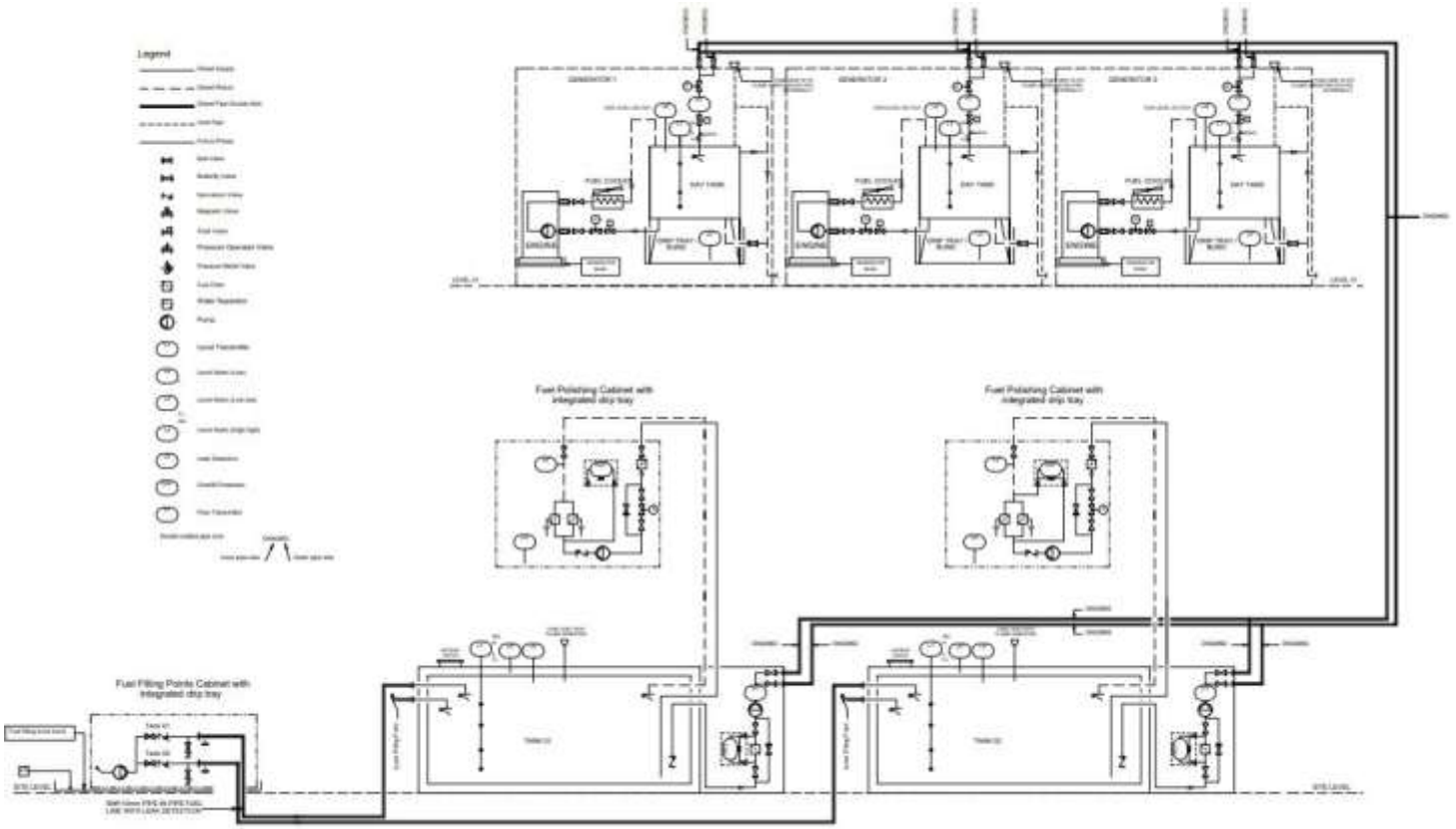
Overview General example:




FIBER CONNECTION

# 6. Fuel System

## 6.1 P&ID (Simplified version)




## 6.2 Basic principles of the installation (Hardware)

### 6.2.1 Fuel storage and handling system

The fuel system includes the following main components andauxiliaries;

Central fuel fill station, located close to the fuelcontainer
One container with diesel fuel storage tanks , 2 x 15.000 ltr. , dubbel walled, provided with;
- Overfill protection (mechanical)
- level sensor for containment measurement and generating fuel level alarm signals.
- Electronic leakage detection

### 6.2.2 Basic principles of the installation;

In the container, close to each Main tank, a distribution block is mounted. On the distribution block 4 outlets are included, one for each genset.

The outlets are operated by a magnetic valve (with a manual bypass).

At the moment of fuel request the valve is opened for fuel transfer to the requesting genset. The energizing of the valve will be done via the Generator Control Panel requesting fuel.

### 6.2.3 Level measurement storage tanks;

Each tank has its own level measurement by analogue value and for low level indication. The level indication of the tank in monitored by the Main Control System.

At low level (15%) the tank will reach "blocked" status by the MCP.

The MCP will send a tank blocked signal to each generator control system The Generator Control System will select the other tank as preferred tank, if available. The low level can be changed by a password on the HMI.

### 6.2.4 Genset Fuel System

Per generator set a 780 ltr. fuel day tank, installed in the container, provided with;

Drip tray
Level indicator
Level switch for start/stop operation fuel transfer pump
Level switch for Low; low indication
Level Low Low indication by Level transmitter
Leak detection switch
Fuel anti-siphon solenoid valve (KIWA-regulations) and by-pass
Per generator set container a fire wire system, consisting off:

One (1), fire valve in each central filling line to the fuel day tank
One (1), fire valve in the engine fuel supply line
Fire wired system with one (1) thermal fuse (TL 124 °C)
Necessary manual operated valves to guarantee save operation.
Two (2), fuel transfer pumps systems, each provided with;

Two (2) fuel transfer pumps
Drip tray under each pump
Leak detection switch under each pump
Overpressure release valve

### 6.2.5 Fuel system safety devices

The fuel day tanks and storage tanks are provided with the following safety devices, measurement systems and auxiliaries;

Manual operated fuel level indicator on the fuel day tank
Fuel day tank level low alarm at 70%: indicating a level low alarm in the Comap on the GCP.

The operator can accept this alarm but the signal will remain active until the condition is correct.
Fuel level day tank High alarm at 95%: indicating a High level alarm in the Comap on the GCP.
The fuel request is stopped and the fuel valves is closed.
Fuel day tank leakage detection: indicating a leakage alarm in the Comap on the GCP.
The fuel request is stopped and the fuel valve is closed.
Fuel pump leakage detection: indicating a leakage alarm in the Comap on the GCP. Fuel system will be blocked and other fuel transfer system is initiated.
Fuel pump failure: indicating a pump failure alarm in the Comap on the GCP.
All fuel day tank vent lines are combined to a central vent line routed to all fuel storage tanks.
Mechanical overfill protection valve in the storage tanks to prevent overfilling during fuel supply.
Leak detection sensor for leakage detection of the storage tank
Leak detection unit for leakage detection double shield fuel supply lines.
The fuel day tank is provided with an anti-siphon valve to prevent fuel spill/leakage when the fuel supply line to the engine is damaged/leaking. This valve is automatically controlled by the GCP and is opened when the genset starts. This valve is closed with an delay of 30 sec. when the genset is stopped. A by-pass valve is installed for emergency purposes.

**6.3 System monitoring and failures**

If the demanding fuel day tank is not filled within 5 min. the Comap on the GCP will automatically change over to the second redundant fuel pump unit.

In case the second redundant fuel pump unit cannot fill the demanding fuel day tank within the time, the day tank will not be filled.

Each fuel storage tank is provided with an level sensor.

The sensors shows the containment of the particular tank in the HMI on the Main Control System. From sensor the following level alarm signals are indicated:

2.250 ltr. - low low level (15%) (block tank)
3.750 ltr. - low level (25%)
All alarm- and operating signals are provide by modbus to the BMS system.

In case of a total failure of one of the gensets the fuel supply can be blocked by closing the manual operated valves in the central fuel supply line.

Automatic fuel supply to the remaining genset is still guaranteed.

Because of the automatic operation and the sequences selection of the fuel pumps the system will automatically change over to another fuel pump so fuel supply is secured from both Main tanks

### 6.4 Fuel Transfer pumps control

At the start level , 75% of nominal day tank, the GCP will initiate a fuel request status. The control system regulates the pumps.

At each new request the other pump will be started.

When genset stops, the day tank will be topped up to stop level.

### 6.5 Fuel transfer Pump Failure (Alarm)

In the event of the following failures the other/next pump will be selected:

**Thermal trip of selected pump.**

When the pump is mechanically blocked or any other failure occurs, the thermal protection will trip.

The trip is received by the control system and an alarm will occure "Trip Fuel Pump-x ", and therefore the pump will be blocked out.

**Isolator active of selected pump**

If the local isolator is switched off

The opened position received by the control system and an alarm will occur "safety switch Pump -x ", and therefore the pump will be blocked out.

**Selection switch off of selected pump**

If the selection switch is not in auto position a aux. contact will indicate. This position is received by the control system and an alarm will occur "Fuel pump-x not Auto", and therefore the pump will be blocked out.

**Transfer time out of selected pump**

If the fuel transfer time takes too long and an alarm occurs "Fuel time out Fuel pump

-x "the control system will block the selected pump.

### 6.6 Tank Servicing

If the storage tank or fuel lines from one tank needs to be serviced, the selection switch from this storage tank will be set to off.

From this point the genset controller will automatically select the available tank.

# SOLAR

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## 1. Scope of Works

### Scope of Supply & Work for SPGP

Scope of works for the Solar plant includes all design, engineering, procurement, supply and construction of the Hybrid Inverter System with Generator connected solar photovoltaic power plant with combined solar output from car park and main office building.

The supplier will provide Hybrid Inverter System with Generator connected solar power generating system TIER 1 to generate electricity from solar system to meet the electrical load requirement of the building whilst remaining connected to the electrical network. A grid connected system will run in parallel to the grid (LT Bus). The grid will be supplemented by the electricity energy generated from SOLAR during sunny days.

### Solar modules offered shall be

### Photovoltaic modules

1. Standards: To BS EN IEC 61730-1 and BS EN IEC 61730-2.
2. Third-party certification: PV Cycle, CE, Positive Quality Continuous Quality Assurance, microgeneration certification scheme (MCS)
3. Application class: To BS EN 61140, Class III.
4. Cell type: Monocrystalline to BS EN 61215
5. Format: As per manufacturer preference.
6. Module interconnections
   - 6.1. Standard: To BS EN 62852.
   - 6.2. Module connectors: Polarized and suitably rated for the applicable d.c. voltage and current.
   - 6.3. Ingress protection (minimum): To BS EN 60529, IP65.
7. Nominal output of module
   - 7.1. Power output tolerance: 0/3%.
8. Output warranty: Minimum of 90% power output after ten years.
9. Operating Temperature: 0 oC to + 40 oC

**REFERENCE STANDARDS**:

| | |
|---|---|
| IEC 60529 | Solar Photovoltaic Energy Systems- Terminology |
| IEC : 61215 Ed 2 or Latest | Crystalline silicon terrestrial photovoltaic (PV) modules- Design qualification and type approval |
| IEC : 60904-I (2006) | Photovoltaic Devices-Part-I: Measurement of Photovoltaic current–Voltage Characteristic |
| ISO : 9000 | Basic environmental testing procedure for Electronic and Electrical items |
| ISO : 9000 | Safety Guidelines for grid connected photovoltaic systems mounted on the buildings |
| IEC 60364-7-712 (1997) | Electrical Installations of Buildings Part 7: requirements for special installations or locations<br>Section, 712: Photovoltaic power supply systems |
| IEC 60364-4-41 | Protection against electric shock |
| IEC 61730 | PV Module Safety Qualification |
| PV Module Safety Qualification<br>IEC 61701 | Resistance to Salt mist and corrosion |
| UL 1703 | Comply with the National Electric Code (NEC), OSHA |

## 2. System Description

Solar Photo Voltaic (SPV) system shall consist of mainly the following: -

- Solar panels
- Module mounting structure
- Junction boxes
- Earthing System
- Lightning Arrestors
- Power conditioning unit string inverter
- Metering
- Cable and other accessories

DC distribution board shall be provided in between solar array and string Inverter. It shall have DC MCCB of suitable rating for connection and disconnection of array section. The string inverter shall have one common multi display meters for measuring the different string voltage and string current,

kW, kWh, 3 ph energy meter. AC distribution board shall be provided in between string inverter and loads depending on load.

No electrical storage batteries shall be required as electricity generated by the solar panels will be fed to supply building load.

**2.1 SPV Module**

Individual Solar PV module should be of capacity not less than 615Wp confirming to IEC: 61215 Ed 2 or latest-Edition II, IEC 61701, IEC: 61730-I:2007, IEC: 61730-II: 2007, UL 1703 certified, certified under ISO 9001: 2008 & ISO 14001. The Solar PV module should be monocrystalline Si solar cell of appropriate size and number so as to accommodate in the minimum space of Rooftop area.

SPV modules of similar output and from same manufacturer with not more than + 3% tolerance in single string shall be employed to avoid array mismatch losses.

The solar cell shall have surface anti-reflective coating to help to absorb more light in all weather conditions.

Photo/electrical conversion efficiency of SPV module shall not be less than

22 % with only positive tolerance.

Fill factor of the module shall not be less than 72%.

Each module shall have low iron tempered glass front for strength & superior light transmission. It shall also have touch multi-layered polymer back sheet for environmental protection against moisture & provide high voltage electrical insulation. Transitivity of glass shall be not less than 91%.

Module junction box (weather resistant) shall be designed for long life outdoor operation in harsh environment.

The bird spike shall be provided to avoid bird sitting on the solar modules at the highest point of the array/module structure.

The PV modules shall be suitable for continuous outdoor use.

The bidder shall provide the sample solar PV module electrical characteristics including current-voltage (I-V) performance curves and temperature

Coefficients of power, voltage and current. However, the tabulated document with all the relevant data like voltage, current, power output for all the modules also to be provided.

The PV modules shall be equipped with bypass diode/optimizers to minimize power drop caused by shade or a fault PV.

SPV module shall be highly reliable, light weight and shall have a service life of more than 25 years. SPV modules shall have a limited power loss of not more than 10% of nominal output at the end of 10 years and of not more than 20% of nominal output at the end of 25 years. The rated output of any supplied module shall not vary more than 3-5% from the average power rating of all ratings. Each modules, therefore, has to be tested and rating displayed. The yearly degradation should not be more than 01 % .

Whenever more than one module is required, identical modules shall be used.

The solar modules shall have suitable encapsulation & sealing arrangements, to protect the silicon cells from complete moisture proofing (IP 65) for the, entire life of solar modules.

The terminal box on the module should have a provision for opening for replacing the cable, if required.

The array structure shall be grounded properly using maintenance free earthing kit as per IEC 60364-5-54, tested & certified by CPRI.

**2.2 Module Mounting Structure (MMS)**

The MMS to be used for mounting the SPV modules shall be as under:

i) Fixed-tilt type.

ii) Azimuth: 0° True South/North.

Tilt angle: 10°- 15° tilt angle shall provide with adequate spacing to prevent inter- row shading.Structure shall comply with IEC 61215/61646.

The mounting steel structure and its galvanizing shall be as per acceptable

The mounting structure shall be suitably designed for mechanical and electrical installation. It shall support SPV modules at a given orientation, absorb and transfer the mechanical loads along with applicable wind loads to the base properly.

While designing of MMS additional care is needed to ensure that the material size used is capable to withstand the wind forces generated on account of heavy wind speed of respective sea wind zone. MMS with documented results of wind tunnel testing and resonant frequency dampening is preferred.

To reduce the pressure on structure and foundation, clear spacing between two adjacent modules shall be sufficient to allow wind passage.

The minimum clearance between the lower edge of the modules and developed roof level shall be adequately elevated above relevant plain. Minimum 200 mm or higher and to employer's approval.

Contractor has to choose suitable foundation design(s) depending on roof slab conditions, geographical condition, regional wind speed, bearing capacity, slope stability etc.

The structure shall be designed to allow easy replacement of any module.

Spacing between rows shall be so designed that shadow of one row of modules to next is avoided.

The Contractor (successful bidder) shall furnish detailed design calculation.

Nut & bolts, supporting structures including module mounting structures shall have to be adequately protected against all climatic conditions prevailing in the area.

All fasteners shall be of stainless steel of grade SS 304 or suitable equivalent.

The mounting structure shall be grounded properly using maintenance free earthing kit.

The mounting structure & foundation shall be designed to withstand applicable speed of wind zone of the applicable site as given in relevant International/Kenya wind load codes / standards. Suitable fastening arrangement such as grouting and clamping should be provided to secure the installation against the specific wind speed. The contractor shall ensure that the design has been certified by a recognized lab/ institution in this regard and submit the same to the Employer.

**2.3 Array Junction Boxes (AJB)/String Monitoring Box (SMB)**

To receive the DC output from field array, junction box / string monitor Box (SMB) as per design requirement shall be provided in between solar array and DCDB/PV Inverters. They shall be rated for 600/1000V and comply with IEC61439-2, UL1741 and standards.

AJB can also be integrated into Inverter for space saving.

AJB having polycarbonate enclosure of dust & vermin proof shall conform to IP 65 protection.

Array junction box allows several PV strings to be connected in parallel.

Suitable capacity MCBs/MCCB shall be provided for controlling the DC power output to the inverter along with necessary surge arrestors.

A DC dis-connector switch must isolate the array DC circuit as per requirement.

**2.4 DC Distribution Board/DC combiner box**

To receive the DC output from junction box /string monitor box (SMB) as per approved design requirement DCB to be provided in between JCB/SMB and PV inverter. They shall be rated for 600/1000V and comply with IEC61439-2, UL1741 and standards.

Sufficient no. of switchboards / DC DB wherever required shall be provided.

DCDB should be equipped with appropriate functionality, safety (including fuses, grounding, etc.) and protection.

The terminals will be connected to bus-bar arrangement of proper sizes to be provided. The panels/ boxes will have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables.

DC DB enclosure of dust & vermin proof shall conform to IP 65 protection if out door.

DC DB allows requisite connections from JB/SMB to be connected in parallel.

Suitable capacity MCBs/MCCB shall be provided for controlling the DC power output to the PV inverter along with necessary surge arrestors.

A DC dis-connector switch in DCDB must isolate the array DC circuit as per requirement.

**2.5 PV Inverter for solar plant**

Inverters for SPV Solar Plant, shall be Grid interactive and string inverters type with associated control, protection and data logging/ monitoring devices etc. all integrated into inverter.

It shall be collectively capable of running in isolated as well as grid synchronized mode (multi-Mode inverter).

SPGP shall not be integrated with the Generators .

String inverters as per design shall be of requisite numbers having equal to total AC capacity as per requirement of the site.

Maximum Power Point Tracker (MPPT) shall be integrated into the inverter to maximize energy drawn from the solar PV array. MPPT shall be microprocessor/micro controller based to minimize power losses and maximize energy utilization. The details of working mechanism of MPPT shall be

mentioned by the Bidder in its proposal. The MPPT unit shall confirm to IEC 62093 for design qualification.

The Inverter shall always give preference to Solar power, and will use Grid power only when the solar power is unable to meet the loads requirement.

Inverter should comply with IEC 61683 for efficiency and measurements and should comply with IEC 60068-2 for environmental testing.

The efficiency of the string inverter shall be more than 95% at full load. The inverter shall have high overload capacity. The Bidder should specify the overload capacity in the bid.

The DC energy produced has to be utilized to maximum and supplied to the bus for inverting to AC voltage to extract maximum energy from solar array.

AC Voltage and Variation

i) AC voltage 3-ph, 415V AC

ii) Voltage variation (+10% to – 10%),

iii) Frequency variation 50+/-1.5 Hz

iv) Total harmonic voltage distortion less than 3% to synchronize with standard /local grid.

v) The bidder to specify the DC input voltage of PV inverter

Communication interface shall be an integral part of inverter and shall be suitable to be connected to local computer and also remotely via the web.

Inverters must operate in synergy and intelligently to optimize maximum generation at all times with minimum losses.

The Inverter shall be capable of controlling power factor dynamically. Inverters should be equipped with components required to support reactive power.

The Inverters shall be designed for continuous, reliable power supply as per specification and shall have internal protection arrangement against any sustained fault in the feeder line and against lightning strikes in the feeder line.

The PV inverter shall have the required protection arrangements against earth leakage faults.

Specifically, the inverter shall be three phase power conditioning unit using static solid-state components. DC side of inverters shall have contactors / MCBs of suitable rating to allow safe start up and shut down of the system.

The Inverter shall be suitably designed for parallel operation. Each solid-state electronic device shall have to be protected to ensure long life of the inverter as well as smooth functioning of the inverter.

Each DC distribution board and sub-array junction box/ SMU etc (as per requirement) shall have suitably rated MCBs / fuses for its connection if integrated in inverter.

The Inverters shall be capable of complete automatic operation including wake-up, synchronization & shut down independently & automatically.

The Inverter must have the feature to work in tandem with other similar Inverters and be able to be successively & automatically switched "ON" and "OFF" based on solar radiation variations during the day.

Degree of protection of the indoor Inverter shall be at least IP-54 and that of outdoor at least IP-65.

Built in with data logging to remotely monitor plant performance through external PC shall be provided (PC shall be provided along with SPV Plant).

The system should be capable of providing all the data including that of meter and Inverter to the central software on IEC-104 protocol. All the equipment/hardware /software for complying with the same will be in the Bidder's scope.

Both AC & DC lines shall have suitable fuses, surge arrestors and contactors to allow safe start up and shut down of the system. Fuses used in the DC circuit should be DC rated.

Inverters front panel shall be provided with display (LCD or equivalent) to monitor the following:

i) DC power input ii) DC input voltage iii) DC current

ii) AC output power

iii) AC voltage (all the 3 phases)

iv) AC current (all the 3 phases)

Provision should be available in the Inverter for remote monitoring of all the parameters.

Protection required in Inverter

i) Input side disconnection switch

ii) Ground fault monitoring

iii) DC reverse polarity protection

iv) DC over voltage / current limitation protection

v) AC short circuit protection

vi) AC over voltage / current limitation protection

vii) DC and AC side surge protection (MOV) built-in

viii) Any other protection in view of battery.

ix) Anti-islanding protection

It should have user friendly LED/LCD display for programming and view on line parameters.

The Inverter shall have arrangement for adjusting DC input current and should trip against sustainable fault downstream and shall not start till the fault is rectified.

The output power factor of inverter is suitable for all voltage range or sink of reactive power.

The Inverter shall be able to withstand an unbalanced load conforming to IEC standard and relevant electricity condition. The Inverter shall include appropriate self-protective and self-diagnostic features to protect itself and the PV array from damage in the event of Inverter component failure or from parameters – beyond the Inverter's safe operating range due to internal or external causes.

The Inverter shall go to shutdown/standby mode, with its contacts open, under the following conditions before attempting an automatic restart after an appropriate time delay.

i) When the power available from the PV array is insufficient to supply the losses of the Inverter, the Inverter shall go to standby/shutdown mode.

ii) The Inverter control shall prevent excessive cycling of shut down during insufficient solar radiance.

Operation outside the limits of power quality as described in the technical data sheet should cause the power conditioner to disconnect the grid. Additional parameters requiring automatic disconnection are

i) Neutral voltage displacement

ii) Over current

iii) Earth fault

iv) And reverse power

v) In each of the above cases, tripping time should be adequate to protect the inverter.

Internal surge protection shall consist of three MOV type surge-arrestors connected from +ve and –ve terminals to earth (via Y arrangement).

**2.6 Lightning Protection**

The SPV Power Plant shall be provided with Lightning protection connected to proper earth pits. Earthing pits shall be measured to have an earthing resistance of 5.0Ω or less at the time of installation. If this level cannot be obtained with the soil at the facility, then soil conditioning (engineered backfill) shall be implemented to improve the earthing resistance within acceptable levels.

Lightning protection, placed at strategic locations, shall be used to protect the arrays against lightning strikes. The bidder shall give detailed design showing location of Lightning Conductor / masts and the protection coverage on array without causing any shadow on the modules to the Employer. All designs shall be submitted to the Employer for approval before its implementation.

Necessary concrete foundation for holding the lightning conductor in position to be made after giving due consideration to maximum wind speed and maintenance requirement at site in future.

The lightning conductor shall be earthed through copper conductor strips and connected to with earth pits per applicable International Standards. Suitable number of earth pits shall be provided for each lightning arrestor. Each lightning conductor shall be fitted with individual earth pit as per required Standards including accessories.

Early Streamer Emission (ESE) lightning arrestors to be provided.

**2.7 Remote Monitoring**

Supply of remote monitoring systems complete with associated equipment to enable remote/local monitoring of all necessary parameters including; Energy yield from the Solar PV, Real time power from the PV, Solar Module temperature, Solar Insolation and wind density for Solar PV parameters.

**2.8 Cables**

- **Cables and Wiring:**

All instruments and Panel wiring shall be of heat resisting and self-extinguishing type in compliance with International Standards. Plastic or porcelain cleats of the limited compression type shall be used for holding wiring runs. All wires shall be suitable for bending to meet the terminal studs at right angles.

Metal cases of all apparatus mounted on panels shall be separately earthed by means of copper wire or strips.

The following color scheme of the wiring shall be used as per standard. a) AC three phase circuits:

i) No.1 Phase: Red No.2 Phase: Yellow No.3 Phase: Blue

ii) Neutral Conductor: Black

iii) Connection to Earth: Green

iv) D.C. circuits: Brown for positive (+) and Grey for negative (-)

- **Cables and Accessories:**

Cables of appropriate size to be used in the system shall have the following characteristics:

i) Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards
ii) Temp. Range: –100C to +800C
iii) Voltage rating 660/1000V for 415 volts 3 phase.
iv) Excellent resistance to heat, cold, water, oil, abrasion, Ultraviolet (UV) radiation.
v) Flexible.
vi) Sizes of cables between array interconnections, array to junction boxes, junction boxes to inverter etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum. The cables (as per IS) should be insulated with a special grade PVC compound formulated for outdoor use.

All the cables shall conform to the requirements of the related standards and codes for:

i) DC cable for photovoltaic system

ii) XLPE / PVC insulated (heavy duty) electric cables for working voltages up to and including 1100V.

iii) Recommended current ratings

iv) Low carbon galvanized steel wires formed wires and tapes for armoring of cables

v) PVC insulation and sheath

vi) Cross linked polyethylene insulated PVC sheathed cables

vii) Conductors for insulated electrical cables and flexible cords.

viii) Standard test method for density of smoke from the burning or decomposition of plastics.

ix) Tests on gases evolved during combustion of electric cables. x) Tests on electric cables under fire conditions.

- **Technical Requirements:**

i) The cables shall be suitable for laying on racks, in ducts, trenches, trestles, conduits and under- ground buried installation with chances of flooding by water.

ii) All cables of module area if laid on cable trays shall be covered. If cables are to be laid underground, laying shall be as per latest relevant code.

iii) Cables with Copper conductor on DC side & that with aluminum conductor in AC side to be used as power cables shall have tensile strength as per relevant standards. Conductors shall be stranded.

iv) Cables with XLPE insulation, PVC sheathed & armored suitable for a continuous conductor temperature of 900C and short circuit conductor temperature of 2500C shall be used.

v) PVC insulation shall be suitable for continuous conductor temperature of 700C and short circuit conductor temperature of 1600C.

vi) Only terminal cable joints shall be accepted. No cable joints to join two cable ends shall be accepted.

vii) Cables inside the control room shall be laid in suitable Cable Trays of approved type.

viii) Cable terminations for LT cables shall be made with suitable cable lugs & sockets etc. crimped properly and passed through brass compression type cable glands at the entry and exit point of the cubicles.

ix) The panels' bottoms shall be properly sealed to prevent entry of snakes / lizard etc. inside the panel.

x) The terminal end of cables and wires are to be fitted with good quality letter and number ferrules of proper sizes so that the cables can be identified easily.

- **Cable Selection & Sizing:**

All LT power cables of sizes more than 90 sq.mm shall be XLPE insulated, PVC sheathed and armored. Cables shall be sized based on the following considerations:

i) Rated current of the equipment

ii) DC cable: Minimum voltage drop in the cable during full load running condition, maximum voltage drop shall be limited to 1% of the rated voltage.

iii) AC cable: Minimum voltage drop in the cable during full load running condition, maximum voltage drop shall be limited to 2% of the rated voltage.

iv) Short circuit withstand capability.

v) De-rating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:

- Variation in ambient temperature for cables laid in air.
- Grouping of cables.
- Variation in ground temperature and soil resistivity for buried cables.
- Cable lengths shall be considered in such a way that straight through cable joints is avoided. Cables shall be armored type if laid in yard area or directly buried.

DC Cable employed for series connection of PV modules through MC4 connectors shall be of 4/6 sq. mm size subject to voltage drop value within acceptance.

- **Cable Constructional Features**

1.1 kV Grade Cables:

1.1 KV grade XLPE power cables on AC side shall have compacted aluminum conductor, XLPE insulated, armored, inner & outer PVC sheathed conforming to KPLC requirements/specifications.

Withstanding 90 0C continuous conductor temperature and 250 0C during short circuit, inner sheathed with heat resistant elastomeric compound, nylon cord reinforced, outer- sheathed with

heat resistant, oil resistant and flame-retardant heavy-duty elastomeric compound conforming to IEEE requirements/specifications.

control Cables shall have stranded copper conductor, PVC insulated with appropriate grade shall be used for all control cables required for the SPGP. The cables shall be terminated using Cu. Lugs of adequate cross section area with miller insulation between each pair and tinned copper screening.

Control cables shall have minimum conductor cross-section of 1.5Sq.mm.

- **DC Side Cables**
  i) DC cables in the plant shall be with copper conductors to be used between
     a) Module to Modules inter connections.
     b) Strings to String Combiner Box.
     c) String Combiner Boxes (SCBs) / Array Junction Boxes (AJBs) to DC Distribution Board

- **(DCDB) & or SCBs / AJBs to Inverters**

i. Their guiding factor selected cables shall be the current carrying capacity after the considered reduction factors which shall be higher than 1.25 times of Isc under STC as per IEC 60364-
ii. 7-712 and the annual energy yield loss is less than 1% as per prevailing requirements/specifications and to be considered in the Energy Yield Estimation analysis.
iii. The selected cables for the Mini-Grid shall be
   - 1 Core, 4 Sq. mm copper conductor (Electrolytic Tinned Copper IEC 60228, Class 5) or higher size, rated 600/1000V AC, as per module manufacturer recommendations for module-to-module interconnection (normally comes along with modules). The cable shall be solar grade cables with UV and weather resistant protected cables suitable for outdoor applications and confirming to TUV: 2 PfG 1169 / 08.2007.
   - 1 Core, 6 Sq. mm copper conductor (Electrolytic Tinned Copper IEC 60228, Class 5) rated 600/1000V AC, solar grade cable with UV and weather resistant protected cables suitable for outdoor applications according to TUV: 2 PfG 1169 / 08.2007, Ethylene Propylene Rubber (EPR) insulation with Ethylene-Vinyl-Acetate (EVA) outer sheath or higher size as per approved design shall be used for cable joining the string-to-string combiner box (called as home run cables).
   - kV grade, single core with copper conductor, XLPE insulation, armored, with inner & outer PVC sheaths. The cable connecting the SCBs and inverters / DCDB shall be suitable underground laying and shall be 90 -120 sq.mm or more in size.
   - Cables of appropriate size to be used in the system shall have the following characteristics:
     - Temp. Range –10 0C to +80 0C.
     - Excellent resistance to Heat, Fire, oil, cold, water, abrasion, UV radiation.

iv. Flexible Cabling on DC side of the system shall be as short as possible to minimize the voltage drop in the wiring
v. All parts shall be corrosion resistant.

- **Low Tension (LT) Cables**

1.1 kV Grade, Al. conductor PVC armored cables in AC Side shall be used for all LT power cables between control cubicles, Motor Control Centers (MCC), respective feeders, etc.

These cables shall be laid on structural supports and using galvanized cable trays of adequate strength. The cable shall be terminated using Al. Lugs of adequate cross section area.

## 3. Cable Tray Specifications

- **LV Cable Tray Specifications**

Route the cable trays to cause minimum amount of obstruction. Independent cable trays shall be provided for power and communication cables.

Obtain approval of the route and fixing method before erecting cable trays.

Power cable trays

Extra heavy duty return flange; gauges shall be a minimum of 1.5mm over 600mm and flange height shall be a minimum of 75mm.

Communication cable trays

Gauges shall be a minimum of 1mm for tray up to 225mm, 1.2mm between 225-300mm, and 1.5 mm above 300mm. flange height shall be a minimum of 12mm.

Cable trays general.

Cable tray and cable fitting shall be fully perforated; slot sizes shall be 20mm x 7mm (or similar) running parallel to the length of the cable tray and 13.5 x 11.0 (mm) (or similar) running perpendicular to the length of the cable tray and shall be

Cable trays shall be supported on purposely made suitably treated mild steel supports which shall permit easy adjustments and modification or by suitable channel, brackets and accessories to BS 6946 at intervals necessary to provide a rigid fixing in accordance with manufacturers recommended fixing centers.

The Channels shall be manufactured to BS 6946 from 2.5mm materials conforming to

BSEN10142:2000 and BSEN 10143:2006.

The Brackets shall be manufactured to BS6946 from 6mm mild steel, 40mm wide, hot dip galvanized after manufacture to BSEN ISO 1461 and shall have a hole size of 14mm dia. to accept M12 setscrews

The cable trays shall be capable of carrying without undue deflection, the total weight of the cables likely to be inserted regardless of the location of the joints.

Ventilated Cable tray covers shall be provided to all external trays and shall be secured using proprietary clips and fixing in accordance with manufacturers recommendations.

Cables shall be fixed to the trays by means of copper or brass saddles and clips. All saddles, clips, straps etc. shall be fixed to the trays by means of brass screws or bolts or nuts.

NB. Steel wire or PVC tie-wraps of any description will not be permitted.

Earth continuity connectors shall be fitted between each length of cable tray to ensure compliance with BS 7671

## 4. Preparation of the Equipment for Commissioning

After completion of the installation at site and for the preparation of plant commissioning, the contractor shall check all the equipment and installation in accordance with the agreed standards, latest relevant code of practices of Kenyan Standards, specific instructions furnished by the particular equipment suppliers/manufacturers.

Checks required to be made on all equipment and installations at site shall comprise, but not limited to, the following:

- Physical inspection of Modules for removal of any foreign bodies, external defects, such as damaged, loose connection in Junction Boxes & Inverter etc. loose foundation bolts etc.
- Check for the free movement of mechanism for the circuit – breaker, rotating parts of the rotating machines and devices.
- Check for tightness of all cable joints and bus bar termination ends as well as earth connections in the main earthing network.
- Check for clearance of live bus bars and connectors from the metal enclosure.
- Check for proper alignment of all the modules etc.
- Continuity checks in case of power and control cables.
- Checking of all mechanical and electrical interlocks including tripping of breakers using manual operation of relay.
- Checking of alarm and annunciation circuits by manual actuation of relevant relays.
- Check and calibrate devices requiring field adjustment/calibration like adjustment of relay setting etc.
- Check for proper connection to earth network of all non-current carrying parts of the equipment and installation.

The relevant tests shall be carried out in accordance with relevant IS/IEC of latest issue.

The tests which are to be carried out on the equipment shall include, but not be limited to, testing of all electrical equipment as well as the system as a whole shall be carried out to ensure that the equipment and its components are in satisfactory condition and will successfully perform its functional operations. The inspection of the equipment shall be carried out to ensure that all materials, workmanship and installations conform to the following:

i) Completeness of the installation.

ii) Each pole to earth insulation resistance test.

- Cables

i) Insulation resistance test shall be conducted by Magger for cables rated up to 1.1kV grade.

ii) All 1.1 kV cables shall be subjected to high voltage test after joining and terminating but before commissioning as per relevant standards.

iii) In each test, the metallic sheath / screen / armor should be connected to earth.

iv) Continuity of all the cores, correctness of all connections as per wiring diagram, correctness of polarity and phasing of power cables and proper earth connection of cable glands, cable boxes, armor and metallic sheath, shall be checked.

## 5. Testing & Commissioning

The testing and commissioning for all electrical equipment at site shall be according to the procedures listed below:

All electrical equipment shall be tested, installed and commissioned in accordance with the latest relevant standards and code of practices published by Kenyan Standards wherever applicable.

Accepted design, engineering and construction standards, as well as accepted code of practices and stipulations made in the relevant general specifications.

The contractor in the presence of representative / Consultant of Employer shall carry out all tests using his own calibrated instruments, testing equipment as well as qualified testing personnel.

The results of all tests shall conform to the specification requirements as well as any specific performance data, guaranteed during finalization of the contract.

A suitable variable load bank to be provided by the contractor for use during testing and commissioning. The load bank to be suitably sized for the mini-grid capacity.

## 1. Design and Drawings for Buildings and Civil and structural works of Each Plant

The bidder is to provide requisite buildings as per his optimized design for each SPGP. For indoor type equipment / Inverter etc.

Submission of Drawings by contractor for Approvals

The Contractor shall submit designs, drawings, calculations, and datasheets as applicable for each mini-grid within 25 – 45 days in stages from the date of award for approval by the Employer. The timely approval of design and drawings are critical for timely completion of work.

## 2. Warranties of Major Equipment

The warranties of major equipment of both generation (SPGP) and PDN are found in the table below.

Table 16: Minimum Warranty Requirement for Major Equipment.

| | Equipment | Minimum Warranty Requirement |
|---|---|---|
| 1. | Solar Photovoltaic Modules | a) Product Warranty:<br>The manufacturer should warrant the Solar Module(s) to be free from the defects and/or failures specified below for a period not less than ten (10) years from the date of sale to the original customer ("CENTRAL BANK OF KENYA")<br>Defects and/or failures due to manufacturing.<br>Defects and/or failures due to quality of materials.<br>Non conformity to specifications due to faulty manufacturing and/or inspection processes<br>b) Performance Warranty:<br>A 25-year long-term performance warranty with a maximum linear decrease in peak power at STC of 2.5% in the first year, |
| 2. | PV Inverter | Minimum 10 years Warranty |