



KRA/HQS/NCB-073/2019-2020: PROPOSED OFFICE FIT-OUT AND RENOVATION WORKS AT
CORPORATE BUSINESS CENTRE (CBC) BUILDING, ELGON ROAD, UPPER HILL, NAIROBI
FOR
KENYA REVENUE AUTHORITY

BILL OF QUANTITIES - PHASE 11

VOLUME 1

[Contact email: eprocurement@kra.go.ke](mailto:eprocurement@kra.go.ke)

CLOSING DATE: 2ND JUNE 2020 AT 11.00 AM - TIMES TOWER

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Tender Notice

The Kenya Revenue Authority invites sealed bids from eligible candidates for the following tenders:

NO.	DESCRIPTION	ELIGIBILITY	SITE VISIT	CLOSING DATE AND TIME
1	KRA/HQS/NCB-073/2019-2020: PROPOSED OFFICE FIT-OUT AND RENOVATION WORKS AT CORPORATE BUSINESS CENTRE (CBC) BUILDING, ELGON ROAD, UPPER HILL, NAIROBI	OPEN	19 TH and 21 ST May ,2020 11.00 AM CBC- UPPER HILL	2 ND June, 2020 11.00 AM Times Tower

- Interested eligible candidates may obtain further information and inspect the tender documents with detailed requirements at the office of the Deputy Commissioner-Supply Chain Management, Times Tower Building, 25th Floor.
- A complete set of bidding documents in English may be obtained from KRA E-Procurement portal available on the KRA website www.kra.go.ke. Prospective bidders should register for E-Procurement to enable them access the KRA portal under "New Supplier Registration" found under the Tender Tab. For enquiries email to: eprocurement@kra.go.ke
- Bidders to note that Bill of quantities and Technical drawings are separately attached and marked **appendix 1 and 2 respectively**.
- Bidders will be evaluated using the criteria set out on page 303 to 305.**
- Mandatory site visit** is scheduled for 19th May 2020. Those who will not make it on 19th May 2020 can visit on 21st May 2020. Contact person Edward Biese. **Tel: 0724 386 082**
- Existing Suppliers with V-numbers and SRM passwords will automatically obtain the tender document in their SRM supplier portal. Existing Suppliers List is available on KRA Website under Tenders
- Completed Bids are to be saved as PDF documents marked "**KRA/HQS/NCB-73/2019-2020: : Proposed Office Fit-Out and Renovation Works at Corporate Business Centre (CBC) Building, Elgon Road, Upper Hill, Nairobi**" and submitted to the appropriate KRA E-procurement Web Portal found on the KRA website so as to be received on or before **2nd June 2020 at 11.00 a.m.**
- Submission shall strictly **be done Electronically via KRA E-Procurement Portal**. Bidders to note that system bid submission issues shall not be addressed **within 24 hours to the tender closing date and time**.
- Bids will be opened electronically promptly after closing time and Bidders or their representatives are welcome to witness the opening at **Times Tower Building**.
- An **original hard copy** of the Bid Security of not less than the indicated amount or equivalent amount in a freely convertible currency must be dropped in the **Tender security Box** located at **Times Tower Building**, Ground Floor any day before the tender closing date. The Bid Security must be in a sealed envelope bearing the Tender Description and addressed to the address indicated below. **Deputy Commissioner-Supply Chain Management**

Times Tower Building, 25th Floor,
P.O Box 48240- 00100 GPO,
Tel. +254 020 310900
Nairobi, Kenya.
website: www.kra.go.ke
Email : eprocurement@kra.go.ke

Any canvassing or giving of false information will lead to automatic disqualification.

SECTION II

NOTES TO TENDERERS

The Contract Documents consist of the Agreement and Schedule of Conditions of Building Works (1999 Edition) published by the Joint Building Council of Kenya, the Drawings listed herein, the General Description of Materials herein and those Bills of Quantities containing all modifications thereof as incorporated in the documents before the signing of the Contract takes place.

These Contract Documents supersedes all enquiries, proposals, agreements, negotiations and commitments, whether written or verbal, prior to the date of execution of this Contract.

Tenderers shall be deemed to have inspected and be fully acquainted with all Contract Documents prior to the submission of Tenders.

GENERAL INFORMATION:

Project Name: Proposed Office Fit-Out and Renovation Works at Corporate Business Centre (CBC) Building, Elgon Road, Upper Hill, Nairobi

Location of Site: Corporate Business Centre, Elgon Road, Upper Hill, Nairobi

Employer: The Kenya Revenue Authority (KRA)

Lead Consultants: Design Source Limited

Architect: Design Source Limited

Quantity Surveyor: SwiftCost Consultants.

Services Engineers: Building Services - Group

DESCRIPTION OF PROJECT

The description hereunder is a general guide only and Tenderers are referred to the Architect's and Engineer's drawings for tender purposes.

The works generally consist of office interior fit-out and configuration. The scope of work to be undertaken include partitioning in office spaces using blocks, gypsum and glass. The surface application and finishes is in textured premium wall paper and various types of paints and applications. Floor finishes are granito tiles in the office areas and floor carpets in the enclosed offices. Ceiling finishes include paint works on some of the areas and gypsum ceiling on specified areas. The doors are glass doors in the offices and hard wood folding doors in the board rooms; while

the windows include installation of aluminium blinds. Services include plumbing, drainage, firefighting installation, electrical and lift installations. The external works include improvements and modifications at the gate house to meet security standards and needs.

The gross floor areas measured over external walls are as follows: -

Description	Approx. Areas (m²)
Third Floor	459m ²
Fifth Floor	459m ²
Seventh Floor	336m ²
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Total Area	1,254m²
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No liability shall be accepted should the information provided under this heading be considered misleading.

INFORMATION TO BE PROVIDED BY TENDERER'S

Tenderers are to provide, prior to appointment and within seven days of being requested by the Architect or Quantity Surveyor to do so, the following information:-

- i) Proposed construction management team and system including names of key personnel
- ii) List of proposed sub-contractors
- iii) Bar-chart or simple programme
- iv) Fully detailed costing of the Preliminaries
- v) Written confirmation from a recognized Bank or other acceptable Financial Institution that such Institution would be prepared to bind themselves as Surety for 10% of the contract sum in accordance with Clause 16 of the conditions for the full period of the contract, i.e. until the Contractor has complied with all of his obligations in terms of the Agreement and Schedule of Conditions of Building Contract.
- vi) Construction documentation lead-in period required for the various elements of the works.

EXTRACTS FROM PRELIMINARIES

The following clauses are highlighted and Tenderers are requested to take particular note of their contents as no claims due to the misunderstanding of the true meaning and intent thereof will be entertained.

Tenderers are to note that these clauses do not in any way reduce their liabilities and/or obligations arising from their compliance with the remainder of the contract documentation.

- i) **INSURANCE OF THE WORKS:** The Contractor shall arrange and pay for Insurance of the Works.
- ii) **CONTRACT DOCUMENTS:** The drawings as listed in Annexure "A" will form part of the Contract Documents.
- iii) **INTERPRETATION OF DRAWINGS, SPECIFICATIONS AND BILLS OF QUANTITIES:** Should any part or parts of any drawings, specifications or Bills of Quantities not be clearly intelligible to the Tenderer, or should there be any doubt or obscurity as to the meaning or intentions thereof, the Tenderer must, before submitting his tender, obtain in writing from the Architect, the necessary information to clarify same.

It will be deemed that, when tendering for this project, the Tenderer was fully acquainted with:-

- all the drawings from the Project, with the nature and requirements of the work to be done and the Scope of the Contract, and
- the Contract Documents, as amended

No consideration will be given to any claim resulting from his having failed to take the opportunity of inspecting and studying the said drawings and documents before submitting his tender.

The said drawings may be inspected at the offices of the Architect by prior appointment.

- iv) **ORDERING OF MATERIALS:** Should the Tenderer consider that he will be unable to obtain materials for any item on the drawings or items described in the Bills of Quantities or to obtain such materials timeously to suit the programme for the Works or to obtain such materials in specified sizes, he is to report this in writing to the Architect before the closing date for tenders and obtain the Architects written directives in connection therewith.

If the Tenderer fails to do this, his tender will be taken as firm for all items described in the Bills of Quantities and he will be responsible for supplying such materials timeously to meet the programme for the works.

- v) **PRICING PRELIMINARIES:** These Bills of Quantities have been formulated in the conventional manner, whereby the Preliminaries have been included as a separate section, in order to enable Tenderers to price their site establishment costs, site management, etc.

In pricing the Preliminaries, Tenderers are required to price the relevant items individually, as a single lump sum preliminaries amount will not be accepted.

In the event that a Tenderer elects not to price the Preliminaries section as contained within these Bills of Quantities, then it will be deemed that all relevant Preliminaries costs would

have been included within the rates as tendered within the measured Bills of Quantities. Adjustment of the preliminaries will, in this instance, only be by measured final quantities applied to tendered rates.

- vi) **PRICING OF BILLS OF QUANTITIES:** Tenderers are to allow opposite each item for all costs in connection therewith. All prices to include, unless otherwise stated, for all materials, fabrication, conveyance and delivery, unloading, storing, unpacking, hoisting, labour, setting, fitting and fixing in position, cutting and waste (except where to be measured in accordance with the Standard Method of Measurement) patterns, models and templates, plant, temporary works, returning of packings, duties, taxes, imposts, establishment charges, overheads, profit and all other obligations arising out of the Contract.

Items left unpriced will be deemed to be covered in prices against other items throughout these Bills of Quantities and no claim for any extras arising out of the Tenderer's omission to price any item will be entertained.

Prices for all plant, temporary works, services and other items provided shall include for the supply, maintenance, operating cost and subsequent removal and making good as necessary.

All rates are to include Value Added Tax (VAT)

ADJUSTMENTS OF ERRORS IN THE PRICED TENDER DOCUMENTS

GENERALLY

There shall be no correction of errors. Bidders are informed that bids with arithmetic errors shall be disqualified.

CALCULATION OF BUILDER'S WORK ELEMENT

The Builder's Work Element to the Contract Sum will be calculated by taking the tendered sum and omitting the value of all Prime Cost and Provisional Sums (i.e. the total value of all items priced by the Contractor).

TYPES OF ERRORS

- (a) **Arithmetical Errors**

Arithmetical errors will include errors in extension of rates, additions or subtractions and the transfer of figures from one Bills of Quantities to another, and in all cases will be corrected.

- (b) **Pricing Errors**

Should any rates or prices included in the Bills of Quantities be obviously erroneous, these rates or

prices will be corrected, subject to consultation with the Contractor, so as to be fair and reasonable to both parties to the Contract. Such rates and prices will be ascertained by either taking Bill rates, rates pro-rata to Bill rates or calculated new rates, and the resulting discrepancies between these revised rates and those rates previously included shall be classed as arithmetical errors and included in the total sum of errors.

PREPARATION OF VARIATION ACCOUNT

When the variation account is prepared omissions and additions in the Builders' Work element will be based on corrected figures and rates, and the sum total of such omissions and additions will be subjected to the adjustment percentage mentioned previously.

PREPARATION OF VALUATIONS FOR CERTIFICATES

All valuations of Builders' Work for Certificates shall be calculated based on corrected figures and rates, and the sum of total of Works executed and materials on site will be subject to the percentage mentioned previously.

SECTION III

INSTRUCTIONS TO TENDERERS

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INSTRUCTIONS TO TENDERERS.

1. General/Eligibility/Qualifications/Joint venture/Cost of tendering

- 1.1 The Employer as defined in the Appendix to Conditions of Contract invites tenders for Works Contract as described in the tender documents. The successful tenderer will be expected to complete the Works by the Intended Completion Date specified in the tender documents.
- 1.2 All tenderers shall provide the Qualification Information, a statement that the tenderer (including all members of a joint venture and subcontractors) is not associated, or has not been associated in the past, directly or indirectly, with the Consultant or any other entity that has prepared the design, specifications, and other documents for the project or being proposed as Project Manager for the Contract. A firm that has been engaged by the Employer to provide consulting services for the preparation or supervision of the Works, and any of its affiliates, shall not be eligible to tender.
- 1.3 All tenderers shall provide in the Form of Tender and Qualification Information, a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary.
- 1.4 In the event that pre-qualification of potential tenderers has been undertaken, only tenders from pre-qualified tenderers will be considered for award of Contract. These qualified tenderers should submit with their tenders any information updating their original pre-qualification applications or, alternatively, confirm in their tenders that the originally submitted pre-qualification information remains essentially correct as of the date of tender submission.
- 1.5 Where no pre-qualification of potential tenderers has been done, all tenderers shall include the following information and documents with their tenders, unless otherwise stated:
 - (a) copies of documents defining the constitution or legal status, place of registration, and principal place of business; written power of attorney of the signatory of the tender to commit the tenderer:
 - (b) total monetary value of construction work performed for each of the last five years:

- (c) experience in works of a similar nature and size for each of the last five years, and details of work under way or contractually committed; and names and addresses of clients who may be contacted for further information on these contracts;
- (d) major items of construction equipment proposed to carry out the Contract and an undertaking that they will be available for the Contract.
- (e) qualifications and experience of key site management and technical personnel proposed for the Contract and an undertaking that they shall be available for the Contract.
- (f) reports on the financial standing of the tenderer, such as profit and loss statements and auditor's reports for the past five years;
- (g) evidence of adequacy of working capital for this Contract (access to line(s) of credit and availability of other financial resources);
- (h) authority to seek references from the tenderer's bankers;
- (i) information regarding any litigation, current or during the last five years, in which the tenderer is involved, the parties concerned and disputed amount; and
- (j) proposals for subcontracting components of the Works amounting to more than 10 percent of the Contract Price.

1.6 Tenders submitted by a joint venture of two or more firms as partners shall comply with the following requirements, unless otherwise stated:

- (a) the tender shall include all the information listed in clause 1.5 above for each joint venture partner;
- (b) the tender shall be signed so as to be legally binding on all partners;
- (c) all partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms;
- (d) one of the partners will be nominated as being in charge,

authorised to incur liabilities, and receive instructions for and on behalf of all partners of the joint venture; and

(e) the execution of the entire Contract, including payment, shall be done exclusively with the partner in charge.

1.7 To qualify for award of the Contract, tenderers shall meet the requirements as set in the criteria of evaluation (**pages 303 - 305**).

1.8 The figures for each of the partners of a joint venture shall be added together to determine the tenderer's compliance with the minimum qualifying criteria of clause 1.7

1.9 Each tenderer shall submit only one tender, either individually or as a partner in a joint venture. A tenderer who submits or participates in more than one tender (other than as a subcontractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the tenderer's participation to be disqualified.

1.10 The tenderer shall bear all costs associated with the preparation and submission of his tender, and the Employer will in no case be responsible or liable for those costs.

1.11 The tenderer, at the tenderer's own responsibility and risk, is encouraged to visit and examine 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 be at the tenderer's own expense.

1.12 The procuring entity's employees, committee members, board members and their relative (spouse and children) are not eligible to participate in the tender.

1.13 The document shall be downloaded from the KRA website free of charge.

1.14 The procuring entity shall allow the tenderer to review the tender document free of charge before purchase.

2. Tender Documents

2.1 The complete set of tender documents comprises the documents listed below and any addenda issued in accordance with Clause 2.4.

- (a) These Instructions to Tenderers
- (b) Form of Tender and Qualification Information
- (c) Conditions of Contract
- (d) Appendix to Conditions of Contract
- (e) Specifications
- (f) Drawings
- (g) Bills of Quantities
- (h) Forms of Securities

2.2 The tenderer shall examine all Instructions, Forms to be filled and Specifications in the tender documents. Failure to furnish all information required by the tender documents, or submission of a tender not substantially responsive to the tendering documents in every respect will be at the tenderer's risk and may result in rejection of his tender.

2.3 A prospective tenderer making an inquiry relating to the tender documents may notify the Employer in writing at the address indicated in the letter of invitation to tender. The Employer will only respond to requests for clarification received earlier than seven days prior to the deadline for submission of tenders. Copies of the Employer's response will be forwarded to all persons issued with tendering documents, including a description of the inquiry, but without identifying its source.

2.4 Before the deadline for submission of tenders, the Employer may modify the tendering documents by issuing addenda. Any addendum thus issued shall be part of the tendering documents and shall be communicated in writing to all tenderers. Prospective tenderers shall acknowledge receipt of each addendum in writing to the Employer.

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2.5 To give prospective tenderers reasonable time in which to take an addendum into account in preparing their tenders, the Employer shall extend, as necessary, the deadline for submission of tenders, in accordance with Clause 4.2 here below.

3. Preparation of Tenders

3.1 All documents relating to the tender and any correspondence shall be in English language.

3.2 The tender submitted by the tenderer shall comprise the following:

- (a) These Instructions to Tenderers, Form of Tender, Conditions of Contract, Appendix to Conditions of Contract and Specifications;
 - (b) Tender Security;
 - (c) Priced Bill of Quantities;
 - (d) Qualification Information Form and Documents;
 - (e) Alternative offers where invited; and
 - (f) Any other materials required to be completed and submitted by the tenderers.
- 3.3 The tenderer shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items for which no rate or price is entered by the tenderer will not be paid for when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities. All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause relevant to the Contract, as of 30 days prior to the deadline for submission of tenders, shall be included in the tender price submitted by the tenderer.
- 3.4 The rates and prices quoted by the tenderer shall only be subject to adjustment during the performance of the Contract if provided for in the Appendix to Conditions of Contract and provisions made in the Conditions of Contract.
- 3.5 The unit rates and prices shall be in Kenya Shillings.
- 3.6 Tenders shall remain valid for a period of **335 days** from the date of submission. However in exceptional circumstances, the Employer may request that the tenderers extend the period of validity for a specified additional period. The request and the tenderers' responses shall be made in writing. A tenderer may refuse the request without forfeiting the Tender Security. A tenderer agreeing to the request will not be required or permitted to otherwise modify the tender, but will be required to extend the validity of Tender Security for the period of the extension, and in compliance with Clause 3.7 - 3.11 in all respects.
- 3.7 The tenderer shall furnish, as part of the tender, a Tender Security in the amount and form specified in the appendix to invitation to tenderers. This shall be in the amount not exceeding 2 percent of the tender price

- 3.8 The format of the Tender Security should be in accordance with the form of Tender Security included in Section G - Standard forms or any other form acceptable to the Employer . Tender Security shall be valid for 30 days beyond the validity of the tender.
- 3.9 Any tender not accompanied by an acceptable Tender Security shall be rejected. The Tender Security of a joint venture must define as “Tenderer” all joint venture partners and list them in the following manner: a joint venture consisting of” ”, ”.....”, and “ ”.
- 3.10 The Tender Securities of unsuccessful tenderers will be returned within 28 days of the end of the tender validity period specified in Clause 3.6.
- 3.11 The Tender Security of the successful tenderer will be discharged when the tenderer has signed the Contract Agreement and furnished the required Performance Security.
- 3.12 The Tender Security may be forfeited
- (a) if the tenderer withdraws the tender after tender opening during the period of tender validity;
 - (b) if the tenderer does not accept the correction of the tender price, pursuant to Clause 5.7;
 - (c) in the case of a successful tenderer, if the tenderer fails within the specified time limit to
 - (i) sign the Agreement, or
 - (ii) furnish the required Performance Security.
- 3.13 Tenderers shall submit offers that comply with the requirements of the tendering documents, including the basic technical design as indicated in the Drawings and Specifications. Alternatives will not be considered, unless specifically allowed in the invitation to tender. If so allowed, tenderers wishing to offer technical alternatives to the requirements of the tendering documents must also submit a tender that complies with the requirements of the tendering documents, including the basic technical design as indicated in the Drawings and Specifications. In addition to submitting the basic tender, the tenderer shall provide all information necessary for a complete evaluation of the alternative, including design calculations, technical

specifications, breakdown of prices, proposed construction methods and other relevant details. Only the technical alternatives, if any, of the lowest evaluated tender conforming to the basic technical requirements shall be considered.

- 3.14 **Bidders to note that the COMBINED TECHNICAL AND FINANCIAL proposal shall be submitted through the KRA supplier portal. The bidder shall submit combined technical and financial proposals electronically via the supplier portal in the Notes and attachment Section of the RFX (Tender).**
- 3.15 The tender shall be typed or written in indelible ink and shall be signed by a person or persons duly authorised to sign on behalf of the tenderer, pursuant to Clause 1.5 (a) or 1.6 (b), as the case may be. All pages of the tender where alterations or additions have been made shall be initialized by the person or persons signing the tender.
- 3.16 Clarification of tenders shall be requested by the tenderer to be received by the procuring entity not later than 7 days prior to the deadline for submission of tenders.
- 3.17 The procuring entity shall reply to any clarifications sought by the tenderer within 3 days of receiving the request to enable the tenderer to make timely submission of its tender.
- 3.18 The tender security shall be in the amount of **Kshs 700,000.00** and valid for **365 days**

4. Submission of Tenders

- 4.1 Bidders to note that the COMBINED TECHNICAL AND FINANCIAL proposal shall be submitted through the KRA supplier portal. The bidder shall submit Combined technical and financial proposals electronically via the supplier portal in the Notes and attachment Section of the RFX (Tender)
- 4.2 The Authority shall not accept Hard copy tenders.
- 4.3 Any tender received after the deadline prescribed in clause 4.2 will be returned to the tenderer un-opened.

The tenderer may modify the tender after submission and resubmit to the respective folders. All prior submissions cannot be deleted or overwritten. Tenderer to note that

the latest submission shall be considered as the final version and all prior submissions shall be disregarded. No tender may be modified after the deadline for submission of tenders.

- 4.4 Withdrawal of a tender between the deadline for submission of tenders and the expiration of the period of tender validity specified in the invitation to tender or as extended pursuant to Clause 3.6 may result in the forfeiture of the Tender Security pursuant to Clause 3.11.
- 4.5 Tenderers may only offer discounts to, or otherwise modify the prices of their tenders by submitting tender modifications in accordance with Clause 4.4..

5. Tender Opening and Evaluation

- 5.1 The tenders will be opened by the Employer, including modifications made pursuant to Clause 4.4, in the presence of the tenderers' representatives who choose to attend at the time and in the place specified in the invitation to tender. Envelopes marked "WITHDRAWAL" shall be opened and read out first. Tenderers' and Employer's representatives who are present during the opening shall sign a register evidencing their attendance.
- 5.2 The tenderers' names, the tender prices, the total amount of each tender and of any alternative tender (if alternatives have been requested or permitted), any discounts, tender modifications and withdrawals, the presence or absence of Tender Security, and such other details as may be considered appropriate, will be announced by the Employer at the opening. Minutes of the tender opening, including the information disclosed to those present will be prepared by the Employer.
- 5.3 Information relating to the examination, clarification, evaluation, and comparison of tenders and recommendations for the award of Contract shall not be disclosed to tenderers or any other persons not officially concerned with such process until the award to the successful tenderer has been announced. Any effort by a tenderer to influence the Employer's officials, processing of tenders or award decisions may result in the rejection of his tender.
- 5.4 To assist in the examination, evaluation, and comparison of tenders, the Employer at his discretion, may ask any tenderer for clarification of the tender, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, telex or facsimile but no change in the price or substance of the tender shall be sought, offered, or permitted except as required to confirm the

correction of arithmetic errors discovered in the evaluation of the tenders in accordance with Clause 5.7.

- 5.5 Prior to the detailed evaluation of tenders, the Employer will determine whether each tender (a) meets the eligibility criteria defined in Clause 1.7.
- 5.6 If a tender is not substantially responsive, it will be rejected, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.
- 5.7 Tenders determined to be substantially responsive will be checked for any arithmetic errors. Errors will be corrected as follows:
- (a) where there is a discrepancy between the amount in figures and the amount in words, the amount in words will prevail; and
 - (b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will prevail, unless in the opinion of the Employer, there is an obvious typographical error, in which case the adjustment will be made to the entry containing that error.
 - (c) In the event of a discrepancy between the tender amount as stated in the Form of Tender and the corrected tender figure in the main summary of the Bill of Quantities, the amount as stated in the Form of Tender shall prevail.
 - (d) The Error Correction Factor shall be computed by expressing the difference between the tender amount and the corrected tender sum as a percentage of the corrected Builder's Work (i.e. Corrected tender sum less P.C. and Provisional Sums)
 - (e) The Error Correction Factor shall be applied to all Builder's Work (as a rebate or addition as the case may be) for the purposes of valuations for Interim Certificates and valuation of variations.
 - (f) the amount stated in the tender will be adjusted in accordance with the above procedure for the correction of errors and, with concurrence of the tenderer, shall be considered as binding upon the tenderer. If the tenderer does not accept the corrected amount, the tender

may be rejected and the Tender Security may be forfeited in accordance with clause 3.11.

- 5.8 The Employer will evaluate and compare only the tenders determined to be substantially responsive in accordance with Clause 5.5.
- 5.9 In evaluating the tenders, the Employer will determine for each tender the evaluated tender price by adjusting the tender price as follows:
- (a) making any correction for errors pursuant to clause 5.7;
 - (b) excluding provisional sums and the provision, if any, for contingencies in the Bill of Quantities, but including Dayworks where priced competitively.
 - (c) making an appropriate adjustment for any other acceptable variations, deviations, or alternative offers submitted in accordance with clause 3.12; and
 - (d) making appropriate adjustments to reflect discounts or other price modifications offered in accordance with clause 4.6
- 5.10 The Employer reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the tender documents or otherwise result in unsolicited benefits for the Employer will not be taken into account in tender evaluation.
- 5.11 The tenderer shall not influence the Employer on any matter relating to his tender from the time of the tender opening to the time the Contract is awarded. Any effort by the Tenderer to influence the Employer or his employees in his decision on tender evaluation, tender comparison or Contract award may result in the rejection of the tender.
- 5.12 There shall be no preference.

6. Award of Contract

- 6.1 Subject to Clause 6.2, the award of the Contract will be made to the tenderer whose tender has been determined to be substantially

responsive to the tendering documents and who has offered the lowest evaluated tender price, provided that such tenderer has been determined to be (a) eligible in accordance with the provision of Clauses 1.2, and (b) qualified in accordance with the provisions of clause 1.7 and 1.8.

- 6.2 Notwithstanding clause 6.1 above, the Employer reserves the right to accept or reject any tender, and to cancel the tendering process and reject all tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected tenderer or tenderers or any obligation to inform the affected tenderer or tenderers of the grounds for the action.
- 6.3 The tenderer whose tender has been accepted will be notified of the award prior to expiration of the tender validity period in writing. This notification (hereinafter and in all Contract documents called the "Letter of Acceptance") will state the sum (hereinafter and in all Contract documents called the "Contract Price") that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract. At the same time the other tenderers shall be informed that their tenders have not been successful.
- The contract shall be formed on the parties signing the contract.
- 6.4 The Agreement will incorporate all agreements between the Employer and the successful tenderer.
- 6.5 Within 21 days after receipt of the Letter of Acceptance, the successful tenderer shall deliver to the Employer a Performance Security in the amount stipulated in the Appendix to Conditions of Contract and in the form stipulated in the Tender documents. The Performance Security shall be in the amount and specified form
- 6.6 Failure of the successful tenderer to comply with the requirements of clause 6.5 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Tender Security.
- 6.7 Upon the furnishing by the successful tenderer of the Performance Security, the Employer will promptly notify the other tenderers that their tenders have been unsuccessful.
- 6.8 Preference where allowed in the evaluation of tenders shall not be allowed for contracts not exceeding one year (12 months)

- 6.9 The tender evaluation committee shall evaluate the tender within 30 days of the validity period from the date of opening the tender.
- 6.10 The parties to the contract shall have it signed within 30 days from the date of notification of contract award unless there is an administrative review request.
- 6.11 Contract price variations shall not be allowed for contracts not exceeding one year (12 months)
- 6.12 Where contract price variation is allowed, the valuation shall not exceed 15% of the original contract price.
- 6.13 Price variation request shall be processed by the procuring entity within 30 days of receiving the request.
- 6.14 The procuring entity may at any time terminate procurement proceedings before contract award and shall not be liable to any person for the termination.
- 6.15 The procuring entity shall give prompt notice of the termination to the tenderers and on request give its reasons for termination within 14 days of receiving the request from any tenderer.
- 6.16 A tenderer who gives false information in the tender document about its qualification or who refuses to enter into a contract after notification of contract award shall be considered for debarment from participating in future public procurement.

7. Corrupt and Fraudulent practices

- 7.1 The procuring entity requires that tenderers observe the highest standards of ethics during procurement process and execution of contracts. A tenderer shall sign a declaration that he has not and will not be involved in corrupt and fraudulent practices.

SECTION IV

CONDITIONS OF CONTRACT

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CONDITIONS OF CONTRACT

1. Definitions

1.1 In this Contract, except where context otherwise requires, the following terms shall be interpreted as indicated;

“**Bill of Quantities**” means the priced and completed Bill of Quantities forming part of the tender.

“**Compensation Events**” are those defined in Clause 24 hereunder.

“**The Completion Date**” means the date of completion of the Works as certified by the Project Manager, in accordance with Clause 31.

“**The Contract**” means the agreement entered into between the Employer 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,

“**The Contractor**” refers to the person or corporate body whose tender to carry out the Works has been accepted by the Employer.

“**The Contractor’s Tender**” is the completed tendering document submitted by the Contractor to the Employer.

“**The Contract Price**” is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

“**Days**” are calendar days; “**Months**” are calendar months.

“**A Defect**” is any part of the Works not completed in accordance with the Contract.

“**The Defects Liability Certificate**” is the certificate issued by Project Manager upon correction of defects by the Contractor.

“**The Defects Liability Period**” is the period named in the Contract Data and calculated from the Completion Date.

“Drawings” include calculations and other information provided or approved by the Project Manager for the execution of the Contract.

“Dayworks” are Work inputs subject to payment on a time basis for labour and the associated materials and plant.

“Employer”, or the **“Procuring entity”** as defined in the Public Procurement Regulations (i.e. Central or Local Government administration, Universities, Public Institutions and Corporations, etc) is the party who employs the Contractor to carry out the Works.

“Equipment” is the Contractor’s machinery and vehicles brought temporarily to the Site for the execution of the Works.

“The Intended Completion Date” is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date may be revised only by the Project Manager by issuing an extension of time or an acceleration order.

“Materials” are all supplies, including consumables, used by the Contractor for incorporation in the Works.

“Plant” is any integral part of the Works that shall have a mechanical, electrical, chemical, or biological function.

“Project Manager” is the person named in the Appendix to Conditions of Contract (or any other competent person appointed by the Employer and notified to the Contractor, to act in replacement of the Project Manager) 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.

“Site” is the area defined as such in the Appendix to Condition of Contract.

“Site Investigation Reports” are those reports that may be included in the tendering documents which are factual and interpretative about the surface and subsurface conditions at the Site.

“Specifications” means the Specifications of the Works included in the Contract and any modification or addition made or approved by the Project Manager.

“Start 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).

“A Subcontractor” is a person or corporate body who has a Contract with the Contractor to carry out a part of the Work in the Contract, which includes Work on the Site.

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

“A Variation” is an instruction given by the Project Manager which varies the Works.

“The Works” are what the Contract requires the Contractor to construct, install, and turnover to the Employer, as defined in the Appendix to Conditions of Contract.

2. Interpretation

- 2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning in English Language unless specifically defined. The Project Manager will provide instructions clarifying queries about these Conditions of Contract.
- 2.2 If sectional completion is specified in the Appendix to Conditions of Contract, reference in the Conditions of Contract to the Works, the Completion Date and the Intended Completion Date apply to any section of the Works (other than references to the Intended Completion Date for the whole of the Works).
- 2.3 The following documents shall constitute the Contract documents and shall be interpreted in the following order of priority;
- (1) Agreement,
 - (2) Letter of Acceptance,
 - (3) Contractor’s Tender,
 - (4) Appendix to Conditions of Contract,

- (5) Conditions of Contract,
- (6) Specifications,
- (7) Drawings,
- (8) Bill of Quantities,
- (9) Any other documents listed in the Appendix to Conditions of Contract as forming part of the Contract.

Immediately after the execution of the Contract, the Project Manager shall furnish both the Employer and the Contractor with two copies each of all the Contract documents. Further, as and when necessary the Project Manager shall furnish the Contractor [always with a copy to the Employer] with three [3] copies of such further drawings or details or descriptive schedules as are reasonably necessary either to explain or amplify the Contract drawings or to enable the Contractor to carry out and complete the Works in accordance with these Conditions.

3. Language and Law

- 3.1 Language of the Contract and the law governing the Contract shall be English language and the Laws of Kenya respectively unless otherwise stated.

4 Project Manager's Decisions

- 4.1 Except where otherwise specifically stated, the Project Manager will decide contractual matters between the Employer and the Contractor in the role representing the Employer.

5 Delegation

- 5.1 The Project Manager may delegate any of his duties and responsibilities to others after notifying the Contractor.

6 Communications

6.1 Communication between parties shall be effective only when in writing. A notice shall be effective only when it is delivered.

7 Subcontracting

7.1 The Contractor may subcontract with the approval of the Project Manager, but may not assign the Contract without the approval of the Employer in writing. Subcontracting shall not alter the Contractor's obligations.

8 Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities etc. as listed in the Appendix to Conditions of Contract and also with the Employer, as per the directions of the Project Manager. The Contractor shall also provide facilities and services for them. The Employer may modify the said List of Other Contractors etc., and shall notify the Contractor of any such modification.

9 Personnel

9.1 The Contractor shall employ the key personnel named in the Qualification Information, to carry out the functions stated in the said Information or other personnel approved by the Project Manager. The Project Manager will approve any proposed replacement of key personnel only if their relevant qualifications and abilities are substantially equal to or better than those of the personnel listed in the Qualification Information. If the Project Manager asks the Contractor to remove a person who is a member of the Contractor's staff or work force, stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the Work in the Contract.

10 Works

10.1 The Contractor shall construct and install the Works in accordance with the Specifications and Drawings. The Works may commence on the Start Date and shall be carried out in accordance with the Program submitted by the Contractor, as updated with the approval of the Project Manager, and complete them by the Intended Completion Date.

11 Safety and Temporary Works

- 11.1 The Contractor shall be responsible for the design of temporary works. However before erecting the same, he shall submit his designs including specifications and drawings to the Project Manager and to any other relevant third parties for their approval. No erection of temporary works shall be done until such approvals are obtained.
- 11.2 The Project Manager's approval shall not alter the Contractor's responsibility for design of the Temporary works and all drawings prepared by the Contractor for the execution of the temporary or permanent Works, shall be subject to prior approval by the Project Manager before they can be used.
- 11.3 The Contractor shall be responsible for the safety of all activities on the Site.

12. Discoveries

- 12.1 Anything of historical or other interest or of significant value unexpectedly discovered on Site shall be the property of the Employer. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.

13. Work Program

- 13.1 Within the time stated in the Appendix to Conditions of Contract, the Contractor shall submit to the Project Manager for approval a program showing the general methods, arrangements, order, and timing for all the activities in the Works. An update of the program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining Work, including any changes to the sequence of the activities.

The Contractor shall submit to the Project Manager for approval an updated program at intervals no longer than the period stated in the Appendix to Conditions of Contract. If the Contractor does not submit an updated program within this period, the Project Manager may withhold the amount stated in the said Appendix from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue program has been submitted. The Project Manager's approval of the program shall not alter the Contractor's obligations. The Contractor may revise the program and submit it to the Project

Manager again at any time. A revised program shall show the effect of Variations and Compensation Events.

14. Possession of Site

- 14.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Appendix to Conditions of Contract , the Employer will be deemed to have delayed the start of the relevant activities, and this will be a Compensation Event.

15. Access to Site

- 15.1 The Contractor shall allow the Project Manager and any other person authorised by the Project Manager, access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

16. Instructions

- 16.1 The Contractor shall carry out all instructions of the Project Manager which are in accordance with the Contract.

17. Extension or Acceleration of Completion Date

- 17.1 The Project Manager shall extend the Intended Completion Date if a Compensation Event occurs or a variation is issued which makes it impossible for completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining Work, which would cause the Contractor to incur additional cost. The Project Manager shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Project Manager in writing for a decision upon the effect of a Compensation Event or variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay caused by such failure shall not be considered in assessing the new (extended) Completion Date.
- 17.2 No bonus for early completion of the Works shall be paid to the Contractor by the Employer.

18. Management Meetings

- 18.1 A Contract management meeting shall be held monthly and attended by the Project Manager and the Contractor. Its business shall be to review the plans for the remaining Work and to deal with matters raised in accordance with the early warning procedure. The Project Manager shall record the minutes of management meetings and provide copies of the same to those attending the meeting and the Employer. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

19. Early Warning

- 19.1 The Contractor shall warn the Project Manager at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the Work, increase the Contract Price or delay the execution of the Works. The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible.
- 19.2 The Contractor shall cooperate with the Project Manager in making and considering proposals on how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the Work and in carrying out any resulting instructions of the Project Manager.

20. Defects

- 20.1 The Project Manager shall inspect the Contractor's work and notify the Contractor of any defects that are found. Such inspection shall not affect the Contractor's responsibilities. The Project Manager may instruct the Contractor to search for a defect and to uncover and test any Work that the Project Manager considers may have a defect. Should the defect be found, the cost of uncovering and making good shall be borne by the Contractor, However, if there is no defect found, the cost of uncovering and making good shall be treated as a variation and added to the Contract Price.
- 20.2 The Project Manager shall give notice to the Contractor of any defects before the end of the Defects Liability Period, which begins at Completion, and is defined in the Appendix to Conditions of Contract. The Defects Liability Period shall be extended for as long as defects remain to be corrected.

- 20.3 Every time notice of a defect is given, the Contractor shall correct the notified defect within the length of time specified by the Project Manager's notice. If the Contractor has not corrected a defect within the time specified in the Project Manager's notice, the Project Manager will assess the cost of having the defect corrected by other parties and such cost shall be treated as a variation and be deducted from the Contract Price.

21. Bills Of Quantities

- 21.1 The Bills of Quantities shall contain items for the construction, installation, testing and commissioning of the Work to be done by the Contractor. The Contractor will be paid for the quantity of the Work done at the rate in the Bills of Quantities for each item.
- 21.2 If the final quantity of the Work done differs from the quantity in the Bills of Quantities for the particular item by more than 25 percent and provided the change exceeds 1 percent of the Initial Contract price, the Project Manager shall adjust the rate to allow for the change.
- 21.3 If requested by the Project Manager, the Contractor shall provide the Project Manager with a detailed cost breakdown of any rate in the Bills of Quantities.

22. Variations

- 22.1 All variations shall be included in updated programs produced by the Contractor.
- 22.2 The Contractor shall provide the Project Manager with a quotation for carrying out the variations when requested to do so. The Project Manager shall assess the quotation, which shall be given within seven days of the request or within any longer period as may be stated by the Project Manager and before the Variation is ordered.
- 22.3 If the work in the variation corresponds with an item description in the Bills of Quantities and if in the opinion of the Project Manager, the quantity of work is not above the limit stated in Clause 21.2 or the timing of its execution does not cause the cost per unit of quantity to change, the rate in the Bills of Quantities shall be

used to calculate the value of the variation. If the cost per unit of quantity changes, or
if the nature or timing of the work in the variation does not correspond with items in the Bills of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of Work.

- 22.4 If the Contractor's quotation is unreasonable, the Project Manager may order the variation and make a change to the Contract price, which shall be based on the Project Manager's own forecast of the effects of the variation on the Contractor's costs.
- 22.5 If the Project Manager decides that the urgency of varying the Work would prevent a quotation being given and considered without delaying the Work, no quotation shall be given and the variation shall be treated as a Compensation Event.
- 22.6 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning.
- 22.7 When the Program is updated, the Contractor shall provide the Project Manager with an updated cash flow forecast.

23. Payment Certificates, Currency of Payments and Advance Payments

- 23.1 The Contractor shall submit to the Project Manager monthly applications for payment giving sufficient details of the Work done and materials on Site and the amounts which the Contractor considers himself to be entitled to. The Project Manager shall check the monthly application and certify the amount to be paid to the Contractor within 14 days. The value of Work executed and payable shall be determined by the Project Manager.
- 23.2 The value of Work executed shall comprise the value of the quantities of the items in the Bills of Quantities completed, materials delivered on Site, variations and compensation events. Such materials shall become the property of the Employer once the Employer has paid the Contractor for their value. Thereafter, they shall not be removed from Site without the Project Manager's instructions except for use upon the Works.
- 23.3 Payments shall be adjusted for deductions for retention. The Employer shall pay the Contractor the amounts certified by the Project Manager within 30 days of the date of issue of each certificate.

- 23.4 If an amount certified is increased in a later certificate or as a result of an award by an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.
- 23.5 Items of the Works for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.
- 23.6 The Contract Price shall be stated in Kenya Shillings. All payments to the Contractor shall be made in Kenya Shillings and foreign currency in the proportion indicated in the tender, or agreed prior to the execution of the Contract Agreement and indicated therein. The rate of exchange for the calculation of the amount of foreign currency payment shall be the rate of exchange indicated in the Appendix to Conditions of Contract. If the Contractor indicated foreign currencies for payment other than the currencies of the countries of origin of related goods and services the Employer reserves the right to pay the equivalent at the time of payment in the currencies of the countries of such goods and services. The Employer and the Project Manager shall be notified promptly by the Contractor of any changes in the expected foreign currency requirements of the Contractor during the execution of the Works as indicated in the Schedule of Foreign Currency Requirements and the foreign and local currency portions of the balance of the Contract Price shall then be amended by agreement between Employer and the Contractor in order to reflect appropriately such changes.
- 23.7 The Authority does not encourage advance payment. In the event that an advance payment is granted, the following shall apply:-
- a) On signature of the Contract, the Contractor shall at his request, and without furnishing proof of expenditure, be entitled to an advance of 10% (ten percent) of the original amount of the Contract. The advance shall not be subject to retention money.
 - b) No advance payment may be made before the Contractor has submitted proof of the establishment of deposit or a directly liable guarantee satisfactory to the Employer in the amount of the advance payment. The guarantee shall be in the same currency as the advance.

- c) Reimbursement of the lump sum advance shall be made by deductions from the Interim payments and where applicable from the balance owing to the Contractor. Reimbursement shall begin when the amount of the sums due under the Contract reaches 20% of the original amount of the Contract. It shall have been completed by the time 80% of this amount is reached.

The amount to be repaid by way of successive deductions shall be calculated by means of the formula:

$$R = A(x^1 - x^{11})$$

80 - 20

Where:

R = the amount to be reimbursed

A = the amount of the advance which has been granted

X¹ = the amount of proposed cumulative payments as a percentage of the original amount of the Contract. This figure will exceed 20% but not exceed 80%.

X¹¹ = the amount of the previous cumulative payments as a percentage of the original amount of the Contract. This figure will be below 80% but not less than 20%.

- d) with each reimbursement the counterpart of the directly liable guarantee may be reduced accordingly.

24. Compensation Events

24.1 The following issues shall constitute Compensation Events:

- (a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Appendix to Conditions of Contract.
- (b) The Employer modifies the List of Other Contractors, etc., in a way that affects the Work of the Contractor under the Contract.
- (c) The Project Manager orders a delay or does not issue drawings, specifications or instructions required for execution of the Works on time.

- (d) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon the Work, which is then found to have no defects.
 - (e) The Project Manager unreasonably does not approve a subcontract to be let.
 - (f) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the Letter of Acceptance from the information issued to tenderers (including the Site investigation reports), from information available publicly and from a visual inspection of the Site.
 - (g) The Project Manager gives an instruction for dealing with an unforeseen condition, caused by the Employer or additional work required for safety or other reasons.
 - (h) Other contractors, public authorities, utilities, or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.
 - (i) The effects on the Contractor of any of the Employer's risks.
 - (j) The Project Manager unreasonably delays issuing a Certificate of Completion.
 - (k) Other compensation events described in the Contract or determined by the Project Manager shall apply.
- 24.2 If a compensation event would cause additional cost or would prevent the Work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.
- 24.3 As soon as information demonstrating the effect of each compensation event upon the Contractor's forecast cost has been provided by the Contractor, it shall be assessed by the Project Manager, and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Project Manager shall adjust the Contract Price based on the Project Manager's own forecast. The Project Manager will assume that the Contractor will react competently and promptly to the event.

- 24.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having co-operated with the Project Manager.
- 24.5 Prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the Appendix to Conditions of Contract.
- 24.6 The Contractor shall give written notice to the Project Manager of his intention to make a claim within thirty days after the event giving rise to the claim has first arisen. The claim shall be submitted within thirty days thereafter.

Provided always that should the event giving rise to the claim of continuing effect, the Contractor shall submit an interim claim within the said thirty days and a final claim within thirty days of the end of the event giving rise to the claim.

25. Price Adjustment

- 25.1 The Project Manager shall adjust the Contract Price if taxes, duties and other levies are changed between the date 30 days before the submission of tenders for the Contract and the date of Completion. The adjustment shall be the change in the amount of tax payable by the Contractor.
- 25.2 The Contract Price shall be deemed to be based on exchange rates current at the date of tender submission in calculating the cost to the Contractor of materials to be specifically imported (by express provisions in the Contract Bills of Quantities or Specifications) for permanent incorporation in the Works. Unless otherwise stated in the Contract, if at any time during the period of the Contract exchange rates shall be varied and this shall affect the cost to the Contractor of such materials, then the Project Manager shall assess the net difference in the cost of such materials. Any amount from time to time so assessed shall be added to or deducted from the Contract Price, as the case may be.
- 25.3 Unless otherwise stated in the Contract, the Contract Price shall be deemed to have been calculated in the manner set out below and in sub-clauses 25.4 and 25.5 and shall be subject to adjustment in the events specified thereunder;
- (i) The prices contained in the Contract Bills of Quantities shall be deemed to be based upon the rates of wages and other emoluments and expenses as determined by the Joint Building Council of Kenya (J.B.C.) and set out in the schedule of basic rates issued 30 days before

the date for submission of tenders. A copy of the schedule used by the Contractor in his pricing shall be attached in the Appendix to Conditions of Contract.

- (ii) Upon J.B.C. determining that any of the said rates of wages or other emoluments and expenses are increased or decreased, then the Contract Price shall be increased or decreased by the amount assessed by the Project Manager based upon the difference, expressed as a percentage, between the rate set out in the schedule of basic rates issued 30 days before the date for submission of tenders and the rate published by the J.B.C. and applied to the quantum of labour incorporated within the amount of Work remaining to be executed at the date of publication of such increase or decrease.
- (iii) No adjustment shall be made in respect of changes in the rates of wages and other emoluments and expenses which occur after the date of Completion except during such other period as may be granted as an extension of time under clause 17.0 of these Conditions.

25.4 The prices contained in the Contract Bills of Quantities shall be deemed to be based upon the basic prices of materials to be permanently incorporated in the Works as determined by the J.B.C. and set out in the schedule of basic rates issued 30 days before the date for submission of tenders. A copy of the schedule used by the Contractor in his pricing shall be attached in the Appendix to Conditions of Contract.

25.5 Upon the J.B.C. determining that any of the said basic prices are increased or decreased then the Contract Price shall be increased or decreased by the amount to be assessed by the Project Manager based upon the difference between the price set out in the schedule of basic rates issued 30 days before the date for submission of tenders and the rate published by the J.B.C. and applied to the quantum of the relevant materials which have not been taken into account in arriving at the amount of any interim certificate under clause 23 of these Conditions issued before the date of publication of such increase or decrease.

25.6 No adjustment shall be made in respect of changes in basic prices of materials which occur after the date for Completion except during such other period as may be granted as an extension of time under clause 17.0 of these Conditions.

25.7 The provisions of sub-clause 25.1 to 25.2 herein shall not apply in respect of any materials included in the schedule of basic rates.

26. Retention

- 26.1 The Employer shall retain from each payment due to the Contractor the proportion stated in the Appendix to Conditions of Contract until Completion of the whole of the Works. On Completion of the whole of the Works, half the total amount retained shall be repaid to the Contractor and the remaining half when the Defects Liability Period has passed and the Project Manager has certified that all defects notified to the Contractor before the end of this period have been corrected.

27. Liquidated Damages

- 27.1 The Contractor shall pay liquidated damages to the Employer at the rate stated in the Appendix to Conditions of Contract for each day that the actual Completion Date is later than the Intended Completion Date. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not alter the Contractor's liabilities.
- 27.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the overpayment, calculated from the date of payment to the date of repayment, at the rate specified in Clause 23.30

28. Securities

- 28.1 The Performance Security shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a reputable bank acceptable to the Employer, and denominated in Kenya Shillings. The Performance Security shall be valid until a date 30 days beyond the date of issue of the Certificate of Completion.

29. Dayworks

- 29.1 If applicable, the Dayworks rates in the Contractor's tender shall be used for small additional amounts of Work only when the Project Manager has given written instructions in advance for additional work to be paid for in that way.
- 29.2 All work to be paid for as Dayworks shall be recorded by the Contractor on Forms approved by the Project Manager. Each completed form shall be verified and signed by the Project Manager within two days of the Work being done.
- 29.3 The Contractor shall be paid for Dayworks subject to obtaining signed Dayworks forms.

30. Liability and Insurance

- 30.1 From the Start Date until the Defects Correction Certificate has been issued, the following are the Employer's risks:
- (a) The risk of personal injury, death or loss of or damage to property (excluding the Works, Plant, Materials and Equipment), which are due to;
 - (i) use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works, or
 - (ii) negligence, breach of statutory duty or interference with any legal right by the Employer or by any person employed by or contracted to him except the Contractor.
 - (b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in Employer's design, or due to war or radioactive contamination directly affecting the place where the Works are being executed.
- 30.2 From the Completion Date until the Defects Correction Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is the Employer's risk except loss or damage due to;
- (a) a defect which existed on or before the Completion Date.

- (b) an event occurring before the Completion Date, which was not itself the Employer's risk
 - (c) the activities of the Contractor on the Site after the Completion Date.
- 30.3 From the Start Date until the Defects Correction Certificate has been issued, the risks of personal injury, death and loss of or damage to property (including, without limitation, the Works, Plant, Materials, and Equipment) which are not Employer's risk are Contractor's risks.
- The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts stated in the Appendix to Conditions of Contract for the following events;
- (a) loss of or damage to the Works, Plant, and Materials;
 - (b) loss of or damage to Equipment;
 - (c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract, and
 - (d) personal injury or death.
- 30.4 Policies and certificates for insurance shall be delivered by the Contractor to the Project Manager for the Project Manager's approval before the Start Date. All such insurance shall provide for compensation required to rectify the loss or damage incurred.
- 30.5 If the Contractor does not provide any of the policies and certificates required, the Employer may effect the insurance which the Contractor should have provided and recover the premiums from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.
- 30.6 Alterations to the terms of an insurance shall not be made without the approval of the Project Manager. Both parties shall comply with any conditions of insurance policies.

31. Completion and taking over

- 31.1 Upon deciding that the Works are complete, the Contractor shall issue a written request to the Project Manager to issue a Certificate of Completion of the Works. The Employer shall take over the Site and the Works within seven [7] days of the Project Manager's issuing a Certificate of Completion.

32. Final Account

32.1 The Contractor shall issue the Project Manager with a detailed account of the total amount that the Contractor considers payable to him by the Employer under the Contract before the end of the Defects Liability Period. The Project Manager shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 30 days of receiving the Contractor's account if it is correct and complete. If it is not, the Project Manager shall issue within 30 days a schedule that states the scope of the corrections or additions that are necessary. If the final account is still unsatisfactory after it has been resubmitted, the Project Manager shall decide on the amount payable to the Contractor and issue a Payment Certificate. The Employer shall pay the Contractor the amount due in the Final Certificate within 60 days.

33. Termination

33.1 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract. These fundamental breaches of Contract shall include, but shall not be limited to, the following;

- (a) the Contractor stops work for 30 days when no stoppage of work is shown on the current program and the stoppage has not been authorised by the Project Manager;
- (b) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within 30 days;
- (c) the Contractor is declared bankrupt or goes into liquidation other than for a reconstruction or amalgamation;
- (d) a payment certified by the Project Manager is not paid by the Employer to the Contractor within 30 days (for Interim Certificate) or 60 days (for Final Certificate) of issue.
- (e) the Project Manager gives notice that failure to correct a particular defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Project Manager;
- (f) the Contractor does not maintain a security, which is required.

- 33.2 When either party to the Contract gives notice of a breach of Contract to the Project Manager for a cause other than those listed under Clause 33.1 above, the Project Manager shall decide whether the breach is fundamental or not.
- 33.3 Notwithstanding the above, the Employer may terminate the Contract for convenience.
- 33.4 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible. The Project Manager shall immediately thereafter arrange for a meeting for the purpose of taking record of the Works executed and materials , goods, equipment and temporary buildings on Site.

34. Payment Upon Termination

- 34.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Project Manager shall issue a certificate for the value of the Work done and materials ordered and delivered to Site up to the date of the issue of the certificate. Additional liquidated damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable by the Contractor.
- 34.2 If the Contract is terminated for the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Project Manager shall issue a certificate for the value of the Work done, materials ordered, the reasonable cost of removal of equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works.
- 34.3 The Employer may employ and pay other persons to carry out and complete the Works and to rectify any defects and may enter upon the Works and use all materials on the Site, plant, equipment and temporary works.
- 34.4 The Contractor shall, during the execution or after the completion of the Works under this clause remove from the Site as and when required, within such reasonable time as the Project Manager may in writing specify, any temporary buildings, plant, machinery, appliances, goods or materials belonging to or hired by him, and in default the Employer may (without being responsible for any loss or damage) remove and sell any such property of the Contractor, holding the proceeds less all costs incurred to the credit of the Contractor.

Until after completion of the Works under this clause the Employer shall not be bound by any other provision of this Contract to make any payment to the Contractor, but upon such completion as aforesaid and the verification within a reasonable time of the accounts therefore the Project Manager shall certify the amount of expenses properly incurred by the Employer and, if such amount added to the money paid to the Contractor before such determination exceeds the total amount which would have been payable on due completion in accordance with this Contract the difference shall be a debt payable to the Employer by the Contractor; and if the said amount added to the said money be less than the said total amount, the difference shall be a debt payable by the Employer to the Contractor.

35. Release from Performance

- 35.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor, the Project Manager shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop Work as quickly as possible after receiving this certificate and shall be paid for all Work carried out before receiving it.

36. Corrupt gifts and payments of commission

The Contractor shall not;

- (a) Offer or give or agree to give to any person in the service of the Employer any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of this or any other Contract for the Employer or for showing or forbearing to show favour or disfavour to any person in relation to this or any other contract for the Employer.
- (b) Enter into this or any other contract with the Employer 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 thereof have been disclosed in writing to the Employer.

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 Regulations issued under The Exchequer and Audit Act Cap 412 of the Laws of Kenya.

37. Settlement Of Disputes

37.1 In case any dispute or difference shall arise between the Employer or the Project Manager on his behalf and the Contractor, either during the progress or after the completion or termination of the Works, such 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 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

On the request of the applying party. The institution written to first by the aggrieved party shall take precedence over all other institutions.

37.2 The arbitration may be on the construction of this Contract or on any matter or thing of whatsoever nature arising thereunder or in connection therewith, including any matter or thing left by this Contract to the discretion of the Project Manager, or the withholding by the Project Manager of any certificate to which the Contractor may claim to be entitled to or the measurement and valuation referred to in clause 23.0 of these conditions, or the rights and liabilities of the parties subsequent to the termination of Contract.

37.3 Provided that no arbitration proceedings shall be commenced on any dispute or difference where notice of a dispute or difference 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.

- 37.4 Notwithstanding the issue of a notice as stated above, the arbitration of such a dispute or difference shall not commence unless an attempt has in the first instance been made by the parties to settle such dispute or difference amicably with or without the assistance of third parties. Proof of such attempt shall be required.
- 37.5 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:
- 37.5.1 The appointment of a replacement Project Manager upon the said person ceasing to act.
- 37.5.2 Whether or not the issue of an instruction by the Project Manager is empowered by these Conditions.
- 37.5.3 Whether or not a certificate has been improperly withheld or is not in accordance with these Conditions.
- 37.5.4 Any dispute or difference arising in respect of war risks or war damage.
- 37.6 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 Employer and the Contractor agree otherwise in writing.
- 37.7 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 award any sums which ought to have been the subject of or included in any certificate.
- 37.8 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 requirement or notice had been given.
- 37.9 The award of such Arbitrator shall be final and binding upon the parties.

SECTION V

APPENDIX TO CONDITIONS OF CONTRACT

THE EMPLOYER IS

Name: _____

Address: _____

Name of Authorised Representative: _____

Telephone: _____

Facsimile: _____

The Project Manager is

Name:

Address: _____

Telephone: _____

Facsimile: _____

The name (and identification number) of the Contract is KRA _____

The Works consist of _____ interior renovation
works _____

The Start Date shall be _____ to be
determined _____

The Intended Completion Date for the whole of the Works shall be: to be determined.

The following documents also form part of the Contract: tender award, bill of quantities

The Contractor shall submit a revised program for the Works within 14 days of delivery of the Letter of Acceptance.

The Site Possession Date shall be (shall be communicated to the winning bidder).

The Site is located at **CORPORATE BUSINESS CENTRE (CBC) BUILDING, ELGON ROAD, UPPER HILL, NAIROBI** and is defined in drawings (Attached drawings)

The Defects Liability period is 6 months

Other Contractors, utilities etc., to be engaged by the Employer on the Site
Include those for the execution of ;

1. _____

2. _____

3. _____

4. _____

The minimum insurance covers shall be;

1. The minimum cover for insurance of the Works and of Plant and Materials in respect of the Contractor's faulty design is to be determined

2. The minimum cover for loss or damage to Equipment is 5Million

3. The minimum for insurance of other property is 5Million

4. The minimum cover for personal injury or death insurance

- For the Contractor's employees is 5Million

- And for other people is _____5 million_____

The following events shall also be Compensation Events:

1. _____based on
contract_____
2. _____
3. _____
4. _____

The period between Program updates is 90 days.

The amount to be withheld for late submission of an updated Program is ___pending valuation

The proportion of payments retained 10% percent.

The Price Adjustment Clause shall not apply

The liquidated damages for the whole of the Works is Kshs. 60,000 (per day)

The Performance Security shall be for the following minimum amounts equivalent as a percentage of the Contract Price 10% percent.

The Completion Period for the Works is___to be determined_ [Weeks]

The rate of exchange for calculation of foreign currency payments is ___CBK Forex rate

The schedule of basic rates used in pricing by the Contractor is as attached [*Contractor to attach*].

Advance Payment shall not **be granted**.

Tender No: KRA/HQS/NCB-073/2019-2020
Bill of Quantities

The declaration of No Conflict of Interest is incorporated in the Confidential Business Questionnaire

Bidders are advised to download free of charge a soft copy from the KRA website.

Tender Validity Period is **335 days** from the date of tender opening.

Tender prices are to be quoted in Kenya Shillings or any other freely convertible currency.

The bill of quantities and drawing attached and named **appendix 1 and 2 respectively**.

The bidder must provide an appropriate written power of attorney establishing the authorization of the signatory to the tender documents to bind the bidder.

Combined technical and financial proposal shall be submitted electronically via KRA E-Procurement Portal

A bid security of **Kshs 700,000.00** and valid for **365 days** from the date of tender opening.

Mandatory site visit is scheduled on 19th and 21st May 2020 at 11.00am at CBC - Upper hill.

Opening of Technical and financial Proposals will be done in public at the time of closing the tender.

Bidders will be evaluated using the criteria set out on page 303 to 305.

Bidders are expected to examine all instructions, forms, terms, specifications, and other information in the Bidding Documents.

Failure to furnish all information required by the Bidding Documents or to submit a bid not substantially responsive to the Bidding Documents in every respect will be at the Bidder's risk and may result in the rejection of its bid.

SECTION VI

SPECIFICATIONS

Notes for preparing Specifications

- 1.0 Specifications must be drafted to present a clear and precise statement of the required standards of materials, and workmanship for tenderers to respond realistically and competitively to the requirements of the Employer and ensure responsiveness of tenders. The Specifications should require that all materials, plant, and other supplies to be permanently incorporated in the Works be new, unused, of the most recent or current models, and incorporating all recent improvements in design and materials unless provided otherwise in the Contract. Where the Contractor is responsible for the design of any part of the permanent Works, the extent of his obligations must be stated.
- 1.1 Specifications from previous similar projects are useful and may not be necessary to re-write specifications for every Works Contract.
- 1.2 There are considerable advantages in standardizing **General Specifications** for repetitive Works in recognized public sectors, such as highways, urban housing, irrigation and water supply. The General Specifications should cover all classes of workmanship, materials and equipment commonly involved in constructions, although not necessarily to be used in a particular works contract. Deletions or addenda should then adapt the General Specifications to the particular Works.
- 1.3 Care must be taken in drafting Specifications to ensure they are not restrictive. In the Specifications of standards for materials, plant and workmanship, existing Kenya Standards should be used as much as possible, otherwise recognized international standards may also be used.
- 1.4 The Employer should decide whether technical solutions to specified parts of the Works are to be permitted. Alternatives are appropriate in cases where obvious (and potentially less costly) alternatives are possible to the technical solutions indicated in tender documents for certain elements of the Works, taking into consideration the comparative specialized advantage of potential tenderers.

The Employer should provide a description of the selected parts of the Works with appropriate reference to Drawings, Specifications, Bills of Quantities, and Design or Performance criteria, stating that the alternative solutions shall be at least structurally and functionally equivalent to the basic design parameters and Specifications.

Such alternative solutions shall be accompanied by all information necessary for a complete evaluation by the Employer, including drawings, design calculations, technical specifications,

breakdown of prices, proposed construction methodology, and other relevant details. Technical alternatives permitted in this manner shall be considered by the Employer each on its own merits and independently of whether the tenderer has priced the item as described in the Employer's design included with the tender documents.

SECTION VII

DRAWINGS

Attached separately and marked Appendix 2

SECTION VIII

BILL OF QUANTITIES

Notes for preparing Bills of Quantities

1.0 The objectives of the Bills of Quantities are;

- (a) to provide sufficient information on the quantities of Works to be performed to enable tenders to be prepared efficiently and accurately; and
- (b) 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 in sufficient 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 brief as possible.

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

(a) Preliminaries.

The preliminaries should indicate the inclusiveness of the unit prices, and should state the methods of measurement which have been adopted in the preparation of the Bill of Quantities and which are to be used for the measurement of any part of the Works.

The number of preliminary items to be priced by the tenderer should be limited to tangible items such as site office 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.

(b) Work Items

- (i) The 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.

General items common to all parts of the Works may be grouped as a separate section in the Bill of Quantities.

- (ii) 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 or down where appropriate.
- (iii) The following units of measurement and abbreviations are recommended for use.

<i>Unit</i>	<i>Abbreviation</i>	<i>Unit</i>	<i>Abbreviation</i>
cubic meter	m ³ or cu m	millimeter	mm
hectare	ha	month	mon
hour	h	number	nr
kilogram	kg	square meter	m ² or sq m
lump sum	sum	square millimeter	mm ² or sq mm
meter	m	week	wk
metric ton (1,000 kg)	t		

- (iv) The commencing surface should be identified in the description of each item for Work involving excavation, boring or drilling, for which the commencing surface is not also the original surface. The excavated surface should be identified in the description of each item for Work involving excavation for which the excavated surface is not also the final surface. The depths of Work should be measured from the commencing surface to the excavated surface, as defined.

(c) Daywork Schedule

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 Employer of the realism of rates quoted by the tenderers, the Daywork Schedule should normally comprise:

- (i) a list of the various classes of labour, and materials for which basic Day work rates or prices 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 Day work basis; and

- (ii) a percentage to be entered by the tenderer against each basic Day work Subtotal amount for labour, materials and plant representing the Contractor's profit, overheads, supervision and other charges.

(d) Provisional Quantities and Sums

- (i) Provision for quantity contingencies in any particular item or class of Work with a high expectation of quantity overrun should be made by entering specific "Provisional Quantities" or "Provisional Items" in the Bill of Quantities, and not by increasing the quantities for that item or class of Work beyond those of the Work normally expected to be required. To the extent not covered above, a general provision for physical contingencies (quantity overruns) should be made by including a "Provisional Sum" in the Summary of the Bill of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a "Provisional Sum" in the Summary of the Bill of Quantities. The inclusion of such provisional sums often facilitates budgetary approval by avoiding the need to request periodic supplementary approvals as the future need arises.
- (ii) Provisional sums to cover specialized works normally carried out by Nominated Sub Contractors should be avoided and instead Bills of Quantities of the specialised 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 specialised 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.

(e) Summary

The Summary should contain a tabulation of the separate parts of the Bills of Quantities carried forward, with provisional sums for Daywork, for physical (quantity) contingencies, and for price contingencies (upward price adjustment) where applicable.

SECTION IX

STANDARD FORM

- (i) Form of Invitation for Tenders
- (ii) Form of Tender
- (iii) Letter of Acceptance
- (iv) Form of Agreement
- (v) Form of Tender Security
- (vi) Performance Bank Guarantee
- (vii) Bank Guarantee for Advance Payment
- (viii) Qualification Information
- (ix) Tender Questionnaire
- (x) Confidential Business Questionnaire
- (xi) Statement of Foreign Currency Requirement
- (xii) Details of Sub-Contractors
- (xiii) Request for Review Form

FORM OF INVITATION FOR TENDERS

_____ [date]

To: _____ [name of Contractor]
_____ [address]

Dear Sirs:

RE: PROPOSED OFFICE FIT-OUT AND RENOVATION WORKS AT CORPORATE BUSINESS CENTRE (CBC) BUILDING, ELGON ROAD, UPPER HILL, NAIROBI

You have been prequalified to tender for the above project.

We hereby invite you and other prequalified tenderers to submit a tender for the execution and completion of the above Contract.

A complete set of tender documents may be purchased by you from _____

[mailing address, cable/telex/facsimile numbers].

All tenders must be accompanied by _____ number of copies of the same and a security in the form and amount specified in the tendering documents, and must be delivered to

[address and location]

at or before 2nd June 2020 at 11.00 am. Tenders will be opened immediately thereafter, in the presence of tenderers' representatives who choose to attend.

Yours faithfully,

_____ Authorised Signature

_____ Name and Title

8.1 FORM OF TENDER

Date _____
Tender No. _____

To: KENYA REVENUE AUTHORITY
P. O. BOX 48240 – 00100 NAIROBI.

Gentlemen and/or Ladies:

1. Having examined the tender documents including Addenda Nos. [Insert numbers], the receipt of which is hereby duly acknowledged, we, the undersigned, carry out work for the **proposed Office Fit-Out and Renovation Works at Corporate Business Centre (CBC) Building, Elgon Road, Upper Hill, Nairobi) KRA/HQS/NCB-073/2019-2020** in conformity with the said tender documents for the sum of

..... (total tender amount in words and figures)

or such other sums as may be ascertained in accordance with the Schedule of Prices attached herewith and made part of this Tender.

2. We undertake, if our Tender is accepted carry out the works in accordance with the work plan specified in the Schedule of Requirements.

3. If our Tender is accepted, we will obtain the guarantee of a bank in a sum of equivalent to **10%** percent of the Contract Price for the due performance of the Contract , in the form prescribed by Kenya Revenue Authority

4. We agree to abide by this Tender for a period of **335 days** from the date fixed for tender opening of the Instructions to tenderers, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

5. This Tender, together with your written acceptance thereof and your notification of award, shall constitute a Contract, between us. Subject to signing of the Contract by the parties.

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

Dated this _____ day of _____ 20 _____

[signature]

[in the capacity of]

Duly authorized to sign tender for an on behalf of _____

LETTER OF ACCEPTANCE

_____ [date]

To: _____
[name of the Contractor]

[address of the Contractor]

Dear Sir,

This is to notify you that your Tender dated _____
for the execution of _____
[name of the Contract and identification number, as given in the Tender documents] for the Contract
Price of Kshs. _____ [amount in figures][Kenya
Shillings _____ (amount in words)] in accordance with the Instructions
to Tenderers is hereby accepted.

You are hereby instructed to proceed with the execution of the said Works in accordance with the
Contract documents.

Authorized Signature

Name and Title of Signatory

Attachment : Agreement

FORM OF AGREEMENT

THIS AGREEMENT, made the _____ day of _____ 20 _____
between _____ of [or whose registered office is
situated at] _____
(hereinafter called “the Employer”) of the one part AND
_____ of [or whose registered office is
situated at] _____
(hereinafter called “the Contractor”) of the other part.

WHEREAS THE Employer is desirous that the Contractor executes

(name and identification number of Contract) (hereinafter called “the Works”) located
at _____ [Place/location of the Works] and the Employer has accepted
the tender submitted by the Contractor for the execution and completion of such Works and the
remedying of any defects therein for the Contract Price of
Kshs _____ [Amount in figures], Kenya
Shillings _____ [Amount in words].

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents shall be deemed to form and shall be read and construed as part of this Agreement i.e.
 - (i) Letter of Acceptance
 - (ii) Form of Tender
 - (iii) Conditions of Contract Part I
 - (iv) Conditions of Contract Part II and Appendix to Conditions of Contract
 - (v) Specifications
 - (vi) Drawings

(vii) Priced Bills of Quantities

3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, 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.

IN WITNESS whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

The common Seal of _____

Was hereunto affixed in the presence of _____

Signed Sealed, and Delivered by the said _____

Binding Signature of Employer _____

Binding Signature of Contractor _____

In the presence of (i) Name _____

Address _____

Signature _____

[ii] Name _____

Address _____

Signature _____

FORM OF TENDER SECURITY

WHEREAS(hereinafter called “the Tenderer”) has submitted his tender dated for the construction of
..... (name of Contract)

KNOW ALL PEOPLE by these presents that WE having our registered office at(hereinafter called “the Bank”), are bound unto(hereinafter called “the Employer”) in the sum of Kshs..... for which payment well and truly to be made to the said Employer, the Bank binds itself, its successors and assigns by these presents sealed with the Common Seal of the said Bank this Day of20.....

THE CONDITIONS of this obligation are:

1. If after tender opening the tenderer withdraws his tender during the period of tender validity specified in the instructions to tenderers
Or
2. If the tenderer, having been notified of the acceptance of his tender by the Employer during the period of tender validity:
 - (a) fails or refuses to execute the form of Agreement in accordance with the Instructions to Tenderers, if required; or
 - (b) fails or refuses to furnish the Performance Security, in accordance with the Instructions to Tenderers;

We undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to him, owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This guarantee will remain in force up to and including thirty (30) days after the period of tender validity, and any demand in respect thereof should reach the Bank not later than the said date.

[date]

[signature of the Bank]

[witness]

[seal]

PERFORMANCE BANK GUARANTEE

_____ [Date]

TO: The Kenya Revenue Authority
P.O. Box 4824 - 00100 GPO
Nairobi, Kenya

Dear Sir,

WHEREAS _____ (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ (hereinafter called "the Works");

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognised bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Kshs. _____ (*amount of Guarantee in figures*) Kenya Shillings _____ (*amount of Guarantee in words*), and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of Kenya Shillings _____ (*amount of Guarantee in words*) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change, addition or other modification of the terms of the Contract or of the Works to be performed thereunder or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this Guarantee, and we hereby waive notice of any change, addition, or modification.

This guarantee shall be valid until the date of issue of the Certificate of Completion.

SIGNATURE AND SEAL OF THE GUARANTOR _____

Name of Bank _____

Address _____

Date _____

BANK GUARANTEE FOR ADVANCE PAYMENT

To: _____ [name of Employer] _____ (Date)
_____ [address of Employer]

Gentlemen,

Ref: _____ [name of Contract]

In accordance with the provisions of the Conditions of Contract of the above-mentioned Contract, We, _____ [name and Address of Contractor] (hereinafter called "the Contractor") shall deposit with _____ [name of Employer] a bank guarantee to guarantee his proper and faithful performance under the said Contract in an amount of Kshs. _____ [amount of Guarantee in figures] Kenya Shillings _____ [amount of Guarantee in words].

We, _____ [bank or financial institution], as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surety merely, the payment to _____ [name of Employer] on his first demand without whatsoever right of objection on our part and without his first claim to the Contractor, in the amount not exceeding Kshs _____ [amount of Guarantee in figures] Kenya Shillings _____ [amount of Guarantee in words], such amount to be reduced periodically by the amounts recovered by you from the proceeds of the Contract.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed thereunder or of any of the Contract documents which may be made between _____ [name of Employer] and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

No drawing may be made by you under this guarantee until we have received notice in writing from you that an advance payment of the amount listed above has been paid to the Contractor pursuant to the Contract.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until _____ (name of Employer) receives full payment of the same amount from the Contract.

Yours faithfully,

Signature and Seal _____

Name of the Bank or financial institution _____

Address _____

Date _____

Witness: Name: _____

Address: _____

Signature: _____

Date: _____

QUALIFICATION INFORMATION

1. Individual Tenderers or Individual Members of Joint Ventures

1.1 Constitution or legal status of tenderer (attach copy or Incorporation Certificate);

Place of registration: _____

Principal place of business _____

Power of attorney of signatory of tender _____

1.2 Total annual volume of construction work performed in the last five years

Year	Volume	
	Currency	Value

1.3 Work performed as Main Contractor on works of a similar nature and volume over the last five years. Also list details of work under way or committed, including expected completion date.

Project name	Name of client and contact person	Type of work year of completion	Value of performed and Contract
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

1.4 Major items of Contractor's Equipment proposed for carrying out the Works. List all information requested below.

Item of Equipment	Description, Make and age (years)	Condition(new, good, poor) and number available	Owned, leased (from whom?), or to be purchased (from whom?)

_____	_____	_____	
_____	_____	_____	
_____ (etc.)			

- 1.5 Qualifications and experience of key personnel proposed for administration and execution of the Contract. Attach biographical data.

Position	Name	Years of experience (general)	Years of experience in proposed position
Project Manager			
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
(etc.)			

- 1.6 Financial reports for the last five years: balance sheets, profit and loss statements, auditor's reports, etc. List below and attach copies.

- 1.7 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List below and attach copies of supportive documents.

- 1.8 Name, address and telephone, telex and facsimile numbers of banks that may provide reference if contacted by the Employer.

- 1.9 Statement of compliance with the requirements of Clause 1.2 of the Instructions to Tenderers.

1.10 Proposed program (work method and schedule) for the whole of the Works.

2 Joint Ventures

2.4 The information listed in 1.1 - 1.10 above shall be provided for each partner of the joint venture.

2.5 The information required in 1.11 above shall be provided for the joint venture.

2.6 Attach the power of attorney of the signatory(ies) of the tender authorizing signature of the tender on behalf of the joint venture

2.7 Attach the Agreement among all partners of the joint venture (and which is legally binding on all partners), which shows that:

- a) all partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms;
- b) one of the partners will be nominated as being in charge, authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture; and
- c) the execution of the entire Contract, including payment, shall be done exclusively with the partner in charge.

TENDER QUESTIONNAIRE

Please fill in block letters.

1. Full names of tenderer

.....

2. Full address of tenderer to which tender correspondence is to be sent (unless an agent has been appointed below)

.....

3. Telephone number (s) of tenderer

.....

4. Telex address of tenderer

.....

5. Name of tenderer's representative to be contacted on matters of the tender during the tender period

.....

6. Details of tenderer's nominated agent (if any) to receive tender notices. This is essential if the tenderer does not have his registered address in Kenya (name, address, telephone, telex)

.....

.....

Signature of Tenderer

Make copy and deliver to: _____ (Name of Employer)



CONFIDENTIAL BUSINESS QUESTIONNAIRE FORM

You are requested to give the particulars indicated in Part 1; either Part 2(a), 2(b) or 2 (c) whichever applied to your type of business; and Part 3.

You are advised that it is a serious offence to give false information on this form.

Part 1 – General	
1.1	<i>Business Name</i>
1.2	<i>Location of Business Premises.</i>
1.3	<i>Plot No..... Street/Road</i> <i>Postal Address</i> <i>Tel No. Fax</i> <i>Email</i>
1.4	<i>Nature of Business ,.....</i>
1.5	<i>Registration Certificate No.</i>
1.6	<i>Maximum Value of Business which you can handle at any one time – Kshs.</i>
1.7	<i>Name of your Bankers Branch</i>
Part 2 (a) – Sole Proprietor	
2a.1	<i>Your Name in Full</i> <i>Age</i>
2a.2	<i>Nationality</i> <i>Country of Origin</i> <i>Citizenship Details</i>
Part 2 (b) Partnership	
2b.1	<i>Given details of Partners as follows:</i>

2b.2	<u>Name</u>	<u>Nationality</u>	<u>Citizenship Details</u>
	<u>Shares</u>		
	1.....		
		
	2.....		
		
	3.....		
		
	4.....		
		

Part 2 (c) – Registered Company

2c.1	Private or Public	
		
2c.2	State the Nominal and Issued Capital of Company-		
	Nominal Kshs.	
	Issued Kshs.	
2c.3	Given details of all Directors as follows		
	<u>Name</u>	<u>Nationality</u>	<u>Citizenship Details</u>
	<u>Shares</u>		
	1.....		
		
	2.		
		
	3.		
		
	4.		
		
	5		
		
		

Part 3 – Eligibility Status

3.1	Are you related to an Employee, Committee Member or Board Member of Kenya Revenue Authority? Yes _____ No _____
3.2	If answer in '3.1' is YES give the relationship.

3.3 Does an Employee, Committee Member, Board Member of Kenya Revenue Authority sit in the Board of Directors or Management of your Organization, Subsidiaries or Joint Ventures? Yes_____ No_____

3.4 If answer in '3.3' above is **YES** give details.

.....
.....
.....
.....

3.5 Has your Organization, Subsidiary Joint Venture or Sub-contractor been involved in the past directly or indirectly with a firm or any of its affiliates that have been engaged by Kenya Revenue Authority to provide consulting services for preparation of design, specifications and other documents to be used for procurement of the goods under this invitation? Yes_____ No_____

3.6 If answer in '3.5' above is **YES** give details.

.....
.....
.....
.....

3.7 Are you under a declaration of ineligibility for corrupt and fraudulent practices? YES_____ No_____

3.8 If answer in '3.7' above is **YES** give details:

.....
.....
..
.....
.....

3.9 Have you offered or given anything of value to influence the procurement process? Yes _____ No_____

3.10 If answer in '3.9' above is **YES** give details

.....
.....
.....
.....

I DECLARE that the information given on this form is correct to the best of my knowledge and belief.

Date Signature of Candidate

.....

- If a Kenya Citizen, indicate under "Citizenship Details" whether by Birth, Naturalization or registration.

STATEMENT OF FOREIGN CURRENCY REQUIREMENTS

(See Clause 23] of the Conditions of Contract)

In the event of our Tender for the execution of _____
_____ (*name of Contract*) being accepted, we would require in
accordance with Clause 21 of the Conditions of Contract, which is attached hereto, the
following percentage:

(Figures)..... (Words).....

of the Contract Sum, (Less Fluctuations) to be paid in foreign currency.

Currency in which foreign exchange element is required:

.....

Date: The Day of 20.....

Enter 0% (zero percent) if no payment will be made in foreign currency.

Maximum foreign currency requirement shall be _____(percent) of the Contract
Sum, less Fluctuations.

(Signature of Tenderer)

DETAILS OF SUB-CONTRACTORS

If the Tenderer wishes to sublet any portions of the Works under any heading, he must give below details of the sub-contractors he intends to employ for each portion.

Failure to comply with this requirement may invalidate the tender.

(1) Portion of Works to be sublet:

[i] Full name of Sub-contractor
and address of head office:

.....

(ii) Sub-contractor's experience
of similar works carried out
in the last 3 years with
Contract value:

.....

.....

(2) Portion of Works to sublet:

(i) Full name of sub-contractor
and address of head office:

.....

.....

(ii) Sub-contractor's experience
of similar works carried out
in the last 3 years with
contract value:

.....

[Signature of Tenderer)

Date

LETTER OF NOTIFICATION OF AWARD

_____ [Date]

TO: The Kenya Revenue Authority
P.O. Box 4824 - 00100 GPO
Nairobi, Kenya

To:

RE: Tender No.

Tender Name

This is to notify that the contract/s stated below under the above mentioned tender have been awarded to you.

1. Please acknowledge receipt of this letter of notification signifying your acceptance.
2. The contract/contracts shall be signed by the parties within 30 days of the date of this letter but not earlier than 14 days from the date of the letter.
3. You may contact the officer(s) whose particulars appear below on the subject matter of this letter of notification of award.

(FULL PARTICULARS)

SIGNED FOR ACCOUNTING OFFICER

FORM RB 1

REPUBLIC OF KENYA
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*) ofdated the...day of20.....in the matter of Tender No.....of20...

REQUEST FOR REVIEW

I/We.....,the above named Applicant(s), of address: Physical address.....Fax 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.
- etc.

By this memorandum, the Applicant requests the Board for an order/orders that: -

- 1.
 - 2.
- etc

SIGNED(Applicant)

Dated on.....day of/...20...

FOR OFFICIAL USE ONLY

Lodged with the Secretary Public Procurement Administrative Review Board on day of20.....

SIGNED

Board Secretary

ELECTRICAL INSTALLATIONS SPECIFICATIONS

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1.0 GENERAL SPECIFICATIONS

1.1 Definitions

"Work" or "Works" used in this section of the Specification shall mean all the work required to be carried out in connection with the electrical installations as specified herein and shown on the drawings.

"Sub-contractor" shall be synonymous as far as the carrying out of the electrical works are concerned, and shall include either the sub-contractor, his own approved domestic sub-contractor, or a Nominated Sub-contractor, as appropriate. However final responsibility to the Engineer and the Owner will be the sub-contractor as defined on page 1/3 of this document.

The Engineer reserves the right to appoint a person or firm who will be vested with the authority of the Engineer in respect of the quality and sufficiency of materials and workmanship and other general requirements, but not in respect of variations or other matters which in any way affect the sub-contract Sum. Such appointment will not be a person to whom the sub-contractor shall object for reasons considered to be sufficient by an Arbitrator appointed under Clause 36 of the Conditions of sub-contract.

1.2 Work by approved person or firm

The whole of the electrical installations shall be carried out by a person or firm who is registered with the Ministry of Energy under an appropriate class of registration and shall be authorized to issue a Commencement of Work Notice and a Completion Certificate once the installation work has been completed. He must be conversant with the latest statutory requirements of the Kenya Power & Lighting Co. Ltd. to ensure that only the installation practice acceptable to them is followed.

Such person or firm shall constantly keep on the Site a literate Agent or Representative competent and experienced in the kind of work involved, who shall give his whole time to the superintendence of the electrical works. Such Agent or Representative shall receive on behalf of the person or firm, directions and instructions from the sub-contractor or Engineer and such directions and instructions shall be deemed to be given to them in accordance with the Conditions of sub-contract.

The Works shall be executed under the direction and to the entire satisfaction in all respects of the sub-contractor and Engineer who shall at all times during normal working hours have access to the works and to the yards and workshops of the person or firm carrying out these installations and subsidiary sub-contractors or other places where work is being prepared for the Works.

1.3 Scope of the works

It will be deemed that the sub-contractor has allowed for everything for the proper and satisfactory execution and completion of the works according to the true intent and meaning of the drawings and the Specification taken together, and to the approval of the Engineer.

It will be deemed that the sub-contractor, prior to submitting his tender for the works has obtained all particulars, information, explanations and clarifications from all appropriate sources, including the Engineer, necessary for the complete and correct preparation of that tender. Any claim based upon want of knowledge in any respect will not be entertained.

1.4 Drawings

The drawings used in the preparation of these Bills of Quantities are scheduled on the relevant Section hereof and are deemed to be Sub-Contract Drawings.

1.5 Standard of materials

Where material and equipment is specifically described and named in the Specification, it is so named or described for the purpose of establishing a standard of materials and workmanship to which the sub-contractor shall adhere. Alternatives may be supplied or used provided they are equal or superior to those specified. The sub-contractor shall submit, with his bid, a list indicating the manufacturer and place of origin of the various items of equipment that he proposes to supply. Should the sub-contractor install the material or carry out the method in question before receiving approval from the proper authorities, the Engineer shall direct the contractor to remove the material in question immediately. The fact that this material has been installed shall have no bearing or influence on the decision by the Engineer. All materials condemned by the Engineer are to be removed from the works and suitable materials shall be installed in their place at the expense of the sub-contractor.

1.6 Procurement of materials

The sub-contractor is advised that no assistance can be given in the procurement of materials to be used in the work. The sub-contractor may be called upon to show evidence that satisfactory arrangements have been made for the procurement of any materials required to complete the Works. Copies of purchase orders to suppliers may be requested.

The sub-contractor shall be responsible for all site and/or drawing measurements required for completion of quantities of materials required for the proper execution of the Works.

No claims for extra payment will be considered on the grounds of insufficient knowledge, or other errors on the part of the sub-contractor.

1.7 Low Voltage Switchboard

The sub-contractor must assure that switchgear can withstand the system fault level at the place of installation.

The switchgear shall be designed throughout to secure safety during operation, inspection, cleaning and maintenance and shall be so arranged as to minimize the risk of fire arising or spreading.

The switchboards shall be manufactured in accordance with BS EN 6097, which co-ordinates the requirements for electrical power switchgear and associated apparatus. It is not intended that this B.S. should cover the requirements for specific apparatus for which separate British Standards exist. All equipment and material used in the switchboard shall be in accordance with the appropriate B.S.

1) Construction

The switchboard shall comprise the equipment required for the Installations with all current transformers, auxiliary fuses, labels, small wiring and interconnections necessary for the satisfactory operation of the switchboard.

Switchboards shall be of the flush fronted, enclosed, metal clad type with full front or rear access, suitable for indoor use, sectionalized as necessary to facilitate transport and erection. The maximum height shall be approximately 2.0 metres.

A suitable connection chamber containing all field terminals shall be provided at the top or bottom of the switchboard as appropriate.

All bus-bars and bus-bar connections shall consist of high conductivity copper and be provided in accordance with BS EN 5486. The bus-bars shall be clearly marked L1, L2, and L3 for the phases and N for the neutral. The bus-bars shall be so arranged in the switchboard that extensions to the left and right may be made in the future should the need arise.

Small wiring, which will be neatly arranged and cleared, shall be colored according to the phase or neutral connection.

2) Switches and fuse switches

These shall be in strict accordance with BS EN 6097-2 switches. Means of locking the switches in the "OFF" position shall be provided.

All fuse switches shall comply with B.S. 1361 and shall have a fault rating at least equal to the fault rating of the switchboard in which they are installed. Cartridge fuse links to B.S. 88 category AC 46, Class Q1 and fusing factor not exceeding 1.5 shall be supplied with each fused switch.

Mounting arrangements shall be such that individual complete fuse switches may be disconnected and withdrawn when necessary without extensive dismantling work.

When switches are arranged in tier formation all necessary horizontal and vertical barriers shall be provided to ensure segregation from adjacent units. Means of locking the switches in the "OFF" position shall be provided.

3) Earth bar

A hard drawn high conductivity copper earthing bar shall be provided for the full length of the board and all fuse switch units and circuit breakers shall be bonded to this bar.

1.8 Distribution boards

Where the requirement for fuses is indicated on the drawing the distribution boards shall be fitted with high quality fuse carriers and bases, removable insulated shields to provide adequate protection against accidental contact with live metal, and circuit indicating labels fixed inside the cover.

Where the requirement for miniature circuit breakers is indicated on the drawings, the distribution boards shall be fitted with moulded thermoplastic units of the combined thermal overload and magnetic short circuit tripping type to BS EN 60898:1991 having clearly marked "ON" and "OFF" positions. MCB's of all ratings shall have a minimum short circuit current breaking capacity of 3,000 A for single pole breakers and 4,000 A for triple pole breakers.

Bus-bars shall be rated as the nominated current for the main isolator in their entire length.

A complete list of circuit details on typed cartridge paper glued to stiff cardboard and covered with a sheet of perspex, and held in position with four suitable fixings, shall be fitted to the inner face of the lids of each distribution panel. The appropriate M.C.B. rating shall be stated on the circuit chart against each circuit in use. Ivorine labels shall be secured to the insulation barriers in such a manner as to indicate the number of the circuit shown on the circuit chart.

1.9 Steel conduits

Conduits shall be heavy gauge Class B welded to B.S. 31. In no case will conduits smaller than 20 mm diameter be used in the works. Conduits installed within buildings shall be bake enameled finish

except where specified otherwise. Where installed externally or in damp conditions they shall be galvanized. Conduit fittings, accessories or equipment used in conjunction with galvanized conduits shall also be galvanized or otherwise as approved by the Engineer.

1.10 Non metallic conduits

Conduit shall be best quality new super high impact grade heavy gauge Class 'A' rigid PVC unplastic conduit as manufactured by Metro Plastic Ltd. to B.S. 4607: Part 2: suitable for plain connections or as specified.

1.11 Cable trays

Cable trays shall be fabricated from perforated mild steel tray of minimum 14 SWG with returned flanges and coupling pieces for rigidity and strength.

Unless otherwise stated in the specification or shown on the drawings the cable tray shall be painted grey enamel for indoor use and shall be hot dipped galvanized for outdoor use.

1.12 Sheet steel cable trunking

Trunking shall be minimum 18 gauge zinc coated steel, enameled to approved color, to the sizes shown on the drawings.

1.13 Cables and flexible cords

All cables used in the sub-contract shall be manufactured in accordance with the current appropriate British Standards Specifications which are as follows:-

Rubber insulated cables and flexible cords	-	B.S.S 6500
P.V.C. insulated cables and flexible cords	-	B.S.S 6004
P.V.C. insulated armoured cables	-	B.S.S 6346
Butyl rubber insulated cables	-	B.S.S 6101v

The sub-contractor will, at the Engineer's discretion, be required to submit samples of cables for his approval; he reserves the right to call for cables of an alternative manufacture without any extra cost being incurred.

P.V.C. insulated cables shall be 500/1000 volts grade. No cable smaller than 1.5 sq. mm (3/.029) shall be used unless otherwise specified.

1.14 Armoured P.V.C. insulated and sheathed cables

Shall be 11,000-600/1000 volts grade manufactured to B.S. 6346 with copper stranded conductors.

The cable cores shall be identified in accordance with the current edition of B.S. 6346.

PVC insulated, aluminium strip armoured and PVC sheathed multi core cables shall have solid aluminium conductors and shall be 11,000-600/1000 volt grade, manufactured in accordance with B.S. 6346.

1.15 Lighting switches

(a) Wall Switches: Shall be flush type contained in steel or pvc boxes of the ratings and gangs appropriate; complete with overlapping white cover plates and switch dollies. They shall be to B.S. 3676.

(b) Ceiling Switches: Shall be of semi-recessed pattern, white, for fixing to a standard conduit box, or surface pattern to B.S. 3676.

(c) Surface Wall Switches: Shall be contained in a steel box with steel cover plate, with rating and gangs as specified on the drawings and to BS 3676

1.16 Sockets and switched sockets

Shall be 13 amp, flush pattern in pvc box complete with overlapping ivory or BMA or brass finish coverplates.

They shall be 13 amp, 3 pin, shuttered, switched or unswitched as specified on the drawings to B.S. 1363. All sockets or switch-sockets shall be with fused plug top containing a fuse whose rating shall be suitable for the load connected to it. The plug top shall be to B.S. 1363.

Surface type sockets or switch sockets shall be in a steel box with metal- clad steel cover plates or ivory insulated with ivory mounting block and back plate and to B.S. 1363.

Shall be flush, D P switched or unswitched in a PVC box with ivory or BMA or matt chrome overlapping cover-plate with or without pilot light to B.S. 3676

Surface fused spur boxes shall be in a steel box, D P switched or unswitched with metalclad steel cover plates to B.S. 3676.

1.17 Telephone outlets

These shall consist of 100 x 100 x 50 mm deep steel box with single or double outlet telephone cord-outlet plate and white.

1.18 Time switches

These shall be 30 amp, A C 200/250 volts 50 C/S with 9 hours spring reserve.

1.19 Clock connectors

Shall be fused 2 amps, S P with earthing facilities, flush, ivory or matt chrome either square pattern flush to fit on standard switch box or round pattern to fit on standard conduit box.

1.20 Watertight sockets

Shall be of rating 5 amp, or 15 amp, single pole and neutral with earth or three pole and neutral with earth, IP54 protection and to IEC 669-1

1.21 Fireman's switches

Shall be 15 amps, or 30 amps, DP as specified on the drawings and having cast iron weatherproof enclosures, finished red and complying with IEE Regulations.

1.22 Connectors

Shall be of the porcelain normal size 2 brass screws type of appropriate rating. These shall be fitted at all conduit box lighting point outlets for jointing of looped P.V.C. cables with flexible cables.

1.23 Lamp holders

Shall be of the extra heavy H.O. skirted pattern and shall be provided for every specified lighting fitting and shall be B.C. E.S. or G.E.S as required. All E.S. and G.E.S holders shall be heavy brass type (except for plain pendants where reinforced bakelite type shall be used). The screwed cap of the E.S. and G.E.S holders shall be connected to the neutral.

Where lamp holders are supported by flexible cable, the holders shall have "cord grip" arrangements and in the case of metal shades, earthing screws shall be provided on each of the holders.

The Contractor must order the appropriate type of holder when ordering lighting fittings, to ensure that the correct types of holders are provided irrespective of the type normally supplied by the manufacturers.

1.24 Amps

All lamps shall be suitable for normal stated supply voltage and the number and sizes of lamps detailed in the drawings shall be supplied and fixed. The sub-contractor must verify the actual supply voltage with the supply authority before ordering the lamps.

Tungsten filament lamps shall be manufactured in accordance with B.S. 161, B.S. 4533. Tubular fluorescent lamps shall comply with BSEN 60081. Tabular fluorescent lamps shall be T8/26mm with electronic control gear.

WORKMANSHIP

1.25 Workmanship generally

The workmanship and method of installation shall conform to the best standard practice. All work shall be performed by skilled tradesmen and to the satisfaction of the Engineer. Helpers shall have qualified supervision.

Any work that does not, in the opinion of the Engineer, conform to the best standard practice will be removed and reinstated at the sub-contractor's expense.

Permits, Certificates or Licenses must be held by all tradesmen for the type of work in which they are involved where such Permits, Certificates or Licenses exist under Government Legislation.

1.26 Installations liaison

The sub-contractor shall liaise with the Engineer in planning the works before work is commenced. Particular care shall be taken by the sub-contractor to ensure there is close liaison with other sub-contractors in installing services, to prevent clashing of service positions, etc. Any work which has to be re-done due to negligence in this respect shall be the sub-contractor's responsibility.

1.27 Regulations and standards

All work executed by the sub-contractor shall comply with the current edition of the "Regulations for the Electrical Equipment of Buildings" issued by the Institution of Electrical Engineers, and with the Regulations of the Local Electricity Authority.

Where the two sets of regulations appear to conflict, they shall be clarified with the Engineer.

1.28 Working drawings

The sub-contractor shall prepare such working drawings as may be necessary, which shall be complete in such detail not only that the works can be executed on site but also that the Engineer can approve the sub-contractor's proposals, detailed designs and intentions in the execution of the works.

If the sub-contractor requires any further instructions, details, contract drawings or information drawings to enable him to prepare his working drawings or proposals, he shall apply in writing to the Engineer for such information at a time which is neither unreasonable distant from nor unreasonably close to the date when it is needed.

All working drawings shall be submitted to the Engineer for approval. If not so submitted the sub-contractor shall accept at his own cost, the risk that any work commenced or which he intends to commence on site, may be rejected.

The Engineer, in giving his approval to the working drawings, will presume that any necessary action has been, or shall be, taken by the sub-contractor to ensure that the Installations shown thereof have been cleared with any other person or bodies whose Installations and works might be affected.

Should he fail in this respect then he shall be liable to pay for any alteration or modification to his own, or other person or body's Installations which are incurred, notwithstanding any technical or other approval which the sub-contractor's working drawings may have received from the Engineer.

Working drawings to be prepared by the sub-contractor shall include but shall not be restricted to the following:-

- (a) Any drawings required by the sub-contractor or the Engineer to enable structural provision to be made including builders work drawings or schedules and those for detailing of holes, chases, fixings, foundations, cables and pipework ducting whether below or above ground or in or outside or below buildings.
- (b) General and layout arrangement drawings of all plant, control boards, fittings and apparatus or any part thereof.
- (c) Schematic layout drawings of services and of control equipment.

- (d) Layout drawings of all embedded and non-embedded pipework, ducts, and electrical conduits.
- (e) Complete circuit drawings of the equipment together with associated circuit descriptions.
- (f) Such other drawings as are called for in the text of the Specification or as the Engineer may reasonable require.

Three copies of all working drawings shall be submitted to the Engineer for approval. One copy will be returned to the Contractor indicating approval or any amendments that may be required.

Approved working drawings shall not be departed from except as may be approved or directed by the Engineer.

Approval by the Engineer of working drawings shall neither relieve the sub-contractor of any of his obligations under the contract nor relieve him from correcting any errors found subsequently in the approved working drawings or other working drawings and in the works on site or elsewhere associated therewith.

The sub-contractor shall ensure that his working drawings are submitted to the Engineer for approval at a time not unreasonably close to the date when such approval is required. Late submission will not relieve him of his obligation to complete the Works within the agreed contract period and in a manner that would receive the approval of the Engineer.

1.29 Shop drawings

Before manufacture of any item is begun the sub-contractor shall submit three copies of detailed drawings of all pieces of equipment including sizes, capacities, construction details, etc. and as may be required to determine the suitability of the equipment for the approval of the Engineer. Approval shall not relieve the sub-contractor of the full responsibility of errors or the necessity of checking the drawings himself or of furnishing the materials and equipment and performing the work required by the drawings and Specification.

1.30 Setting out works

The sub-contractor is to set out the works and take all measurements and dimensions required for the erection of his materials on site, making any modifications in detail as may be found necessary during the progress of the works, submitting any such modifications or alterations in detail to the Engineer before proceeding, and must allow in his Tender for all such modifications and for the provision of any sketches or drawings related thereto.

1.31 Positions and sizes of services, plant, equipment, fittings and apparatus

The contract drawings give a general indication of the intended layout. The positions of the equipment and appliances, and also the exact routes of the ducts, mains and distribution pipework shall be confirmed before installation is commenced. The exact siting of appliances, pipework etc. may vary from that indicated.

The routes of services and positions of apparatus shall be determined by approved dimensional details on wiring drawings or on site by the sub-contractor in consultation with the Engineer.

Services through ducts shall be arranged to allow maximum access along the ducts and the services shall be readily accessible for maintenance. Any work which has to be re-done due to negligence in this respect shall be the sub-contractor's responsibility.

The sub-contractor shall be deemed to have allowed in the contract sum for locating terminal points of services (e.g. switches, socket outlets, lighting points, control switches, thermostats and other initiating devices) in position plus or minus 1.2 m horizontally and vertically from the locations shown on the contract drawings. Within these limits no variations in the contract sum will be made unless the work has already been executed in accordance with previously approved working drawings and with the approval of the Engineer.

1.32 Access to plant rooms

It shall be the responsibility of the sub-contractor to ensure that all equipment ordered in respect of this sub-contract is to be constructed in such a manner that it may, if necessary, be dismantled to enable it to pass to its final position.

1.33 Positions of points and switches

Although the approximate positions of all points are shown on the drawings, enquiry shall be made as to the exact positions of all M.C.B. panels, lighting points, socket outlets etc., before work is actually commenced. The sub-contractor must approach the Engineer with regard to ceiling panel layouts.

Where two or more points are shown adjacent to each other on the drawings, e.g. socket outlet and telephone outlet, they shall be lined up vertically or horizontally.

1.34 Identification of plant and components

The sub-contractor shall supply and fix approved identification labels to all major components of plant, starters, switches and items of control equipment, with black Traffolyte or equal labels engraved in white lettering denoting its name, function and section controlled. The labels shall be mounted on equipment in the most convenient positions, care been taken to ensure the labels can be read without difficulty.

1.35 Nameplates

All apparatus shall have a nameplate showing the size, name of equipment, serial number and all other information usually provided in stamped, edged or engraved lettering to be perfectly legible to the satisfaction of the Engineer, bearing the name and address of the manufacturer Nameplates shall not be painted ove2.

Motors shall have serial number, voltage, cycle, phase and horsepower.

1.36 Main power supply

The sub-contractor will be required to liaise with the Kenya Power & Lighting Company Limited in order to determine the most appropriate and the most economical method of bringing in the service line cable.

The location of the H.T metering panel and main M.V. Switchboard is shown on the relevant drawing. The layout and the provision of ducts must be agreed with the Kenya Power & Lighting Co Ltd.

The supply voltage shall be 240 volts single phase, or 415 volts, 3 phase, 50 Hz and 11 kilovolts,3 phase,50Hz at the intake point. The sub-contractor shall allow for liaising with the K P & L to ensure that the supply is made available by the Company at the appropriate time and to suit the programme of construction work.

The sub-contractor will be required to give all notices, completion forms, etc., to K P & L to enable the installation to be tested upon completion and shall pay all fees arising from the testing or any subsequent re- testing of the installation.

1.37 Distribution boards

Insulated barriers shall be fitted between phases and neutrals in all boards, and to shroud live parts.

Neutral cables shall be connected to the neutral bar in the same sequence as the phase cables are connected to the M.C.B's. This shall also apply to earth bars when installed.

1.38 Conduit installation generally

A separate conduit system is required for each installation, lighting, power, telephone, etc. Surface conduit shall be run in square symmetrical lines and shall be fixed by means of spacer-bar saddles spaced at not more than 0.9 m (for 20 and 25 conduit) and 1.2 m for larger sizes, for steel conduits and 0.6 m for PVC conduits. Surface conduit shall also be fixed on both sides of all boxes at a distance not greater than 0.2 m, the box itself being securely fixed. Where such an arrangement of boxes and saddles would prove to be both unsightly and unnecessary, short lengths of conduit not exceeding 0.6 m in length between boxes need not be secured further than by connection to the adjacent boxes.

Concealed conduit run in chases in walls shall be fixed by means of mild steel pipe hooks or non-metallic saddles spaced not more than 0.9 m. Where conduit is concealed behind plaster it shall be chased to a depth of either 15 mm below finished plaster level, or installed flush with the structural wall level before application of plaster, whichever is the lesser depth.

Conduit cast-in-situ shall be frequently secured to steel reinforcement work with heavy binding wire to prevent movement of conduit and conduit boxes during pouring and vibrating of concrete.

Outlet boxes shall be filled with paper to prevent ingress of concrete, and all boxes shall be securely fixed to shuttering with nails, or by means which shall be visible as a marker on removal of shuttering only where these marks can be concealed. Conduit shall be installed after the first grid of steel reinforcement work is securely fixed and all open ends of conduit shall be protected by couplings plugged with a suitable non-metallic stopping plug. The number of right angle bends in conduit cast-in-situ shall not exceed two between boxes. Where straight runs of conduit are installed draw-in boxes shall be provided at distances not exceeding 25 metres and at places approved by the Engineer.

Immediately prior to installing the wiring all conduit and fittings shall be dried and cleaned out by drawing through a cloth swab. Rawplugs shall be used for fixing to aluminium section, rawnuts, spring toggles, gravity toggles or rawbolts shall be used for fixing to other materials as approved by the Engineer. Corners shall be turned by easy bends or sets made in accordance with the manufacturer's instructions without altering the section or splitting the conduit.

Conduits shall be installed in such a manner as to prevent interference with other services and shall be kept at least 225 mm clear of gas or water pipes, and heat in excess of 70⁰ C. Where this is impossible or impractical, insulation, to the prior written approval of the Engineer, shall be used.

Where conduit runs enter specified areas requiring flameproof equipment, barrier boxes shall be inserted immediately before the conduit enters the flameproof area. All conduits installed within this area shall be solid drawn galvanised, as shall be conduit fittings and accessories and Buxton Certified as suitable for Group II hazards. Equipment shall comply with B.S. 229.

Where buried in the ground outside the building the whole of the buried conduit is to be painted with two coats of approved bitumastic composition before covering up.

Where run on the surface, unpainted fittings and joints shall be painted with two coats of oil bound enamel applied to rust and grease free metalwork.

All horizontal surface conduit runs shall be erected at near ceiling level, and for all surface work the boxes used shall be tangent entry types.

All Conduits shall be efficiently drained before wiring, and ventilated in suitable positions to offset the effects of condensation.

The conduit shall be of such sizes that the conductors shall be easily drawn in after all tube has been installed, and they shall be in accordance with the Capacity of Conduits Table contained in the current edition of the I.E.E. Regulations.

Special care shall be taken to prevent dirt and rubbish getting into the conduit work during erection, screwed metal caps or plugs only shall be used for protecting open ends. Plugs of waste wood, paper, etc., shall under no circumstances be used.

Any conduit boxes and other fittings used on external walls, and in other wet situations which may be described in later clauses, shall have machined flanges and lids and shall be fitted with gaskets to prevent ingress of moisture.

The crossing of expansion joints shall be made with flexible conduit connecting each end of the conduit, the whole sleeved with 50 mm diameter PVC conduit. Care shall be taken to ensure that the flexible conduit/ conduit connectors are correctly installed and will not become disconnected when expansion and contraction takes place.

1.39 Non-metallic conduits

Where ceiling boxes, including extension rings, are flush with the ceiling surface, break joint rings shall be provided to hide the joints.

Where a non-metallic outlet box of thermoplastic material is used for the fixing or suspension of a lighting fitting the box shall be fitted with steel insert clips.

All spare ways in junction boxes etc. left for possible future extension shall be fitted with stopping plugs.

The conduit shall be bent and formed strictly in accordance with the manufacturer's instructions. Small sizes i.e. 20 and 25 mm diameter shall be bent cold by inserting the correct size bending spring. It is essential for right angle bends that the conduit is bent past 90° to allow for "spring back"

Larger sizes of conduit shall be pre-heated before inserting a rubber cord to prevent kinking. Conduit badly formed or bent, or damaged in any way, shall not be used.

Joints shall be made water-tight by the use of 'Egaweld' cement applied with a brush or rag. The cement shall be applied to the complete circumference of the conduit. Conduit shall be thoroughly cleaned at the ends to ensure a good adhesion to the fittings.

All conduit fittings and accessories including couplers, ordinary clips, saddle pipe hooks, reducers, stopping plugs, locknuts and male and female bushes shall be manufactured dimensionally, similar to B.S. 31 where applicable. Solid tees shall not be used. Solid or inspection elbows or bends or inspection tees shall be used only in exceptional circumstances and then only with the approval of the Engineer.

Where it eases the installation of cast-in-situ back entry boxes for the loop-in system, purpose made bends manufactured by Egatube may be used. They shall comprise a tight bend with a push socket at one end and a threaded socket at the other.

A means of expansion shall be provided in conduit runs in excess of 10 m without any bend or set, by the use of expansion couplings, which shall also be used at building expansion joints.

Unless it is clearly specified or shown on the drawing, the method of installing conduit shall be subject to the approval of the Engineer.

Small standard circular non-metallic conduit boxes, conforming dimensionally with B.S. 31 to standard circular non-metallic lids and brass fixing screws, shall be provided and fixed at all junctions.

Where ceiling roses occur and the ceiling box is recessed below the finished level of the ceiling, suitable extension rings to accommodate the ceiling rose must be provided.

1.40 Flexible conduit and fittings

All flexible conduits for connection to motors or machinery shall be a minimum 0.5 m length of metallic W.T. type. All ends shall be sweated into conduit threaded brass sweating glands with Tinman's solder, no spirit being used. A separate earth wire 1/1.78 mm (7/029) (tinned) shall be wound round the flexible conduit and efficiently bonded to the rigid conduit and apparatus at each end.

The solid conduit shall terminate in a large BESA or adaptable box enclosing sufficient coils of motor cable to enable "Tong-Test" reading to be taken in each conducto². Earth continuity shall be maintained by means of a copper conductor sized in accordance with BSEN 7671 subject to a minimum 1.5 sq. mm and have green insulation.

1.41 Telephone / Computer Conduits

The arrangements and size of telephone conduits is to be such as will accommodate the number of circuits as indicated on the drawings. Where conduits enter adaptable boxes each conduit is to be numbered to indicate the outlet point which it feeds. Unless otherwise stated on the drawings, conduits will terminate in standard metal boxes to B.S. 1363 with flush fitting cover plate. Draw wires of piano quality steel wire of not less than 22 swg are to be left in all telephone conduits. Draw-in boxes are required in telephone conduits on the same basis as laid down for power and lighting.

Telephone outlet boxes, draw-in boxes and the telephone distribution boxes are to be marked internally with yellow paint to distinguish them from boxes provided for other services.

1.42 Cable trays

Cable trays shall be appropriately fixed on robust and substantial brackets fixed into walls or shall be suspended on rods securely fixed to the structure together with a bracket arrangement as required to facilitate the support for the cable tray. Suspension rods shall be minimum 8 mm diameter mild steel. Brackets or suspension supports shall be provided as necessary, the spacing of which shall not exceed 2.0 m.

Where the cable tray changes direction the minimum radius of bends shall not be less than 300 mm on the inside of the bend and in no case shall be less than the bending radius of the cable supported.

All brackets, suspension rods and attachments shall be finished as the cable tray supported.

1.43 Sheet steel cable trunking

The sub-contractor shall provide cable trunking to the details and sizes stated on the drawings. It shall be utilised where two or more distribution panels are connected together and where several surface conduits would otherwise have to be run alongside each other. The Engineer must be consulted as to precise details concerning trunking routes and applications.

All necessary accessories including long sleeve couplings and pieces, bends, tees, reducers, Offices, fillets, pinracks, cable retainers, etc. shall be deemed to have been allowed for.

It shall have two adjacent fixings at 600 mm centres.

Where trunking passes through walls and floors the cover plate shall be fitted before installation and shall project at least 38 mm on either side of the finished wall surface.

Fire protection barriers shall be provided at each point where trunking runs pass through floors.

Vertical lines shall be fitted with pinracks to support cables at intervals not greater than 1,500 mm.

1.44 Sheet steel cable trunking

Cable retainers and lid fixings shall be provided at all ends of trunking and for each accessory. Lid fixings shall be provided at intervals not exceeding 750 mm along straight lengths. Cable retainers shall be provided at intervals not exceeding 1,500 mm except where trunking is inverted when the distance shall not exceed 600 mm.

1.45 Continuity tests

Before any wiring is carried out, tests shall be made on all conduit and trunking systems. Any part of the system where the tests give readings exceeding one-half ohm impedance shall be corrected at the sub-contractor's expense. Test reading shall be sent to the Engineer.

The Engineer will check tests as necessary. The sub-contractor shall again carry out similar tests before the installation is handed over.

1.46 Wiring generally

Wiring shall be carried out in an approved type of PVC insulated single core copper conductor cable, minimum conductor size 1.5 sq. mm (3/0361), of one manufacture throughout the installation, and

delivered to site with each coil having its seal intact and a label bearing the name of manufacturer, classification, size, description of cable, length and grade.

The colours of the cores shall comply with the colour code requirements of BSEN 7671

Cables shall be drawn in at accessories, distribution boards and switchgear after the erection of the conduit system.

Under no circumstances shall it be permitted to draw cable into an incomplete section of the conduit installation. The wiring shall be carried out on the looping-in principle. All joints shall be made at the terminals of main switches, and socketted outlets, etc., and fixed apparatus only. No joints shall be made in boxes unless approved.

The cables shall be run in the conduit so as not to exceed the capacities as set out in BSEN 7671.

Where fittings and accessories require earthing, an earth continuity conductor shall be run through the conduit. The earth continuity conductor shall be a bare copper wire of minimum size 2.5 sq. mm and shall be continuous between terminals. All metal boxes shall be equipped with an earth terminal. Each final sub-circuit that is required to be earthed shall be provided with its own individual earth continuity conductor which shall be run from a terminal on the earth bar in the distribution board or consumer's control unit protecting the particular final sub-circuit. Attention is drawn to the requirements to install earth continuity conductors when plastic conduit systems are used. The load and return conductors of the same circuit or circuits shall, in all cases, be drawn in the same conduit.

Not more than six final sub-circuit cables shall run in conduits feeding outlet boxes without the approval of the Engineer. Not more than eight cables running straight back to the distribution board shall be enclosed in any one conduit.

Cables shall be terminated at equipment positions unless otherwise indicated, by means of either sweated lugs of appropriate size eyelet type cable termination, or crimped type termination of reputable manufacture. Shake proof washers shall be used where electric motors are connected.

Cables shall be fitted with thimbles where cable cores are larger than terminal holes.

Cables shall be doubled or twisted back on themselves for all single connections, firmly twisted together before any connection is made and pinched screws shall not be permitted to cut the conductors.

1.47 Sub-circuit wiring

No lighting circuits shall comprise more than 10 points. Cables with different cross-sectional area of copper shall not be used in combination.

Power circuit P.V.C. cable shall be:

- (i) 2.5 sq. mm for one, two or three 5 amp sockets wired in parallel
- (ii) 2.5 sq. mm for one 15 amp socket.
- (iii) 2.5 sq. mm for one or two 13 amp sockets wired in parallel from 20 amp fuseway
- (iv) 2.5 sq. mm for a maximum of six 13 amp sockets wired from a 30 amp fuseway.
- (v) 4 sq. mm for ring main containing a maximum of ten 13 amp sockets wired from a 30 amp fuseway.

1.48 Armoured cables

An approved system of compression terminations as recommended by the cable manufacturer shall be used. For cables 16 sq. mm and upwards terminations to be swaged and fitted with ferrules.

To eliminate the possibility of damage to cables due to thermal expansion, allowance for movement shall be made by the introduction of a bend or set in each core adjacent to the terminal.

The cables shall be terminated at the equipment served by a mechanical type cable gland. The glands shall be complete with armouring clamps suitable for bonding the armouring to the unit served by means of copper tape, and the bonds shall be carried out at the time of making the joints. PVC shrouds shall be fitted over terminal cable glands.

The wire armoury of the cable shall be used wholly as an earth continuity conductor and the resistance of the wire armoury shall have resistance not more than twice the largest current carrying conductor of the cable.

P.V.C., X.L.P.E,S.W.A, P.V.C. cables shall be terminated using "Telecom B" type glands and a P.V.C. tapered sleeve shall be provided to shroud each gland.

1.49 Armoured cables

Where cables rise from floor level to switchgear, etc., they shall be protected by P.V.C. conduit, to a height of 600 mm from finished floor level, whether the cable is run on the surface or recessed into the wall.

1.50 Heat resisting cable

Final connections to cookers, water heaters, etc. shall be made using butyl rubber insulated cable as C.M.A reference 6101v butyl (single core 600/1000 volts).

This type of cable shall be used in all instances where a temperature exceeding 100 F but not exceeding 150 F is likely to be experienced

Final connections to all lighting fittings (and other equipment where a temperature in excess of 150 F is likely to be experienced) shall be made using silicone rubber insulated cable or equal approved.

1.51 Flexible cords

Shall be cord not less than 0.75 sq. mm in size, unless otherwise specified, to B.S. 6500.

Circular white twin T.2.S. flex shall be used for plain pendant fittings up to 100 watts. For all other type of lighting fittings the flexible cable shall be silicone rubber insulated.

1.52 Main cables

Cables shall at all times be handled with care and every effort made to avoid damage. Unloading, rolling to position and mounting of cable drums shall be carried out efficiently and carefully in the recognised manner and cable shall be pulled from the top of drum and twisting shall at all times be avoided.

Adequate numbers of drum jacks, rollers and other handling accessories shall be used and make-shift arrangements will not be tolerated. In all cases care shall be taken to break the rotation of the drum and cable shall not be dragged over loose earth, concrete or any surface but shall be adequately supported on rollers or man-handled into position.

The sub-contractor shall take particular care to avoid damage to other services which may run adjacent to or across the route of the cable being installed.

Cables shall be installed with a minimum of 200 mm clearances of any equipment or pipe work including lagging associated with other services. Where this condition is unavoidable or difficult to

maintain the Engineer shall be informed prior to the installation being commenced, otherwise the sub-contractor may be called upon to divert or adjust the route of any cable so affected.

Cables shall not be installed within 300 mm of a metal roof, unless clipped to the lower side of wooden joists or otherwise protected from radiant heat.

Cables passing through structural floors shall be tightly wrapped with protective tape and grouted in with hardwood filler below, shaped to suit the cables passing through.

Where cables are run vertically, heavy gauge sheet metal guards shall be supplied and fixed to the wall. The casing shall be fixed from floor level to the underneath side of the appropriate end dividing box or to a height of 1.5 metres above floor level.

Where cables run through service ducts or cable trenches they shall be fixed by means of purpose made cable hangers which shall be of the "Unistrut" pattern.

Hangers shall be of non-ferrous metal and shall be treated with one coat of metal primer and two coats of anticorrosive paint and shall be suitable for horizontal and vertical mounting either cast in or secured to concrete structure using such brackets and adaptors as are available from the manufacturers.

Hangers shall be spaced according to BSEN 7671 or to the manufacturer's recommendations, as appropriate, for the supports of the cables. The Contractor shall take particular care to avoid sagging or stress on any cable by wrongly positioned or inadequately spaced hangers.

Single and multi-way cleats shall be of cast alloy, interlocking pattern, for mounting either on steel channels or directly to concrete structure in the case of single-way cleats.

The sizes of cleats shall be selected such that all cleats can be tightened down without exerting undue pressure or strain on the cables.

In the case of vertical cables the cleats shall be so designed and of sufficient number to grip the cable firmly to prevent creeping. No cable shall run without fixing and all cable hangers and racks shall be approved by the Engineer before installation.

Where cable routes are subject to numerous changes in level and direction, additional cable hangers shall be provided to satisfactorily negotiate all such obstructions.

Where cables are spaced some distance from a supporting surface, the cable racks shall be separately bolted to additional lengths of channel section which in turn shall be fixed to brackets bolted and fixed into the structure. Cables shall be colour correct throughout their length.

Identification for cables installed within buildings shall be supplied and attached to each cable at intervals not greater than 15 metres and at all conspicuous positions such as within cable ducts, manholes, and at all cable terminations.

Discs shall be machine engraved from non-deteriorating black "Traffolyte" or similar material, display white engraving indicating the design voltage, the designation of load, and the number and cross sectional area of the cores.

The characters shall not be less than 3 mm high and shall be clearly legible.

After the installations of cables all ducts shall be adequately sealed to prevent the ingress of moisture. The sealing substance shall be of the non-hardening type.

1.53 Labeling

All plant, apparatus, equipment, distribution boards, distribution cases, terminals and cable cores shall be securely and properly labeled to the approval of the Engineer. The labeling shall clearly show the identification of the item and if applicable its control function and the part of the system controlled. Labels shall be of Traffolyte sheet fixed with screws or rivets.

1.54 Earthing

The earthing of the installation shall comply with the following requirements:-

- (i) It shall be carried out in accordance with BSEN 7671 and in accordance with the requirements of The Kenya Power and Lighting Co Ltd.
- (ii) At all main distribution panels and main service positions a 25 mm x 3 mm minimum cross-sectional area copper tape shall be provided and all equipment including the lead sheath and armouring of cables, distribution boards and metal frames shall be bonded thereto.
- (iii) The earth tape in sub-clause (ii) shall be connected by means of a copper tape or cable of suitable c.s.a to a copper electrode.

- (iv) All tapes to be soft high conductivity copper, untinned except where otherwise specified and where run underground, on or through walls, floors, etc., it shall be served with corrosion resisting tape or coated with corrosion compound and braided.
- (v) Where the earth electrode is located outside the building a removable test link shall be provided inside the building as near as possible to the point of entry to the tape, for isolation of the earth electrode for testing purposes.
- (vi) Earthing of sub-main equipment shall be deemed to be satisfactory where the sub-main cables are M.I.C.S or conduit with separate earth wire, and the installation is carried out in accordance with the figure stated in the current edition of the I.E.E. Regulations.
- (vii) Where an earth rod is specified it shall be of proprietary manufacture, solid hand drawn copper of 15 mm diameter driven into the ground to a minimum depth of 3.6 m. It shall be made up of 1.2 m sections with internal screw and socket joints and fitted with hardened steel tip and driving cap.

Connections to the rod shall be by means of a purpose-made clamp of non-ferrous metal, and the actual connection made below ground level in a concrete inspection pit with removable inspection cover.

- (viii) Earth plates will not be permitted
- (ix) Where an earth rod is used, the earth resistance shall be tested in the manner described in the current edition of the I.E.E Regulations, by the Contractor in the presence of the Engineer, and the Contractor shall be responsible for the supply of all test equipment.
- (x) Where copper tape is fixed to the building structure it shall be by means of purpose-made non-ferrous saddles which space the conductor away from the structure a minimum distance of 6 mm. Fixings shall be made using purpose-made plugs. No fixings requiring holes to be drilled through the tape will be accepted.
- (xi) Joints in copper tape shall be tinned before assembly, rivetted with a minimum of two copper rivets and sweated solid.
- (xii) Where holes are drilled in the earth tape for connection to items of equipment the effective c.s.a must be not less than required to comply with the Regulations.
- (xiii) Bolts, nuts and washers for any fixing to the earth tape must be of non-ferrous materials.

1.55 Insulation

The insulation resistance to earth and between poles of the whole wiring system, fittings and lamps, shall not be less than the requirements of BSEN 7671. Complete tests shall be made on all circuits by the sub-contractor before the installations are handed over.

A report of all tests shall be furnished by the sub-contractor to the Engineer who will then check test with his own instruments if necessary

1.56 Cable ends

All cable ends connected up in switchgear, M.C.B. panels etc., shall have the insulation carefully cut back and the ends sealed with Hellerman rubber slip-on cable end markers.

The markers shall be of the appropriate phase colour. Black cable with black cable end markers shall only be used for neutral cables.

The wiring for impulse clocks, emergency lighting, and other systems, shall also have end markers of the same colours as the respective insulations detailed in the following clause.

All bus-bars shall be painted with colours corresponding to the phases, and cable boxes shall have the respective phase colours painted on the exteriors.

Phase colours shall be indicated on fuse switches, switch fuses, and isolators by means of coloured discs, minimum diameter 6 mm fixed to front covers.

1.57 Cable insulation colours

Unless otherwise stated in later clauses the insulation colours shall be in accordance with the following table.

Where other systems are installed the cable colours shall be in accordance with the details stated in the appropriate clause.

Non-braided P.V.C. cable shall be used unless otherwise stated in other clauses.

System	Insulation Colour	Cable End Marker	Lighting and Power
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1.59 Vibration isolation

Vibration absorbing devices shall be used to isolate all motorised equipment including refrigeration plant, air handling units, fans etc., to ensure that no objectionable vibrations or sound be transmitted to the building structure.

Spring type isolation shall be of cast iron construction with floating top plate for leveling purpose complete with adjusting belt. The spring to be incorporated into this housing shall be as determined by the isolation manufacturer to provide 95% dampening efficiency.

Rubber vibration isolators shall be of the rubber in sheer type having a suitable arrangement of material to achieve compression and sheer in each direction. Sound pads of 6 mm ribbed neoprene shall be used with all isolators.

1.60 Lighting Fittings

The sub-contractor shall provide, install (including internal wiring) and connect all lighting fittings in accordance with the makes and types marked on the drawings, complete with the lamps of number, wattage and colour required by the Engineer.

Conduit suspensions shall be provided for all pendant fittings. The stems shall be screwed to ball and socket type dome lids with positive earth connection.

White break joint rings shall be provided wherever necessary. Circuit cables shall not be routed through bulkhead or other fittings where the cables would be liable to undue temperature rise and shall terminate in a fixed base connector in a conduit box mounted behind or adjacent to the fitting. Final connection to each fitting shall be carried out with silicone rubber insulated cable.

Conduit terminations to all aluminium fittings shall be fitted with brass bushes to prevent corrosive action between the steel and aluminium components. Where PVC conduit is used non-ferrous bushes may be replaced with an insulated pattern.

All fluorescent fittings shall be complete with quick starting control gear, power factor capacitors and "warm white" lamps. The metalwork of all fittings and starting equipment shall be effectively earthed to the installation. Fittings without a shunt connected PF capacitor shall incorporate a voltage dependent resistor to counteract surge voltages.

All fittings shall be cleaned with anti-static cleaning fluid prior to handover.

1.61 Security lighting installations

The layout of external security lighting installations is as shown on the layout drawing. The sub-contractor shall provide lighting columns in compliance with the details shown on the relevant drawings. These shall be primed and after installation painted to the approval of the Engineer

The cabling to various lighting columns shall be PVC/XLPE/SWA cables of the size and type as shown on the drawings. The cables shall generally be laid direct in ground at a depth of 600 mm with 50 mm sand bed under and over and provided with Danger Hatari concrete tiles throughout their length. Where cables cross roads or permanently finished surfaces these shall be drawn through PVC or concrete ducts provided by the sub-contractor.

The cables at the positions of the lighting columns shall be terminated by using brass compression glands. Each lighting column shall be provided with a lucy-cut-out fused at 5 Amps. The cabling to the luminaire at the top of the lighting standard shall be 1.5 mm PVC with earth.

The lighting installations shall be controlled by means of a photoelectric cell operating a suitably rated contactor.

The luminaires complete with lamps shall be provided under this sub-contract.

1.62 Over and Under-Voltage, Phase Failure and Phase Sequence Protection

The main incoming 415Volts switchboards and control panels shall be equipped with a relay which detects unacceptably high or low voltages.

It will monitor all phases and will cause all incoming circuit breaker(s) to trip when the voltage exceeds a maximum or minimum(which shall be selected from a range of settings).Visual indication shall be given of the cause of tripping and an electrical hours counter will record the time which during the supply exceeds the set limits.

Resetting of the relay shall be automatic but re-closure of the tripped circuit breaker shall be manual. It shall be possible to delay the operation of the relay in order to ride through transient voltage variations.

Phase failure shall cause the circuit breaker to trip immediately and in correct phase sequence will prevent the circuit breaker from being closed.

The Lovato Electronic Voltmeter relay type RVT manufactured by the Officine Electromeccanica Lovato OF Italy or equal and approved that meets the requirements for the application.

1.63 Surge Voltage Protection.

In order to give protection against transient over-voltages surges such as result from lightning strike, surge arresters shall be installed on the 415 Volts busbar of the main LV Panel.

They shall be connected permanently between each phase and earth and shall be suitable for continuous operation at 415 Volts. It shall comply with the class 2.5Ka requirements according to IEC 99.

1.64 Fault Levels.

The following prospective symmetrical fault levels are to be assumed for initial design considerations:

- 11kV KPLC overhead supply line 200MVA r.m.s.
- 415 Volts bus bars (secondary terminals of LV supply transformers) 30MVA r.m.s.

It shall be the responsibility of the subcontractor to ascertain the true fault levels.

1.65 Fire Detection and Alarm system

The sub-contractor shall be responsible for supplying, installing, wiring and commissioning a complete fire alarm system to BS 5839: 2002.

The system shall consist of manual break glass points, electronic sounders, beam detectors, smoke and heat detectors and a Fire Alarm panel complete with a charger and batteries installed in the positions shown on the drawings. The Fire alarm panel shall be connected to 240 V, 50 Hz A.C. power supply through a 13 Amps un-switched fused spur unit incorporating a pilot light.

The system shall work in the event of a signal being initiated from any break-glass contact and all bells shall ring simultaneously. The bells shall continue ringing until manually reset at the panel.

On silencing the bells, the buzzer within the panel shall remain operative until such time that the glass for the break glass contact has been replaced.

The wiring throughout shall be in 1.5 sq. mm Fire Tuff cables, enclosed in 25 mm diameter pvc or GI galvanised conduit. A completely separate and independent conduit system shall be used for wiring to fire alarm equipment.

The fire detection and alarm system shall be analogue addressable or convectional system as described in the drawings and bills of quantities.

The fire alarm system shall be commissioned by the specialist supplier who will also issue the completion certificate for the works

The operation of the fire alarm system on completion shall be demonstrated to the Engineer and the Owner and one copy of the operating instructions shall be provided to the Engineer and two copies to the Owner.

1.66 Record drawings (as installed)

During the execution of the works the sub-contractor shall, in a manner approved by the Engineer record on working or other drawings at site all information necessary for preparing record drawings of the installed works. Marked-up working or other drawings and other documents shall be made available to the Engineer as he may require for inspection and checking.

Record drawings may, subject to the approval of the Engineer, include approved working drawings adjusted as necessary and certified by the sub-contractor as a correct record of the installation of the works.

They shall include but are not restricted to the following drawings and information:-

- a) Working drawings amended as necessary but titled "Record Drawings" and certified as a true record of the "as installed" Works. Subject to the approval of the Engineer such working drawings as may be inappropriate may be omitted.
- b) Fully dimensioned drawings of all plant and apparatus.
- c) General arrangement drawings of equipment, other areas containing plant forming part of the works and the like, indicating the accurate size and location of plant and apparatus suitable cross- referenced to the drawings mentioned in (b) above and hereinafter.
- d) Route, types, sizes and arrangement of all pipework and ductwork including date of installation of underground pipe.
- e) Relay adjustment charts and manuals.
- f) Routes, types, sizes and arrangement of all electric cables, conduits, ducts and wiring including the date of installation of buried work.

- g) System schematic and trunking diagrams showing all salient information relating to control and instrumentation.
- h) Schematic diagrams of individual plant, apparatus and switch and control boards. These diagrams to include those peculiar to individual plant or apparatus and also those applicable to system operation as a whole.

Marked-up drawings of the installation of the works shall be kept up to date and completed by the date of Practical or Sectional Completion. Two copies of the record drawings of the works shall be provided not later than one month later.

The sub-contractor shall supply for fixing in sub-stations, switchrooms, boiler houses, plant rooms, pump houses, the office of the Maintenance Engineer and other like places, suitable valve and instruction charts, schematic diagrams of instrumentation and of the electrical reticulation as may be requested by the Engineer. All such charts and diagrams shall be of suitable plastic material on a stiff backing and must be approved by the Engineer before final printing.

Notwithstanding the sub-contractor's obligations referred to above, if he fails to produce to the Engineers approval, either:-

- a) The marked-up drawings during the execution of the works, OR
- b) The record drawings etc. within one month of section or practical completion; the Engineer may have these drawings produced by others. The cost of obtaining the necessary information and preparing such drawings, etc. will be recovered from the sub-contractor.

1.67 Spares

The sub-contractor shall prepare a schedule of manufacturers' recommended spares together with any special tools required for maintenance purposes. The schedules shall indicate the number of individual spares required for each items of plant included in the works and the cost of each item.

1.68 Maintenance manual

On practical completion of the works, the sub-contractor shall provide to the Engineer, 2 copies of a Maintenance Manual relating to the installation of the Works.

The Manual shall be loose-leaf type, international A4 size with stiff covers, cloth bound.

The Manual shall contain full operating and maintenance instructions for each item of equipment, plant and apparatus, set out in a form dealing systematically with each system. It shall include the following and any other items listed in the text of the specification:

- a) System description
- b) Plant
- c) Valve operation
- d) Switch operation
- e) Procedure for fault finding
- f) Emergency procedures
- g) Lubrication requirements
- h) Maintenance and servicing periods and procedures
- i) Colour coding legend for all services
- j) Schematic and wiring diagrams of plant and apparatus
- k) Record drawings, true to scale, reduced to international A4 size
- l) Lists of primary and secondary spares

1.69 Checking of work

The subcontractor shall satisfy himself as to the correctness of the connections he makes to all items of equipment supplied before it is put into operation. Details of operation, working pressures, temperatures, voltages, phase, power rating, etc. shall be confirmed by manufacturers or their agents, the confirmation to be received before the system is first operated.

1.70 Temporary and trial usage

It shall be understood and agreed that temporary or trial usage by the Owner of any device, machinery, apparatus, equipment or any other work or materials supplied under this sub-contract before final completion and written acceptance by the Engineer is not considered as evidence of acceptance of the item by the Owner. It is further understood and agreed that the Owner shall have the privilege of such temporary and trial usage as soon as the sub-contractor shall claim that the said work is completed in accordance with the drawings and Specification and to the manufacturer's instructions, and for such reasonable length of time as the Engineer shall deem suitable for making a complete and thorough test of the apparatus or system under test.

No claim for damage will be made by the sub-contractor for injury to or breaking of any parts of the Works which have been placed under test and which has been caused by weakness, flaw, or inaccuracy of structural parts or by defective material or workmanship of any kind whatsoever.

1.71 Setting to work and regulating the system

Each system shall be properly balanced, graded and regulated to ensure that correct distribution is achieved and where existing installations are affected, the sub-contractor shall also regulate these systems to ensure that their performance is maintained.

The proving of any system of plant or equipment as to compliance with the Specification shall not be approved by the Engineer, except at his discretion, until tests have been carried out under operating conditions pertaining to the most onerous conditions specified except where the time taken to obtain such conditions are unreasonable.

1.72 Tests at Sub-contractor's works

The Engineer shall have access at all reasonable times to such parts of the sub-contractor's or his sub-contractor's works as may be necessary for the purpose of inspecting, examining and testing the materials, workmanship and performance of plant.

Except where otherwise provided, the sub-contractor shall provide all labour, materials, power, fuel, stores, apparatus and properly calibrated and certified instruments for carrying out necessary tests at his own or his sub-contractor's works.

1.73 Testing on site

Upon completion of the works the sub-contractor shall subject all systems to an operating test in which he shall adjust all controls, speeds, etc., all to the satisfaction of the Engineer.

Test Certificates are to be provided by the sub-contractor and signed by the Engineer who witnesses the test. All test certificates are to be submitted to the Engineer and shall contain the following particulars therein:-

- a) Earth continuity;
- b) Neutral earth loop impedance;
- c) Insulation resistance;
- d) Earth resistance

For the purpose of all tests the sub-contractor shall provide all apparatus, attendance and assistance necessary together with all skilled labour and shall if requested, demonstrate the accuracy of any installation.

On completion, the installation must be tested in accordance with BSEN 7671: Part 7 and the sub-contractor must allow for preparing a test report for submission to the Engineer and the Kenya Power & Lighting Co. Ltd.

1.74 Hand-over

Practical completion shall occur and the Defects Liability Period shall commence only when the works and supporting services have been tested, commissioned and operated to the satisfaction of the Engineer and the Owner, and when KP & L approval has been obtained in writing.

The sub-contractor shall arrange with the Engineer and the Owner for a complete demonstration of each and every service to be carried out and or instruction to be given to the relevant operation staff of the Owner.

The sub-contractor shall prepare approved check lists of all controls and items of equipment, tools, spares and the like; he shall provide the 'as built' drawings and maintenance manual required herein; and shall clear the site and the installed systems of all surplus material, rubbish and dirt; prior to handing over the works.

2.0 PARTICULAR SPECIFICATIONS

2.1. Location

The site of the proposed work is along Elgon Road, CBC Building, Upperhill, Nairobi.

2.2. Scope of Works.

The Electrical sub-contractor shall supply and install the complete Electrical Services installation systems comprising and not limited to:

- Kenya Power and Lighting Company Limited (KPLC) Mains Cable ductwork from the nearest power network to the Main LV switchboard.
- Main metering panel in the switch room
- Sub-mains cable from metering panel to the switchboard.
- Distribution power supply cables from the main switch board to the Distribution boards through the service ducts.
- Distribution Boards and Consumer Units
- Cable trays, metal trunking and PVC ducts and /or conduits
- Small power wiring for raw power
- Voice communications wiring and accessories
- Small Power outlets plates
- Mechanical equipment power circuits and Isolators
- Lighting wiring both internal and external.
- Light fittings both internal and external
- Emergency Lighting system
- Switching controls
- Security installations wiring containment
- Telephone Cable ductwork from the nearby Telkom Kenya Ltd network to the Main Distribution Frame (MDF).
- Main Distribution Frame (MDF)
- Earthing and Bonding
- KPLC liaison in connection with power supply to the facility
- Telephone Authority liaison in connection with the new facility.
- Liaison with Client appointed specialist contractors.

2.3. Method of Installation

Generally the method of installation shall comprise main distribution utilizing armoured copper cables drawn in ducts or surface on cable tray to sub-boards and distribution boards, PVC single wires in concealed PVC conduit and in trunking to the final circuits.

The final distribution wires installation shall be run in trunking within the suspended floor slabs and concealed within the fabric of the building/structure.

All final circuits shall be complete with the appropriately sized cable protective devices (CPD) in accordance with the requirement of the current issue of the IEE Wiring regulations (BS 7671 - 1998).

2.4. Power Supply

The electrical supply to the works shall be derived from the Kenya Power & Lighting Company network at a pressure of 415 volts, 50 Hz. The Electrical subcontractor will connect to the existing rising mains located in the building's Electrical duct. Two rising mains (Maintained and non-maintained) have been provided.

The Electrical subcontractor shall make all the necessary arrangements with KPLC for the provision of the power supply connections and Certification for the new works.

The Electrical subcontractor shall provide details and information in time for the entire necessary Builder's work to the Main Contractor for the provision of all ducts, sleeves and draw pits for the installation of the supply and communication cables.

2.5. Power Distribution

The Electrical subcontractor shall supply and install armoured distribution cables, Sub-Boards and Distribution Boards in positions as shown on layout drawings and in accordance with the schematic diagram

The various levels shall be fed by distribution boards and consumer units recessed or surface mounted as shown on layout drawings. The Distribution Boards will be fed from the main switchboards in the respective switch rooms via rising mains run in power duct.

2.6. Low Voltage Switchboard

The Contractor must assure that switchgear can withstand the system fault level at the place of installation.

The switchgear shall be designed throughout to secure safety during operation, inspection, cleaning and maintenance and shall be so arranged as to minimize the risk of fire arising or spreading.

The switchboards shall be manufactured in accordance with BS EN 6097, which co-ordinates the requirements for electrical power switchgear and associated apparatus. It is not intended that this B.S. should cover the requirements for specific apparatus for which separate British Standards exist. All equipment and material used in the switchboard shall be in accordance with the appropriate B.S.

(i) Construction

The switchboard shall comprise the equipment required for the Installations with all current transformers, auxiliary fuses, labels, small wiring and interconnections necessary for the satisfactory operation of the switchboard.

Switchboards shall be of the flush fronted, enclosed, metal clad type with full front or rear access, suitable for indoor use, sectionalized as necessary to facilitate transport and erection. The maximum height shall be approximately 2.0 metres.

A suitable connection chamber containing all field terminals shall be provided at the top or bottom of the switchboard as appropriate.

All bus-bars and bus-bar connections shall consist of high conductivity copper and be provided in accordance with BS EN 5486. The bus-bars shall be clearly marked L1, L2, L3 for the phases and N for the neutral. The bus-bars shall be so arranged in the switchboard that extensions to the left and right may be made in the future should the need arise.

Small wiring, which will be neatly arranged and cleated, shall be coloured according to the phase or neutral connection.

(ii) Switches and fuse switches

These shall be in strict accordance with BS EN 6097-2 switches. Means of locking the switches in the "OFF" position shall be provided.

All fuse switches shall comply with B.S. 1361 and shall have a fault rating at least equal to the fault rating of the switchboard in which they are installed. Cartridge fuse links to B.S. 88 category AC 46, Class Q1 and fusing factor not exceeding 1.5 shall be supplied with each fused switch.

Mounting arrangements shall be such that individual complete fuse switches may be disconnected and withdrawn when necessary without extensive dismantling work.

When switches are arranged in tier formation all necessary horizontal and vertical barriers shall be provided to ensure segregation from adjacent units. Means of locking the switches in the "OFF" position shall be provided.

(iii) Earth bar

A hard drawn high conductivity copper earthing bar shall be provided for the full length of the board and all fuse switch units and circuit breakers shall be bonded to this bar.

2.7. Distribution boards

Where the requirement for fuses is indicated on the drawing the distribution boards shall be fitted with high quality fuse carriers and bases, removable insulated shields to provide adequate protection against accidental contact with live metal, and circuit indicating labels fixed inside the cover.

Where the requirement for miniature circuit breakers is indicated on the drawings, the distribution boards shall be fitted with moulded thermoplastic units of the combined thermal overload and magnetic short circuit tripping type to BS EN 60898:1991 having clearly marked "ON" and "OFF" positions. MCB's of all ratings shall have a minimum short circuit current breaking capacity of 3,000 A for single pole breakers and 4,000 A for triple pole breakers.

Bus-bars shall be rated as the nominated current for the main isolator in their entire length.

A complete list of circuit details on typed cartridge paper glued to stiff cardboard and covered with a sheet of Perspex, and held in position with four suitable fixings, shall be fitted to the inner face of the lids of each distribution panel. The appropriate M.C.B. rating shall be stated on the circuit chart against each circuit in use. Ivorine labels shall be secured to the insulation barriers in such a manner as to indicate the number of the circuit shown on the circuit chart.

2.8. Steel conduits

Conduits shall be heavy gauge Class B welded to B.S. 31. In no case will conduits smaller than 20 mm diameter be used in the works. Conduits installed within buildings shall be bake enameled finish except where specified otherwise. Where installed externally or in damp conditions they shall be galvanised. Conduit fittings, accessories or equipment used in conjunction with galvanised conduits shall also be galvanised or otherwise as approved by the Engineer.

2.9. Non metallic conduits

Conduit shall be best quality new super high impact grade heavy gauge Class 'A' rigid PVC un-plastic conduit as manufactured by Metro-plastic Ltd. Or equal and approved to B.S. 4607: Part 2: suitable for plain connections or as specified.

2.10. Cable trays

Cable trays shall be fabricated from perforated mild steel tray of minimum 14 SWG with returned flanges and coupling pieces for rigidity and strength.

Unless otherwise stated in the specification or shown on the drawings the cable tray shall be painted grey enamel for indoor use and shall be hot dipped galvanised for outdoor use.

2.11. Sheet steel cable trunking

Trunking shall be minimum 18 gauge zinc coated steel, enamelled to approved colour, to the sizes as described in the bills of quantities or shown on the drawings.

2.12. Cables and flexible cords

All cables used in the Contract shall be manufactured in accordance with the current appropriate British Standards Specifications which are as follows:-

Rubber insulated cables and flexible cords	-	B.S.S 6500
P.V.C. insulated cables and flexible cords	-	B.S.S 6004
P.V.C. insulated armoured cables	-	B.S.S 6346
Butyl rubber insulated cables	-	B.S.S 6101v

The Contractor will, at the Engineer's discretion, be required to submit samples of cables for his approval; he reserves the right to call for cables of an alternative manufacture without any extra cost being incurred.

P.V.C. insulated cables shall be 500/1000 volts grade. No cable smaller than 1.5 sq. mm (3/.029) shall be used unless otherwise specified.

2.13. Armoured P.V.C. insulated and sheathed cables

Shall be 600/1000 volts grade manufactured to B.S. 6346 with copper stranded conductors.

The cable cores shall be identified in accordance with the current edition of B.S. 6346.

PVC insulated, aluminium strip armoured and PVC sheathed multi core cables shall have solid aluminium conductors and shall be 600/1000 volt grade, manufactured in accordance with B.S. 6346.

2.14. Lighting switches

- (a) Wall Switches: Shall be flush type contained in steel or pvc boxes of the ratings and gangs appropriate; complete with overlapping white cover plates and switch dollies. They shall be to B.S. 3676.
- (b) Surface Wall Switches: Shall be contained in a steel box with steel cover plate, with rating and gangs as specified on the drawings and to BS 3676

2.15. Sockets and switched sockets

Shall be 13 amp, flush pattern in pvc box ivory white moulded socket plates. They shall be 13 amp, 3 pin, shuttered, switched or un-switched as specified on the drawings to B.S. 1363. All sockets or switch-sockets shall be with fused plug top containing a fuse whose rating shall be suitable for the load connected to it. The plug top shall be to B.S. 1363.

Surface type sockets or switch sockets shall be in a steel box with metal- clad steel cover plates or ivory insulated with ivory mounting block and back plate and to B.S. 1363.

Shall be flush, D P switched or un-switched in a pvc box with ivory or BMA or matt chrome overlapping cover-plate with or without pilot light to B.S. 3676

Surface fused spur boxes shall be in a steel box, D P switched or un-switched with metal clad steel cover plates to B.S. 3676.

2.16. Telephone outlets

These shall consist of 75 x 75 x 50 mm deep steel box with single or double outlet telephone cord-outlet plate and white.

2.17. Time switches

These shall be 30 amp, A C 200/250 volts 50 C/S with 9 hours spring reserve.

2.18. Clock connectors (Not Applicable)

Shall be fused 2 amps, S P with earthing facilities, flush, ivory or matt chrome either square pattern flush to fit on standard switch box or round pattern to fit on standard conduit box.

2.19. Watertight sockets

Shall be of rating 5 amp, or 15 amp, single pole and neutral with earth or three pole and neutral with earth , IP54 protection and to IEC 669-1

2.20. Fireman's switches

Shall be 15 amp, or 30 amp, DP as specified on the drawings and having cast iron weatherproof enclosures, finished red and complying with IEE Regulations.

2.21. Connectors

Shall be of the porcelain normal size 2 brass screws type of appropriate rating. These shall be fitted at all conduit box lighting point outlets for jointing of looped P.V.C. cables with flexible cables.

2.22. Lampholders

Shall be of the extra heavy H.O. skirted pattern and shall be provided for every specified lighting fitting and shall be B.C. E.S. or G.E.S as required. All E.S. and G.E.S holders shall be heavy brass type (except for plain pendants where reinforced Bakelite type shall be used). The screwed cap of the E.S. and G.E.S holders shall be connected to the neutral.

Where lamp holders are supported by flexible cable, the holders shall have "cord grip" arrangements and in the case of metal shades, earthing screws shall be provided on each of the holders.

The Contractor must order the appropriate type of holder when ordering lighting fittings, to ensure that the correct types of holders are provided irrespective of the type normally supplied by the manufacturers.

2.23. Amps

All lamps shall be suitable for normal stated supply voltage, and the number and sizes of lamps detailed in the drawings shall be supplied and fixed. The Contractor must verify the actual supply voltage with the supply authority before ordering the lamps.

Tungsten filament lamps shall be manufactured in accordance with B.S. 161, B.S. 4533. Tubular fluorescent lamps shall comply with BSEN 60081. Tabular fluorescent lamps shall be T8/26mm with electronic control gear.

WORKMANSHIP

2.24. Workmanship generally

The workmanship and method of installation shall conform to the best standard practice. All work shall be performed by skilled tradesmen and to the satisfaction of the Engineer. Helpers shall have qualified supervision.

Any work that does not, in the opinion of the Engineer, conform to the best standard practice will be removed and reinstated at the Contractor's expense.

Permits, Certificates or Licenses must be held by all tradesmen for the type of work in which they are involved where such Permits, Certificates or Licenses exist under Government Legislation.

2.25. Installations liaison

The Contractor shall liaise with the Engineer in planning the works before work is commenced. Particular care shall be taken by the Contractor to ensure there is close liaison with other sub-contractors in installing services, to prevent clashing of service positions, etc. Any work which has to be re-done due to negligence in this respect shall be the Contractor's responsibility.

2.26. Regulations and standards

All work executed by the Contractor shall comply with the current edition of the "Regulations for the Electrical Equipment of Buildings" issued by the Institution of Electrical Engineers, and with the Regulations of the Local Electricity Authority.

Where the two sets of regulations appear to conflict, they shall be clarified with the Engineer.

2.27. Working drawings

The Contractor shall prepare such working drawings as may be necessary, which shall be complete in such detail not only that the works can be executed on site but also that the Engineer can approve the Contractor's proposals, detailed designs and intentions in the execution of the works.

If the Contractor requires any further instructions, details, contract drawings or information drawings to enable him to prepare his working drawings or proposals, he shall apply in writing to the Engineer for such information at a time which is neither unreasonable distant from nor unreasonably close to the date when it is needed.

All working drawings shall be submitted to the Engineer for approval. If not so submitted the Contractor shall accept at his own cost, the risk that any work commenced or which he intends to commence on site, may be rejected.

The Engineer, in giving his approval to the working drawings, will presume that any necessary action has been, or shall be, taken by the Contractor to ensure that the Installations shown thereof have been cleared with any other person or bodies whose Installations and works might be affected. Should he fail in this respect then he shall be liable to pay for any alteration or modification to his own, or other person or body's Installations which are incurred, notwithstanding any technical or other approval which the Contractor's working drawings may have received from the Engineer.

Working drawings to be prepared by the Contractor shall include but shall not be restricted to the following:-

- (a) Any drawings required by the Contractor or the Engineer to enable structural provision to be made including builders work drawings or schedules and those for detailing of holes, chases, fixings, foundations, cables and pipework ducting whether below or above ground or in or outside or below buildings.
- (b) General and layout arrangement drawings of all plant, control boards, fittings and apparatus or any part thereof.
- (c) Schematic layout drawings of services and of control equipment.
- (d) Layout drawings of all embedded and non-embedded pipework, ducts, and electrical conduits.
- (e) Complete circuit drawings of the equipment together with associated circuit descriptions.
- (f) Such other drawings as are called for in the text of the Specification or as the Engineer may reasonable require.

Three copies of all working drawings shall be submitted to the Engineer for approval. One copy will be returned to the Contractor indicating approval or any amendments that may be required.

Approved working drawings shall not be departed from except as may be approved or directed by the Engineer.

Approval by the Engineer of working drawings shall neither relieve the Contractor of any of his obligations under the contract nor relieve him from correcting any errors found subsequently in the approved working drawings or other working drawings and in the works on site or elsewhere associated therewith.

The Contractor shall ensure that his working drawings are submitted to the Engineer for approval at a time not unreasonably close to the date when such approval is required. Late submission will not relieve him of his obligation to complete the Works within the agreed contract period and in a manner that would receive the approval of the Engineer.

2.28. Shop drawings

Before manufacture of any item is begun the Contractor shall submit three copies of detailed drawings of all pieces of equipment including sizes, capacities, construction details, etc. and as may be required to determine the suitability of the equipment for the approval of the Engineer. Approval shall not relieve the Contractor of the full responsibility of errors or the necessity of checking the drawings himself or of furnishing the materials and equipment and performing the work required by the drawings and Specification.

Upon award of the subcontract the subcontractor shall produce Three sets of the working drawings to Engineer prior to commencement of the work. The Engineer has to approve the drawings for the subcontractor to proceed with the works. The drawings shall be in A3 hard copies.

2.29. Setting out works

The Contractor is to set out the works and take all measurements and dimensions required for the erection of his materials on site, making any modifications in detail as may be found necessary during the progress of the works, submitting any such modifications or alterations in detail to the Engineer before proceeding, and must allow in his Tender for all such modifications and for the provision of any sketches or drawings related thereto.

2.30. Positions and sizes of services, plant, equipment, fittings and apparatus

The contract drawings give a general indication of the intended layout. The positions of the equipment and appliances, and also the exact routes of the ducts, mains and distribution pipe work shall be confirmed before installation is commenced. The exact sitting of appliances, pipe work etc. may vary from that indicated.

The routes of services and positions of apparatus shall be determined by approved dimensional details on wiring drawings or on site by the Contractor in consultation with the Engineer.

Services through ducts shall be arranged to allow maximum access along the ducts and the services shall be readily accessible for maintenance. Any work which has to be re-done due to negligence in this respect shall be the Contractor's responsibility.

The Contractor shall be deemed to have allowed in the contract sum for locating terminal points of services (e.g. switches, socket outlets, lighting points, control switches, thermostats and other initiating devices) in position plus or minus 1.2 m horizontally and vertically from the locations shown on the contract drawings. Within these limits no variations in the contract sum will be made unless the work has already been executed in accordance with previously approved working drawings and with the approval of the Engineer.

2.31. Access to plant rooms

It shall be the responsibility of the Contractor to ensure that all equipment ordered in respect of this Contract is to be constructed in such a manner that it may, if necessary, be dismantled to enable it to pass to its final position.

2.32. Positions of points and switches

Although the approximate positions of all points are shown on the drawings, enquiry shall be made as to the exact positions of all M.C.B. panels, lighting points, socket outlets etc., before work is actually commenced. The Contractor must approach the Engineer with regard to ceiling panel layouts.

Where two or more points are shown adjacent to each other on the drawings, e.g. socket outlet and telephone outlet, they shall be lined up vertically or horizontally.

2.33. Identification of plant and components

The Contractor shall supply and fix approved identification labels to all major components of plant, starters, switches and items of control equipment, with black Traffolyte or equal labels engraved in white lettering denoting its name, function and section controlled. The labels shall be mounted on equipment in the most convenient positions, care being taken to ensure the labels can be read without difficulty.

2.34. Nameplates

All apparatus shall have a nameplate showing the size, name of equipment, serial number and all other information usually provided in stamped, edged or engraved lettering to be perfectly legible to the satisfaction of the Engineer, bearing the name and address of the manufacturer Nameplates shall not be painted over.

Motors shall have serial number, voltage, cycle, phase and horsepower.

2.35. Main power supply

The Contractor will be required to liaise with the Kenya Power & Lighting Company Limited in order to determine the most appropriate and the most economical method of bringing in the service line cable.

The location of the main M.V. Switchboard is shown on the relevant drawing. The layout and the provision of ducts must be agreed with the Kenya Power & Lighting Co Ltd.

The supply voltage shall be 0.240 volts single phase, or 0.415 and 11kvolts, 3 phase, 50 Hz. The Contractor shall allow for liaising with the K P & LC to ensure that the supply is made available by the Company at the appropriate time and to suit the programme of construction work.

The Contractor will be required to give all notices, completion forms, etc., to K P & L C to enable the installation to be tested upon completion and shall pay all fees arising from the testing or any subsequent re- testing of the installation.

2.36. Distribution boards

Insulated barriers shall be fitted between phases and neutrals in all boards, and to shroud live parts.

Neutral cables shall be connected to the neutral bar in the same sequence as the phase cables are connected to the M.C.B's. This shall also apply to earth bars when installed.

2.37. Conduit installation generally

A separate conduit system is required for each installation, lighting, power, telephone, etc.

Surface conduit shall be run in square symmetrical lines and shall be fixed by means of spacer-bar saddles spaced at not more than 0.9 m (for 20 and 25 conduit) and 1.2 m for larger sizes, for steel conduits and 0.6 m for PVC conduits. Surface conduit shall also be fixed on both sides of all boxes at

a distance not greater than 0.2 m, the box itself being securely fixed. Where such an arrangement of boxes and saddles would prove to be both unsightly and unnecessary, short lengths of conduit not exceeding 0.6 m in length between boxes need not be secured further than by connection to the adjacent boxes.

Concealed conduit run in chases in walls shall be fixed by means of mild steel pipe hooks or non-metallic saddles spaced not more than 0.9 m. Where conduit is concealed behind plaster it shall be chased to a depth of either 15 mm below finished plaster level, or installed flush with the structural wall level before application of plaster, whichever is the lesser depth.

Conduit cast-in-situ shall be frequently secured to steel reinforcement work with heavy binding wire to prevent movement of conduit and conduit boxes during pouring and vibrating of concrete.

Outlet boxes shall be filled with paper to prevent ingress of concrete, and all boxes shall be securely fixed to shuttering with nails, or by means which shall be visible as a marker on removal of shuttering only where these marks can be concealed. Conduit shall be installed after the first grid of steel reinforcement work is securely fixed and all open ends of conduit shall be protected by couplings plugged with a suitable non-metallic stopping plug. The number of right angle bends in conduit cast-in-situ shall not exceed two between boxes. Where straight runs of conduit are installed draw-in boxes shall be provided at distances not exceeding 25 metres and at places approved by the Engineer.

Immediately prior to installing the wiring all conduit and fittings shall be dried and cleaned out by drawing through a cloth swab. Raw plugs shall be used for fixing to aluminium section, rawlnuts, spring toggles, gravity toggles or rawlbolts shall be used for fixing to other materials as approved by the Engineer. Corners shall be turned by easy bends or sets made in accordance with the manufacturer's instructions without altering the section or splitting the conduit.

Conduits shall be installed in such a manner as to prevent interference with other services and shall be kept at least 225 mm clear of gas or water pipes, and heat in excess of 700 C. Where this is impossible or impractical, insulation, to the prior written approval of the Engineer, shall be used.

Where conduit runs enter specified areas requiring flameproof equipment, barrier boxes shall be inserted immediately before the conduit enters the flameproof area. All conduits installed within this area shall be solid drawn galvanised, as shall be conduit fittings and accessories and Buxton Certified as suitable for Group II hazards. Equipment shall comply with B.S. 229.

Where buried in the ground outside the building the whole of the buried conduit is to be painted with two coats of approved bitumastic composition before covering up.

Where run on the surface, unpainted fittings and joints shall be painted with two coats of oil bound enamel applied to rust and grease free metalwork.

All horizontal surface conduit runs shall be erected at near ceiling level, and for all surface work the boxes used shall be tangent entry types.

All Conduits shall be efficiently drained before wiring, and ventilated in suitable positions to offset the effects of condensation.

The conduit shall be of such sizes that the conductors shall be easily drawn in after all tube has been installed, and they shall be in accordance with the Capacity of Conduits Table contained in the current edition of the I.E.E. Regulations.

Special care shall be taken to prevent dirt and rubbish getting into the conduit work during erection, screwed metal caps or plugs only shall be used for protecting open ends. Plugs of waste wood, paper, etc., shall under no circumstances be used.

Any conduit boxes and other fittings used on external walls, and in other wet situations which may be described in later clauses, shall have machined flanges and lids and shall be fitted with gaskets to prevent ingress of moisture.

The crossing of expansion joints shall be made with flexible conduit connecting each end of the conduit, the whole sleeved with 50 mm diameter PVC conduit. Care shall be taken to ensure that the flexible conduit/ conduit connectors are correctly installed and will not become disconnected when expansion and contraction takes place.

2.38. Flexible conduit and fittings

All flexible conduits for connection to motors or machinery shall be a minimum 0.5 m length of metallic W.T. type. All ends shall be sweated into conduit threaded brass sweating glands with Tinman's solder, no spirit being used. A separate earth wire 1/1.78 mm (7/029) (tinned) shall be wound round the flexible conduit and efficiently bonded to the rigid conduit and apparatus at each end.

The solid conduit shall terminate in a large BESA or adaptable box enclosing sufficient coils of motor cable to enable "Tong-Test" reading to be taken in each conducto². Earth continuity shall be maintained by means of a copper conductor sized in accordance with BSEN 7671 subject to a minimum 1.5 sq. mm and have green insulation.

2.39. Telephone / Computer Conduits

The arrangements and size of telephone conduits is to be such as will accommodate the number of circuits as indicated on the drawings. Where conduits enter adaptable boxes each conduit is to be numbered to indicate the outlet point which it feeds. Unless otherwise stated on the drawings, conduits will terminate in standard metal boxes to B.S. 1363 with flush fitting cover plate. Draw wires of piano quality steel wire of not less than 22 SWG are to be left in all telephone conduits. Draw-in boxes are required in telephone conduits on the same basis as laid down for power and lighting.

Telephone outlet boxes, draw-in boxes and the telephone distribution boxes are to be marked internally with yellow paint to distinguish them from boxes provided for other services.

2.40. Cable trays

Cable trays shall be appropriately fixed on robust and substantial brackets fixed into walls or shall be suspended on rods securely fixed to the structure together with a bracket arrangement as required to facilitate the support for the cable tray. Suspension rods shall be minimum 8 mm diameter mild steel. Brackets or suspension supports shall be provided as necessary, the spacing of which shall not exceed 2.0 m.

Where the cable tray changes direction the minimum radius of bends shall not be less than 300 mm on the inside of the bend and in no case shall be less than the bending radius of the cable supported.

All brackets, suspension rods and attachments shall be finished as the cable tray supported.

2.41. Continuity tests

Before any wiring is carried out, tests shall be made on all conduit and trunking systems. Any part of the system where the tests give readings exceeding one-half ohm impedance shall be corrected at the Contractor's expense. Test reading shall be sent to the Engineer.

The Engineer will check tests as necessary. The Contractor shall again carry out similar tests before the installation is handed over.

2.42. Wiring generally

Wiring shall be carried out in an approved type of PVC insulated single core copper conductor cable, minimum conductor size 1.5 sq. mm (3/0361), of one manufacture throughout the installation, and

delivered to site with each coil having its seal intact and a label bearing the name of manufacturer, classification, size, description of cable, length and grade.

The colours of the cores shall comply with the colour code requirements of BSEN 7671

Cables shall be drawn in at accessories, distribution boards and switchgear after the erection of the conduit system.

Under no circumstances shall it be permitted to draw cable into an incomplete section of the conduit installation. The wiring shall be carried out on the looping-in principle. All joints shall be made at the terminals of main switches, and socket outlets, etc., and fixed apparatus only. No joints shall be made in boxes unless approved.

The cables shall be run in the conduit so as not to exceed the capacities as set out in BSEN 7671.

Where fittings and accessories require earthing, an earth continuity conductor shall be run through the conduit. The earth continuity conductor shall be a bare copper wire of minimum size 2.5 sq. mm and shall be continuous between terminals. All metal boxes shall be equipped with an earth terminal. Each final sub-circuit that is required to be earthed shall be provided with its own individual earth continuity conductor which shall be run from a terminal on the earth bar in the distribution board or consumer's control unit protecting the particular final sub-circuit. Attention is drawn to the requirements to install earth continuity conductors when plastic conduit systems are used. The load and return conductors of the same circuit or circuits shall, in all cases, be drawn in the same conduit.

Not more than six final sub-circuit cables shall run in conduits feeding outlet boxes without the approval of the Engineer. Not more than eight cables running straight back to the distribution board shall be enclosed in any one conduit.

Cables shall be terminated at equipment positions unless otherwise indicated, by means of either sweated lugs of appropriate size eyelet type cable termination, or crimped type termination of reputable manufacture. Shake proof washers shall be used where electric motors are connected.

Cables shall be fitted with thimbles where cable cores are larger than terminal holes.

Cables shall be doubled or twisted back on themselves for all single connections, firmly twisted together before any connection is made and pinched screws shall not be permitted to cut the conductors.

2.43. Sub-circuit wiring

No lighting circuits shall comprise more than 10 points. Cables with different cross-sectional area of copper shall not be used in combination.

Power circuit P.V.C. cable shall be:

- (i) 2.5 sq. mm for one, two or three 5 amp sockets wired in parallel
- (ii) 2.5 sq. mm for one 15 amp socket.
- (iii) 2.5 sq. mm for one or two 13 amp sockets wired in parallel from 20 amp fuseway
- (iv) 2.5 sq. mm for a maximum of six 13 amp sockets wired from a 30 amp fuseway.
- (v) 4 sq. mm for ring main containing a maximum of ten 13 amp sockets wired from a 30 amp fuseway.

2.44. Armoured cables

An approved system of compression terminations as recommended by the cable manufacturer shall be used. For cables 16 sq. mm and upwards terminations to be swaged and fitted with ferrules.

To eliminate the possibility of damage to cables due to thermal expansion, allowance for movement shall be made by the introduction of a bend or set in each core adjacent to the terminal.

The cables shall be terminated at the equipment served by a mechanical type cable gland. The glands shall be complete with armouring clamps suitable for bonding the armouring to the unit served by means of copper tape, and the bonds shall be carried out at the time of making the joints. PVC shrouds shall be fitted over terminal cable glands.

The wire armour of the cable shall be used wholly as an earth continuity conductor and the resistance of the wire armour shall have resistance not more than twice the largest current carrying conductor of the cable.

P.V.C., S.W.A, P.V.C. cables shall be terminated using "Telecom B" type glands and a P.V.C. tapered sleeve shall be provided to shroud each gland.

2.45. Heat resisting cable

Final connections to cookers, water heaters, etc. shall be made using butyl rubber insulated cable as C.M.A reference 6101v butyl (single core 600/1000 volts).

This type of cable shall be used in all instances where a temperature exceeding 100 F but not exceeding 150 F is likely to be experienced

Final connections to all lighting fittings (and other equipment where a temperature in excess of 150 F is likely to be experienced) shall be made using silicone rubber insulated cable or equal approved.

2.46. Flexible cords

Shall be cord not less than 0.75 sq. mm in size, unless otherwise specified, to B.S. 6500.

Circular white twin T.2.S. flex shall be used for plain pendant fittings up to 100 watts. For all other type of lighting fittings the flexible cable shall be silicone rubber insulated.

2.47. Main cables

Cables shall at all times be handled with care and every effort made to avoid damage. Unloading, rolling to position and mounting of cable drums shall be carried out efficiently and carefully in the recognised manner and cable shall be pulled from the top of drum and twisting shall at all times be avoided.

Adequate numbers of drum jacks, rollers and other handling accessories shall be used and make-shift arrangements will not be tolerated. In all cases care shall be taken to break the rotation of the drum and cable shall not be dragged over loose earth, concrete or any surface but shall be adequately supported on rollers or man-handled into position.

The Contractor shall take particular care to avoid damage to other services which may run adjacent to or across the route of the cable being installed.

Cables shall be installed with a minimum of 200 mm clearances of any equipment or pipe work including lagging associated with other services. Where this condition is unavoidable or difficult to maintain the Engineer shall be informed prior to the installation being commenced, otherwise the Contractor may be called upon to divert or adjust the route of any cable so affected.

Cables shall not be installed within 300 mm of a metal roof, unless clipped to the lower side of wooden joists or otherwise protected from radiant heat.

Cables passing through structural floors shall be tightly wrapped with protective tape and grouted in with a hardwood filler below, shaped to suit the cables passing through.

Where cables are run vertically, heavy gauge sheet metal guards shall be supplied and fixed to the wall. The casing shall be fixed from floor level to the underneath side of the appropriate end dividing box or to a height of 1.5 metres above floor level.

Where cables run through service ducts or cable trenches they shall be fixed by means of purpose made cable hangers which shall be of the "Unistrut" pattern.

Hangers shall be of non-ferrous metal and shall be treated with one coat of metal primer and two coats of anticorrosive paint and shall be suitable for horizontal and vertical mounting either cast in or secured to concrete structure using such brackets and adaptors as are available from the manufacturers.

Hangers shall be spaced according to BSEN 7671 or to the manufacturer's recommendations, as appropriate, for the supports of the cables. The Contractor shall take particular care to avoid sagging or stress on any cable by wrongly positioned or inadequately spaced hangers.

Single and multi-way cleats shall be of cast alloy, interlocking pattern, for mounting either on steel channels or directly to concrete structure in the case of single-way cleats.

The sizes of cleats shall be selected such that all cleats can be tightened down without exerting undue pressure or strain on the cables.

In the case of vertical cables the cleats shall be so designed and of sufficient number to grip the cable firmly to prevent creeping. No cable shall run without fixing and all cable hangers and racks shall be approved by the Engineer before installation.

Where cable routes are subject to numerous changes in level and direction, additional cable hangers shall be provided to satisfactorily negotiate all such obstructions.

Where cables are spaced some distance from a supporting surface, the cable racks shall be separately bolted to additional lengths of channel section which in turn shall be fixed to brackets bolted and fixed into the structure. Cables shall be colour correct throughout their length.

Identification for cables installed within buildings shall be supplied and attached to each cable at intervals not greater than 15 metres and at all conspicuous positions such as within cable ducts, manholes, and at all cable terminations.

Discs shall be machine engraved from non-deteriorating black "Traffolite" or similar material, display white engraving indicating the design voltage, the designation of load, and the number and cross sectional area of the cores.

The characters shall not be less than 3 mm high and shall be clearly legible.

After the installations of cables all ducts shall be adequately sealed to prevent the ingress of moisture. The sealing substance shall be of the non-hardening type.

2.48. Labelling

All plant, apparatus, equipment, distribution boards, distribution cases, terminals and cable cores shall be securely and properly labeled to the approval of the Engineer. The labeling shall clearly show the identification of the item and if applicable its control function and the part of the system controlled. Labels shall be of Traffolite sheet fixed with screws or rivets.

2.49. Earthing

The earthing of the installation shall comply with the following requirements:-

- (i) It shall be carried out in accordance with BSEN 7671 and in accordance with the requirements of The Kenya Power and Lighting Co Ltd.
- (ii) At all main distribution panels and main service positions a 25 mm x 3 mm minimum cross-sectional area copper tape shall be provided and all equipment including the lead sheath and armouring of cables, distribution boards and metal frames shall be bonded thereto.
- (iii) The earth tape in sub-clause (ii) shall be connected by means of a copper tape or cable of suitable c.s.a to a copper electrode.
- (iv) All tapes to be soft high conductivity copper, untinned except where otherwise specified and where run underground, on or through walls, floors, etc., it shall be served with corrosion resisting tape or coated with corrosion compound and braided.
- (v) Where the earth electrode is located outside the building a removable test link shall be provided inside the building as near as possible to the point of entry to the tape, for isolation of the earth electrode for testing purposes.
- (vi) Earthing of sub-main equipment shall be deemed to be satisfactory where the sub-main cables are M.I.C.S or conduit with separate earth wire, and the installation is carried out in accordance with the figure stated in the current edition of the I.E.E. Regulations.

- (vii) Where an earth rod is specified it shall be of proprietary manufacture, solid hand drawn copper of 15 mm diameter driven into the ground to a minimum depth of 3.6 m. It shall be made up of 1.2 m sections with internal screw and socket joints and fitted with hardened steel tip and driving cap.

Connections to the rod shall be by means of a purpose-made clamp of non-ferrous metal, and the actual connection made below ground level in a concrete inspection pit with removable inspection cover.

- (viii) Earth plates will not be permitted

- (ix) Where an earth rod is used, the earth resistance shall be tested in the manner described in the current edition of the I.E.E Regulations, by the Contractor in the presence of the Engineer, and the Contractor shall be responsible for the supply of all test equipment.

- (x) Where copper tape is fixed to the building structure it shall be by means of purpose-made non-ferrous saddles which space the conductor away from the structure a minimum distance of 6 mm. Fixings shall be made using purpose-made plugs. No fixings requiring holes to be drilled through the tape will be accepted.

- (xi) Joints in copper tape shall be tinned before assembly, rivetted with a minimum of two copper rivets and sweated solid.

- (xii) Where holes are drilled in the earth tape for connection to items of equipment the effective c.s.a must be not less than required to comply with the Regulations.

- (xiii) Bolts, nuts and washers for any fixing to the earth tape must be of non-ferrous materials.

2.50. Lightning Protection Installations (Not Applicable)

The Electrical subcontractor shall supply and install a complete Lightning Protection System in accordance with BS 60 and as shown on drawings.

The system will comprise of 25 x 3 mm copper tape air termination conductor network at the roof linked to the ground via a 25 x 3 mm copper down conductor system run surface on walls up to 1800 mm from finished ground level where it is run in the RC columns.

A test terminal shall be provided for each of the down conductor and ground electrode link. 1500 mm long 12 mm diameter earth electrodes shall be provided as shown on drawings and complete with a pre-cast concrete 300 x 300 x 300mm inspection chamber.

2.51. Insulation

The insulation resistance to earth and between poles of the whole wiring system, fittings and lamps, shall not be less than the requirements of BSEN 7671. Complete tests shall be made on all circuits by the Contractor before the installations are handed over.

A report of all tests shall be furnished by the Contractor to the Engineer who will then check test with his own instruments if necessary

2.52. Cable ends

All cable ends connected up in switchgear, M.C.B. panels etc., shall have the insulation carefully cut back and the ends sealed with Hellerman rubber slip-on cable end markers.

The markers shall be of the appropriate phase colour. Black cable with black cable end markers shall only be used for neutral cables.

The wiring for impulse clocks, emergency lighting, and other systems, shall also have end markers of the same colours as the respective insulations detailed in the following clause.

All bus-bars shall be painted with colours corresponding to the phases, and cable boxes shall have the respective phase colours painted on the exteriors.

Phase colours shall be indicated on fuse switches, switch fuses, and isolators by means of coloured discs, minimum diameter 6 mm fixed to front covers.

2.53. Cable insulation colours

Unless otherwise stated in later clauses the insulation colours shall be in accordance with the following table.

Where other systems are installed the cable colours shall be in accordance with the details stated in the appropriate clause.

Non-braided P.V.C. cable shall be used unless otherwise stated in other clauses.

System	Insulation Colour	Cable End Marker	Lighting and Power
1)	Mains and sub-mains		

- | | | | |
|----|--------------|-------|--------|
| a) | Red Phase | Red | Red |
| b) | Yellow Phase | Red | Yellow |
| c) | Blue Phase | Red | Blue |
| d) | Neutral | Black | Black |

2) Sub-circuits single phase

- | | | | |
|----|--------------|-------|--------|
| a) | Red Phase | Red | Red |
| b) | Yellow Phase | Red | Yellow |
| c) | Blue Phase | Red | Blue |
| d) | Neutral | Black | Black |

3) Sub-circuits three phase

- | | | | |
|----|--------------|--------|--------|
| a) | Red Phase | Red | Red |
| b) | Yellow Phase | Yellow | Yellow |
| c) | Blue Phase | Blue | Blue |
| d) | Neutral | Black | Black |

4) Fire Alarm Grey Grey

5) Impulse Clock White White

6) Emergency lighting

- | | | |
|---------|-------|-------|
| Phase | Red | Red |
| Neutral | Black | Black |

2.54. Phase colouring of bus bars

Phase colouring of bus-bars in the switchboard and M.C.B. panels shall be as follows:-

- | | | | |
|----------|---|-----------|---------|
| Top Bar | - | Phase 1 - | Red |
| Next Bar | - | Phase 2 - | Yellow |
| Next Bar | - | Phase 3 - | Blue |
| Next Bar | - | Neutral | - Black |

2.55. Vibration isolation

Vibration absorbing devices shall be used to isolate all motorised equipment including refrigeration plant, air handling units, fans etc., to ensure that no objectionable vibrations or sound be transmitted to the building structure.

Spring type isolation shall be of cast iron construction with floating top plate for leveling purpose complete with adjusting belt. The spring to be incorporated into this housing shall be as determined by the isolation manufacturer to provide 95% dampening efficiency.

Rubber vibration isolators shall be of the rubber in sheer type having a suitable arrangement of material to achieve compression and sheer in each direction. Sound pads of 6 mm ribbed neoprene shall be used with all isolators.

2.56. Lighting Fittings

The Contractor shall collect, install (including internal wiring) and connect all lighting fittings in accordance with the makes and types marked on the drawings, complete with the lamps of number, wattage and colour required by the Engineer.

Conduit suspensions shall be provided for all pendant fittings. The stems shall be screwed to ball and socket type dome lids with positive earth connection.

White break joint rings shall be provided wherever necessary. Circuit cables shall not be routed through bulkhead or other fittings where the cables would be liable to undue temperature rise and shall terminate in a fixed base connector in a conduit box mounted behind or adjacent to the fitting. Final connection to each fitting shall be carried out with silicone rubber insulated cable.

Conduit terminations to all aluminium fittings shall be fitted with brass bushes to prevent corrosive action between the steel and aluminium components. Where PVC conduit is used non-ferrous bushes may be replaced with an insulated pattern.

All fluorescent fittings shall be complete with quick starting control gear, power factor capacitors and "warm white" lamps. The metalwork of all fittings and starting equipment shall be effectively earthed to the installation. Fittings without a shunt connected PF capacitor shall incorporate a voltage dependent resistor to counteract surge voltages.

All fittings shall be cleaned with anti-static cleaning fluid prior to handover.

2.57. Security lighting installations

The layout of external security lighting installations is as shown on the layout drawing. The Contractor shall provide lighting columns in compliance with the details shown on the relevant drawings. These shall be primed and after installation painted to the approval of the Engineer

The cabling to various lighting columns shall be PVC SWA cables of the size and type as shown on the drawings. The cables shall generally be laid direct in ground at a depth of 600 mm with 50 mm sand bed under and over and provided with Danger Hatari concrete tiles throughout their length. Where cables cross roads or permanently finished surfaces these shall be drawn through PVC or concrete ducts provided by the Contractor.

The cables at the positions of the lighting columns shall be terminated by using brass compression glands. Each lighting column shall be provided with a lucy-cut-out fused at 5 amps. The cabling to the luminaire at the top of the lighting standard shall be 1.5 mm PVC with earth.

The lighting installations shall be controlled by means of a photoelectric cell operating a suitably rated contactor.

The luminaires complete with lamps shall be provided under this Contract.

2.58. Fire Detection and Alarm system (Not Applicable)

The Contractor shall be responsible for supplying, installing, wiring and commissioning a complete fire alarm system to BS 5839: 2002.

The system shall consist of manual breakglass points, electronic sounders, smoke and heat detectors and a Fire Alarm panel complete with a charger and batteries installed in the positions shown on the drawings. The Fire alarm panel shall be connected to 240 v, 50 Hz A.C. power supply through a 13 amps unswitched fused spur unit incorporating a pilot light.

The system shall work in the event of a signal being initiated from any break-glass contact and all bells shall ring simultaneously. The bells shall continue ringing until manually reset at the panel.

On silencing the bells, the buzzer within the panel shall remain operative until such time that the glass for the break glass contact has been replaced.

The wiring throughout shall be in 1.5 sq. mm Fire Tuff cables, enclosed in 25 mm diameter pvc conduit. A completely separate and independent conduit system shall be used for wiring to fire alarm equipment.

The fire alarm system shall be commissioned by the specialist supplier who will also issue the completion certificate for the works

The operation of the fire alarm system on completion shall be demonstrated to the Engineer and the Owner and one copy of the operating instructions shall be provided to the Engineer and two copies to the Owner.

The Electrical subcontractor shall supply smoke and heat detectors, short circuit isolators and electronic sounders wired in 3core 1.5 mm sq fire resistant cables as FP200 or equal drawn in 25 mm diameter PVC conduit concealed in walls and slabs and as shown on drawings.

The Electrical subcontractor shall allow for the specialist supplier's testing and commissioning of the fire detection and alarm system in accordance with BS5839:2000 and to the satisfaction of the Engineer and Client.

2.59. Mechanical Equipment Power Installation.

The Electrical subcontractor shall supply and install all the mechanical circuits as shown in the schematic drawing comprising single PVC cables drawn in concealed conduit and surface mounted galvanized metal conduits to the water booster pumps and fire pumps.

The Electrical subcontractor shall supply and install all the TP& N Isolators in positions as detailed in this specification and as shown on the layout drawing.

The Electrical subcontractor shall supply, install and connect up all the cables up to the Isolators for the mechanical equipment and control panels.

2.60. Record drawings (as installed)

During the execution of the works the Contractor shall, in a manner approved by the Engineer record on working or other drawings at site all information necessary for preparing record drawings of the installed works. Marked-up working or other drawings and other documents shall be made available to the Engineer as he may require for inspection and checking.

Record drawings may, subject to the approval of the Engineer, include approved working drawings adjusted as necessary and certified by the Contractor as a correct record of the installation of the works.

They shall include but are not restricted to the following drawings and information: -

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- a) Working drawings amended as necessary but titled "Record Drawings" and certified as a true record of the "as installed" Works. Subject to the approval of the Engineer such working drawings as may be inappropriate may be omitted.
- b) Fully dimensioned drawings of all plant and apparatus.
- c) General arrangement drawings of equipment, other areas containing plant forming part of the works and the like, indicating the accurate size and location of plant and apparatus suitable cross-referenced to the drawings mentioned in (b) above and hereinafter.
- d) Route, types, sizes and arrangement of all pipework and ductwork including date of installation of underground pipe.
- e) Relay adjustment charts and manuals.
- f) Routes, types, sizes and arrangement of all electric cables, conduits, ducts and wiring including the date of installation of buried work.
- g) System schematic and trunking diagrams showing all salient information relating to control and instrumentation.
- h) Schematic diagrams of individual plant, apparatus and switch and control boards. These diagrams to include those peculiar to individual plant or apparatus and also those applicable to system operation as a whole.

Marked-up drawings of the installation of the works shall be kept up to date and completed by the date of Practical or Sectional Completion. Two copies of the record drawings of the works shall be provided not later than one month later.

The Contractor shall supply for fixing in sub-stations, switch rooms, boiler houses, plant rooms, pump houses, the office of the Maintenance Engineer and other like places, suitable valve and instruction charts, schematic diagrams of instrumentation and of the electrical reticulation as may be requested by the Engineer. All such charts and diagrams shall be of suitable plastic material on a stiff backing and must be approved by the Engineer before final printing.

Notwithstanding the Contractor's obligations referred to above, if he fails to produce to the Engineers approval, either:-

- a) The marked-up drawings during the execution of the works, OR

- b) The record drawings etc. within one month of section or practical completion; the Engineer may have these drawings produced by others. The cost of obtaining the necessary information and preparing such drawings, etc. will be recovered from the Contractor.

The subcontractor shall prepare the as installed drawings at the completion for the subcontract. The drawings shall be in AUTOCAD Release 14 version and 3No. Sets of A3 hard copies

2.61. Spares

The Contractor shall prepare a schedule of manufacturers' recommended spares together with any special tools required for maintenance purposes. The schedules shall indicate the number of individual spares required for each items of plant included in the works and the cost of each item.

2.62. Maintenance manual

On practical completion of the works, the Contractor shall provide to the Engineer 2 copies of a Maintenance Manual relating to the installation of the Works.

The Manual shall be loose-leaf type, international A4 size with stiff covers, cloth bound.

The Manual shall contain full operating and maintenance instructions for each item of equipment, plant and apparatus, set out in a form dealing systematically with each system. It shall include the following and any other items listed in the text of the specification:

- a) System description
- b) Plant
- c) Valve operation
- d) Switch operation
- e) Procedure for fault finding
- f) Emergency procedures
- g) Lubrication requirements
- h) Maintenance and servicing periods and procedures
- i) Colour coding legend for all services
- j) Schematic and wiring diagrams of plant and apparatus
- k) Record drawings, true to scale, reduced to international A4 size
- l) Lists of primary and secondary spares

2.63. Checking of work

The Contractor shall satisfy himself as to the correctness of the connections he makes to all items of equipment supplied before it is put into operation. Details of operation, working pressures, temperatures, voltages, phase, power rating, etc. shall be confirmed by manufacturers or their agents, the confirmation to be received before the system is first operated.

2.64. Temporary and trial usage

It shall be understood and agreed that temporary or trial usage by the Owner of any device, machinery, apparatus, equipment or any other work or materials supplied under this Contract before final completion and written acceptance by the Engineer is not considered as evidence of acceptance of the item by the Owner. It is further understood and agreed that the Owner shall have the privilege of such temporary and trial usage as soon as the Contractor shall claim that the said work is completed in accordance with the drawings and Specification and to the manufacturer's instructions, and for such reasonable length of time as the Engineer shall deem suitable for making a complete and thorough test of the apparatus or system under test.

No claim for damage will be made by the Contractor for injury to or breaking of any parts of the Works which have been placed under test and which has been caused by weakness, flaw, or inaccuracy of structural parts or by defective material or workmanship of any kind whatsoever.

2.65. Setting to work and regulating the system

Each system shall be properly balanced, graded and regulated to ensure that correct distribution is achieved and where existing installations are affected, the Contractor shall also regulate these systems to ensure that their performance is maintained.

The proving of any system of plant or equipment as to compliance with the Specification shall not be approved by the Engineer, except at his discretion, until tests have been carried out under operating conditions pertaining to the most onerous conditions specified except where the time taken to obtain such conditions are unreasonable.

2.66. Tests at Contractor's works

The Engineer shall have access at all reasonable times to such parts of the Contractor's or his sub-contractor's works as may be necessary for the purpose of inspecting, examining and testing the materials, workmanship and performance of plant.

Except where otherwise provided, the Contractor shall provide all labour, materials, power, fuel, stores, apparatus and properly calibrated and certified instruments for carrying out necessary tests at his own or his sub-contractor's works.

2.67. Testing on site

Upon completion of the works the Contractor shall subject all systems to an operating test in which he shall adjust all controls, speeds, etc., all to the satisfaction of the Engineer.

Test Certificates are to be provided by the Contractor and signed by the Engineer who witnesses the test. All test certificates are to be submitted to the Engineer and shall contain the following particulars therein:-

- a) Earth continuity;
- b) Neutral earth loop impedance;
- c) Insulation resistance;
- d) Earth resistance

For the purpose of all tests the Contractor shall provide all apparatus, attendance and assistance necessary together with all skilled labour and shall if requested, demonstrate the accuracy of any installation.

On completion, the installation must be tested in accordance with BSEN 7671: Part 7 and the Contractor must allow for preparing a test report for submission to the Engineer and the Kenya Power & Lighting Co. Ltd.

2.68. Hand-over

Practical completion shall occur and the Defects Liability Period shall commence only when the works and supporting services have been tested, commissioned and operated to the satisfaction of the Engineer and the Owner, and when KP & L approval has been obtained in writing.

The Contractor shall arrange with the Engineer and the Owner for a complete demonstration of each and every service to be carried out and or instruction to be given to the relevant operation staff of the Owner.

The Contractor shall prepare approved check lists of all controls and items of equipment, tools, spares and the like; he shall provide the 'as built' drawings and maintenance manual required herein; and shall clear the site and the installed systems of all surplus material, rubbish and dirt; prior to handing over the works.

BILLS OF QUANTITIES

GENERAL NOTES

1. Unless stated otherwise in the tender documents, the Contract shall be for the whole Works, based on the unit rates and prices in the Bills of Quantities submitted by the bidder.
2. The bidder or tenderer shall fill in rates and prices for all items of the Works in the contract bills. Items against which no rate or price is entered by the bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the rates for other items and prices in the Bills of Quantities.
3. All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date for submission of bids, shall be included in the rates and prices and the total Bid Price submitted by the bidder. The bid rates and prices shall also include all associated costs to be borne by the Contractor including all overheads, profits and supervision costs.
4. The rates in the contract bills shall be used in the valuation of variations and for interim payments.
5. Unless otherwise provided in these bills of quantities, the rates and prices quoted by the bidder shall not be subject to adjustment during the performance of the Contract on account of price fluctuations or fluctuations in the rate of exchange of the various currencies.
6. There shall be no component of 'Preliminaries and General Items' as these have been captured in the bills of quantities for main works.
7. Rates shall be inclusive of all Labour, tools, overheads, profits etc. and all associated/ancillary costs necessary for completing the installations.

PLUMBING & DRAINAGE SERVICES INSTALLATIONS SPECIFICATIONS

SECTION 1: GENERAL MECHANICAL SPECIFICATION

1. General

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

2. Quality of Materials

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

All products or materials not manufactured by the Contractor shall be products of reputable manufacturers and so far as the provisions of the Specification is concerned shall be as if they had been manufactured by the Contractor.

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

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

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

3. Regulations and Standards

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

- a) The Kenya Government Regulations.
- b) The United Kingdom Institution of Electrical Engineers (IEE) Regulations for the Electrical Equipment of Buildings.
- c) The United Kingdom Chartered Institute of Building Services Engineers (CIBSE) Guides.
- d) British Standard and Codes of Practice as published by the British Standards Institution (BSI)
- e) The Local Council By-laws.
- f) The Electricity Supply Authority By-laws.
- g) Local Authority By-laws.
- h) The Kenya Building Code Regulations.
- i) Kenya Standards

4. Electrical Requirements

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

The supply power up to and including local isolators shall be provided and installed under the Electrical Works. All other wiring and connections to equipment shall form part of this section of the works.

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

The starting current of all electric motors and equipment shall not exceed the maximum permissible starting currents described in the Electricity Supply Company By-laws & Regulations.

All electrical plant and equipment supplied by the Contractor shall be rated for the supply voltage and frequency obtained in Kenya, that is 415 Volts, 50Hz, 3-Phase or 240Volts, 50Hz, 1-phase.

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

5. Transport and Storage

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

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

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

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

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

6. Site Supervision

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

7. Installation

Installation of all special plant and equipment shall be carried out by the Contractor under adequate supervision from skilled staff provided by the plant and equipment manufacturer or his appointed agent in accordance with the best standards of modern practice and to the relevant regulations and standards described under Clause 3 of this Section.

8. Testing

8.1. General

The Engineer reserves the right to inspect and test or witness all manufactured plant equipment and materials.

The right of the Engineer relating to the inspection, examination and testing of plant during manufacture shall be applicable to Insurance companies and inspection authorities so nominated by the Engineer.

The Contractor shall give two week's notice to the Engineer of his intention to carry out any inspection or tests and the Engineer or his representative shall be entitled to witness such tests and inspections.

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

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

The foregoing provisions relate to tests at manufacturer's works and as appropriate to those carried out at site.

8.2. Material Tests

All material for plant and equipment to be installed under this Contract shall be tested, unless otherwise directed, in accordance with the relevant BS Specification concerned.

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

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

If stock material, which has not been specially manufactured for the plant and equipment specified is used, then the Contractor shall submit satisfactory evidence to the Engineer that such materials conform to the requirements stated herein in which case tests of material may be partially or completely waived.

Certified mill test reports of plates, piping and other materials shall be deemed acceptable.

8.3. Manufactured Plant and Equipment - Work Tests

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

Clause 8.1 shall apply where appropriate.

8.4. Pressure Testing

All pipework installations shall be pressure tested in accordance with the requirements of the various sections of this Specification.

The installations may be tested in sections to suit the progress of the works but all tests must be carried out before the work is buried or concealed behind building finishes. All tests must be witnessed by the Engineer or his representative and the Contractor shall give 48 hours notice to the Engineer of his intention to carry out such tests.

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

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

9. Colour Coding

Unless stated otherwise in the Particular Specification all pipework shall be colour coded in accordance with the latest edition of BS 1710 and to the approval of the Engineer or Architect.

10. Welding

All welding unless stated otherwise shall be arc welding.

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

Welding codes and symbols shall be to BS 499.

For arc welding, welding, welders, welding processes procedures etc. shall be to BS EN 287 & BS EN 288. Materials for welding shall be grouped as per (published document of the BSI) PD CR 15608. Arc welded joints in steel shall comply with the guidelines in BS EN ISO 25817.

Welders where prior approval shall not be required shall comply with BS 4872.

Generally all welding shall comply with the requirements of BS EN 1011.

10.1. Welder's Qualifications

Any welder employed on this Contract shall have passed the trade tests as laid down by the Government.

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

SECTION 2 - GENERAL SPECIFICATIONS FOR PLUMBING AND DRAINAGE

1.0 MATERIALS AND STANDARDS

1.1 General

This section specifies the general requirements for plumbing and drainage forming part of the Contract Works and shall apply except where specifically stated elsewhere in the specification or on the contract Drawings.

Where the standard specified has been withdrawn, superseded or made obsolete, the standard replacing it shall prevail.

Pipework and Fittings

Pipework materials to be used are as follows: -

1.2 Cold Water Mains

Unplasticised PVC, galvanized steel medium or heavy grade, or polypropylene as specified on the drawings.

1.3 Black Steel Pipework

All black steel pipework up to 65mm nominal bore shall be manufactured in accordance with BS 1387 Medium Grade, with tempered place threads in accordance with BS 21. All fittings shall be malleable iron and manufactured in accordance with BS 143.

Pipe joints shall be screwed and socketed and sufficient coupling unions shall be allowed so that fittings can be disconnected without cutting the pipe. Running nipples and long screws shall not be permitted unless exceptionally approved by the Engineer.

All black steel pipework, 80mm nominal bore up to 150mm nominal bore, shall be manufactured to comply in all respects with the specification for 65mm pipe, except that screwed and bolted flanges shall replace union and coupling for the joint of pipes to valves other items of plant.

All flanges shall comply with the requirements of BS 10 to the relevant classification contained hereinafter under section C of the Specification.

1.4 Galvanized Steel Pipework

Galvanized Steel pipework shall be manufactured to comply in all respects with the standards described for black steel pipework in paragraph 3.2 above.

Galvanizing shall be carried out in accordance with the requirements of BS 1387 and BS 143 respectively.

1.5 Copper Tubing

All copper tubing shall be manufactured in accordance with BS EN 1057:1996.

Pipe joints shall be made with soldered capillary fittings and connections to equipment shall be with compression fittings manufactured in accordance with BS 864.

Short copper connection tubes between galvanized pipework and sanitary fittings shall not be used because of the risk of galvanic action.

If, as may occur in certain circumstances, it is not possible to make the connection in any way than the use of copper tubing, then a brass straight connector shall be positioned between the galvanized pipe and the copper tube in order to prevent direct contact.

1.6 Cast Iron Pipework

a) Internal Services

Cast Iron pipework and fittings for use above ground in connection with internal building services, shall be manufactured with spigot and socket joints of the weight required by the local authority and shall fully comply with the requirements of BS 416.

All joints on Cast Iron spigot and socket pipes shall be made with an approved cold caulking compound and so installed as to allow for any expansion or contraction, which may take place.

All Cast Iron pipe work, branches, tees bends and other fittings shall be supplied complete with inspection covers for cleaning purposes. These inspection covers shall be included as parts of the fittings and shall comply with requirements of BS 416.

b) External Services

Cast iron pipe work, which is used in connection with buried external services, shall be manufactured, coated and tested in accordance with the requirements of BS 1211 or BS EN 545, BS EN 598 or BS EN 969 where BS 1211 is obsolete.

All buried cast iron bends, elbows swept tees and other fittings, shall comply with the requirements of BS 1130.

Joining on external cast iron pipes shall be carried out in accordance with one of the methods described in BS 8301 or BS EN 752 (Parts 1 to 4) where BS 8301 is obsolete, to the approval of the Engineer.

1.7 Pitch fibre Pipework

Pitch Fibre Pipework and fittings for use in connection with external drainage services shall be manufactured in accordance with the requirements of BS 2760. Pipes shall be connected by means of purpose tapered joints manufactured in accordance with the requirements of the notes contained under Appendix C of BS 2760.

Until such a time as the use of pitch impregnated fibre is covered by a code of practice, the jointing, laying and cutting of these pipes shall be carried out in accordance with the requirements of the notes contained under appendix C of BS 2760.

1.8 Concrete Pipe

Where concrete pipe and fittings are used in connection with the conveyance surface water of sewage under atmospheric pressure, they shall be manufactured in accordance with the requirements of BS 5911, except where otherwise stated.

The joints of concrete pipe and fittings may be one of the following depending application and conditions: -

- 1) Flexible rebated type (storm water drainage only)
- 2) Ordinary spigot and socket type
- 3) Flexible spigot and socket type.
- 4) Ordinary related type (Storm water drainage only)

All joints shall be sealed with suitable rubber gaskets manufactured in accordance with BS 7874:1998, BS EN 681 or BS EN 682:2002.

Joints (3) and (4) shall be made with approved cement mortar mix.

1.9 Asbestos Cement Pressure Pipe

Where asbestos cement pressure pipes and fittings are used in connection with external, above ground or buried water services, they shall be manufactured in accordance with the requirement of BS EN 512:1995.

The classification of these pipes fall into classes:

A, B, C and D, respectively, and the class to be used shall depend upon the pressure conditions pertaining to site.

Where Cast iron detachable joints are used for connecting pipes, the material shall comply with the BS specification, then the materials used shall be of quality not less than that required by this standard.

All joints shall be sealed with suitable rubber gaskets manufactured in accordance with BS 7874:1998, BS EN 681 or BS EN 682:2002.

1.10 PVC (Hard) Pressure Pipes and Fittings

All PVC pipes and fittings shall be manufactured in accordance with BS 3505: 1986, BS EN 1452 (Parts 1 to 5) or the relevant Kenya Bureau of Standards.

Jointing

The method of jointing to be employed shall be that of solvent welding, using the pipe and manufacturer's approved cement. Seal ring joint shall be introduced where it is necessary to accommodate thermal expansion.

Anchoring

The bends, valves and hydrant tees etc, in the line of the water main shall be adequately anchored to resist thrust due to internal water pressure. A concrete block shall be cast under and around the pipe and between it and sides of the trench. Well-rammed material shall be used to support the pipe and either side of the concrete.

Pipe Bed

Pipes shall be uniformly laid on a 75mm thick bed, (sand or red soil) and must not be allowed to rest on the joint or on stones etc.

Backfilling

For the protection of the pipe, initial backfilling shall be carried out as soon as possible after laying. The initial backfill shall be fine grained material thoroughly compacted around the pipe and consolidated to a depth of 6" above the crown of the pipe and at no time shall heavy rocks, stones or other objects be included in the balance of the backfill that might protrude the initial backfill layer and come into contact with the pipe.

Testing

Pipelines shall be tested in sections under an internal water pressure normally one and a half times the maximum allowable working pressure of the class of pipe used. Testing shall be carried out as soon as practical after laying and when the pipeline is adequately anchored. Precautions shall be taken to eliminate all air from the test section and to fill the pipe slowly to avoid risk of damage due to surge.

1.11 Polypropylene Random Copolymer Pipe, PP-R80

Pipes shall be manufactured with materials in accordance with German DIN 8077. Dimensions, test methods, pressure ratings and physical characteristics shall comply with DIN 8078. Other references shall be made to E-DIN 1988, DIN 8076, DIN 16928, DVS 2207/2208/223, DIN 16962, DIN 4109, DIN 18381, etc.

Pipes shall be supplied in plain-ended lengths of 4 metres each.

Jointing

The method of joining to be employed shall be that of poly-fusion welding and/or using threaded fittings.

Internal Monitoring

Internal pipe monitoring shall be done in accordance with DIN ISO 9001.

Anchoring

Mounting of pipework on the surface of the wall/floor shall be done using either fixed points or loose/sliding mounting points.

All bends, valves and tees etc, in the line of water main shall be adequately anchored to resist thrust due to internal water pressure. Concrete surround shall be placed around the pipe and sides of the trench. Well-rammed material shall be used to support the pipe and either side of the concrete.

Supports to Fittings

In underground installation care shall be taken to ensure that heavy components such as valves are fully supported so that the pipeline carries no weight.

Backfilling

For the protection of the pipe initial backfilling shall be carried out as soon as possible after laying. The initial backfill shall be fine-grained material thoroughly compacted around the pipe and consolidated to depth of 6" above the crown of the pipe. At no time shall heavy rocks, stones or other object be included in the balance of the backfill that might protrude the initial backfill and come into contact with the pipe.

Testing

Pipelines shall be tested in section under an internal water pressure normally one and a half times the maximum allowable working pressure of the class pipe used. The test medium (water) and the pipework material must be at the same temperature, and the test medium must be at a temperature that is as constant as possible. Testing shall be carried out as soon as practicable after laying and when the pipeline is anchored precautions shall be taken to eliminate all air from the test section and the pipe slowly to avoid risk of damage due to surge.

1.12 MuPVC Waste Systems

All pipes and fittings shall be manufactured in accordance with BS 5255: 1989 or the relevant Kenya Bureau of Standards.

Pipe shall be supplied in plain-ended lengths.

Thickness

The Minimum acceptable wall thickness of pipe and fittings shall be as follows:

Size (in) Thickness (mm)	Size (mm)	Pipe and Fittings	Wall
1...	32		1.8
1	40		1.9
2	50		2.0

Jointing

The method of joining to be employed shall be that of solvent welding, using the pipe and manufacturer's approved cement. Seal rings joints shall be introduced where it is necessary to accommodate thermal expansion.

Anchoring

All bends, valves and hydrant tees etc, in the line of water main shall be adequately anchored to resist thrust due to internal water pressure. A concrete block shall be cast under and around the pipe and between it and sides of the trench. Well-rammed material shall be used to support the pipe and either side of the concrete.

Workmanship

The installation method of jointing shall be solvent welding; and both jointing and fixing shall comply in all respect to the manufacturer's site-work instructions. The maximum intervals between pipe supports at 200c shall be as follows: -

Nominal size (in) (mm)	Nominal size (mm)	Horizontal (mm)	Vertical
1... 500	32 1200		
1 500	40 1200		
2 900	50 2000		

3		80
900	2000	
4		100
1000	2000	
6		150
1000	2000	

Pipes shall be fixed in straight runs and horizontal runs and shall be laid to gradients in conformity with BS 5572 of Practice for Sanitary and in any event not less than 18mm/m unless otherwise specified.

Pipes passing through wall or floor shall be sleeved to allow unrestricted movements.

The works shall be inspected and tested during installation at any stage in accordance with BS EN 12056 - 2:2000. All work, which will be concealed, shall be tested before it is finally enclosed and verified by the Clerk of Works.

Pipe Bed

Pipes shall uniformly be laid on a 75mm thick bed, (Sand or red soil) and not be allowed to rest on the joint or on stones etc.

Supports to Fittings

In underground installation care shall be taken to ensure that heavy components such as valves are fully supported so that the pipeline carries no weight.

Backfilling

For the protection of the pipe initial Backfilling shall be carried out as soon as possible after laying. The initial backfill shall be fine-grained material thoroughly compacted around the pipe and consolidated to depth of 6" above the crown of the pipe. At no time shall heavy rocks, stones or other object be included in the balance of the backfill that might protrude the initial backfill and come into contact with the pipe.

Testing

Pipelines shall be tested in section under an internal water pressure normally one and a half times the maximum allowable working pressure of the class pipe used. Testing shall be carried out as soon as practicable after laying and when the pipeline is anchored precautions shall be taken to eliminate all air from the test section and the pipe slowly to avoid risk of damage due to surge.

1.13 A.B.S. Waste System

Where indicated on the Drawings and Schedules, the contractor shall supply and fix A.B.S. waste pipes and fittings.

The pipes, traps and fittings shall be in accordance with the relevant British Standards, including BS EN 274 (parts 1 to 3), and fixed generally in accordance with manufacturer's instructions and BS EN 12056 - 2:2000.

Jointing of pipes shall be carried out by means of solvent welding, the manufacturer's instructions and BS EN 12056 - 2:2000.

Jointing of pipes shall be carried out by means of solvent welding. The manufacturer's recommended method of joint preparation and fixing shall be followed.

Standard brackets, as supplied for use with this system, shall be used wherever possible. Where the building structure renders this impracticable the contractor shall provide purpose made supports, centres of which shall not exceed one metre.

Expansion joints shall be provided as indicated. Supporting brackets and pipe clips shall be fixed on each side of these joints.

1.14 PVC Soil System

The contractor shall supply and fix PVC soil pipes and fittings as indicated on the Drawings and Schedules.

Pipes and fittings shall be in accordance with relevant British Standards, including BS 4514 and fixed to the manufacturer's instructions and BS EN 12056 - 2:2000.

The soil system shall incorporate synthetic rubber gaskets as provided by the manufacturer who's fixing instructions shall be strictly adhered to.

Connections to WC pans shall be effected by the use of a WC connector, gasket and cover, fixed to suit pan outlet.

Suitable supporting brackets and pipe clips shall be at maximum of meter centers.

The contractor shall be responsible for the joint into the Gully Trap on Drain Trap as indicated on the drawings.

1.15 uPVC Square Rainwater System pipe and Gutter

Gutter shall be concrete and as specified by the structural engineer.

Rainwater pipes shall be supplied in plain-ended lengths and shall comply with BS EN 12200.

The minimum acceptable wall thickness of rainwater pipes shall be 1.80mm.

Pipe support brackets must be adequate to screen expansion gaps.

The grade of UPVC used for gutter and pipe shall have a minimum softening point of 75°C when tested by the Vicat method as described in BS EN ISO 306:1997.

The pipe and gutter shall be colour Grey, to BS 5252, 10.A. 07, black white or rustic

1.16 uP.V.C. Rainwater Fittings

All fittings shall be injection moulded and shall be compatible with pipe and gutters and shall conform to the BS 4576, BS EN 607 or the appropriate Kenya Standards.

All rain-pipes and fittings shall be Colour Grey to British Standard 5252, 12.A. 07 or black, white or rustic.

Brackets shall be to BS EN 1462.

Gutter connecting fittings shall have integrally moulded seal retaining cavities housing a rubber seal of hollow section.

The fitting shall incorporate a gutter-retaining clip.

Gutters shall be supplied in plain-ended lengths.

Rain water pipes shall be circular in section, 65mm nominal diameter complying in all respects to British Standard 4576 or the relevant Kenya Standards.

Rainwater pipes shall be supplied in plain-ended lengths. The minimum acceptable wall thickness of rainwater pipes shall be 1.80mm

Pipe support brackets must be adequate to screen expansion gaps.

The grade of UPVC used for gutter and pipe shall have a minimum softening point of 75°C when tested by the Vicat method as described in BS EN 306:1997.

The pipe and gutter shall be Colour Grey, to BS 5252, 10.A.07. Black, white or rustic.

1.17 uPVC Underground Drainage System

(a) Pipes and fitting

The pipes and fittings shall comply in all respects to British Standard 4660 & BS EN 13598 - 1 :2003, BS EN 1401 - 1:1998 or the relevant Kenya Standards.

Pipes shall be supplied in plain-ended lengths.

The minimum acceptable wall thickness of pipe and fittings will be as follows:

110mm pipe	3.0mm	
160mm pipe	3.9mm	
110mm junction only	3.50mm socket	3.80mm body
All other fittings	3.20mm socket	3.40mm body
160mm all fittings	4.30mm socket	4.70mm body

The method of jointing to be employed shall be by lip seal socketed fittings. Jointing to other materials shall be made in the manner specified by the manufacturer.

The grade of UPVC used for the pipes shall have a minimum softening point of 82°C when tested by the 'Vicat' method 102D as described in British Standard BS EN ISO 306:1997, BS 2782-1:1997.

Holderbats shall be made of Mild Steel protected from corrosion by galvanizing or such coating for optimum fit. To fit pipe supports a special purpose made PVC packing piece may be used.

The base of soil and vent stack connection to the below ground drain shall be made with a bend of minimum centre lines radius of 250mm.

Minor changes of direction where permitted shall be made with a variable bend that has a constant effective length.

(b) Excavation of Trenches

The installation, method of joining shall conform in all respects to the manufacturer's site work instruction.

Trenches shall be excavated to a sufficient depth to allow a 50mm minimum bed below the underside of the pipe. Trenches width shall be not less than the outlet diameter of the plus 300mm and not wider than necessary.

(c) Trench Invert

The base of the trench shall be such that even support is given to the pipe for its full length. Soft spots shall be removed and replaced with compacted granular material as described below. High spots and rock shall be removed to allow full 50mm-bed depth.

(d) Pipe bed

The bed shall be composed of granular material to the specification called for below and shall cover the full trench width and length and boned to gradient.

(e) Laying and jointing

Pipes and fitting shall be laid true to gradient in straight lines and joined in accordance with manufacturer's instructions. All pegs used for alignment and other purposes must be removed after use and before side filling. All joints shall be watertight complying with BS 8301:1985, BS EN 752 (parts 1 to 4).

Pipe barrels shall be in continuous contact with the trench bed when laid.

(f) Side Filling

The side filling of pipes shall be composed of hard granular material, which shall be to the requirements below.

Side fillings must be placed equally on both sides of the pipe and compacted, so as to buttress the pipes against the trench walls. Side filling shall continue up to pipe crown level as a minimum and above this level if required by the Engineer.

(g) Back Filling

The first 300mm of backfill above crown level shall be taken from selected trench spoil all passing 25mm sieve. It shall be placed in two 150mm layers each firmly tramped. Above the 300mm level mechanical fillings and compaction may be used.

Where cover is less than 450mm the pipe shall be covered with 75mm of selected material laid to support a concrete tile or slab indicating the presence of a service.

(h) Granular Material for Bed and Side Fill

The material may be composed of crushed stone, clinker, quarry scalping, ballast, gravel, shingle or all-in aggregate to British Standard BS EN 12620:2002.

All material for bed and site fill shall be hard and granular passing 20mm sieve and shall contain not more than 5 per cent fines passing 3mm sieve.

The material shall have a compaction factor of 0.3 or less.

1.18 Valves

a) Draw-off Taps and Stop Valves (Up to 50mm Nominal Bore)

Draw-off taps and valves up to 50mm nominal bore, unless otherwise stated or specified for attachment or connection to sanitary fitment shall be manufactured in accordance with the requirements of BS 1010.

b) Gate Valves

All gate valves 80mm nominal bore and above, other than those required for fitting to buried water mains shall be of Cast Iron construction, in accordance with the requirements of BS 3464.

All gate valves required for fitting to buried water mains shall be of Cast Iron construction in accordance with the requirements of BS 5163.

All gate valves up to and including 65mm nominal bore shall be of Bronze construction in accordance with the requirements of BS 5154 and BS EN 12288:2003.

The pressure classification of all valves shall depend upon the pressure conditions pertaining to the site of works.

c) Globe Valves

All globe valves up to and including 65mm nominal bore shall be of Bronze construction in accordance with the requirements of BS 5154 and BS EN 12288:2003.

The pressure classification of all globe valves shall depend upon the pressure conditions pertaining to the site of works.

d) Check or Non-Return Valves

All check or non-return valves 80mm nominal bore and above shall be of the swing check type of Cast Iron construction in accordance with the requirement of BS EN 12334:2001.

The pressure classification of all globe valves shall depend upon the pressure conditions pertaining to the Site of works.

e) Ball Valves

All ball valves for use in connection with hot and cold water services shall be of the Portsmouth type in accordance with the requirements of B.S.1212, constructed from Bronze or other corrosion resistant materials. These valves fall into three pressure classifications as follows: -

- | | | | |
|-------|-----------------|---|--------------------|
| (i) | Low pressure | - | 3.58 bars maximum |
| (ii) | Medium pressure | - | 7.72 bars maximum |
| (iii) | High pressure | - | 12.62 bars maximum |

The pressure classification required for each ball valve will be designated in the description of its associated equipment contained in section C of the Specification.

(f) Manually Operated Mixing Valves

Mixing valves for shower fittings and other appliances being provided under the contractor Works shall be manufactured in accordance with the requirements of BS EN 1287:1999 from Bronze or other corrosion resistant materials.

1.19 Waste Fitment Traps

a) Standard and Deep Seal P & S Traps

Where standard or deep seal traps are specified they shall be manufactured in suitable non-ferrous materials in accordance with the full requirements of BS EN 274.

In certain circumstances, Cast Iron traps may be required for cast iron baths and in these instances bath traps shall be provided which are manufactured in accordance with the full requirements of BS 1291.

b) Anti-Syphon Traps

Where anti-syphon traps are specified, these shall be similar or equal to the range of traps manufactured by Geberit Limited, New Hythe Business Park, Aylesford, Kent, England.

The trade name for traps manufactured by this company is 'Terrain'.

1.20 Pipe Supports

a) General

This sub-clause deals with pipe supports securing pipes to the structure of buildings for above ground application.

The variety and type of support shall be kept to a minimum and their design shall be such as to facilitate quick and secure fixings to metal, concrete, masonry or wood.

Consideration shall be given, when designing supports, to the maintenance of desired pipe falls and the restraining of pipe movements to a longitudinal axial direction only.

The contractor shall supply and install all steelwork forming part of the pipe support assemblies and shall be responsible for making good damage to builders work associated with the pipe support installation.

The contractor shall submit all his proposals for pipe supports to the Engineer for approval before any erection works commence.

b) Steel and Copper Pipes and Tubes

Pipe runs shall be secured by clips connected to pipe hangers, wall brackets, or trapeze type supports. 'U' bolts shall not be used as a substitute for pipe clips without the prior approval of the Engineer.

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An approximate guide to the maximum permissible supports spacing in metres for Steel and Copper pipe and tube is given in the following table for horizontal runs.

Size	Steel Tube	Copper Tube	
		To BS EN 1057:1996	To BS 1387
Nominal s			
Bore			
15mm	2.0m	1.25m	
20mm	2.5m	2.0m	
25mm	2.5m	2.0m	
32mm	3.0m	2.5m	
40mm	3.0m	2.5m	
50mm	3.0m	2.5m	
65mm	3.5m	3.0m	
80mm	3.5m	3.0m	
100mm	4.0m	3.0m	
125mm	4.5m	3.0m	
150mm	4.5m	3.5m	

The support spacing for vertical runs shall not exceed one and a half times the Distances given for horizontal runs.

c) Cast Iron and Asbestos Cement Spigot and Socket Jointed Pipes

Cast Iron and asbestos cement socketed pipes shall generally be supported at every socket joint by means of either Holder bats secured rigidly to the structure, or purpose made scrapes for attachments to rigid steel support brackets.

When Holder bats are used, they shall conform to the requirements of BS 416. Suitable anchors shall be provided at all changes of pipe directions, junctions and tees to counteract the effect of end thrust loads.

(d) Asbestos Cement Pressure Pipe

Asbestos Cements pressure pipe with either cast iron detached joints or asbestos cement screw joints shall be supported and anchored on either side of the joints. The joints shall remain free.

Pipe hangers and trapeze type supports shall not be suitable for the suspension of asbestos pressure pipes unless they are designated with suitable restrictions to prevent swinging at the same time providing the necessary support requirements.

Within building, asbestos pressure pipes shall be carried either on concrete support on rigidly fixed steel wall brackets.

Suitable anchors shall be provided at all changes of pipe directions junctions and tees to counteract the effect of end thrust loads.

(e) Concrete and Pitch Pipes

These pipes shall not be used for above ground application.

f) Expansion Joints and Anchors

Where practicable, cold pipework systems shall be arranged with sufficient bends and changes of direction to absorb pipe expansion providing that the pipe stresses are contained within the working limits prescribed in the relevant BS specification.

Where piping anchors are supplied, they shall be fixed to the main structure only.

Details of all anchor design proposals shall be submitted to the Engineer for approval before erection commences.

The contractor when arranging his piping shall ensure that no expansion movements are transmitted directly to connections and flanges on pumps or other items of plant.

The contractor shall supply flexible joints to prevent vibrations and other movements being transmitted from pumps to piping systems or vice versa.

1.21 Sanitary Appliances

All sanitary appliances supplied and installed as part of the contract works shall comply with the general requirements of BS 6465 and the particular requirements of the latest BS Specifications.

1.21 Pipe Sleeves

Main runs of pipework are to be fitted with sleeves where they pass through walls and floors. Generally, the sleeves shall be of PVC except where they pass through the structure, where they shall be of mild steel. The sleeves shall have 6mm - 12mm clearances all around the pipe or for insulated pipework all around the installation. The sleeve will then be packed with slag wool or similar material.

2.0 Installation

2.1 General

Installation of all pipework, valves, fittings and equipment shall be carried out under adequate supervision from skilled staff to the relevant codes and standards as specified herein. The contractor shall be responsible to the Main Contractor for ensuring that all builders' work associated with his piping installation is carried out in a satisfactory manner to the approval of the Engineer.

2.2 Above Ground Installation

a) Water Services

Before any joint is made, the pipes shall be hung in their supports and adjusted to ensure that the joining faces are parallel and any falls which shall be required are achieved without springing the pipe.

Where falls are not shown on the Contract Drawings or stated elsewhere in the Specification, pipework shall be installed parallel to the lines of the buildings and as close to the walls, ceilings, columns, etc., as is practicable.

All water systems shall be provided with sufficient drain points and automatic air vents to enable them to function correctly. Valves and other user equipment shall be installed with adequate access for operation and maintenance. Where valves and other operational equipment are unavoidably installed beyond normal reach or in such position as to be difficult to reach from a small stepladder, extension spindles with floor or wall pedestals shall be provided.

Screwed piping shall be installed with sufficient number of unions to facilitate easy removal of valves and fittings, and to enable alterations of pipework to be carried out without the need to cut the pipe.

Full allowances shall be made for the expansion and contraction of pipework, precautions being taken to ensure that any force produced by the pipe movements are not transmitted to valves, equipment or plant.

All screwed joints to piping and fittings shall be made with P.T.F.E. tape.

The test pressure shall be maintained by the pump for about one hour and if there is any leakage, it shall be measured by the quantity of water pumped into the main in that time. A general leakage of 4.5 litres per 25mm of diameter, per 1.6 kilometre per 24 hours per 30 metres head, may be considered reasonable but any visible individual leak shall be repaired.

b) Sanitary Services

Soil, waste and vent pipe system shall be installed in accordance with the best standard of modern practice as described in BS EN 12056 - 2:2000 to the approval of the Engineer.

The contractor shall be responsible for ensuring that all ground waste fittings are discharged to a gully trap before passing to the sewer via a manhole.

The contractor shall provide all necessary rodding and inspection facilities within the draining system in positions where easy accessibility is available.

Where a branch requires rodding facilities in a position to which normal access is unobtainable, then that branch shall be extended so as to provide a suitable purpose made rodding eye in the nearest adjacent wall or floor to which easy access is available.

The vent stacks shall terminate above roof level and where stack passes through roof, a weather skirt shall be provided. The contractor shall be responsible for sealing the roof after installation of the stacks.

The open end of each stack shall be fitted with a plastic coated or galvanized steel wire guard.

Access for rodding and testing shall be provided at the foot of each stack.

c) Sanitary Appliances

All sanitary appliances associated with the contract works shall be installed in accordance with the best standard of modern practice as described in BS 6465 to the approval of the Engineer.

2.3 Underground Installation

a) General

All underground water and drainage service installations shall be carried out in accordance with the best standard of modern practice as described in BS EN 752 and BS 6700 respectively and the following clause.

b) Sequence of Operation for Underground Service Installation

(i) Setting Out

As described in BS EN 752

(ii) Breaking Up Surface (If in Roads)

As described in BS EN 752

(iii) Excavation and Timbering

As described in BS EN 752 and 503 and the following:-

Excavation shall be made to such depths and dimensions as may be required by the Engineer to obtain prior falls and firm foundations. No permanent constructions shall be commenced on any bottom until the excavation has been examined and approved by the Engineer.

Should the Contractor in error or without the instructions of the Engineer make any excavation below the required level of the pipe or bed, as the case may be, then he shall be required to refill such excavation to the correct levels with concrete 1: 4: 8 to 38mm maximum aggregate size.

The Contractor's prices shall have included for excavating in all materials met with, for trimming bottoms to the necessary falls and for any extra excavation required for planking, strutting and working space.

The Contractor shall keep the whole of the trenches or other excavations free from water and shall execute such works and install such pumps as may be necessary to keep the excavation dry at all times.

No sub-soil water shall discharge into the sewage system without written permission of the Engineer.

(iv) Laying of Concrete Beds or other Supports for Pipes

As described in BS EN 752 and the following:-

All drains below buildings and roads shall be encased in concrete 150mm thick.

Concrete beds and supports shall be concrete 1:3:6 to 25mm maximum aggregate size.

(v) Pipe Laying and Jointing

Drain pipes shall be laid and jointed as described under BS EN 752.

Water pipes shall be laid and jointed as described under BS EN 752

(vi) Man-holes

(a) General

All manholes provided under the Contract works shall be constructed of approved materials and in an approved manner.

All manholes shall be watertight and if constructed of brickwork, solid block work or stone work, they shall be rendered internally with a cement mortar of at least 12mm thickness and finished with a smooth surface.

The sides of all channels in every manhole shall be ought up vertically to a height of not less than the diameter of the drain and shall be benched in good concrete from the top of the channels at an surface with a coat of 1:1 cement mortar.

In all other respects, manhole shall be constructed in accordance with BS EN 752.

(b) Rectangular and Square Manholes

Rectangular and square straight through manholes shall be constructed from brickwork, solid blockwork, stone and concrete to comply with the following minimum internal dimensions (millimetres).

Depth below Wall Ground of Chamber Outgoing above Invert Benching	internal Access Thickness shaft Dimension sL X W	Size of	Internal Main Shaft Diameter	Height of Chamber Dimension sL X W
Up to 740	-	-	100 to 150	610x460
-	-	150		
Up to 740	-	-	230 to 460	760x760
-	-	150		
Up to 1200	-	-	100 to 150	760x760
-	-	150		
160 to 1200	-	-	230 to 460	910x910
-	-	150		
1220 to 1800	-	-	100 to 150	910x910
-	-	150		
1220 to 1800	-	-	230 to 460	1070x910
-	-	150		
1830 to 4550	760x760	-	100 to 150	1370x910
1370	230			
1830 to 4550	760x760	-	230 to 460	1370x1070
230				1370

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4570 & Over	760x760	100 to 150	1370x1140	
1680		230		
4570 & Over	760x760	230 to 460	1370x1140	1680
230				

When branches are connected into the manhole, the length and width dimension of the chamber shall be increased as follows:-

Length

Branch Diameter

100mm 300mm/branch on the side with most branches

150mm 380mm/branch on the side with most branches

230and 300mm 460mm/branch on the side with most branches

460mm 610mm/branch on the side with most branches

Width

Branch Diameter

100mm to 300mm for each side with branches plug

160mm 460mm or the diameter of the main drain which ever is the greater

(d) Precast Concrete Circular Manholes

Where specified straight through precast concrete manholes shall be manufactured and constructed to comply with BS 5911 and the following dimensional requirements, (Dimension: Millimetres)

Depth Ground of Outgoing	Internal Access Shaft	Size Main Channel	Chamber Diameter	Height Chamber Above
--------------------------------	-----------------------------	-------------------------	---------------------	----------------------------

Invert	Diameter	Diameter		Benching
Up to 740	-	100 to 460	910	-
760 to 2410	-	100 to 460	1070	-
2440 to 4550	-	100 to 460	1220	1370
4570 & over	760	100 to 460	1370	2680

When branches are connected into manhole the internal diameter of the chamber shall be increased as necessary up to maximum chamber diameter 1830.

(d) Steps Iron and Covers

Access shaft to manhole of depth greater than 760mm shall be provided with approved steps iron at suitable intervals. Every manhole or manhole access shaft shall be fitted with a removable airtight cast iron cover to adequate size and strength, fixed in a manner that prevents surface water gaining into the system.

Cast manhole covers and frames shall be manufactured in accordance with the requirements of BS EN 124:1994 and shall generally be classified into the following categories:

Heavy Duty : For Carriageway
 Medium Duty : For Footpaths
 Light Duty : For domestic premises or other places where they do not

have to carry wheeled Traffic.

(e) Back Drop Connections

Where the level of the branch drain entering the manhole is higher than can be suitably accommodated by the normal type benching, then the branch drain shall be connected to the manhole by means of a back drop Connection.

(f) Channels

Where the branch channel connects to the main channel in the manhole, the invert of the branch channel shall be a minimum of 38mm higher than the main channel.

(g) Testing of Pipelines

After pipelines are connected up and joints have been sealed, the pipeline shall be tested before pipes are, if required hunched or surrounded in concrete
Methods of testing and inspection shall be in accordance with the Specification.

(h) Concrete Bedding Hunching and Surround

Concrete 3 bedding, hunching and surrounding shall be provided as necessary or where called for by the Engineer in accordance with the requirements laid down in BS EN 752.

(i) Backfilling

Backfilling of trenches, headings and around manholes shall be carried out in accordance with the methods described in BS BS EN 752.

(j) Reinstatement of Surface

Following the final Backfilling of all trenches, headings and manhole surrounds, the surface of the excavated areas shall be fully reinstated to the approval of the Engineer.

Where excavation have been carried out in public highways or other areas are not forming part of the site, the contractor shall be deemed to have allowed in his price for all charges associated with the temporary and final reinstatement requirements of the local of highway Authority concerned.

No Claims for extra in this respect will be accepted.

(k) Sewer Connection

Sewer contractor shall pay all charges associated with the connection by the local Authority of the drainage to the main sewer, including necessary reinstatements

3.0 Testing and Inspection

3.1 Site Tests - Pipework Systems

a) Above Ground Internal Water Services Installation

All water service pipe system installed above ground shall be tested hydraulically for a period of one hour to not less than one and half times to design working pressure.

If preferred, the contractor may test the pipelines in sections. Any such section found to be satisfactory need not be the subject of a further test when system has been completed, unless specifically requested by the Engineer.

During the test, each branch and joint shall be examined carefully for leaks and any defects revealed shall be made good by the contractor and the section re-tested.

The contractor shall take all necessary precautions to prevent damage occurring to special valves and fittings during the tests. Any item damaged shall be repaired or replaced at the contractor's expenses.

b) Underground Water Mains

After laying, jointing and anchoring, the main shall be slowly and carefully charged with water, so that all air is expelled and allowed to stand full for three days before testing under pressure.

A long main shall be tested in sections as the work of laying proceeds and all joints shall be exposed for inspection during the testing.

The open end of the main may be temporarily used for testing under moderate pressure by fitting a water pipe expanding plug, of which several types are available. The end of the main and the plug should be secured by struts or otherwise, to resist the end thrust of the water pressure in the main.

If the section of main terminates with a sluice valve, the wedge of the valve shall not be used to retain the water, instead the valve shall be fitted temporarily with a blank flange, or if a socket valve with a plug and the wedge shall be placed in the open position while testing. The Contractor shall provide suitable end supports to withstand the end thrust of the water pressure in the main.

c) Above Ground Soil Waste and Ventilation System

All soil, waste and ventilating pipe system forming part of the above ground installation, shall be given appropriate test procedures as described in BS EN 12056 - 2:2000.

Smoke tests on above ground soil, waste and ventilating pipe system shall not be permitted.

Pressure tests shall be carried out before any work which is to be concealed is finally enclosed.

In all respects, tests shall comply with the requirements of BS EN 12056 - 2:2000.

d) Underground Drainage System

A site test shall be carried out on all drainage pipes before concrete hunching or surrounds are applied. These tests shall be carried out preferably from manhole to manhole.

Short branch drains connected to a main drain between manholes shall be tested as one system with the main drain. In long branches a testing junction shall be inserted next to the junction with the main drain and the branch tested separately. After the test has been passed, the testing junction shall be effectively sealed.

Water tests shall be carried out in accordance with the methods described under BS EN 752 and the test pressure shall not be less than 1,520mm head at the highest point in the pipe section and not more than 10,360 head at any point it the section.

The test pressure shall be maintained for a period of one hour during which time the pipe and joints shall be inspected for sweating and leakage. Any leak discovered during the tests shall be made good by the Contractor and the section re-tested.

In addition to pressure tests, drain pipe runs shall also be tested for straightness where applicable. This test shall be carried out in accordance with one of the two methods described in BS EN 752.

Testing of manholes shall be carried out in accordance with the methods described under BS EN 752.

(e) Above Ground Soil Waste and Ventilation System

All soil waste and ventilating pipe system forming part of the above ground installation shall be given appropriate test procedures as described in BS 12056 - 2:2000.

Smoke tests on above ground soil, waste and ventilation pipe system shall not be permitted.

Pressure tests shall be carried out before any work, which is to be concealed, is finally enclosed.

In all other respects, testes shall comply with the requirements of BS 12056 -2:2000.

3.2 Site Test - Performance

Following satisfactory pressure test on the pipework system, operational tests shall be carried out in accordance with the relevant BS on the systems as a whole to establish that special valves, gauges, control, fittings, equipment and plant are functioning correctly to the satisfaction of the Engineer.

All hot water pipework shall be installed with pre-formed fibre glass lagging to a thickness of 25mm where the pipe runs above a false ceiling or in areas where the ambient temperature is higher than normal with the result that pipe “sweating”, due to condensation will cause nuisance.

All lagged pipes which run in a visible position after erection shall be given a canvas cover and prepared for painting as follows:

- i) Apply a coating of suitable filler until the canvas weave disappears and allow to dry.
- ii) Apply two coats of an approved paint and finish in suitable gloss enamel to colours approved by the Engineer.

All lagging for cold and hot water pipes erected in crawl ways, ducts and above false ceiling which, after erection are not visible from the corridors of rooms, shall be covered with a reinforced aluminium foil finish banded in colours to be approved by the Engineer.

In all respects, unless otherwise stated, the hot and cold water installation shall be carried out in accordance with the best standard of modern practice as described in CP 342 and BS 6700 respectively to the approval of the Engineer.

The test pressure shall be applied by means of a manually operated test pump or, in the case of long main or mains of large diameter, by a power driven test pump which shall not be left unattended. In either case precautions shall be taken to ensure that the required pressure is not exceeded.

Pressure gauges should be recalibrated before the tests.

The contractor shall be deemed to have included in his price for all test pumps, and other equipment required under this specification.

The test pressure shall be one and a half times the maximum working pressure except where a pipe is manufactured from a material for which the relevant BS specification designates a maximum test pressure.

4.0 Sterilization of Hot and Cold Water Systems

All underground and above ground water distribution systems cisterns, tanks, pumps etc shall be thoroughly sterilized and flushed out after the completion of all tests and before being fully commissioned for handover.

The sterilization procedures shall be carried out by the contractor in accordance with the requirements of BS 6700:1997 and to the approval of the Engineer.

5.0 Water Mains

5.1 Piping

All piping shall be plain ended and suitable for use with flexible mechanical couplings (e.g. Viking Johnson, Dresser or Gibault). Steel pipes shall comply with BS 534 or BS EN 10224:2002. Galvanised steel pipes for distribution system shall comply with BS Galvanized steel pipes for distribution system shall comply with BS 1387-1967 medium tubes and be supplied with flanges on pipes 75mm diameter and over.

All pipes less than 75mm diameter shall be screwed and socketed, unless otherwise stated.

5.2 U.P.V.C Pipes

UPVC piping shall be in accordance with BS 3505: 1986.

The maximum sustained working pressure to which the pipes and fittings will be subjected is based on water at a temperature of 20°C.

The Contractor shall submit full details of the colour of the pipe he intends to supply. The Colour of the pipe shall be such as to meet the requirements of 'material' and 'opacity' in BS 3505 or BS EN 1452.

The pipes up to and including 50mm diameter shall be of solvent weld type. The pipe shall be supplied with interchangeable sockets pre-formed at the factory and of such internal diameter that it takes the plain end of the pipe with same nominal diameter.

The joints shall sustain the end thrust to which the pipe shall be submitted. The contractor shall supply sufficient quality of the cleaner and adhesive which shall be required to make the joints with the pipes.

The pipes of 75mm diameter and over shall consist of a grooved socket at one end of the pipe. The socket shall be designed to give a clearance fit on the outside diameter of the parent pipe. The sealing medium that shall seat in the groove shall be a rubber ring.

If the formation of the socket and groove results in the thinning of the original wall thickness of the pipe, it shall be compensated for by shrinking the outside of the socket area as by reinforcing sleeve of the same material as the pipe.

The socket and groove shall incorporate no sharp angles where the stress points are created.

The socket and groove shall incorporate no sharp angles where the stress points are created.

The joint shall take 10% deformation of the spigot at the point where the stress points where it enters the socket without leakage from the pipe when subjected to the test pressure specified for the pipe.

Thermal expansion of the pipe shall be accommodated in the joint. The joint shall be capable of lined deflection up to 30°C.

The sealing ring shall supply be of the first grade natural rubber and the physical properties of the mix shall meet the requirement of BS 7874:1998, BS EN 681 or BS EN 682.

The contractor shall supply sufficient quantity of any lubricant or other material that shall be needed to make the joint, which shall be assembled by hand.

The fittings shall have the same type of joint and or the pipes to be used. The contractor shall submit full lists of the materials, dimensions and test pressures of the fittings offered.

Precautions shall be taken to avoid damage of the pipes and fittings.

In handling and storing the pipes and fittings, every care shall be taken to avoid distortion, flattening, scoring or other damage. The pipes and fittings shall not be allowed to drop or strike objects. Pipe lifting and lowering shall be carried out by approved equipment only. Special care shall be taken in transit, handling and storage to avoid any damage to the ends.

All jointing of pipes and fittings shall be carried strictly in accordance with the manufacturer's instructions.

5.3 Manufacturer's Instructions

The contractor shall be responsible for obtaining copies of any manufacturer's instructions for pipe joining and shall familiarize himself and his employees with these instructions.

All necessary tools and equipment required for laying, jointing and testing of pipes and joints shall be provided by the contractor at no extra cost.

5.4 Fittings and Specials for Galvanized Steel Pipes

All specials shall be of such dimensions as will meet with piping supplied. Screw down stop valves shall comply with BS 1010. Specials shall comply with BS EN 10241:2000.

5.5 Flanged Adaptors and Flanges

Flanged adaptors shall be piece suitable for connecting a flanged sluice valve to the type of piping supplied. All flanged or special shall conform to BS 10 part 1 and shall be drill to Table 'C' and machined across the faces. The flanged adaptors shall comply with BS 78 and BS 3961. All PVC flanged shall be supplied with metal backing rings jointing of flanges shall be carried out using the joint rings, bolts and washers as necessary.

5.6 Tees

The spigot ends of all tees shall be suitable for connection to the pipework supplied using the aforementioned flexible mechanical joints and branches shall be flanges drilled to BS 10 table 'C'.

5.7 Hydrants

Hydrants shall comprise a 75mm sluice valve and a 75mm Duckfoot bend with gunmetal screw connection to detailed drawings. These specials shall comply with the requirements of BS 750.

5.8 Gate Valves

All gate valves 80mm nominal bore and above, other than those required for fitting to buried water mains shall be of cast iron construction, in accordance with the requirements of BS 3464.

All gate valves required for fitting to buried water mains shall be of cast iron construction in accordance with the requirements of BS 5163.

All gate valves up to and including 65mm nominal bore shall be of bronze construction in accordance with the requirements of BS 5154:1991 and/or BS EN 12288:2003.

The pressure classification of all valves shall depend upon the pressure conditions pertaining to the site of works.

5.9 Air Valves

Air valves shall be of cast iron conforming to BS EN 1561:1997. They shall not be suitable for working pressure nor less than that specified for the class of pipe to which they are connected.

5.10 Ball Float Valves

Ball float valves shall be to BS 1212 parts 1 and 2 shall be suitable for working pressure not less than the working pressure for the class of pipe specified for connection to the ball float valve.

5.11 Non-Return Valves

Non-return valves shall be of cast iron with flanges and shall conform to BS EN 12334:2001.

5.12 Stop Cocks

Stopcock up to 50mm diameter shall be brass and shall conform to BS 1010.

5.13 Rubber and Insertion Jointing

Rubber and insertion jointing for flange jointed shall comply with BS 7874,:1998, BS EN 681, BS EN 682 and no jointing rings shall be used in the contract, which have not been supplied by manufacturers approved by the Engineer.

5.14 Bituminous paints

All bituminous or tar paints for protection of buried steel bolts, pipes specials etc. shall be the best of their respective kinds manufactured by approved makers.

5.15 Steel Pipe and Fittings for Rising Main

All piping shall be plain ended and suitable for use with flexible mechanical couplings (e.g. Viking Johnson, Dresser). The grade of steel used shall comply with the requirements of BS EN 10216 - 1:2002, BS EN 10217 - 1:2002. Pipes shall be welded or seamless and shall conform to BS 534: 1990 and/or BS EN 10224:2002 or an equivalent acceptable standard.

All pipes shall be externally and internally protected with bitumen in accordance with BS 534: 1990 and/or BS EN 10224:2002.

The external protection shall be reinforced with oven glass, cloth glass, tissue wrapping or by other approved material.

The ends of all bitumen lined pipes, fittings and specials shall be closed by means of discs or other suitable covers firmly held in place.

5.16 Drain-Off Taps, Stops Valves for Water Services

Fittings for mains of size 50mm or under shall comply with BS 1010. Samples must be submitted to the Engineer for approval prior to installation of fittings.

5.17 Storage of Plants and Material

The contractor shall, at his own expenses, make arrangements for dumps along the route of the pipe line for storage of pipes, his plant and materials to suit his own convenience, but such arrangements shall be subjected to the Engineer's approval.

5.18 Loading, Handling and Conveying of Pipes

The contractor shall before commencing to lay the pipes, valves or other materials examine them and ascertain that they are in perfectly sound condition and he shall be responsible for any laying. The stocking of pipes and specials on site, loading and unloading etc. shall be carried out to the satisfaction of the Engineer.

5.19 Interferences with Fences, Drains, Pipes, Property etc.

The contractor shall ensure the proper reinstatement of fences, drains, telephone lines, KP&LC. Cables etc where affected by his work. All service shall be adequately protected and propped to the satisfaction of the Engineer. The contractor shall be liable for any damage caused to the service due to his failure to provide adequate protection.

5.20 Method of Excavation

- a) The Contractor shall excavate the pipe trenches in the line and to the depths indicated by the Engineer. Except where otherwise indicated on the Drawings or indicated by the Engineer, it is intended that the trench shall be excavated to such a depth as will allow of a minimum cover of 5000mm over top of the barrel of the pipe when laid plus or minus a tolerance of 75mm either way. All trenches shall be excavated in open cuttings.
- b) Where the trenches passes through grassland, arable land or garden, whether enclosed or otherwise, the turf, if any shall be pared off and staked, and the productive soil shall be carefully removed for a width of 600mm greater than the nominated trench width or equal to the overall width of track of the excavating machine, whichever is greater, and laid aside to be subsequently used in reinstating the surface of the ground after the trench has been refilled.
- c) The bottom of the trench shall be property trimmed off, and all low places or irregularities shall be where rock or large stones are encountered, they shall be cut down to a depth of at least 75mm below the level at which the bottoms of the barrel of the pipes are to be laid, and covered to a like depth with materials, so as to form a fine and even bed for the pipe.
- d) Joints holes shall be excavated to suit minimum dimension as to allow the joints to be well and properly jointed.
- e) The pipe trench shall be kept clear of water at all times.
- f) The contractor shall whenever necessary by means of timbering, or otherwise support the sides of the trench so as to make them thoroughly secure, and afford adequate support to adjoining roads, lands, buildings and property during the whole time the trench remains open and shall remove such timbering or other work shall be deemed to be included in the rate for excavation. In case the Contractor is instructed by the Engineer to leave any portion of such timber in position, he will be paid for it accordingly.

- g) The cleared width inside the timbering in the case of single pipes shall be at least 320mm in excess of the external diameter of the pipe be laid, in order to allow it to be freely lowered into position, in the trench without damage to the external protection.
- h) Where more than one pipe is to be laid parallel, then the clear width inside the timbering shall be at least 520mm in excesses of the combined external diameters of the pipes.
- i) Should the excavations be taken out to a greater depth than is specified the bottom shall be made good to the correct level with mix 1:3:6 concrete or other materials approved by the Engineer. No payment shall be made for any other excavation carried out by the contractor and the cost of filling up to required levels.
- j) If a mechanical excavator is used by the contractor, he shall indemnify the employer against all claims for damages that in the opinion of the Engineer, may be caused by the use of this plant. When a mechanical excavator is used the bottom 230mm of excavation shall be got out by hand to ensure an even bed for the pipes.

5.21 Main Laying

Mains shall be laid in straight lines and/or smooth curves as indicated on the drawings. The vertical profile of the pipes shall be to even gradients. Any pipes not so laid shall be removed if so directed by the Engineer, and re-laid in proper manner at the contractor's expense.

In laying the pipes and specials, care shall be taken not to damage the protective linings and the pipes shall be handled with tackle as directed by the Engineer.

The pipes and specials shall be slug and sounded with hammer for flaws before they are lowered into trench. After the pipes or specials have been checked they shall be cleaned internally and carefully lowered into trench and set to proper gradient and line so that is a continuous rise from each washout to air valve.

5.22 Temporary Bench Marks and Sight Rails.

The contractor shall fix rails for use with boning rods at intervals of not more than 65 meters and temporary Bench mark related to the survey of Kenya Datum shall be provided at intervals as directed by the Engineer.

5.23 Curves and Bends

Large diameter curves of main shall wherever possible be formed by giving a set not exceeding 30 to each joint, bends being used only where large diameter curves are not possible.

5.24 Cutting of Pipes

The contractor shall, subject to approval of the Engineer, cut pipes to such lengths as directed. Pipes should be cut off clean and square while the axis cuts should be made with an approved cutter from rotary cutting machine, engineer may approve cutting by oxyacetylene cutters.

5.25 Flanged Joints

In laying pipes and specials with flanged joints, flanges shall be brought together and bolted with the faces absolutely parallel. A rubber jointing ring 3mm thick shall be used in each flange joint and one washer with each bolt. The ring shall be a strip ring lying within the bolt circle and full flange width ring.

The bolts shall be tightened up gradually and equally in customary manner in order to distribute the stress evenly over the flange.

5.26 Surface Boxes

Sluice valves, air valves and fire hydrants shall be covered with surface boxes in accordance with details as shown on the Drawings. In roads and footpaths the boxes shall be laid flush with the surface.

5.27 Fixing of Valves, Air Valves and Washouts Pipes

The contractor shall fix the sluice valves, air valves, washout pipes pipes complete with iron casing for spindles and surface boxes in accordance with and in position shown on the drawings. As far as possible the cutting of pipes for this should be avoided.

5.28 Support and Anchor Blocks

Concrete mix 1:3:6 shall be placed around and against bends and other specials in trenches.

5.29 Colour Coding

All underground pipes are to be wrapped with adhesive plastic tape at each meter in colours blue for drinking water and green for untreated water. All pipework above ground and valves in valve chambers and pits are to be painted in similar colours.

5.30 Lettering

The lettering for sluice valves, fire hydrants, air valve and washout abbreviated SV FH and WO respectively shall be in accordance with the detail shown on the Drawings colour as detailed hereafter: -

Untreated water: background	White lettering on green
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Drinking water:	White on blue background
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Fire Hydrant: background	White lettering on yellow
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5.31 Testing

- a) The test pressure shall be one and a half the maximum working pressure except where a pipe is manufactured from a material for which the relevant BS specification designates a maximum test pressure should not exceed 120,180 and 240 meters/head for class B, C, or D pipes, respectively.

The pump shall maintain the test pressure for about one hour and if there is any leakage it shall be measured by the quantity of water pumped into the main that time.

- b) When a section of the mains has been jointed, the ends shall be closed with caps, plugs or flanges, which must be strongly strutted against a solid backfilled rammed as hereinafter and as shown on the Drawing, for it's whole length so as to cover the mains to a depth of not less than 500mm, except at the joint holes which shall be kept clear of all backfiring, if necessary by the use of timbering, so that each joint is left fully exposed for inspection. No backfilling will be permitted before testing of each section.

As long a section of main as possible shall be tested at one time subject to the maximum length of open trench approved by Engineer or permitted by the Highway Authority, and the test shall be carried out within 12 working days of the completion of such sections of mains.

Where a main is laid across a road or in such a position as to interfere seriously with the normal use of the road, the contractor may, with the consent of the Engineer and at his own risk, fill in such joint holes as may be necessary.

He shall at his own expense, re-excavate any or all joint holes necessary to locate a leak and carry out repair work should the results of his hydraulic test prove unsatisfactory.

The section shall then be filled with mains water, great care being taken to drive out all air through air valves, ferrules or otherwise to the approval of the Engineer.

- c) After the section to be tested has been charged and all air liberated it shall stand underrate moderate pressure for several days' final airing. The leakage from the mains and connections from each section tested shall not exceed 4 litres per 25mm diameter of main, per 2Km. Length each 24 hours, every 30 meters head of pressure, and any visible individual shall be repaired.

To determine the rate of leakage, the contractor shall furnish a suitable hydraulic test pump, pressure gauge, connection and water meter or other appliance, for measuring the amount of water pumped.

If the leakage were at a greater rate than that specified, the contractor should re-excavate the trench where necessary and shall remake the joints and replace defective work until the leakage shall be reduced to the allowable amount.

- d) The employer shall charge the contractor the cost of any coupling required to join up tested lengths of main if, in the Engineer's opinion, greater lengths could reasonably have been tested or if failure under test requires the pipe to be cut, or other methods of laying should have been adopted.

The contractor shall supply water used by the contractor in testing the main.

The contractor shall carry out all work, which may be necessary for making temporary connections to the existing mains to obtain water for testing at his own expense.

- e) In carrying out the test for water tightness only the Engineer shall authorize the operation of all valves, but the contractor shall provide all the necessary labour to assist in the opening and closing of the valves to the Engineer's instructions and he shall allow in his price for all his expenses in connection with testing on completion.

The Engineer shall be the sole judge of water tightness.

5.32 Cleansing and Sterilizing the Main

When a pipeline is complete and where applicable, has successfully passed the test it shall be thoroughly washed out using, if possible, an open end. Thereafter it shall be sterilized by being filled with a suitable solution containing not less than 20p.p.m. of free available chlorine or such other Sterilizing agent as the Engineer shall approve. After standing for 24 hours the main shall again be washed out and refilled with mains water prior to the taking of Bacteriological samples.

The contractor shall provide all necessary stop-ends fittings and chemicals for this work.

Emptying and washing out of the pipes shall be done in such a manner as not to damage the trench or cause due flooding of vicinity, and the contractor shall supply and use such piping, specials and/or hose as may be necessary to facilitate the flow of water to the nearest drain or watercourse. Water used for washing out and sterilizing will be supplied by the employer.

Before any section of the mains is put into use, bacteriological samples will be taken by the Engineer's representatives and only on the receipt of a satisfactory certificate from the medical Research Laboratory of the Employer will the main or section of main be permitted to be put into supply and be considered as having been substantially completed.

Any expenditure involved in Providing facilities or materials for taking of samples shall be included in the contractor's tendered rates and Engineer will specify and shall be sole judge as to the number of sample required and points at which they are to be taken.

The cost of the Bacteriological Examination will be borne by the employer but if the sample and samples are not satisfactory the cost of any subsequent analyses will be borne by the contractor.

5.33 Clearance of Site

The contractor shall remove all surplus pipes, special and other fittings from the site as directed by the Engineer. The site of works shall be levelled and all surplus excavation, debris, cut trees or bushes shall be carted to the approved tip sites.

5.34 Existing Installations

a) Cold Water

Where pipes for cold water are to be connected up to existing installations, the condition of the existing installation is to be reported to the Engineer in order to establish if part of the existing installation is to be replaced.

b) Sanitary Fittings

Where existing sanitary fittings are to be removed or replaced, the fittings are to be removed with utmost care and fittings and taps to be handed over to the client.

c) Sealing Off Existing Drains and Manholes

Existing foul, surface water and subsoil drains exposed during progress of work are to be recorded and reported for investigation by the Architects. Where not required to be removed, seal off with concrete or grout solid as directed. Seal o connection to manholes, demolish wall to 50mm below surrounding ground level and fill remainder of manhole with consolidated approved rubber and cover to level of surrounding ground as directed.

6.0 Cold Water Storage Tanks

Cold-water storage tanks shall include the ball valves and connectors for inlet, supply, washout, and overflow and shall also include in the pricing, the price of the overflow and amount pipes to a place to be indicated by the Engineer. Pricing shall also include the washout valve(s).

Where paint is required the contractor shall use the paints, which will not be toxic.

The tanks shall be manufactured to the following British Standards: -

- (a) Galvanized Mild Steel tanks to BS 417.
- (b) Sectional Steel tanks to BS 1564.

Where non-standard sizes shall be used, they shall be manufactured to the relevant standard but with the approval of the Engineer.

7.0 Water Heaters

Electricity Heated

Non-pressure and low-pressure types domestic electric water heaters shall comply with BS EN 60335 and/or BS 3456 - 201:1990. High-pressure types shall be of a standard not less than the appropriate BS

Domestic heaters shall, if nothing else is pacified with 25mm thick fibreglass lagging and enclosed in the corrosion-proofed steel, finished in white stove enamel and be similar to those manufactured by 'Heatrae Sadia Heating'.

Electric thermostatically controlled immersion heaters shall comply with BS 3456 - 201:1990 and/or BS EN 60335 and BS 6700.

Purpose made storage water heaters of the specified size shall comply with BS 853 and shall be to the specified working and test pressure. The heaters shall be provided with all necessary bosses, coils etc, and shall be hot dip galvanized after manufacture. Installation shall, if nothing else is specified, be fibre glass to the specified thickness with finish suitable for painting.

Domestic heaters for floors mounting shall, if not provided with legs, be mounted on a minimum 100mm high concrete plinth.

Floor mounted purpose made heaters shall be provided with minimum 225mm high legs of sufficient strength welded to the heaters and to suitable floor plates. Before galvanizing, wall mounted heaters shall be supplied with all necessary brackets.

8.0 Electrical Services - Motors

Suitably rated control panels shall be supplied and installed as part of this section of the Contract to meet the starting and operating characteristics of the fan, and motors.

The panels shall be either wall or floor mounted to suit the specific area and requirements. Power supplies to these panels shall be extended from adjacent isolating switches to be provided under the electrical services section of this Contract. Complete co-ordination shall be maintained with the electrical services to ensure supply and termination details are satisfactorily carried out to suit the plant and installation requirements.

8.1 Motor Control Panels

All starters, control equipment and the like shall be enclosed in purpose made sheet panels. The panels shall be installed within the plant rooms to suit the dimensions of the actual panels. All details of the panels and layouts within the plant shall be to the approval of the Engineer and shall include:

- Triple pole isolating switch removable neutral link and HRC fuses.
 - Control circuit fuses of the HR cartridge type
- Under voltage release, adjustable and complete tower to allow for voltage associated with the electrical supply and motor starting.
- Over voltage protection.
- Phase failure protection.
- Ammeter of the moving iron mounted on panel with selector switch.
- Voltmeter
- Automatic changeover for duty/standby pump installation
- Level control relay (relay from float switch)
- Pressure switch relay
 - Pilot lamp, green.
- Rotary switch for HAND/OFF/AUTO operation, where required. Removable neutral link of heavy section copper.
- Motor winding over-temperature release. The Contractor shall provide this feature in conjunction with the specified thermistor protection
- Duty selection switches.
- Manual stop-start button units to operate in conjunction with rotary switch.
 - Hours run meter/counter.

The Contractor shall allow at present for the contactors to re-close automatically on the restoration of the mains voltage. This requirement shall be subject to further discussions with the Employer to suit the Diesel plant and the mode of operation of electrical supplies.

All starter panels shall include sufficient miniature circuit breakers, with neutral bar, to supply auxiliary or associated equipment. Two spare 15A SP MCBs shall be included as spares.

All starter panels, motor starters and controllers shall comply with BS EN 60470:2001 and/or BS EN 60947 - 4 - 1:2001. Enclosures shall be rigid, at least 1.6mm thick, with rolled corners stiffened as necessary, dust-proof, vermin-proof, damp and corrosion protected with a grey colour stone enamel or other approved finish, fully tropicalised, with washable air filters. Instruments, gauges, ammeters, indicator lamps, etc shall be flush mounted. Panel doors shall include isolating switches to prevent them being opened unless the switches are in the off position. Each door shall be provided with a lock, and three sets of keys for all panel door locks shall be handed over to the Engineer.

Terminals for all outgoing main and control cables shall be marked and positioned so that the cables may be carried to the outlet from the panel without crossing or being carried round the panel. Terminal numbers and markings shall correspond to those used on connected equipment and wiring diagrams. All internal interconnecting wiring between individual units and the terminal chamber shall be carried out by the panel manufacturer.

Each panel shall be provided with a main isolator so that the whole panel may be completely isolated.

The Contractor shall determine all motor starter requirements and associated auxiliaries and controls prior to manufacture and shall submit the design and circuit diagrams to the Engineer for approval.

Contractors shall determine all motor starter requirements and associated auxiliaries and controls Prior to manufacture and shall submit the design and circuit diagrams to the Engineer for approval.

Contactors shall be of air-break type BS EN 60470:2001 and/or BS EN 60947 - 4 - 1:2001, and shall be provided as follows:

- Magnetic blow-outs and air chutes on each pole.
- Renewable hard drawn copper contacts.
- Auxiliary contacts for remote control.
- Continuously rated operating coils, (Max 240V)
- Thermal overload protection device incorporating single phasing protection.

Starters shall be rated as follows:

- | | | |
|-------------------|---|--|
| Ordinary duty | - | For motors which will run continuously for periods in excess of two hours. |
| Intermediate duty | - | For motors under automatic control other than time controls. When the intervals of operation are greater than two hours. |

Starters shall be of the following type:

- Up to and including 4KW motor: Single phase on/off with overload protection (D.O.L.).

- Over 4 kW and up to 15 kW: Star Delta starter.
- For starters incorporating reduced voltage starting the changeover of voltage shall be automatic.

Terminals shall be accessible and shall be provided with adequate clearance between phases and between phases and earth. Where starters are not enclosed in a composite panel, an integral isolating switch as specified for control panels shall be provided. Where electric motors are either not visible from the control panel or are located more than 10m distance they shall be provided with a local lock-off stop control circuit switch, or a main circuit isolator where there is no control circuit. A weatherproof lock-off stop control circuit switch shall be provided for motors located externally or otherwise exposed to the weather.

8.2 Motors

Motors shall comply with BS 3456 and/or BS 3676 - 1:1989, BS 5733:1979, BS 6220:1983, BS EN 60669 - 1:2000 and shall be arranged for conduit entry as specified.

Motors shall be fitted with locating type bearings and/or heavy thrust bearings at the non-driven and collar type at the drive end. Motors shall be of the totally enclosed fan cooled type, tropicalised to BS 5000 Part 99 suitably finished to resist corrosion by fluids or fumes. The rating of all motors shall be chosen to provide continuously the maximum power requirements of the plant. The motors shall be of the standard induction type. They may be of the squirrel cage, horizontal or vertical spindle type of all to the approval of the Engineer.

Vertical spindle type motors shall be provided with substantial canopies of approved design.

The locked rotor current shall be stated on the name plate of each motor and shall be not more than six times the full load current.

Thermostats shall be fitted to all motors above 5 kW. They shall be fitted during manufacture and their ends shall be brought out to additional terminals on the connector block of the motor.

All motors shall be rated 3 phases, 415 volt or single phase, 240 volt. High power factor continuous maximum rating complying with BS 5000 Part 99 and Class F insulation complying with BS 2757 unless otherwise specified. All motors larger than 4 kW shall be three phase.

All three phase motors shall be supplied with six stud terminals with each end of the stator phase windings connected; terminals shall be of suitable size to accept the cable lugs of the feeding cables. Terminal blocks shall be mounted on the side of the motor case in an approved box complete with lid, gasket and tapped ET entry hole.

Rubber installation shall not be used on coil connections. Each motor shall be fitted with cable terminals and glands to accept the specified types of cable.

No motor shall run at a speed higher than 1500 rpm unless otherwise specified. Motors driving through V-belts shall be fitted with slide rails. The power factor shall not be less than 0.9 lagging. All motors shall be from the same manufacturer as far as possible.

8.3 Cabling and Wiring

The Contractor shall carry out all power and control wiring including LV and ELV or any other voltage for the control equipment and alarm systems and interconnecting wiring between starter panels, remote control items, and motor units as required.

Cabling shall be carried out in PVC insulated, PVC sheathed, single wire armoured and PVC sheathed overall cable, using compression type glands provided with means of securing armoured wires within the body of the gland, under armour moisture seal and outer sheath seal.

Each core termination shall be fitted with a plastic ferrule engraved with an identification corresponding to the wiring diagrams.

Multicore control cables to the remote stop, start allow water cut-out/ alarms shall be 0.62mm² PVC/SWA/PVC where external to the pump station and PVC/PVC or similar, where internal. All cables, whether internal or external being suitably protected.

All conductors shall be copper and the installations, both internal and external being carried out in accordance with the regulations and by-laws previously stated. Trenching and the fixing of cables shall be in accordance with locally specified standards details of which have been specified within the subcontract documents for the electrical services. These details can be made available upon request should the Contractor not be familiar with these requirements.

Details of the ratings, types and methods for all cables and wiring to be supplied under this contract shall be submitted with the tenders, wiring, PVC single core shall be run in either galvanised conduit or galvanised trunking of suitable sizes where surface in plant rooms and heavy gauge PVC were cast into walls, slabs etc.

PARTICULAR SPECIFICATIONS FOR FIRE HOSE REEL SYSTEM

1. General

The particular specifications details the requirements for the supply, installation and commissioning of the fire fighting installation. The hose reel installation shall comply in all respects to the requirements set out in C.O.P. 5306 Part 1: Lower Floors.

The Sub-Contractor shall include far all appurtenances and appliances not necessarily called for in this specification or shown on the Contract Drawings but which are necessary for the completion and satisfactory functioning of the Works.

No claims for extra payment shall be accepted from the Sub-Contractor because of his non-compliance with the above requirements.

If in the opinion of the Sub-Contractor there is a difference between the requirements of the specifications and the Contract Drawings, he shall clarify these differences with the Engineer before tendering.

2. Commencement of Works

The sub-contractor, in submitting his tender shall be deemed to have included for commencing any necessary work on site at such a time as will comply with the main contractor's programme, or shall be directed by the Engineer.

3. Ordering

The sub-contractor shall order materials from the quantities taken from his own approved working drawings and not the quantities shown in the specifications.

4. Spares

Spares shall be presented to the client at hand over.

5. Scope of Works

The Sub-Contractor shall supply, deliver, erect, test and commission all the automatic fire fighting hose reel installation which is called for in this specification and shown on the Contract Drawings.

In connection with the above works the Main- Contractor shall liaise fully with the Plumbing Sub- Contractor who will be responsible for making a new connection to the existing water mains, supplying and laying a metered service pipe, up to the connections to the water tank.

The Sub-Contract be responsible for all electrical & control wiring up to a local isolator provided by the electrical sub-contractor. The Electrical Sub-Contractor shall supply electrical power & cabling, from the distribution board including the local isolator.

The Sub-Contractor shall supply and handover all the wiring and control diagrams necessary; for the Works when required to do so.

Though the Electrical Sub-Contractor shall install the isolator and be responsible for the electrical connections in compliance with electrical regulations, the Sub-Contractor for the Works contained in this document shall supply and install the starting and stopping gears, indication equipment and retain full responsibility for the correct functioning of the installation.

6. Fire Hose Reel Pumps

The fire hose reels pumps shall consist of a duplicate set (duty & stand by) of horizontal multi-stage centrifugal pumps as manufactured by Grundfos or similar approved. Pumps shall be mounted on a steel base frame and fixed on a concrete plinth manufactured by others. Each pump shall be capable of delivering 29.2l/s against (2.4 bar). The complete specification of the packaged pump set to be as follows: -

a) Pumps

High efficiency single impeller pump, enclosed type motor, enclosed in a stainless steel shell.

b) Pump Materials

Suction and Discharge Casing to be made from Grey Cast Iron. Pump body, back plate, shaft, conveyor, diffuser and impeller made from Stainless Steel AISI 304.

c) Motors

T.E.F.C. Squirrel Cage Motors conforming to metric standards suitable for 240 volts (+/-6%), single phase, 50 Hz supply. Windings insulated to Class "F", Speed 2800 RPM, permanent split capacitor, built-in thermal overload and IP 44 protection.

d) Mechanical seal

Self adjusting type with carbon/ceramic with elastomer made of NBR and other components in stainless steel.

e) Base Frame

Welded fabrication from Mild Steel sections with facility for lifting unit.

f) Valve

Pump Isolating Valves shall be Globe Butterfly valves to B.S. 5155 with Cast iron nylon coated disc and black nitrile liner. Non-Return Valves shall tie vertical lift type to be manufactured from Cast Iron with nitrite seal.

g) Control Panel

The control panel will be an integral part of the pump set.

The control panel shall be constructed of mild steel with auto lacquer finish, be moisture, insect and rodent proof and shall be provided complete with spare fuses and a wiring diagram enclosed in plastic laminate.

Standard panel cubicle to be manufactured to IP 55 standards, containing Direct-On Line (DOL) Starters or Star Delta Starters above 4.0kW

Safety features to include 240 volts low voltage controls except for starter coils. Panel shall be mounted on vibration isolators to minimise vibration to electrical equipment.

The panel shall incorporate HRC main fuses and thermal overloads for the pump motors, time control unit for minimum run period, start relay incorporating timing element for standby pump delay, and one set of voltage free changeover contacts to give remote alarm/indication for the indicator lights mentioned.

The pump shall be controlled by a pressure switch and the control panel shall include the following facilities to IP 54 protection-

- i) "On" push button for setting control panel to live
- ii) Green indicator light for indicating control panel live
- iii) Duty pump, pump runs green indicator lights
- iv) Pumps fail red indicator lights

- vi) Hand/Off/Auto Switches
- vii) Line and control circuit fuses
- viii) Low water condition pump cut out with red indicator light

- h) Pressure Switch**

It shall be of Differential adjustment type switch manufactured to IP 44 standards.

Multi-pump sequencing control; to be effected from a single pressure instrument, utilising control circuitry specially for pressure boosting applications.

- j) Pressure Gauge**

2" Dial Bottom Connection to B. S 1780 calibrated in Bars and kPa.

- k) Membrane Tank - (300 litres capacity)**

Fabricated Steel Construction housing a neutral rubber diaphragm ideally suited for drinking water applications. Precharged with Nitrogen to correct pressure at test stage.

- l) Low Level Water Cut-out**

The pumps shall be protected by a low level cut out switch to prevent dry pump run when low level water conditions occur.

7. Pipework

The pipework for the hose reel installation shall be Black steel with pipe threads to B.S.21. Installation shall be to manufacturer's specification.

8. Pipe Fitting

The pipe fittings shall be Black steel.

All changes in direction shall be with standard bends or long radius fittings. No elbows will be permitted.

9. Flanges

The flanges shall comply with B.S.4504:1963. All flanges shall comply to a nominal pressure rating of 16 bar (P.N.16)

10. Gaskets

The gaskets for use with flanges to B. S. 4304:1969 shall comply with B. S. 4865 Part 1: 1072 far pressure up to and not exceeding 64 Bar.

11. Non-return Valves

The non-return valves up to and including 80 mm diameter shall be as Pegler to B.S..5153: 1974 with flanges to B.S. 4504 P. N.16.

The valves shall be of iron construction with gunmetal seat and bronze hinge pin.

12. Gate Valves

The gate valves up to and including 80 mm shall as Pegler non-rising stem and wedge disc to B.S.1952.:. 1964 (B.S. 5154: 1974) with screwed threads to B.S. 21 taper threads.

13. Sleeves

Where pipework passes through walls, doors or ceilings, a sleeve shall be provided one diameter of the pipe, the space between to be packed with mineral wool, to the Engineer's approval.

14. Hose Reels

The hose reels to the installation shall consist of automatic hose reels, swinging recessed hose reel fixed in cabinet.

All the above hose reels shall comply with B.S.: 1976 and B.S, 3169: 1970 and is to be installed to the requirements of C.P. 5306 Part 1 1976.

The hose reels shall be supplied and installed to with first-aid non-kinking hose 30 metres long, with nylon spray jet/Shut-off nozzle. A screw down chrome plate globe valve to B.S. 1010 to the inlet of the reel shall be fitted. The orifice to the nozzle is to be not less than 4.8 mm to maintain a minimum flow of 0.4 l/s to the jet.

The hose reels shall be installed at 1.5 metres centres above the finished floor level in locations shown on contract Drawings.

15. Earthing

The hose reel installation shall be electrically earthed by a direct earth connection.

The installation of the earthing to be carried out by the Electrical Sub-contractor.

16. Finish Painting

Upon completion of testing and commissioning of a hose reel installation, the pipework shall be primed and finish painted with 2 No. coats of red paint to the Architects requirements.

17. Testing and Commissioning

The hose reel installation is to be flushed out before testing to ensure that no builder's debris has entered the system. The installation is to be then tested to one and a half times the working pressure of the installation to the approval of the Engineer.

Simulated fault condition of the pumping equipment, is to be carried out before acceptance of the system by the Engineer and Architect.

18. Instruction Period

The Sub-Contractor shall allow in his contract sum for instructing of the use of the equipment to the Client's maintenance staff. The period of instruction may be within the contract period but may also be required after the contract period has expired.

The period of time required shall be stipulated by the Client but will not exceed two days in which time, the client's staff shall be instructed in the operation and maintenance of the equipment.

**PARTICULAR SPECIFICATIONS FOR PORTABLE FIRE
EXTINGUISHERS**

1. General

The particular specifications details the requirements for the supply, installation and commissioning of the portable fire extinguishers which shall conform to BS EN 3. Colour coding shall be to BS 7863. The Sub-Contractor shall include all appurtenances and appliances not necessarily called for in this specification or shown on the contract drawings but which are necessary for the completion and satisfactory functioning of the equipment.

2. Scope of works

The sub-contractor shall supply, deliver, erect, test and commission all the portable fire extinguishers which are called for in this specification and shown on the contract Drawings and listed in the Bills of Quantities.

3. Water/CO2 Fire Extinguishers

The portable 9 litre water filled CO₂ cartridge operated portable fire extinguishers shall comply with BS EN 3. Cylinder shall be manufactured with 1.6mm Mild Steel Grade CR1 & CR3 to BS 1449. Cylinder lining shall be polythene. Operating valve shall be in diecast Zinc Alloy to BS 1004. Extinguisher shall be colour coded to BS 7863. The fire extinguisher shall have an operating temperature range of 5°C to 60 C. The fire extinguisher shall have been tested to a pressure of 23 bar and have an operating pressure of 12 bar at 20 C. Extinguisher shall have a pressure dial to indicate pressure in fire extinguisher. Minimum discharge time shall be 63 seconds. Discharge range and safe operating distance shall be 6m and 2m respectively.

The extinguishers shall be clearly marked with the following: -

- a) Method of operation
- b) The words 'WATER TYPE' (GAS PRESSURE) in prominent letters, or similar indicating type of extinguishant and propellant
- c) Name and address of the manufacturer or responsible vendor.
- d) The nominal charge of the liquid in litres
- e) Colour code to BS 7863
- f) The year of manufacture
- g) British Standard kite mark with the number of the British Standard.

4. Portable Carbon-Dioxide Fire Extinguishers

The 5 Kilogram Portable Carbon-Dioxide fire extinguishers shall comply with BS EN 3 and be colour coded to BS 7863. Cylinder of extinguisher shall be Alloy steel. Operating valve shall be in brass hot stamping. The fire extinguisher shall have an operating temperature range of -20°C to 60 C. The fire extinguisher shall have been tested to a pressure of 250 bar and have an operating pressure of 55 bar at 20 C. Extinguisher shall have a discharge hose complete with a horn and clearly indicate how to use extinguisher safely without getting CO₂ burns. Minimum discharge time shall be 15 seconds. Discharge range and safe operating distance shall be 3m and 2m respectively.

The extinguishers shall be clearly marked with the following:

- a) Method of operation
- b) The words '**CARBON-DIOXIDE TYPE**' (**STORED PRESSURE**) in prominent letters, or similar indicating type of extinguishant and propellant
- c) Name and address of the manufacturer or responsible vendor.
- d) The nominal charge of gas
- e) Colour code to BS 7863
- f) The year of manufacture
- g) British Standard kite mark with the number of the British Standard.
- h) The words "Re-charge after use"

5. ABC Dry Powder Portable Fire Extinguishers

The 9 Kilogram portable ABC dry powder fire extinguishers shall comply with BS EN 3, be colour coded to BS 7863 and shall be capable of extinguishing class A, B & C fires. The dry powder charge shall be non-toxic and retain its free flowing properties under normal storage conditions. Any pressuring agent used as an expelling shall be in dry state; in particular compressed air. The discharge tube and gas tube if either is fitted shall be made of steel, brass, copper or other not less suitable materials. Where a hose is provided it shall not exceed 1.060m and shall be acid and alkali resistant. Provision shall be made for securing the nozzle when not in use. Cylinder of extinguisher shall be 1.6mm Mild steel Grade CR1 & CR3 Alloy to BS 1004. Operating valve shall be in die cast zinc alloy to BS 1004. The fire extinguisher shall have an operating temperature range of -20°C to 60 C. The fire extinguisher shall have been tested to a pressure of 23 bar and have an operating pressure of 12.5 bar at 20 C. Minimum discharge time shall be 46 seconds. Discharge range and safe operating distance shall be 7m and 2m respectively.

The extinguishers shall be clearly marked with the following:

- a) Method of operation

- b) The words 'ABC DRY POWDER TYPE' (GAS CATRIDGE) in prominent letters, or similar indicating type of extinguishant and propellant
- c) Name and address of the manufacturer or responsible vendor.
- d) The nominal charge of dry powder
- e) Colour code to BS 7863
- f) The year of manufacture
- g) British Standard kite mark with the number of the British Standard.
- h) The words "Re-charge after use"
- i) Where appropriate, complete instructions for recharging the extinguisher shall be clearly marked on the extinguisher or otherwise be supplied with the refill.

6. Foam Spray Portable Fire Extinguishers

The 9 litre portable foam spray fire extinguishers shall comply with BS EN 3 and be colour coded to BS 7863. Cylinder of extinguisher shall be 1.6mm Mild steel Grade CR1 & CR3 Alloy to BS 1004. Operating valve shall be in diecast zinc alloy to BS 1004. The fire extinguisher shall have an operating temperature range of 5°C to 60 C. The fire extinguisher shall have been tested to a pressure of 23 bar and have an operating pressure of 12.5 bar at 20 C. Minimum discharge time shall be 21 seconds. Discharge range and safe operating distance shall be 4m and 2m respectively.

The foam spray charge shall be non-toxic and retain its free flowing properties under normal storage conditions. Any pressurizing agent used as an expelling shall be in dry state; in particular compressed air.

The fire extinguisher shall be complete with a discharge nozzle and gas tube and a pressure dial indicate pressure in fire extinguisher. Provision shall be made for securing the nozzle when not in use.

The extinguisher shall be clearly marked with the following information:-

- a) Method of operation
- b) The words 'FOAM SPRAY TYPE' (GAS CATRIDGE) in prominent letters, or similar indicating type of extinguishant and propellant
- c) Name and address of the manufacturer or responsible vendor.
- d) The nominal charge in litres
- e) Colour code to BS 7863
- f) The year of manufacture
- g) British Standard kite mark with the number of the British Standard.
- h) The words "Re-charge after use"
- i) Where appropriate, complete instructions for recharging the extinguisher shall be clearly marked on the extinguisher or otherwise be supplied with the refill.

7 Fire Blanket

Tender No: KRA/HQS/NCB-073/2019-2020
Bill of Quantities

The fire blanket shall be made from cloth woven with pre-asbestos yarn or any other fire proof material and to measure 1210 x 1210mm and shall be fitted with specialties folded so as to offer instantaneous single action release blanket from storing jacket.

PARTICULAR SPECIFICATIONS FOR PLUMBING AND DRAINAGE INSTALLATIONS

1 Introduction

The specifications cover the execution of Plumbing and Drainage installations and should be read in conjunction with other relevant specifications, drawings and contract documents issued to the contractor in conjunction with the sub-contract.

The works include, unless otherwise specified, supply delivery, installation, testing and commissioning, cleaning-up and setting to work all the installations described in the specifications and as shown on the contract drawings.

The provisions of all labour, materials, tools instruments testing apparatus and scaffolding necessary to execute the work in a first class manner, even such labour materials instruments or apparatus which are not specifically mentioned in the contract but are necessary for the satisfactory completion of the work, including such elements as:-

- External cold water supply pipe-work and fittings to ground water storage tanks (by others) and to roof storage tanks (included in works) and all other water reticulation pipe work.
- Connection to existing Local Water Company water mains including meter (refer to bills of quantities)
- Roof water storage tanks and accessories for underground storage tanks complete with all necessary covers, fittings, and washout and overflow pipes. The subcontractor is expected to take the overflow and washout pipes to a reasonable discharge point.
- The water supply pipework to the functional and sanitary as shown on the drawing plus the necessary fixing support and jointing materials from the water storage tanks.
- The sanitary and operational fittings together with the fixing supports and jointing of the supply and discharge pipes.
- The waste and soil pipework from the sanitary and operational fittings to the first manhole including all fixing, supports and jointing materials.
- Fire protection services (where applicable) such as Portable Fire Equipment, Installations including all fixing supports jointings etc.
- All cutting away drilling chasing etc. and all making good will if nothing else is specified, be carried out by the main contractor but it will be the responsibility of the sub-contractor to

ensure that this work is kept to a minimum, be responsible for the correct marking out of all chasers and holes; and will provide also necessary details to the main contractor.

- The sub-contractor shall also be responsible for ensuring that runs for floor or wall chases, holes to be cut or left will be marked out at the appropriate stage of structural work.
- The sub-contractor shall undertake all notifications demanded by the Authorities in order to comply with current regulations and produce all certificates, if any, the authorities without extra charge.
- The sub-contractor shall as part of his tender supply all necessary information such as manufacture, catalogue or type numbers, brochures or copies of catalogue pages, weight and all other relevant information which are necessary to classify the equipment tendered for.
- All other material, labour, tools instruments, scaffolding, etc, which are necessary for completion in a first class manner of the plants to the Engineer satisfaction. Excluded are only materials and workmanship especially mentioned herein as “ Excluded from this Sub-contractor”
- The sub-contractor shall include for cables, pipes etc from central facilities to working area.
- Provide the Engineer for his approval complete working and manufacturing drawing as specified.
- Commissioning and testing of the plants as specified.
- Supply of complete operation and maintenance manuals as specified as well as adequate instruction of the client’s maintenance personnel as specified.
- The sub-contractor shall include for full maintenance during initial maintenance period as specified.

3. Excluded from the Sub-Contract

- All concrete works, inclusive of necessary holes, plinths etc
- All block work (except inspection chambers) inclusive of necessary holes (to be marked by the Sub-contractor) etc.
- All electrical wiring up to and inclusive of isolators and switchboards.

- The main contractor will provide central located facilities for supply of water and power during the construction period.
- Structural bearers, structural supports, concrete plinths and the like for water storage tanks, pumps etc. (to be furnished by main contractor)
- All civil works except those measured in the bills of quantities to the 'first manhole only'.

4. Extent of the Sub-Contractor's Duties

At the commencement of the work, the sub-contractor shall investigate and report to the Engineer if all materials and equipment to be used in the work, and not specified as supplied by others, are available locally. If not available, the subcontractor shall at this stage place orders for the materials in question and copy the orders to Architects and/or the Engineer. Failure to do so shall in no way relieve the sub-contractor from supplying the specified materials and equipment in time.

Any item or material found to be defective shall be replaced by the sub-contractor within seven days of his being notified and any result of defective workmanship shall be repaired including supply of new parts if necessary, immediately upon being notified.

The sub-contractor shall furnish at his own cost any samples of material or workmanship required for the sub-contract works that may be called for by the Engineer for his approval and the Engineer may reject materials or workmanship not in his opinion up to the approved standard. The sub-contractor shall allow in his prices such samples.

The sub-contractor shall when authorized in writing by the Architect or the Engineer, make variations from the specifications and drawing. No profit will be allowed on omitted items or works.

The sub-contractor shall submit to the Architect or to the Engineer claims for any work for which he considers demanding extra payments before the beginning of such work.

The sub-contractor shall be responsible for verifying all dimensions relative to his work by actual measurements taken in the site.

The sub-contractor shall request any alteration to the building structures within 30days of the awarding of the sub-contractor. Only such alteration as deemed unavoidable by the Engineer will be considered.

The sub-contractor shall collaborate with the Engineer and the main contractor in planning the installation before work is commenced. Particular care shall be taken to ensure that there is close collaboration with the other sub-contractors when installing services.

The Engineer and Architects shall have full rights to inspect the work in progress and all materials equipment for use in the installation prior to its erection whether these are on site or the sub-contractor's workshop.

The sub-contractor shall allow for all reasonable access to the works for this purpose. Where large items of equipment are to be installed, the sub-contractor shall advise the main contractor in good time so that access is provided for installation before work is commenced on site.

The sub-contractor or his responsible representative shall be in all site meetings as and when required in order to discuss the works, make necessary decisions, receiving relevant instructions and to confirm fulfilment of time schedules.

5.0 Drawings

Tender Drawings indicate generally the arrangement of the installations and are for assistance in tendering. The position of equipment and apparatus shown thereon are approximate only, the exact positions, together with the actual runs of pipework, conduit etc., will be agreed with the Engineer before commencement of work. It shall be deemed that the prices entered by the sub-contractor include for the repositioning of the various services, to meet the above requirements. No claims will be entertained.

The sub-contractor shall satisfy himself as to correctness of all Drawings and measurements particularly the dimensions of the works already constructed on site. If the sub-contractor finds any discrepancy in the Drawings or between the Drawings and the Specification of between the constructed works and the Drawings he shall immediately refer the same to the Engineer who will decide which shall be followed. Figured dimensions shall be taken in preference to the scale mentioned on or attached to any Drawings. Details shown on Drawings shall be read in conjunction with items in the Specification.

The Engineer will furnish to the sub-contractor within a reasonable time after the receipt by the Engineer of a written request for the same, any details which, in the opinion of the Engineer are necessary for the execution of any part of the work such request to be made only within a reasonable time before it is necessary to execute such work in order to fulfil the contract. One copy of the Drawings, details and Specification shall be kept on the site until the completion of the sub-contract and the Engineer shall at all reasonable times have access to the same.

All copies of Drawings and details shall be returned by the sub-contractor to the Engineer on the completion of the Contract.

Additional Drawings will be issued by the Engineer to suit the design requirements of the works these Drawings being issued either during or after the tender period as may be required or necessary. These drawings will supplement the details contained within the Specification and Bills of Quantities and the tenderer shall be deemed to have taken these into account in his pricing. Where the sub-contractor can demonstrate that the Drawings relate to new or additional items these new or additional items shall be priced to approval and shall be in accordance with the sub-contract rates and prices.

6.0 Sub-contract Working Drawings.

The design drawings show the general design intent and are not intended as installation drawings.

The sub-contractor shall produce detailed installation drawings, fully coordinated, at a scale of not more than 1:50. Showing the full layout of all services including piping arrangements, plant rooms, trunking etc. all fully dimensioned and riser cupboards layouts should be produced at a scale of not less than 1:20.

Drawings, and, where relevant, calculations in respect of the following shall be prepared by the sub-contractor and submitted to the Engineer for his approval commencing within 3 weeks from acceptance of the tender.

- (a) Ductwork & associated fabrication drawings, including support details
- (b) Plants space plans and sections including support
- (c) Connections to sanitary ware
- (d) Manufacturer's detailed dimensional drawings for all plant
- (e) Duct, pipe work and equipment fixing details
- (f) Wiring diagrams and control panel details for all systems, control & power wiring including control sequences
- (g) Lightning protection details
- (h) Builders work requirements

Two copies of the installation drawings must be submitted to the Engineer for comment before any work proceeds. The drawings will be reviewed and one copy will be reviewed and one copy will be returned stamped up with a status as follows:-

'A': No comments work can proceed

'B1': Work can proceed subject to incorporation of comments. Re-submit drawing

'B2': Work can proceed subject to incorporation of comments. Re-submit drawing for review

'C': Drawing Rejected. Work cannot proceed. Re-submit drawing

No work shall be started on site until either an A; B1 or B2 status is advised to the sub-contractor.

Drawings shall be submitted to the Engineer as many times as necessary to achieve A or B1 status.

7.0 Record Drawings.

As soon as the works are complete and all tests have been satisfactorily carried out, the sub-contractor shall hand to the Engineer two sets of hard copy Record (As Built) Drawings, together with one (1 No) CD-Rom of these record drawings, showing the works as finally installed. The certificate of practical completion will not be issued until this condition has been complied with. Record Drawings shall be detailed final as-installed Working Drawings.

The Engineer will provide the sub-contractor with a set of Contract Drawings (in addition to the two sets provided for the sub-contractor's site and office use), which shall be maintained by the sub-contractor's representative on site and which shall be used for recording contract variations as they occur. This set of Drawings shall be available for the Engineer's inspection on site, and shall be kept up to date.

The cost of the preparation and submission of the above Contract and Record Drawings shall be deemed to be included within the sub-contractor's prices.

8.0 Maintenance Manuals.

Before issuing of "Practical Completion Certificate", the sub-contractor shall hand over to the Engineer two full sets of operation and maintenance manuals for each of the systems, plant or equipment as installed. These manuals shall be fully illustrated and written in English. Manuals shall be in binders or bound with A4 size.

9.0 Deletion of Items from Contract

Where Provisional Sum items and contingencies have been identified within the Bills of Quantities these may be expended in whole, in part or may be totally deleted from the sub-contract works. In addition, certain items that have been designed, specified and included within the Bills of Quantities

may finally be deleted from the sub-contract as the Employer has not finally decided whether they are to be provided. It shall be deemed that the tender price entered by the sub-contractor has taken into account the possible deletion of these items, and Provisional Sum items, as no claims for loss or profit or any other such claim will be entertained

10.0 Finish Painting

When all the installations have been set to work, tested and commissioned, the sub-contractor shall prime the pipework with an undercoat and paint 2 No. coats of paints in accordance to BS 1710 Colour coding and to the satisfaction of the Engineer and the Architect.

BILLS OF QUANTITIES

GENERAL NOTES

8. Unless stated otherwise in the tender documents, the Contract shall be for the whole Works, based on the unit rates and prices in the Bills of Quantities submitted by the bidder.
9. The bidder or tenderer shall fill in rates and prices for all items of the Works in the contract bills. Items against which no rate or price is entered by the bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the rates for other items and prices in the Bills of Quantities.
10. All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date for submission of bids, shall be included in the rates and prices and the total Bid Price submitted by the bidder. The bid rates and prices shall also include all associated costs to be borne by the Contractor including all overheads, profits and supervision costs.
11. The rates in the contract bills shall be used in the valuation of variations and for interim payments.
12. Unless otherwise provided in these bills of quantities, the rates and prices quoted by the bidder shall not be subject to adjustment during the performance of the Contract on account of price fluctuations or fluctuations in the rate of exchange of the various currencies.
13. There shall be no component of 'Preliminaries and General Items' as these have been captured in the bills of quantities for main works.
14. Rates shall be inclusive of all Labour, tools, overheads, profits etc. and all associated/ancillary costs necessary for completing the installations.

SECURITY INSTALLATIONS SPECIFICATIONS

PARTICULAR SPECIFICATIONS

CCTV

INTRODUCTION

The system will be used for security and supervisory purpose. The system will be able to record pictures in a hard disk. The recorded pictures can be played back to get archived information whose duration depends on recording speed programmed. The schematic is shown in the drawings provided.

1. CAMERAS

i) OUTLINE

They will be used to capture pictures from various strategic positions. Their locations are shown in the drawings provided.

ii) TYPE

1.1. Cameras can be fixed dome or bullet type for external use and shall be as specified on the drawings.

2. MONITORS

i) OUTLINE

The monitors will be used to display multi screen and spot screen of live and /or recorded pictures.

i) 42" TFT LED MASTER

2.1 The display shall be 42" diagonally

2.2 It shall be a colour monitor with a minimum of 500TVL.

2.3 It shall have SVHS and audio facility.

- 2.4 It shall have inbuilt switchable power supply to allow operation between 110 and 260VAC or better.
- 2.5 It shall have dual standards supporting both NTSC and PAL.
- 2.6 It shall incorporate composite and Y/C (S-VHS) video inputs as standard.
- 2.7 It shall have loop through facility.
- 2.8 The monitor shall be designed, manufactured and originated either from Israel, Japan, United Kingdom or any other European community country.

3. NETWORK VIDEO RECORDER

i) **OUTLINE**

These are control equipment for the system.

They will be installed in the office at the gate house.

Recorder shall be as specified in the bills of quantities.

4. CABLING

Cabling shall be fibre optic or copper as specified in the bills of quantities.

PARTICULAR SPECIFICATIONS FOR INTRUDER ALARM

INTRUDER ALARM

INTRODUCTION

- The system will be used to detect, intrusion of protected area when it is armed.
- It will also indicate areas intruded for security personnel to action.

1. MOTION DETECTOR

- They will be used to detect motion of people in secured area when the system is armed.
- They shall be installed in locations indicted in the drawings provided.

1.1 It shall incorporate both microwave and infrared made of detection technology.

1.2 It shall have ant masking facility.

1.3 It shall have a range, which is able to cover the areas shown in the drawings.

1.4 It shall have anti-taper facility, which must be installed.

2. PANIC BUTTON

- They will be used to activate the alarm in case of an attack or any situation, which require attention from security personnel.
- They shall be installed in locations indicated in the drawings provided.

3. MAGNETIC CONTACTS

- They will be used to detect intrusion of protected doors when the system is armed
- They shall be installed in locations indicated in the drawings provided.

3.1 It shall be made of aluminium

3.2 It shall have two component i.e. a magnet and a contact

3.3 The contacts shall be able to close when the magnet is near and vice versa.

5. ALARM CONTROL PANEL

- *The Main Control panel specified herein shall include a Transmitter, built-in telephone line monitor, 500 event (minimum) memory logger, real time clock, calendar, test timer, battery charging / voltage supervision circuitry, battery lead supervision, diagnostics displays, time / event-based scheduling system, lightning / EMI protection circuits, and the associated optional modules and components for a complete system.*

The firmware shall support programmable "software" features. The following describes the general functional requirements of the system:

- A. The system shall support the connection and reporting of intrusion, fire detection and access control devices to a remote receiver.
- B. The system shall provide identification, annunciation, and communication of alarmed detectors by point and each access control user by number.
- C. The system shall be capable of segregating the points (i.e., a detector or group of detectors zoned together) into separate, independent "areas."
- D. The SYSTEM shall be "modularly" expandable using hard-wired address identification modules.
- E. The SYSTEM shall have electrically supervised detection loops and power supplies (mains and battery(s)). This supervision shall be programmable for the purposes of reporting this information to the RECIEVER.
- F. The SYSTEM shall be capable of monitoring and switching to active telephone lines when trying to establish communications with the RECIEVER and transmitting a report.
- G. The SYSTEM shall be capable of reporting and communicating alarm or trouble event data by reporting to one, two, three or four off-site remote RECIEVERs via dial-up analog telephone lines.
- H. The SYSTEM shall be capable of sending (manually or automatically) test and status reports to remote RECIEVERs.
- I. The SYSTEM shall be programmable locally or remotely. Programming shall be accomplished via a portable programmer or a computer running the Remote Account Manager (RAM) software. Users shall be capable of changing their own user passcode from the Alarm Command Center (ACC) and managers shall be capable of changing the user passcodes and authority assignments by area of other users from the ACC.
- J. The SYSTEM shall annunciate alarm, trouble, service reminders, and other relevant system status messages in custom English text at the ACC.
- K. The SYSTEM shall be capable of executing diagnostics and testing functions locally or remotely.
- L. The SYSTEM shall be capable of activating 128 relays and three additional outputs for auxiliary functions based on its classifications (area vs. panel wide).

M. The SYSTEM shall be capable of controlling relays and automatically executing system functions based on a time / event scheduling program. The program can be hour, day of week or day of month based. Each scheduled event can be exclusive of one of four holiday date definitions that can include one to 365 selected Julian dates. The following functions can be executed:

1. Arm / Disarm a specific area
2. Bypass / Unbypass a point
3. Activate / Deactivate a relay
4. Send a test report
5. Turn an Access Authority Level On / Off

5.1 System Feature/Capability Summary

The following indicates system software/hardware capabilities, capacities, and formats:

- A. Number of Loops/Sensors: 216 separately identifiable points. Each of the points shall be capable of supporting "group zoning." Group zoning refers to the combining of sensors into a separately identifiable and separately annunciated (programmable text) area.
- B. Programming Point Functionality: Each point in the system shall provide for the following type of response in the system.
1. Always on (24 hour response)
 2. On when the system is Master Armed
 3. Only on when the system is Perimeter Armed
 4. Displays / Does Not Display at the ACC when the point is activated
 5. Provides / Does Not Provide entry warning tone
 6. Sounds / Does Not Sound audible alarm indication
 7. The Point is bypassable / not bypassable
 8. Alarm Verification with programmable verification time
 9. Relay activation by Point
 10. Provides / Does Not Provide "watch point" capability
 11. Provides Swinger Bypass
 12. Defers Bypass Report
 13. Can return to the system after being force armed and then restoring
 14. Can return to the system after being bypassed and then restoring
- C. Areas/Accounts: The SYSTEM shall support 8 independent areas. Each of the eight areas shall have custom text associated with the armed state, disarmed state and point-off-normal state. Additionally, the SYSTEM shall be capable of assigning 1 to 8 account identifiers to the areas depending on the distribution of areas per account. Each and all

of the eight areas must be capable of Master and/or Perimeter arming (excluding predefined Interior protection).

The SYSTEM shall be capable of logically grouping 2 or more points into an area, or conversely, dividing the points into two or more areas.

Any area shall be configurable to allow arming by specific users when a programmable number of devices are faulted or bypassed.

Areas shall be independently controlled by their corresponding ACC. Each ACC can be designated to control a specific area, or group of areas, or all areas in the system.

Independent control or relay functions by area shall be possible through programming assignments.

- D. Number of Alarm Command Centers: 32 ACCs, each capable of displaying custom English text on vacuum fluorescent displays and sounding different patterns of audible alarm for different events, shall be required. Up to Eight ACCs can be supervised at one time. An ACC can be programmed to respond to the entry of any of the specifically authorized 250 user passcodes (followed by the [ENT] key) and cycle an assigned access control door using a connected door controller. The event is logged and transmitted (if routing is ON) to the RECIEVER including door and user identity.
- E. Number of User Passcodes: Up to 250 different passcodes shall be required. Each passcode shall be three to six digits (variable) and be assigned a 16-character user name that shall be printed on the local printer and RECIEVER with associated opening and closing reports form the user. Passcodes shall be enabled or disabled by area(s) and shall be assigned one of fourteen different authority levels to carry out functions such as the activation of relays from the ACC. These passcodes shall also be required for carrying various system functions such as arming the system, disarming the system, transmitting a duress code, resetting the system and silencing sounders. A single user passcode shall be able to be used in each of the 8 areas with potentially a different authority level in each area.
- Each of the 250 different passcodes shall be able to be associated with 4 individual access cards/tokens. The authority of any of the four cards assigned to the user will be that of the user, but each card will report in the display, local printer, memory event log and at the RECIEVER as a separate user / subuser number pair.
- F. Testing, Diagnostic, and Programming Facilities: Automatic test reports and remote system access for diagnostics, programming, and log (Logger) uploads shall also be supported via a remote central station computer utilizing the RAM software.

- G. **Logger Capacities and Formats:** 500 events (minimum) indicating time, date, type of event, account number, area number, user ID, point text, user text and primary/secondary event route each event. Logs shall be viewed locally at the ACC and remotely via an upload to a computer running the RAM software. The SYSTEM shall also support the printing of these events on up to three local printers. The SYSTEM shall also send a report to the RECIEVER when the log reaches a programmable "percent full capacity" so that RAM can retrieve the stored events. Events can be routed to specific printers by group, signal type and area.
- H. **Reports:** Reports to RECIEVERs at commercial central stations as a result of system supervision shall include alarm, trouble, missing modules, restoral, system status, AC failure and low battery. The SYSTEM shall also transmit test reports once every 24 hours. CPU failure shall be annunciated locally. The ACCs should display the following information for the indicated system supervisory conditions:
1. Call for Service
 2. Service Panel
 3. Service Param
 4. Service AC Fail
 5. Service Battery Low
 6. Service Battery Missing
 7. Service Communications Failure
 8. Service Keypad
 9. Service Route
 10. Service Printer
 11. Service Point Buss Failure
- I. **Telephone Lines and "Phone Routing":** The SYSTEM shall support two (2) telephone lines that are to be alternated for the transmission of consecutive events. The SYSTEM shall have the capability of communicating with up to four different RECIEVERs (phone numbers), Each Phone Number can be up to 24 digits long. The SYSTEM reports shall be classified, by event, into one or more of four routing groups. Each routing group can specify a RECIEVER to be designated as a primary and another RECIEVER as back-up. Assigning an event to multiple routing groups provides for duplicate destination for the event. The transmission of events, allows the reporting of different types of information to different remote RECIEVERs.
- J. **Number of Programmability of Relay Output Modules:** Eight relays (Form C) are to be provided per octo-relay module for a total of 128 relays plus three additional outputs per

SYSTEM. These multi-purpose modules are programmable and shall be used to implement auxiliary functions (manually or automatically).

Relays and other outputs may be programmed to follow up to 14 different area conditions or up to 12 panel conditions. Relays may also be programmed to follow individual points or groups of points.

- K. Number and Alarm Output Selections: Four different types of alarm output selections shall be supported by the SYSTEM: Steady, Pulsed, California Standard, and Temporal Code 3.

The system can be configured to provide zoned indication of alarm conditions.

- L. Miscellaneous Features: Programmable alarm output timer, 31 programmable entry delay times, exit delay programmable by area, individually programmable point of protection text, point bypassing, and keyswitch arming capability with LED outputs.

- M. Real-Time Clock, Calendar, and Test Timer: The SYSTEM shall incorporate an integral real-time clock, calendar, and a test timer.

- N. Opening and Closing Windows: The system shall be programmed with "normal" opening and closing periods for each day of the week and thus suppress scheduled opening / closing reports and report only the exceptions, i.e., opening / closing outside the pre-defined time window. The SYSTEM shall have the capability to suppress opening / closing reports, overriding the programmed open / close windows during holidays and automatically arming the SYSTEM (by area) at the end of the closing period.

- O. SYSTEM Power Ratings: The SYSTEM shall provide 1.4 amps of auxiliary power and 2 amps of alarm power, both rated at 12 VDC. Additional auxiliary power shall be provided by adding battery/charger modules up to a maximum of 2 amps.

- P. SYSTEM Fault Detection: The SYSTEM shall check the point sensor loops once every 300 milliseconds. The point response time is programmable over a range of 300 milliseconds to 4.5 seconds.

- Q. User-Programmable Features: The SYSTEM shall provide a "user-friendly" interface for programming / customizing the system to the operational criteria of the application. The SYSTEM shall be capable of being operated via:

1. The Command Structure
2. Menu / Command List

- R. These system features shall have restrictions based on fourteen individually programmable levels of passcode authority that can be assigned to system users. The user's passcode shall have the capability of being assigned a different authority level in each of the eight areas. A service passcode can be assigned to the servicing agent allowing the agent limited access to system functions. User-programmable / activated functions include:
1. Arming the system: All areas, specific area(s) only, perimeter instant, perimeter delayed, perimeter partial, watch mode, and arming the system with a duress passcode.
 1. Disarming the system: All areas, specific area(s) only and disarming with a duress passcode.
 2. Viewing system status: Faulted points, event memory, bypassed points, area status and point status.
 3. Implementation functions: Bypass a point, unbypass a point, reset sensors, silence bell, activating relays, initiating the remote programming function locally to allow programming the system from a remote location. The ACCs can also be temporarily readdressed to view the status of a remote area.
 4. Testing the system: Local Walk test, Service Walk test, Fire test, send report to remote RECIEVER to check the telephone link, and programming the time and date for the next test report transmission.
 5. Change system parameters: ACC display brightness, system time and date, and add/delete/change passcodes.
 6. Extend the closing time of system.
 7. Transmitting special alerts and activating audible and visible signals.
 8. Executing multiple commands / ACC keystrokes from a single Menu / Command List item. This function shall be able to have a 16 character (alphanumeric) title to identify it on the ACC display.
 9. Editing of time / event based scheduling program from the ACC.
 10. The SYSTEM shall also provide a "service menu" to implement functions such as viewing and printing the system log, displaying the system firmware revision number, and defaulting (togglng) text displays between custom and default text displays for troubleshooting.

5.2 System Interface Requirements

- A. Grounding: The Contractor shall properly earth ground the SYSTEM to prevent electrostatic charges and other transient electrical surges from damaging the SYSTEM panel.
- B. Primary power: The Contractor shall provide a dedicated 120 VAC power circuit to the SYSTEM system. This circuit shall be connected to the emergency power system. The

120 VAC is stepped down to 16.5 VAC to power the SYSTEM panel using a class two, plug-in transformer. This power circuit shall be properly rated to continuously power all points and functions indefinitely in full alarm condition.

- C. Primary power supervision: When the primary power source fails, the system can be configured to report an "AC Fail" message to a commercial central station. The transmission delay of this message is programmable from one to ninety seconds. The message can also be programmed to "tag-along" with another message transmitted to the central station. The system will always display a loss of primary power on the ACC and may be configured to provide additional audible warning.
- D. Secondary power (standby battery): The Contractor shall provide adequate battery power as defined by the relevant application criteria, (UL 865 and 985 for alarm installations or NFPA 72 chapters for fire applications). Appropriate battery chargers shall be provided consistent with the battery back-up capacity.
- E. Secondary power supervision: When the secondary power source experiences a 85% depletion of its standby capacity, the system can be configured to report a "Low Battery" message to a commercial central station. The system will always display a low battery condition on the ACC and may be configured to provide additional audible warning.
- F. Wiring: The contractor shall provide cables consistent with the manufacturer's recommendations. The following general guidelines shall be followed for wiring installation:
 - 1. Wiring shall be appropriately color-coded with permanent wire markers. Copper conductors shall be used.
 - 2. All signal cables provided under this contract shall be Class II, plenum-rated cable where required. Where subject to mechanical damage, wiring shall be enclosed in metal conduits or surface metallic raceway.
 - 3. Data wires shall not be enclosed in conduit or raceways containing AC power wires.
 - 4. Where EMI may interfere with the proper operation of the SYSTEM circuits, twisted/shielded cable shall be used.
- G. The SYSTEM system shall be protected from EMI and lightning surges.
- H. Telephone interface: The SYSTEM shall be equipped with a phone line monitor and shall interface with the phone lines via RJ-31X jacks for supervision of the telephone line connection to the SYSTEM panel. When a telephone line is determined to be out of service by the SYSTEM panel, the event will be annunciated locally on the ACC and

transmitted to the central station. The transmission delay of this message is programmable from ten to two hundred forty seconds. A telephone line switching modules shall be used to interface to a second telephone line. This interface shall conform with FCC rules part 15 and 68.

- I. Auxiliary function control interfaces: Auxiliary functions such as activating bells, strobes, or lights shall be accomplished using the optional relay modules. These auxiliary interfaces shall be electrically isolated to avoid inter-system interferences or damages.
- J. Functional criteria programmed into system memory shall be backed up by battery power. Additionally, the number of system programmers shall be severely restricted via the use of program locking features and passwords.

5.3 Materials

5.3.1 System Hardware Description:

- A. SYSTEM System: The SYSTEM shall be provided, at minimum, with the following components. Additional accessories shall be provided based on the quantities and features required for the application.
 - 1. Enclosure
 - 2. Lock and key
 - 3. D9412 DACT with removable terminal blocks and single crew mounting bracket
 - 4. Faceplate shield and metal bracket covering rear of D9412 circuit assembly
 - 5. Power transformer
 - 6. Manuals

6. LONG RANGE REMOTE RECEIVERS

- They will be used to receive signals when remote button are activated.
 - They will be installed in the main house building.
- 6.1 They shall be able to receive signals at a range of 200m or above.

7. LONG RANGE REMOTE BUTTONS

- They will be used to send signals to remote receivers when activated
 - They will be carried by authorized personnel.
- 7.1 They shall be able to send signals at a range of 200m or above.

8. SIREN/FLUSHER UNITS

- They will be used for visual and audio located alarm
- They shall be installed in locations indicated in the drawings provided
- 8.1 They shall two components i.e. siren and a flusher
- 8.2 The power input to the unit shall be 12Voc.
- 8.3 The audio range of the siren should be 200m or above
- 8.4 The siren shall produce distress sand when activated
- 8.5 The flusher shall produce flushing red amber light when activated

9. CABLING

- 9.1 Stand alarm cables shall be used.

BILLS OF QUANTITIES

GENERAL NOTES

15. Unless stated otherwise in the tender documents, the Contract shall be for the whole Works, based on the unit rates and prices in the Bills of Quantities submitted by the bidder.
16. The bidder or tenderer shall fill in rates and prices for all items of the Works in the contract bills. Items against which no rate or price is entered by the bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the rates for other items and prices in the Bills of Quantities.
17. All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date for submission of bids, shall be included in the rates and prices and the total Bid Price submitted by the bidder. The bid rates and prices shall also include all associated costs to be borne by the Contractor including all overheads, profits and supervision costs.
18. The rates in the contract bills shall be used in the valuation of variations and for interim payments.
19. Unless otherwise provided in these bills of quantities, the rates and prices quoted by the bidder shall not be subject to adjustment during the performance of the Contract on account of price fluctuations or fluctuations in the rate of exchange of the various currencies.
20. There shall be no component of 'Preliminaries and General Items' as these have been captured in the bills of quantities for main works.
21. Rates shall be inclusive of all Labour, tools, overheads, profits etc. and all associated/ancillary costs necessary for completing the installations.

DATA & STRUCTURED CABLING INSTALLATIONS SPECIFICATIONS

GENERAL SPECIFICATIONS FOR DATA & STRUCTURED CABLING INSTALLATIONS.

1.1. Definition and Abbreviations.

1.1.1. Definitions.

For the purpose of this standard the following definitions apply:

- (i) **Application:** A system, with its associated transmission method, which is supported by telecommunications cabling.
- (ii) **Balance Cable:** A cable consisting of one or more metallic symmetrical cable elements (twisted pair s or quads)
- (iii) **Building Backbone Cable:** A cable that connects the building distributor to a floor distributor. Building backbone cables may also connect floor distributors in the same building.
- (iv) **Building Distributor:** A distributor in which the building backbone cable(s) terminal(s) and at which connections to the campus backbone cable(s) may be made.
- (v) **Building Entrance Facility:** A facility that provides all necessary mechanical and electrical services, that complies with all relevant regulations, for the entry of telecommunications cables into a building.
- (vi) **Cable:** An assembly of one or more cables units of the same type and category in an overall sheath. It may include an overall screen
- (vii) **Cable Element:** The smallest construction unit in a cable. A cable element may have a screen.
NOTE: A pair, a quad, and a single fibre are examples of a cable element.
- (viii) **Cabling:** A system of telecommunications cables, cords and connecting hardware that can support the connection of information technology equipment.
- (ix) **Campus:** A premises containing one or more buildings.

- (x) **Campus Backbone Cable:** A cable that connects the campus distributor to the building distributor(s). Campus backbone cables may also connect building distributors directly.
- (xi) **Campus Distributor:** The distributor from which the campus backbone cabling emanates.
- (xii) **Channel:** The end-to-end transmission path connecting any two pieces of applications-specific equipment. Equipment cables and work area cable are included in the channel.
- (xiii) **Cross- Connect:** A facility enabling the termination of cable elements and either connection, primarily by means of patch cords or jumpers.
- (xiv) **Distributor:** The term used for the functions of a collection of components (e.g. patch panels, patch cords) used to connect cables.
- (xv) **Equipment Cable:** A cable connecting equipment to a distributor.
- (xvi) **Equipment Room:** A room dedicated for housing distributors and applications-specific equipment.
- (xvii) **Floor Distributor:** The distributor used to make connections between the horizontal cable, other cabling subsystem and active equipment
- (xviii) **Generic Cabling:** A structured telecommunications cabling system, capable of supporting a wide range of applications. Applications - Specific hardware is not part of generic cabling.
- (xix) **Horizontal Cable:** A cable connecting the floor distributor to the telecommunication outlet
- (xx) **Hybrid Cable:** An assembly of two or more different types of cable units, cable or categories covered by an overall sheath. An overall screen may cover it.
- (xxi) **Individual Work Area:** The minimum building space, which would be reserved for an occupant.

- (xxii) **Interconnect:** A location at which equipment cables are terminated and interconnected to the cabling subsystems without using a patch cord or jumper.
- (xxiii) **Interface:** A point at which connections are made to the generic cabling.
- (xxiv) **Jumper:** A cable unit or cable element without connectors used to make a connection on the cross-connect.
- (xxv) **Keying:** A mechanical feature of a connector system which guarantees correct orientation of a connection or prevents the connection to a jack or optical fibre adapter of the same type intended for another purpose.
- (xxvi) **Link:** The transmission path between any two interface of generic cabling. It excludes equipment cables and work area cables.
- (xxvii) **Optical Fibre Cable:** (Or Optical Cable): A cable comprising one or more optical fibres cable elements.
- (xxviii) **Optical Fibre Duplex Adapter:** A mechanical device designed to align and join two duplex.
- (xxix) **Optical Fibre Duplex Connector:** A mechanical termination device designed to transfer optical power between two pairs of optical fibres.
- (xxx) **Pair:** A twisted pair or one side circuit (two diametrical facing conductors) in a star quad.
- (xxxi) **Patch Cord:** Flexible cable unit element with connector(s) used to establish connections on a patch panel
- (xxxii) **Patch Panel:** A cross - connect designed to accommodate the use of patch cords. It facilitates administration for moves and changes.
- (xxxiii) **Public Network Interface:** A point of demarcation between public and private network. In many cases it is the point of connection between the network provider's facilities and the customer premises cabling.
- (xxxiv) **Screened Cable:** An assembly of two or more balanced twisted pair cable elements or more quad cable element wrapped by an overall screen or screen contained within a common sheath or tube.

(xxxv) **Screened Twisted Pair Cable:** An electrically conducting cable comprising one or more elements each of which is individually screened. There may be each of which is individually screened. There may be an overall screen in which case the cable is referred to as a screen twisted pair cable with an overall screen.

(xxxvi) **Splice:** A joining of conductors or fibres generally from separate cables.

(xxxvii) **Star Quad:** A cable element, which comprises four insulated conductors twisted together. Two diametrically facing conductors form a transmission.

NOTE 1. Cables containing star quad can be used interchangeably with cables consisting of pairs, provided the electrical characteristics meet the same specifications.

NOTE 2. Often the term quad is used instead of star quad.

(xxxviii) **Telecommunication:** A branch of technology concerned with the transmission, emission and reception of signs, signals, writing, images and sounds; that is information of any nature by cable, radio optical or other electromagnetic system. The term has no legal meaning when used in the document.

(xxxix) **Telecommunication Closet:** An enclosed space for housing telecommunications equipment, cable termination, cross - connect cabling. The telecommunications closet is a recognized cross-connect point between the backbone and the horizontal cabling subsystems.

(xl) **Telecommunication Outlet:** A fixed connecting device where the horizontal cable terminates. The telecommunications outlet provides the interface to the work area cabling.

(xli) **Transition Point:** A location in the horizontal cabling where a change of cable form takes place.

NOTE: For example, where a flat cable connects to round cables or cables with differing numbers of elements are joined.

(xlii) **Twisted Pair:** A cable element, which consists of two insulated conductors twisted together in a determined fashion to form a balanced transmission line.

(xliii) **Unscreened Twisted Pair Cable (UTP):** An electrically conducting cable comprising one or more pairs none of which is screened.

NOTE: There may be an overall screen, in which case the cable is referred to as unscreened twisted pair cable with an overall screen.

(xliv) **Work Area:** A building space where the occupants interact with telecommunications terminal equipment.

(xlv) **Work Area Cable:** A cable connecting the telecommunications outlet to the terminal equipment.

1.1.2 ABBREVIATIONS.

a.c	Alternating Current
ACR	Attenuation to Crosstalk Ratio
ATM	Asynchronous Transfer Mode.
BD	Building Distributor
BFOC	Bayonet Fibre Optic Connector
B-ISDN	Broadband - ISDN
c	Velocity of propagation in free space
C	Connection
CD	Campus Distributor
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
d.c	Direct Current
DUT	Device Under Test.
ELED	Edge Light Emitting Diode.
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference.
EQP	Equipment.
ER	Equipment Room.
FD	Floor Distributor
FDDI	Fibre Distributed Data Interface
ffs	For further Studies.
IC	Integrated Circuit
IDC	Insulation Displacement Connection.
ISDN	Integrated Service Digital Network.
LAN	Local Area Network.
LCL	Longitudinal Conversion Loss
LCTL	Longitudinal Conversion Transfer Loss
LED	Light Emitting Diode.
MUX	Multiplexor
N/A	Not Applicable.

N-BNC	N type to BNC convertor
NEXT	Near End Crosstalk Loss
PBX	Private Branch Exchange.
PMD	Physical Layer Medium Dependent.
S	Splice
SC	Optical Fibre Connector (Subscriber Connector)
SC-D	Duplex SC Connector.
STI	Surface Transfer Impedance.
TC	Telecommunications Closet.
TE	Terminal Equipment
TO	Telecommunications Outlet
TOC	Terminal Open Circuit.
TP	Transition Point.
TP-PMD	Twisted Pair Physical Layer Medium Dependent.

1.2. Standard Applicable

BS EN 50173: 1996 - Information Technology - Generic Cabling Systems

EIA/TIA - 568 - Maximum Cable distances for UTP cable

EIA/TIA - 569 - Quadratics for the design of horizontal, and work area pathways, building entrance facilities, telecommunication closets and equipment rooms.

EIA/TIA - 606 - Guidelines for labeling and administrating the components which comprises a structured wiring system.

1.3. Structure of the Generic Cabling System.

1.3.1. Horizontal Cabling Sub - System.

The horizontal cabling subsystem extends from a floor distributor to the telecommunication outlet(s) connected to it. The subsystem includes the horizontal cables, the mechanical termination of the horizontal cables at the floor distributor, the cross - connection at the floor distributor and the telecommunication outlets.

Horizontal Cables should be continuous from the floor distributor to the telecommunications outlets.

1.3.2. Work Area Cabling.

The work area cabling connects the telecommunication outlet to the terminal equipment.

1.4. Floor Distributor.

There should be a minimum of one floor distributors for every 100m² of floor space reserved for offices. A minimum of one floor distributor should be provided for every floor.

1.5. Telecommunications Outlet

The telecommunication outlets are provided to serve a maximum of 10sq.m of usable floor space. Each individual work shall be served by a minimum of two. A minimum of one telecommunication outlet served by 100Ω cable shall be provided at each work area. Other outlets shall be supported by either balanced cables by optical fibre cable. When the outlet is supported by a cable, two pairs or four pairs shall be provided at each telecommunications outlet; all pairs shall be terminated.

1.6. Telecommunications Closets.

A telecommunications closet should provide all the facilities (Space, power, control etc) for passive components, active devices and public network interface housed within it. Each telecomm closet should have direct access to the backbone.

1.7. Earthing and Bonding.

Earthing shall meet the requirement of HD 384.5.54. Where compatible with required electrical codes, the earthing instruments and requirements of the equipment manufacturers should also be followed.

1.8. Horizontal Cabling.

The maximum horizontal cable length shall be 90m independent of medium. In establishing maximum length, a total mechanical length of 10m is allowed for works area cables, partial cords or jumpers, and equipment cables any horizontal segment.

1.9. Cable Requirement.

Generic Cabling system shall use cables in accordance with H.D. 608 or EN187000. In additions, Sectional Specifications E.N. 50167, EN 50168 and EN 50169 which cover overall screened, category 6 cables with low smoke zero Halogen Sheath Materials suitable for horizontal and backbone application.

1.10. Cable Installation Practices.

1.10.1. General.

Installations and cables management precautions that should be observed include the elimination of cable stress as caused by tension, sharp bend as and tightly cables.

In cabling pathways and in areas occupied by connecting hardware, cable Bends radius requirements shall be observed.

1.10.2. Cable Management.

In order to maintain consistent and correct point - to - point connections, provisions shall be made to ensure that termination provisions shall be made to ensure that terminations are properly located with present to connector positions and their corresponding cable elements.

Such provisions may include the use of colours, alpha - numeric identifiers on other means designed to ensure that cables are connected in a consistent manner throughout the system.

The untwisted length in a cable element as a result of termination to connecting hardware should be as short as possible. Also, for links with category 6 components, pair twisting should be provided to within 13mm.

1.10.3. Screening.

Screens are intended to improve electromagnetic compatibility performance. To achieve this effect they have to be properly bonded.

Screened cabling to be effective, requires that all cabling components are screened and meet requirements for transfer impedance.

Screening has to be continuous for the complete channel. This means that work is cables, equipment cables and the equipment attachment, shall also satisfy the continuity requirement.

1.11. Testing.

The installation must be tested to conform to ISO 11801 requirements for CAT 6 CABLING. These tested shall include but not limited to:

- *Link Tests.*
- *Attenuation*
- *Near End Cross Talk (NEXT)*
- *Return Loss.*
- *ACR.*
- *Impedance.*

PARTICULAR SPECIFICATIONS.

2.1. Location of the site

The site of the proposed work is along Elgon Road, CBC Building, Upperhill, Nairobi.

2.2. Description of the Project.

The proposed development comprises the fit out in an existing building.

The cabling in UTP cat 6A, 4 pair will be a star topology.

The works are to be executed in accordance to the description given in this document or any other directive issued by the client or the Project Manager or Engineer.

2.3. Extent of the Work.

The sub-contractor's work shall include the following:

- (a) Providing horizontal cabling to the cabinet.*
- (b) Providing and connection of cabinet, patch panels, cable organizers and patch cords.*
- (c) Connection to all equipment into the workstations.*
- (d) Connection of terminal equipment plates and provision of work area cabling and patch cords.*
- (e) Providing the components for the data and telecommunication as specified in the bills of quantities.*

2.4. Data Outlets

Data outlets shall be as RJ 45 for CAT6A UTP cable termination and conform to ISO11501.

The data outlet jacks and faceplates shall be as Siemon or Equivalent and approved by Engineer.

2.5. Patch Cords

RJ-45 UTP 4pair CAT6A rated patch cords, shielded as Siemon - 1Metre unless stated otherwise in the bills of quantities or Equivalent and approved by Engineer.

2.6. Patch Panels.

Patch Panels shall be 24 ports as described in the bills of quantities, high density 19" suitable for RJ45 Jacks as Siemon or Equivalent and approved by Engineer.

2.7. Equipment Cabinet.

The equipment shall be standard with capacity as indicated in bills of quantities. It shall incorporate cooling fans and ventilation fins to allow free movement of natural air. Space must be left between the stacks to enable free flow of air. The cabinets' standards must be of high quality finish as fabricated by APC or equal and approved, to the Approval of the Engineer.

2.8. Cabling.

CAT6A UTP, 4 Pair cables conforming to ISO 11801 and ETI series shall be used. Installation and cable management to ISO 11801 and as per general specifications

Cables must be marked at both ends. A unique identifier shall be assigned to every cable, distributors and termination.

2.9. Tests.

Test results for CAT 6A UTP 4pair System must be provided complete with as installed drawings indicating cable routing and any other tests for the project may deemed necessary by either party.

BILLS OF QUANTITIES

GENERAL NOTES

22. Unless stated otherwise in the tender documents, the Contract shall be for the whole Works, based on the unit rates and prices in the Bills of Quantities submitted by the bidder.
23. The bidder or tenderer shall fill in rates and prices for all items of the Works in the contract bills. Items against which no rate or price is entered by the bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the rates for other items and prices in the Bills of Quantities.
24. All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date for submission of bids, shall be included in the rates and prices and the total Bid Price submitted by the bidder. The bid rates and prices shall also include all associated costs to be borne by the Contractor including all overheads, profits and supervision costs.
25. The rates in the contract bills shall be used in the valuation of variations and for interim payments.
26. Unless otherwise provided in these bills of quantities, the rates and prices quoted by the bidder shall not be subject to adjustment during the performance of the Contract on account of price fluctuations or fluctuations in the rate of exchange of the various currencies.
27. There shall be no component of 'Preliminaries and General Items' as these have been captured in the bills of quantities for main works.

Rates shall be inclusive of all Labour, tools, overheads, profits etc. and all associated/ancillary costs necessary for completing the installations.

FIRE ALARM SYSTEM INSTALLATIONS SPECIFICATIONS

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SECTION 1 - GENERAL REQUIREMENTS

1.1. EXTENT OF SUB-CONTRACT

The sub-contract shall include for manufacture, inspection and testing, packing for shipment, insurance, shipping, customs, duties, taxes on completion, setting to work, finishing, painting and maintenance for a period of six calendar months, all to the satisfaction of the Engineer, of the items of Plant and Equipment described or implied within this Specification and shown on the relevant Drawings.

The fire alarm system services within the new facilities are required to be complete in all respects as specified herein, and shall include all items of equipment, materials, accessories, fittings, supports, etc. necessary whether such items are specially referred to in the contract or not. The sub-contractor shall be deemed to have included in his tender price for all items necessary such that the installation are complete in all respects and left in a satisfactory working order.

The sub-contractor shall provide fully detailed working drawings of the entire installation. The drawings shall be submitted for approval within three weeks of the award of the sub-contract such that the Engineer can be made aware of all requirements. It shall be fully the responsibility of the sub-contractor to liaise with the main contractor to ensure all civil and builder's works required for this sub-contract are prepared and/or provided to suit the programme of this contract. No claims will be entertained.

All modifications to proposed new layouts and structures shall be subject to the full approval of the Engineer and the Employer.

1.2. CONTRACT PERIOD AND PROGRAMME

The sub-contractor shall provide within, the stipulated period after the acceptance of his Tender, a complete programme for the execution of this contract. This programme shall indicate the expected dates of the commencement and completion of the following specialist contract works:-

- (i) Submission of Working Drawings for approval.
- (ii) Placing of orders with other specialist or sub-contractors for Plant and Equipment to be incorporated in the Works
- (iii) Receipt by the sub-contractor from other specialist or sub-contractor of Plant to be incorporated in the Works.
- (iv) Manufacture by the sub-contractor of Plant to be incorporated in the Works.
- (v) Inspection and testing required by the Engineer.
- (vi) Shipment from country of supply.
- (vii) Delivery to Site.
- (viii) Erection on site, details for all activities.
- (ix) Tests on Completion.

Operations shall be commenced when instructed and shall be carried forward to completion with the greatest possible expediency, to the satisfaction of the Engineer, in accordance with the Programme. The sub-contractors programme shall be agreed with the main contractor, as the sub-contractor shall adhere fully to the requirements and timing of the agreed main contractors programme.

1.3. DRAWINGS ACCOMPANYING THE TENDER DOCUMENTS

Drawings accompanying this Specification indicate generally the arrangement of the installations and are for assistance in tendering. The position of equipment and apparatus shown thereon are approximate only, the exact positions, together with the actual runs of ductwork, trunking and conduit etc., will be agreed with the Engineer before commencement of work. It shall be deemed that the prices entered by the sub-contractor include for the repositioning of the various services, to meet the above requirements. No claims will be entertained.

The sub-contractor shall satisfy himself as to correctness of all Drawings and measurements particularly the dimensions of the works already constructed on site. If the sub-contractor finds any discrepancy in the Drawings or between the Drawings and the Specification of between the constructed works and the Drawings he shall immediately refer the same to the Engineer who will decide which shall be followed. Figured dimensions shall be taken in preference to the scale mentioned on or attached to any Drawings. Details shown on Drawings shall be read in conjunction with items in the Specification.

2 Copies of all Drawings and of the Specification will be furnished free of cost to the sub-contractor for his own use.

The Engineer will furnish to the sub-contractor within a reasonable time after the receipt by the Engineer of a written request for the same, any details which, in the opinion of the Engineer are necessary for the execution of any part of the work such request to be made only within a reasonable time before it is necessary to execute such work in order to fulfil the contract. One copy of the Drawings, details and Specification shall be kept on the site until the completion of the sub-contract and the Engineer shall at all reasonable times have access to the same.

All copies of Drawings and details shall be returned by the sub-contractor to the Engineer on the completion of the Contract.

Additional Drawings will be issued by the Engineer to suit the design requirements of the works these Drawings being issued either during or after the tender period as may be required or necessary. These

drawings will supplement the details contained within the Specification and Bills of Quantities and the tenderer shall be deemed to have taken these into account in his pricing. Where the sub-contractor can demonstrate that the Drawings relate to new or additional items these new or additional items shall be priced to approval and shall be in accordance with the sub-contract rates and prices.

1.4. SUB-CONTRACT WORKING DRAWINGS

The design drawings show the general design intent and are not intended as installation drawings.

The sub-contractor shall produce detailed installation drawings, fully coordinated, at a scale of not more than 1:50. Showing the full layout of all services including conduits, trunking and cable tray all fully dimensioned. Plantrooms, riser cupboards and switchroom layouts should be produced at a scale of not less than 1:20.

Drawings, and, where relevant, calculations in respect of the following shall be prepared by the sub-contractor and submitted to the Engineer for his approval commencing within 3 weeks from acceptance of the tender.

- (i) Cabling and external cable routes
- (j) Details of all conduit and trunking runs for services
- (k) Details of lighting and power circuits, routes etc.
- (l) Details of sub-main switchgear and distribution boards
- (m) Fire alarm layouts and all circuit diagrams
- (n) Security system installations
- (o) Lightning protection details
- (p) Technical literature for all services
- (q) Layouts of all ducts, chases, holes, trenches and all other services throughout the whole of the building and associated external works

Two copies of the installation drawings must be submitted to the Engineer for comment before any work proceeds. The drawings will be reviewed and one copy will be reviewed and one copy will be returned stamped up with a status as follows:-

‘A’: No comments work can proceed

‘B1’: Work can proceed subject to incorporation of comments. Re-submit drawing

‘B2’: Work can proceed subject to incorporation of comments. Re-submit drawing for review

‘C’: Drawing Rejected. Work cannot proceed. Re-submit drawing

No work shall be started on site until either an A, B1 or B2 status is advised to the sub-contractor.

Drawings shall be submitted to the Engineer as many times as necessary to achieve A or B1 status.

1.5. RECORD DRAWINGS

As soon as the works are complete and all tests have been satisfactorily carried out, the sub-contractor shall hand to the Engineer three sets of hard copy Record (As Built) Drawings, together with one (1 No) CD-Rom of these record drawings, showing the works as finally installed. The certificate of practical completion will not be issued until this condition has been complied with. Record Drawings are in addition to detailed Working Drawings and shall show all cable routes, circuits, trunking, conduits, plant, trenches, ductwork and ducts etc. together with the entire electrical installation, as finally installed.

The Engineer will provide the sub-contractor with a set of Contract Drawings (in addition to the two sets provided for the sub-contractor’s site and office use), which shall be maintained by the sub-contractor’s representative on site and which shall be used for recording contract variations as they occur. This set of Drawings shall be available for the Engineer’s inspection on site, and shall be kept up to date.

The cost of the preparation and submission of the above Contract and Record Drawings shall be deemed to be included within the sub-contractor’s prices.

1.6. MAINTENANCE MANUALS

Before issuing of “Practical Completion Certificate”, the sub-contractor shall hand over to the Engineer three full sets of operation and maintenance manuals for each of the systems, plant or equipment as installed. These manuals shall be fully illustrated and written in English.

1.7. BUILDER'S WORK AND CIVIL WORKS

All Builder's Work and Civil Works incidental to this section of the contract such as the cutting of holes in walls and floors, the provision of foundations for plant and machinery, the building in of lifting beams, breaking into the existing plant rooms and duct systems, changes in levels the protection of existing structures, painting and the re-instatement of the plant rooms and associated areas to their original standard etc. shall be the responsibility of the main contractor. The sub-contractor shall however be fully responsible for the preparation of all such details that relate to this sub-contract works, the details being subject to approval by the Engineer prior to submission of the main Contractor for action. Other items such as the fixing of brackets, cable and duct work ducts and trenching, making good etc., shall be carried out by the sub-contractor to suit the installation of all the services.

It is the sub-contractor's sole responsibility to ensure that all holes and chases etc. are in the required position and that any additional ducts, holes and chases necessary for the erection of the installations in situ concrete walls, floor slabs etc. are included in the early stages of construction as appropriate.

The sub-contractor shall furnish the Engineer and main Contractor with all information as to where foundations, brackets and fixings are required and shall ensure that such work is done in accordance with such information.

The sub-contractor shall include in his tender for all supports, fixings, the plugging of all walls, ceilings and floors to facilitate the fixing of the pipework accessories, and all other portions of the plumbing, drainage and fire fighting installations. Any purpose made fixing brackets shall also be provided and installed by the sub-contractor, including escucheon plates and the like.

The sub-contractor is to set out at the earliest opportunity the position of all holes necessary for the passage of ducts, pipe-work and conduits or otherwise required in connection with his work, and should additional holes or openings be required due to the failure of the sub-contractor to fulfil the conditions of this clause, then he must arrange for the main Contractor to make such openings, etc. at his own expense. The sub-contractor is not to arrange for the cutting of any holes or openings unless specifically authorised to do so and should he do so without approval, he will become liable for any damage to the building or fittings.

The sub-contractor shall supply and install approved pipework support brackets and hangers. It shall be deemed that the prices entered include for any special requirements and that the sub-contractor has visited the site during the tender period to ascertain all details.

The sub-contractor shall pay particular attention to the fixing and alignment of items. All items shall be installed square, true and perpendicular to floors i.e. as shown on Drawings and as may be required at site to the Engineers approval and to suite the existing and new services.

1.8. GUARANTEE

The sub-contractor shall guarantee all work for a period of six months after acceptance by the Engineer. In the event of a defect arising within the contract defects liability period, which, in the opinion of the Engineer, is due to faulty workmanship or materials, the sub-contractor shall, at his own expense, make good such defects where instructed to do so, to the satisfaction of the Engineer.

1.9. SETTING TO WORK

The sub-contractor shall instruct the Employer's Maintenance Engineer or his representative on the operation and maintenance of the various components forming the electrical installation and shall provide such drawings, diagrams and manuals to ensure the Maintenance Engineer or his representative is completely conversant with such installation.

The sub-contractor shall ensure that the Services installations are left in complete safe working order and operating to the satisfaction of the Engineer.

1.10. REGULATIONS AND STANDARDS

The installations must be carried out strictly in accordance with the following documents:-

- (i) The current edition of the 'Regulations for the Electrical Equipment for Buildings' issued by the Institute of Electrical Engineers of the United Kingdom.
- (ii) Electric Power Act, 1997.
- (iii) Relevant British Standard Specifications and Codes of Practice published by the British Standards Institution (hereinafter referred to as BS and CP. respectively).
- (iv) Regulations of the Government of Kenya.
- (v) Any other duly constituted authorities regulations having jurisdiction over the works.
- (vi) The Specification and accompanying documentation and drawings.
- (vii) The Working Drawings produced by the sub-contractor and approved by the Engineer.

The sub-contractor shall undertake all modifications demanded by the authorities in order to comply with the regulations and produce all certificates, if any, for the authorities without extra charge.

1.11. QUALITY OF MATERIALS

All materials, fittings and accessories are to be new and in accordance with the requirements of the current rules and regulations where such exist, and with the relevant British Standard Specification.

Uniformity of type and manufacture of fittings or accessories is to be preserved as far as practicable throughout the whole work.

Wherever in this specification the practice is adopted of specifying a particular item as 'similar' to that listed in a particular firm's catalogue, it is to be clearly understood that this is to indicate the type and quality of the equipment required. No attempt is being made to give preference to the equipment supplied by the firm whose catalogue is quoted.

Where particular manufacturers only are specified herein no alternative makes will be considered without good reason.

All materials shall be good quality, suitable for the purpose specified, and to the approval of the Engineer.

1.12. WORKMANSHIP

The sub-contractor shall take into consideration, when pricing his tender, that there will be other sub-contractors working. Any disruptions to the new services must therefore be kept to an absolute minimum, and in this respect the

Sub-contractor shall include in his prices for carrying out work outside normal operating hours as may be directed by the Engineer. No claim will be entertained where abnormal working hours are required to meet this requirement and completion of the works within the specified contract period.

The sub-contractor shall be fully responsible for the co-ordination of all services, and in this respect, he shall ascertain that the installation of the service will not interfere with other new services. In all cases, services through risers, ducts etc. must be readily accessible for maintenance.

The sub-contractor shall be deemed to have included in his tender prices for locating switches, terminal points, ductwork, outlets and fixtures in positions and/or locations at least one metre both horizontally and vertically from those positions indicated on the contract drawings. Within these limits no variations in the sub-contract sum will be made unless the work has already been executed in accordance with previously approved Working Drawings.

All trade work shall be carried out by tradesmen fully competent and qualified in their respective trades, and the entire installation shall be performed in a neat and workman-like manner.

The sub-contractor shall take every precaution to avoid damage to all new property including roads, paved walkways, grassed areas, landscaping, cables, drains and other services, and he will be held responsible for and shall make good all such damage arising at his own expense to the satisfaction of the Engineer.

The sub-contractor will be responsible for the exact runs and placing of conduits, boxes, ductwork and accessories that are to be cased in concrete ceilings, floors, walls, columns and beams, and for the proper fixing of the conduit work and accessories to the shuttering and the steel reinforcement work.

Where conduit is to be concealed, the pipes etc. shall be in an exact position relative to the finished plaster or such other finishes as may be applied to enable adequate cover to be applied.

Where services are run above the false ceilings the sub-contractor shall ensure that access to all services is readily available such that future maintenance can be carried out without difficulty. Full details shall be included on the Working Drawings such that the Engineer can give consideration to the sub-contractor's proposals.

1.13. LAYING OUT OF WORK

The sub-contractor will be responsible for laying out his work and shall obtain all necessary information as may be required to carry out the work, and such information shall be obtained sufficiently in advance to avoid any possibility of delay to the works as a whole.

The sub-contractor shall be fully responsible, and shall inform himself of, the details of all work being carried out by the various trades on Site, particularly where such trades may interfere one with the other, or where co-ordination is necessary. No claims for extra costs will be met arising from omissions, oversights, or neglect in this regard.

The sub-contractor shall arrange for the supply, in advance of the delivery of the equipment, of all necessary foundation bolts, templates, nuts, plates, sleeves, anchorage, etc. as required and as may be directed by the Engineer.

1.14. ERECTION AND CHECKING OF WORK

The sub-contractor shall provide, and be solely responsible for, all skilled and unskilled labour, tools, lifting tackle and other equipment required for transport to the site, the handling and transport about the site and the erection of the plant and equipment.

As each part of the Works is erected, it shall be subject to approval by the Engineer.

All parts shall pass such tests on the site as required by the Engineer to prove compliance with the contract irrespective of any tests which may already have been carried out at the Manufacturer's Works. In particular all electrical pressure tests made at the Manufacturer's Works shall be repeated at voltages approved by the Engineer.

The sub-contractor shall supply and install all supports, fixing, brackets and similar items as may be necessary for the completion of the installation of the services as specified and as shown on the Drawings.

1.15. PERFORMANCE AND ACCEPTANCE TEST ON SITE

The sub-contractor shall give to the Engineer in writing at least five days notice of the date after which he will be ready to make the specified tests on completion of installation. Unless otherwise agreed, the tests shall take place within seven days after the said date on such day or days as the Engineer shall in writing notify the sub-contractor. The tests shall be carried out under normal working conditions to the satisfaction of the Engineer and shall extend over such continuous periods as he may direct.

All skilled labour, supervision, apparatus, power supply for tests and instruments required for carrying out the tests efficiently will be the responsibility and at the expense of the sub-contractor. The accuracy of the instruments shall be demonstrated if required.

If any part of the installation, plant or equipment fails to pass the specified tests, further tests of the said part shall, if required by the Engineer, be repeated. The sub-contractor shall, without delay, put in hand such modifications as are necessary to meet the requirements as described in the Contract and any expense which the Employer may have incurred by reason of such further tests shall be deducted from the sub-contract price.

Each completed system within the installation shall be tested as a whole under operating conditions to ensure that each component functions correctly in conjunction with the rest of the system.

1.16. TEST RECORDS

The sub-contractor shall make all necessary records of the tests carried out, and when the tests have been successfully completed, he shall provide the Engineer with tests records and reports in a form to be agreed.

The electrical services will be deemed to be complete when the following obligations have been fulfilled by the sub-contractor:-

- a) The satisfactory completion of the Performance and Acceptance Tests on Site.
- b) Test records and reports have been received.
- c) The handing over of two preliminary sets of Record Drawings. The supply of these preliminary Record Drawings shall not relieve the sub-contractor of his obligations to supply Record Drawings in accordance with the requirements of the Specification.
- d) The issue of a completion certificate as required by BS 7671:1992.

1.17. DUST, INSECT AND VERMIN PRODUCTS

All equipment which is affected by ingress of dust shall be effectively dust proofed and also vermin proofed where no protection is afforded in the normal manufactured form. All materials used shall be in general resistant to attack by insects, micro-biological life or other local fauna and such materials shall be to the approval of the Engineer.

1.18. PAINTING AND FINISHING

All mechanical and electrical equipment installed under this sub-contract shall be painted or otherwise finished to approval in accordance with B.S. Code for Standard Colours including all pipework and ductwork, etc. Such finish shall be entirely compatible with the conditions of heat, humidity, exposure to the weather, and other relevant factors arising from the materials, location and condition of operation of the equipment.

The Engineer may request examples of paint finishes, the cost of which shall be deemed to have been included within the tendered prices for all works.

All final painting of equipment, fixtures, and accessories shall be carried out by the sub-contractor, except where it is the usual practice of the manufacturer of items of plant, equipment, and switchgear etc. to apply a high standard of protective finishing paintwork in the shop before despatch. This will be acceptable provided any damage to paintwork which occurs before the plant is taken over, is made good by the sub-contractor at his own costs.

The interior of electrical switchboards, control panels, and similar items, where supplied by the sub-contractor shall be finished in approved enamel and shall comply with the appropriate B.S for enamel

finish. The exteriors of such panels and enclosures shall be of British Standard Specification colour as specified by the Engineer.

1.19. LABELS

All items of plant, cables etc. shall be neatly and clearly labelled externally with identification marks corresponding with those on Drawings or in Specifications. Final details shall be agreed.

Identification labels shall be of laminated plastic material engraved, black or white, with no less than 6mm Lino style letters and shall be fixed on or adjacent to all items by means of at least two brass screws or to approval.

All main switches, circuit breakers, isolators, motors, switch-fuse, consumer's service units, distribution boards etc. shall be neatly and clearly labelled externally with identification marks corresponding with those on Drawings or in Specifications. Final details shall be agreed.

1.20. SPARE PARTS AND SPECIAL TOOLS

The sub-contractor shall submit his recommended list of spares covering a period of two years for all plant and auxiliary equipment supplied under this sub-contract. This list shall be priced individually, but not carried forward to the Bills of Quantities where provisional sums have been included for the purchase of spare parts. Before a Taking-Over Certificate is issued a full set of spares as agreed shall be handed over to the Engineer.

Complete sets of any special tools, as detailed in the Data Schedules, necessary for the operation, maintenance and dismantling of various sections of the plant and equipment shall be provided in a strong box or boxes each fitted with a suitable padlock and two keys. Such tools shall not be used by the sub-contractor during the erection of the plant or equipment. The cost of these tools shall not be carried forward to the Bills of Quantities where a provisional sum has been included for the purchase of these special tools.

1.21. SPECIALIST MANUFACTURERS AND SUB-CONTRACTORS

Where specialists are nominated by the Employer, the sub-contractor shall appoint specialist manufacturers and contractor for any sections of the Works described herein in which he is not himself an experienced, recognised and approved operator.

The Tenderer shall, on submission of his Tender, indicate the names of all proposed specialist manufacturers and contractors, together with the precise sections of the Works for which each will be responsible. The sub-contractor may be required to seek alternative manufacturers or contractors or to accept specialists nominated by the Employer, it shall be deemed that the prices entered include for this requirement.

The sub-contractor shall allow in his prices for phasing work to meet the requirements of the other sub-contractors and any specialists, and for varying his programme or otherwise, to comply with the erection programme of such specialists or sub-contractors. No additional costs will be allowed to the sub-contractor for any disruptions to his programme, or otherwise, in his compliance with the above requirements.

1.22. USE OF SITE

The lands and other places outside the Site which are the property of or under the control of the Employer shall not be used except with the approval of the Engineer.

The sub-contractor shall at any time remove any vehicle, wagon, or any other obstruction within his control that may be required to be moved by the Engineer for any purpose and the sub-contractor shall move such obstruction promptly on instruction being given and at his own cost, unless the Engineer shall decide otherwise.

The sub-contractor shall maintain access for the inspection, operation and maintenance of any of the Employer's plant or work which lies within the Site or elsewhere. The sub-contractor shall not use any portion of the site for any purpose not connected with the Works unless the prior written permission of the Engineer has been obtained.

1.23. POSSESSION OF SITE

It shall be deemed that the prices entered by the sub-contractor for the completion of the works are inclusive of all required temporary supplies as may be directed by the Engineer or the Employer. Other details shall be fully agreed as the works proceed to suit the operational situations as and when they arise.

1.24. INTERFERENCE WITH THE WORKS

The sub-contractor shall not interfere in any way with any existing Works whether the property of the Employer or of a third party and whether the property of the Employer or of a third party and whether the position of such works is indicated to the sub-contractor by the Engineer or not except

where such interference is specifically described as part of the Works either in the contract or in any instruction from the Engineer.

1.25. WATER AND POWER FOR USE ON THE WORKS

Water for construction purposes and for use by the sub-contractor's staff during the contract period will be the responsibility of the main contractor. The sub-contractor will be liable for the cost of any water used. In this respect the sub-contractor shall liaise with main contractor who may be able to assist.

The main contractor shall be responsible for the supply of all electrical power for his own and the nominated sub-contractor's use prior to the issue of the Taking-Over Certificate. However, the individual sub-contractor shall be liable for the cost of any electric current used and any installations provided especially for their use.

1.26. TELEPHONE AND COMMUNICATIONS

The sub-contractor shall liaise with the main contractor for the provision of a telephone at the site, the sub-contractor being fully responsible for all charges and costs incurred in providing this facility.

1.27. SITE OFFICES, WORKSHOP AND STORAGE

An area of land will be provided by the main contractor for the sub-contractor's site offices, workshops and storage. The sub-contractor shall be responsible for providing all buildings, fencing, etc. that he may require and on completion of the Works shall be required to remove all such buildings, fencing etc. and to restore the land to its original condition.

The sub-contractor shall state, with the Tender, the areas that he requires for his site offices, workshops and storage. The areas of land available are limited and the Employer reserves the right to allocate areas of land smaller than the sub-contractor may require, in which case, the sub-contractor shall make such additional or alternative arrangements as may be necessary for his full requirements, all at his own cost.

1.28. HEALTH AND SAFETY OF WORKS

The sanitation of the works shall be the responsibility of the main contractor who shall arrange and maintain all required sanitation facilities to the satisfaction of the Local Authorities, Labour Department and Engineer.

The sub-contractor shall warn his employees and other specialists and sub-contractors that any employee found fouling the site shall be removed from the site immediately.

In this respect, the sub-contractor shall liaise with the main contractor for temporary toilet and ablution facilities, these facilities being connected, on a temporary basis, but to approval, into the existing foul sewage system. Full details shall be agreed. These temporary ablutions are a specific requirement of the Employer and shall therefore be provided for this duration of the contract, all items being removed at the completion of the Works and the existing system fully reinstated to its original condition.

1.29. PROTECTION OF WORKS

The sub-contractor shall carefully protect from injury by weather all work and materials which may be affected thereby and allow in his prices for all dams, pumping, shoring, temporary drains, sumps etc. necessary for the purpose, and shall clear away and make good at his own cost to the satisfaction of the Engineer all damage caused thereby.

1.30. SUNDRIES

The necessary holding down bolts, supporting brackets and templates, guards and screens, locks, piping, conduits, lamps and other requisite sundries whether specified in detail or not shall be provided, under the contract and it shall be deemed that the sub-contractor's prices, rates and the like include for all such items.

1.31. DELETION OF ITEMS FROM CONTRACT

Where Provisional Sum items have been identified within the Bills of Quantities these may be expended in whole, in part or may be totally deleted from the sub-contract works. In addition, certain items that have been designed, specified and included within the Bills of Quantities may finally be deleted from the sub-contract as the Employer may decide otherwise. It shall be deemed that the tender price entered by the sub-contractor has taken into account the possible deletion of these items, and Provisional Sum items, as no claims for loss or profit or any other such claim will be entertained.

1.32. SCHEDULES OF TECHNICAL DATA

Where included in the Tender Documents, Schedules of technical data shall be completed by all Tenderers, otherwise the Tender may not receive full consideration, and will be liable to rejection.

1.33. COPIES OF ORDERS

Copies of all orders for major items of plant, equipment and materials places with suppliers shall be provided in triplicate to the Engineer.

FIRE ALARM SYSTEM TECHNICAL SPECIFICATIONS

Scope

Furnish a complete 24V DC (or to manufacturer's specification) addressable, electrically supervised, zone annunciated, fire detection and alarm system as specified herein and indicated on the drawings. The system shall include but not be limited to a control panel and/or Repeater panels with integral power supply to provide the 24V DC, signal initiating devices, audible and visual alarm devices, and all accessories required to provide a complete and operating system.

The fire alarm system shall be wired as 2 core signal loops. 24V DC power wiring shall be installed to alarm sounders via addressable sounder modules or via conventional monitored sounder outputs within the control panel.

Loop powered sounders shall be connected directly to the signal loops. .

Codes and Standards

The following codes and standards shall apply to work of this section.

BS	- British Standards
ISO	- International Standards Organisation
BS 5839	- Fire Detection and Alarm Systems for Buildings
ISO 9000	- Quality Management System

Qualifications of Installers

Installers of the products supplied for the fire alarm system shall have been in the business of installing Fire Alarm products for at least five years. They shall confirm compliance to the above codes and standards.

Fire Alarm Control Panel (FACP)

Functional Description

The fire alarm control panel (FACP) shall be the central processing unit of the system, receiving and analysing signals from fire sensors, providing audible and visual information to the user, initiating automatic alarm response sequences and providing the means by which the user interacts with the system. It shall be part of the security system.

The FACP shall be easily configurable to meet the exact detection zone and output mapping requirements of the building.

The FACP shall be microprocessor based and operate under a multitasking software program. Operating programs and configuration data shall be contained in reconfigurable non-volatile memory. Retention of the memory shall not rely on any form of battery or capacitor back-up device. The FACP shall incorporate separate processors for loop processing and central processing.

Provision shall be made for each addressable loop to be sub-divided into geographical zones. The section of wiring corresponding to each zone circuit shall be protected from faults in other sections by line isolator modules.

Detectors

- a) Allocate a zone
- b) Set a delay before the panel responds to a fire signal
- c) Indicate pre-alarm
- d) Set day sensitivity and night sensitivity separately
- e) Automatically address loop powered base sounder
- f) Allocate a forty character location text message

Call points

- a) Allocate a zone
- b) Allocate a forty character location text message

Switch units (input)

- a) Allocate a zone for each input and the device itself
- b) Define input action as fire, fault, pre-alarm, technical alarm, evacuate, alert, security alarm, silence alarm, reset, transparent, disablement or test mode.
- c) Change the input action message from the default to any one of the above or to any one of a user defined library of 10 additional action messages.
- d) Set a delay before the panel responds to a fire signal
- e) Select whether the input requires the control panel to be reset or is self clearing upon removal of the input
- f) Allocate a forty character location text message

Relay or sounder units (output)

- a) Allocate a zone for each input and the device itself
- b) Define whether the device responds to evacuate inputs, as a sounder (default ringing), is silenceable, needs to be reset or produces a single pulsed operation of between one and five seconds (programmable)
- c) Has a delay before operating (zero to five minutes)
- d) Allocate a forty character location text message

Loop powered sounders

- a) Allocate a zone
- b) Define whether the device responds to evacuate inputs, as a sounder (default ringing), is silenceable, needs to be reset or produces a single pulsed operation of between one
- c) Has a delay before operating (zero to five minutes)
- d) Select the volume from one of ten settings
- e) Select the tone from one of five settings
- f) Allocate a forty character location text message

Sounders

The FACP shall provide the necessary outputs to separately operate a minimum of four monitored circuits of common system sounders. Each output shall be capable of driving a sounder load of up to 500mA

The FACP shall also be able to monitor the integrity of and control standard sounder circuits, via a suitable addressable module.

The FACP shall be capable of providing a two-stage alarm sounder facility that can be programmed, either on a zonal basis or common system basis, to meet the requirements of the fire authority. Sounder outputs shall be available as follows:

- Alert, intermittent pulsed tone
- Evacuate, continuous tone

The FACP shall have the facility to change, on a per sounder zone basis, the sound output dependent upon whether the source of alarm is:

- an automatic detector, e.g. smoke, heat,
- a manual call point.

The FACP shall have the facility to generate a slow pulsed output to all sounder circuits in response

to a security alert input.

Fault Reporting

The FACP shall monitor all critical system components and interconnections, internal and external, such that a failure, which would prevent the correct operation of the alarm functions, causes the FAULT indicator to light and a message to be given on the alphanumeric display within 60 seconds of occurrence.

The following faults shall be reported in the manner described above:

- a. Loop Short Circuit
- b. Loop Open Circuit
- c. Unconfigured Device
- d. Device missing
- e. Addressable Device Failure
- f. Incorrectly Configured Device
- g. Fire routing equipment fault
- h. System fault (processor)
- i. Extinguisher connection fault
- j. Low battery
- k. Charger failure
- l. Earth fault monitoring
- m. Battery Fault
- n. Mains Failure
- o. Sounder Wiring Open Circuit (per circuit)
- p. Sounder Wiring Short Circuit (per circuit)

To help fault finding and repair, the FACP shall provide text messages to indicate the location of where a fault has occurred in the system.

System Management

The FACP shall incorporate the following system management facilities:

- a. Isolate/re-connect individual outputs or inputs of addressable points
- b. Isolate/re-connect individual zones
- c. Isolate/re-connect individual loops
- d. Isolate/re-connect individual sounder circuits

- e. Isolate/re-connect all volt-free contacts individually
- f. Isolate/re-connect panel inputs
- g. Walk-test of a selected zone to verify detectors and sounders
- h. View system status
- i. Print event log
- j. Print point status
- k. Set time
- l. View contamination status

Access to the facilities describe above shall be restricted to user Engineer level or above. The FACP shall have an event log capable of storing up to the last 500 events that have occurred. It shall be possible to view the content of the log via the alphanumeric display. Events shall be displayed in chronological order with the newest events first. It shall be possible to scroll through the events.

The FACP shall be designed so that, for each type of analogue addressable detector, the overall response time including the sensor, the signal transmission system and the fire decision algorithm, meets the requirement of British Standards.

The FACP shall be capable of isolating a group of selected detectors in areas of the building where maintenance work is carried out.

Automatic Fire Detectors (General)

General

The installer shall have available the following types of analogue addressable automatic sensors, for direct connection to the system addressable loops:

- Ionisation smoke sensors
- Photoelectric smoke sensors
- Heat sensors
- Multi-sensors

Addressable Units

The installer shall be capable of offering two-state addressable versions of the following units, taking only one address from the loop:

- Ionisation smoke detectors
- Photoelectric smoke detectors

- Heat detectors
- Photoelectric beam smoke detectors
- Ultra-violet flame detectors
- Conventional detector interface module
- Addressable sounder modules
- Addressable relay interface modules
- Addressable switch monitoring modules
- Short circuit isolator modules (no address required)
- Loop powered sounders
- Manual call points for indoor use
- Manual call points for outdoor use
- Multiple inputs/outputs

Conventional Units

The installer shall have available the following types of conventional automatic detectors, manual call points and ancillary units for connection to the system via suitable interfaces:

- Ionisation smoke detectors
- Photoelectric smoke detectors
- Photoelectric beam smoke detectors
- Ultra-violet flame detectors
- Heat detectors
- Manual call points for indoor use
- Manual call points for outdoor use
- Remote indicator units
- Sounders

Analogue Addressable and addressable detectors and modules must be able to transmit to the FACP an address to be used in the system configuration.

It must be possible to connect and mix automatic detectors, addressable manual call points and addressable modules within the same zone sub-division of an addressable loop.

All equipment connected to the system addressable loop, either directly or via interfaces, shall be proofed against electrical noise, high frequency pulses and electromagnetic influences from other equipment.

The installer shall have available suitable equipment to test and remove or exchange all three main types of automatic point-type detectors when installed.

Ionisation Smoke Detectors

The ionisation smoke detectors shall be capable of detecting visible and invisible combustion gases emanating from fires, using a dual ionisation chamber in which the air is ionised by a single radioactive source.

The radioactive source used shall be AM 241 of one microcurie or less.

The ionisation smoke detectors shall be designed to have high resistance to contamination and corrosion and shall include RFI screening to minimise the effect of radiated and conducted electrical interference.

The ionisation smoke detectors shall be suitable for operation in air speeds of up to 10m/s and shall incorporate screens to minimise the effects of small insects.

The installer shall have available the following versions of the ionisation smoke detector to meet different applications:

- Analogue addressable
- Two-state addressable
- Conventional

The ionisation smoke detector shall incorporate two LED's, clearly visible from the outside, to provide indication of alarm actuation.

In locations where the detector is not readily visible, remote indicator units shall be provided.

Photoelectric Smoke Detectors

The photoelectric smoke detectors shall be capable of detecting visible combustion gases emanating from fires and shall employ the forward light-scatter principle.

The point-type photoelectric smoke detectors shall be equally sensitive to a wide range of combustible materials.

The design of the point-type photoelectric smoke detector sensing chamber shall be optimised to minimise the effect of dust deposit over a period of time. The chamber cover shall be removable for ease of cleaning or replacement.

The point-type photoelectric smoke detectors shall incorporate screens designed to prevent all but the very smallest of insects from entering the sensing chamber, (50 holes per square centimetre or more).

The photoelectric smoke detectors shall be designed to have high resistance to contamination and corrosion and shall include RFI screening to minimise the effect of radiated and conducted electrical interference.

The installer shall have available the following versions of the point type photoelectric smoke detector to meet different applications:

- Analogue addressable
- Two-state addressable
- Conventional - normal sensitivity
- Conventional - normal sensitivity - delayed response
- Conventional - normal sensitivity - Intrinsically Safe

The photoelectric smoke detector shall incorporate two LED's, clearly visible from the outside, to provide indication of alarm actuation.

In locations where the detector is not readily visible, remote indicator units shall be provided.

Multi-Sensors - Analogue Addressable

The multi-sensor should be capable of monitoring two different sensing elements:

- 1) Photoelectric
- 2) Thermal

The design of the point-type multi-sensor Photoelectric smoke detector sensing chamber shall be optimised to minimise the effect of dust deposit over a period of time. The chamber cover shall be removable for ease of cleaning or replacement.

The point-type multi-sensors shall incorporate screens designed to prevent all but the very smallest of insects from entering the sensing chamber, (50 holes per square centimetre or more).

The multi-sensors shall be designed to have high resistance to contamination and corrosion and shall include RFI screening to minimise the effect of radiated and conducted electrical interference.

The sensor should be able to operate in the following modes:

Combination Mode

The sensor should be able to operate as a Photoelectric sensor but when the ambient temperature reaches 40o C or above, the thermal elements should be capable of sensing the 'Rate of Rise' and adjust the sensitivity of the photoelectric element automatically. The sensitivity of the photoelectric should be increased via an internal algorithm.

Photoelectric mode

The sensor should be able to return the analogue value for the photoelectric element during a normal polling sequence.

The sensor should also be able to signal to the FACP if the thermal sensing element exceeds a fixed temperature threshold.

Thermal mode

The sensor should be able to return the analogue value for the thermal element during a normal polling sequence. The sensor should also be able to signal to the FACP if the photoelectric sensing element exceeds a pre-defined threshold.

The multi-sensor shall incorporate two LED's, clearly visible from the outside, to provide indication of alarm actuation. The LED's should be controlled from the FACP if the LED's flash during the normal polling sequence.

The modes of the multi-sensor should be controlled by the FACP, when the FACP changes from one mode to another the FACP should re-calibrate the multi-sensor.

In locations where the detector is not readily visible, remote indicator units shall be provided.

The multi-sensor should have the capability of monitoring both sensing elements, if either or both of the elements fail it should be reported and displayed at the FACP.

Duct smoke detectors

The installer shall produce standard equipment for the installation of smoke detectors in air ducts. This equipment shall be designed to accommodate the manufacturer's standard smoke detectors and bases: Analogue addressable, Addressable and conventional.

Heat detectors

The heat detectors shall be capable of detecting rapid rise in temperature and/or fixed absolute temperatures.

The heat detectors shall employ two heat-sensing elements with different thermal characteristics to provide a rate of rise dependent response.

The heat detectors shall include RFI screening to minimise the effect of radiated and conducted electrical interference.

The installer shall have available the following versions of heat detectors to meet different applications:

- Analogue addressable - grade 1, 2 or 3.
- Two state addressable - grade 1
- Two state addressable - grade 2
- Conventional - grade 1
- Conventional - grade 2
- Conventional - range 1
- Conventional - static 60°C
- Conventional - static 90°C

The heat detectors shall incorporate two LED's, clearly visible from the outside, to provide an indication of alarm actuation.

In locations where the detector is not readily visible, remote indicator units shall be provided.

Detector Base

The automatic point-type fire detectors shall be fixed to the installation by mean of plugin bases. Analogue addressable bases, two-state addressable detector bases, sounder bases and conventional detector bases shall be available.

The three types of bases specified above shall incorporate the optional feature of being able to lock the detectors in place once plugged in. Termination facilities shall be available for earthing.

The two-state addressable base shall incorporate all the circuitry required for communicating detector statuses to the FACP.

Standard conventional and Analogue Addressable bases shall not contain any electronic circuitry. This shall enable insulation and continuity checks to be completed on the wiring with the detector heads removed.

Other devices

Addressable Manual Callpoints

The addressable manual call points shall monitor and signal to the FACP the status of a switch operated by a “break glass” assembly. They shall be red in colour and suitable for surface or flush mounting. The addressable call points shall be provided with an integral red LED to indicate activation.

One version of the addressable call point shall be available mounted in a weatherproof housing, affording protection to IP 66.

The addressable call points shall be capable of operating by means of thumb pressure and not require a hammer. They shall be capable of being tested using a special ‘key’ without the need for shattering the glass.

The addressable call points shall incorporate a mechanism to interrupt the normal addressable loop scan to provide an alarm response within 3 seconds and shall be field programmable to trigger either an alert or an evacuate response from the FACP.

Addressable multiple inputs/outputs

The multiple input/output device should allow a minimum of eight inputs and eight outputs at one loop address.

The FACP should be able to allocate up to 3 of the eight digital inputs as analogue. The outputs should be able to be operated by the FACP in one of the following modes:

- 1) Intermittent
- 2) Continuous
- 3) One-Shot

The FACP should be capable of operating the outputs in synchronisation with the relay and addressable sounder controllers.

The addressable multiple inputs/outputs module shall provide an LED indication when it is being

polled by the FACP.

Addressable Sounder Module

The addressable sounder module shall be capable of monitoring and controlling two independent circuits of alarm sounders using a single loop address.

24 V DC power to drive the sounders shall be derived independently from the FACP.

The addressable sounder module shall be capable of operating both sets of sounders in a pulsing or continuous mode as determined on the module. Each circuit shall be individually programmable. Sounder circuits shall be capable of synchronisation.

The addressable sounder module shall provide the facility to monitor the wiring to the sounders for open or short-circuit and transmit the necessary fault signal to the FACP. Each sounder circuit shall be separately fused.

The addressable sounder module shall provide the facility to monitor for failure of the power supply for the sounders and transmit the necessary fault signal to FACP.

The addressable sounder module shall provide a green LED indication when the FACP is polling it.

Conventional detector interface module

The conventional detector interface module shall be capable of monitoring two independent zones, each of up to 30 conventional detectors using a single loop address.

24 V DC power to power the conventional detectors shall be derived independently from the FACP.

The conventional detector interface module shall provide the facility to monitor the detector zones for open or short-circuit and transmit the necessary fault signal to the FACP.

The conventional detector interface module shall provide a remote LED facility to indicate detectors in alarm and shall provide a red LED indication when the FACP is polling it.

Addressable relay interface module

The addressable relay interface module shall be capable of switching two independent

relays; either normally open or normally closed, each rated at 30V, 1Amp.

A single input shall provide open and short circuit monitoring facilities, set locally at the unit.

The addressable relay interface module shall use a single loop address.

The unit shall be powered directly from the addressable loop.

The addressable relay interface module shall provide an LED indication when the FACP is polling it.

Addressable switch monitoring module

The addressable switch monitoring module shall be capable of monitoring two independent voltage free contacts, each either normally open or normally closed, using a single loop address.

The unit shall be powered directly from the addressable loop.

The addressable switch-monitoring module shall provide a red LED indication when the FACP is polling it. The LED shall be continuously lit when either input is active.

Short Circuit Isolator Module

The short circuit isolator module shall provide protection on the addressable loop by automatically disconnecting the section of wiring between two modules where a short circuit has occurred.

The short circuit isolator module shall derive power directly from the addressable loop and shall provide an LED indication that the module has tripped. A base mounted version is available.

Loop powered sounders

Addressable electronic sounders shall be connected directly to the detection loops where required. These shall be incorporated in a suitable mounting base so that an analogue smoke or heat sensor may also be connected to the base, if required. Loop powered sounders shall be ceiling or wall mountable. A cover plate shall be fitted when a sensor is not to be fitted on the sounder.

The address of sounders used as sensor bases shall be set automatically at the FACP. This will be above 127 so as not to restrict the number of other addressable devices on the loop.

The loop-powered sounder volume shall be determined at the FACP. The loop powered sounders shall

be programmable to have a minimum sound output of 85 dB (A) at 1 metre distance, and at this output shall have a maximum current consumption of 3 mA from the loop.

Photoelectric beam smoke detectors

The photoelectric beam smoke detectors shall be capable of detecting visible combustion gases emanating from fires and shall utilise the light obscuration principle. The emitter shall project a near infra red beam to the receiver.

Two types are acceptable:

1. The photoelectric beam smoke detectors shall consist of an emitter and a receiver pair. The detectors shall operate over a 5 - 100 metre range.
2. A Photoelectric reflective beam smoke detector consisting of a combined control unit and a separate reflector. The detector shall operate over a 5-30 metre range.

The photoelectric beam smoke detectors shall have automatic recalibration in order to adjust for contamination.

The photoelectric beam smoke detectors shall be designed to have high resistance to corrosion and shall include RFI screening to minimise the effect of radiated and conducted electrical interference.

The photoelectric beam smoke detectors shall incorporate two LED's, clearly visible from the outside and below, to provide indication of alarm actuation and fault.

Ultra-violet flame detectors

The flame detector shall be of a point-type. It shall be mounted on its base using a simple twist action for ease of installation and removal.

The flame detector shall be able to detect weak ultra-violet rays in a 120° cone of vision, in a direct line of sight.

Remote Indicator Unit

The remote indicator unit shall provide a remote indication for any detector that may be located in an enclosed or locked compartment.

The remote indicator unit shall be driven directly from its associated local detector. It shall be either

flush or surface mountable.

Sounders

Two types of Electronic sounders shall be acceptable: loop-powered addressable sounders (see above) and stand-alone versions. Stand-alone versions shall powered by 24 Volts DC from the FACP.

Non loop-powered versions shall be flush or surface mountable, red in colour. They shall have a minimum sound output of 95 dB (A) at 1 meter distance and shall have a maximum current consumption at 24V DC of 100 mA.

Alarm Bells

Fire alarm bells shall be underdome type with a high resonance pressed alloy-steel gong to ensure a load clear-tone ring. They shall be fully suppressed and polarised.

The operating mechanism shall be fully enclosed and the gong shall be red stove enamelled for long life.

Alarm bells shall have a minimum sound output of 95 dB (A) at 1 meter distance, and shall have a maximum current consumption at 24V DC of 30 mA.

BILLS OF QUANTITIES

GENERAL NOTES

1. Unless stated otherwise in the tender documents, the Contract shall be for the whole Works, based on the unit rates and prices in the Bills of Quantities submitted by the bidder.
2. The bidder or tenderer shall fill in rates and prices for all items of the Works in the contract bills. Items against which no rate or price is entered by the bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the rates for other items and prices in the Bills of Quantities.
3. All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date for submission of bids, shall be included in the rates and prices and the total Bid Price submitted by the bidder. The bid rates and prices shall also include all associated costs to be borne by the Contractor including all overheads, profits and supervision costs.
4. The rates in the contract bills shall be used in the valuation of variations and for interim payments.
5. Unless otherwise provided in these bills of quantities, the rates and prices quoted by the bidder shall not be subject to adjustment during the performance of the Contract on account of price fluctuations or fluctuations in the rate of exchange of the various currencies.
6. There shall be no component of 'Preliminaries and General Items' as these have been captured in the bills of quantities for main works.
7. Rates shall be inclusive of all Labour, tools, overheads, profits etc. and all associated/ancillary costs necessary for completing the installations.

UPS SERVICES INSTALLATIONS SPECIFICATIONS

SECTION 1 - GENERAL REQUIREMENTS

1.1. EXTENT OF SUB-CONTRACT

The sub-contract shall include for manufacture, inspection and testing, packing for shipment, insurance, shipping, customs, duties, taxes on completion, setting to work, finishing, painting and maintenance for a period of six calendar months, all to the satisfaction of the Engineer, of the items of Plant and Equipment described or implied within this Specification and shown on the relevant Drawings.

The electrical services within the new facilities are required to be complete in all respects as specified herein, and shall include all items of equipment, materials, accessories, fittings, supports, etc. necessary whether such items are specially referred to in the contract or not. The sub-contractor shall be deemed to have included in his tender price for all items necessary such that the installation are complete in all respects and left in a satisfactory working order.

The sub-contractor shall provide fully detailed working drawings of the entire installation. The drawings shall be submitted for approval within three weeks of the award of the sub-contract such that the Engineer can be made aware of all requirements. It shall be fully the responsibility of the sub-contractor to liaise with the main contractor to ensure all civil and builder's works required for this sub-contract are prepared and/or provided to suit the programme of this contract. No claims will be entertained.

All modifications to proposed new layouts and structures shall be subject to the full approval of the Engineer and the Employer.

1.2. CONTRACT PERIOD AND PROGRAMME

The sub-contractor shall provide within, the stipulated period after the acceptance of his Tender, a complete programme for the execution of this contract. This programme shall indicate the expected dates of the commencement and completion of the following specialist contract works:-

- (x) Submission of Working Drawings for approval.
- (xi) Placing of orders with other specialist or sub-contractors for Plant and Equipment to be incorporated in the Works
- (xii) Receipt by the sub-contractor from other specialist or sub-contractor of Plant to be incorporated in the Works.
- (xiii) Manufacture by the sub-contractor of Plant to be incorporated in the Works.
- (xiv) Inspection and testing required by the Engineer.

- (xv) Shipment from country of supply.
- (xvi) Delivery to Site.
- (xvii) Erection on site, details for all activities.
- (xviii) Kenya Power and Lighting Company Limited (KPLC) Installation Works.
- (xix) TELKOM (Kenya) Installation Works.
- (xx) Tests on Completion.

Operations shall be commenced when instructed and shall be carried forward to completion with the greatest possible expediency, to the satisfaction of the Engineer, in accordance with the Programme. The sub-contractors programme shall be agreed with the main contractor, as the sub-contractor shall adhere fully to the requirements and timing of the agreed main contractors programme.

1.3. DRAWINGS ACCOMPANYING THE TENDER DOCUMENTS

Drawings accompanying this Specification indicate generally the arrangement of the installations and are for assistance in tendering. The position of equipment and apparatus shown thereon are approximate only, the exact positions, together with the actual runs of ductwork, trunking and conduit etc., will be agreed with the Engineer before commencement of work. It shall be deemed that the prices entered by the sub-contractor include for the repositioning of the various services, to meet the above requirements. No claims will be entertained.

The sub-contractor shall satisfy himself as to correctness of all Drawings and measurements particularly the dimensions of the works already constructed on site. If the sub-contractor finds any discrepancy in the Drawings or between the Drawings and the Specification of between the constructed works and the Drawings he shall immediately refer the same to the Engineer who will decide which shall be followed. Figured dimensions shall be taken in preference to the scale mentioned on or attached to any Drawings. Details shown on Drawings shall be read in conjunction with items in the Specification.

2 Copies of all Drawings and of the Specification will be furnished free of cost to the sub-contractor for his own use.

The Engineer will furnish to the sub-contractor within a reasonable time after the receipt by the Engineer of a written request for the same, any details which, in the opinion of the Engineer are necessary for the execution of any part of the work such request to be made only within a reasonable time before it is necessary to execute such work in order to fulfil the contract. One copy of the Drawings, details and Specification shall be kept on the site until the completion of the sub-contract and the Engineer shall at all reasonable times have access to the same.

All copies of Drawings and details shall be returned by the sub-contractor to the Engineer on the completion of the Contract.

Additional Drawings will be issued by the Engineer to suit the design requirements of the works these Drawings being issued either during or after the tender period as may be required or necessary. These drawings will supplement the details contained within the Specification and Bills of Quantities and the tenderer shall be deemed to have taken these into account in his pricing. Where the sub-contractor can demonstrate that the Drawings relate to new or additional items these new or additional items shall be priced to approval and shall be in accordance with the sub-contract rates and prices.

1.4. SUB-CONTRACT WORKING DRAWINGS

The design drawings show the general design intent and are not intended as installation drawings.

The sub-contractor shall produce detailed installation drawings, fully coordinated, at a scale of not more than 1:50. Showing the full layout of all services including conduits, trunking and cable tray all fully dimensioned. Plantrooms, riser cupboards and switchroom layouts should be produced at a scale of not less than 1:20.

Drawings, and, where relevant, calculations in respect of the following shall be prepared by the sub-contractor and submitted to the Engineer for his approval commencing within 3 weeks from acceptance of the tender.

- (r) Cabling and external cable routes
- (s) Details of all conduit and trunking runs for services
- (t) Details of lighting and power circuits, routes etc.
- (u) Details of sub-main switchgear and distribution boards
- (v) Fire alarm layouts and all circuit diagrams
- (w) Security system installations
- (x) Lightning protection details
- (y) Technical literature for all services
- (z) Layouts of all ducts, chases, holes, trenches and all other services throughout the whole of the building and associated external works

Two copies of the installation drawings must be submitted to the Engineer for comment before any work proceeds. The drawings will be reviewed and one copy will be reviewed and one copy will be returned stamped up with a status as follows:-

‘A’: No comments work can proceed

‘B1’: Work can proceed subject to incorporation of comments. Re-submit drawing

‘B2’: Work can proceed subject to incorporation of comments. Re-submit drawing for review

‘C’: Drawing Rejected. Work cannot proceed. Re-submit drawing

No work shall be started on site until either an A, B1 or B2 status is advised to the sub-contractor.

Drawings shall be submitted to the Engineer as many times as necessary to achieve A or B1 status.

1.5. RECORD DRAWINGS

As soon as the works are complete and all tests have been satisfactorily carried out, the sub-contractor shall hand to the Engineer two sets of hard copy Record (As Built) Drawings, together with one (1 No) CD-Rom of these record drawings, showing the works as finally installed. The certificate of practical completion will not be issued until this condition has been complied with. Record Drawings are in addition to detailed Working Drawings and shall show all cable routes, circuits, trunking, conduits, plant, trenches, ductwork and ducts etc. together with the entire electrical installation, as finally installed.

The Engineer will provide the sub-contractor with a set of Contract Drawings (in addition to the two sets provided for the sub-contractor’s site and office use), which shall be maintained by the sub-contractor’s representative on site and which shall be used for recording contract variations as they occur. This set of Drawings shall be available for the Engineer’s inspection on site, and shall be kept up to date.

The cost of the preparation and submission of the above Contract and Record Drawings shall be deemed to be included within the sub-contractor’s prices.

1.6. MAINTENANCE MANUALS

Before issuing of “Practical Completion Certificate”, the sub-contractor shall hand over to the Engineer two full sets of operation and maintenance manuals for each of the systems, plant or equipment as installed. These manuals shall be fully illustrated and written in English.

1.7. BUILDER'S WORK AND CIVIL WORKS

All Builder's Work and Civil Works incidental to this section of the contract such as the cutting of holes in walls and floors, the provision of foundations for plant and machinery, the building in of lifting beams, breaking into the existing plant rooms and duct systems, changes in levels the protection of existing structures, painting and the re-instatement of the plant rooms and associated areas to their original standard etc. shall be the responsibility of the main contractor. The sub-contractor shall however be fully responsible for the preparation of all such details that relate to this sub-contract works, the details being subject to approval by the Engineer prior to submission of the main Contractor for action. Other items such as the fixing of brackets, cable and duct work ducts and trenching, making good etc., shall be carried out by the sub-contractor to suit the installation of all the services.

It is the sub-contractor's sole responsibility to ensure that all holes and chases etc. are in the required position and that any additional ducts, holes and chases necessary for the erection of the installations in situ concrete walls, floor slabs etc. are included in the early stages of construction as appropriate.

The sub-contractor shall furnish the Engineer and main Contractor with all information as to where foundations, brackets and fixings are required and shall ensure that such work is done in accordance with such information.

The sub-contractor shall include in his tender for all supports, fixings, the plugging of all walls, ceilings and floors to facilitate the fixing of the pipework accessories, and all other portions of the plumbing, drainage and fire fighting installations. Any purpose made fixing brackets shall also be provided and installed by the sub-contractor, including escucheon plates and the like.

The sub-contractor is to set out at the earliest opportunity the position of all holes necessary for the passage of ducts, pipe-work and conduits or otherwise required in connection with his work, and should additional holes or openings be required due to the failure of the sub-contractor to fulfil the conditions of this clause, then he must arrange for the main Contractor to make such openings, etc. at his own expense. The sub-contractor is not to arrange for the cutting of any holes or openings unless specifically authorised to do so and should he do so without approval, he will become liable for any damage to the building or fittings.

The sub-contractor shall supply and install approved pipework support brackets and hangers. It shall be deemed that the prices entered include for any special requirements and that the sub-contractor has visited the site during the tender period to ascertain all details.

The sub-contractor shall pay particular attention to the fixing and alignment of items. All items shall be installed square, true and perpendicular to floors i.e. as shown on Drawings and as may be required at site to the Engineers approval and to suite the existing and new services.

1.8. GUARANTEE

The sub-contractor shall guarantee all work for a period of six months after acceptance by the Engineer. In the event of a defect arising within the contract defects liability period, which, in the opinion of the Engineer, is due to faulty workmanship or materials, the sub-contractor shall, at his own expense, make good such defects where instructed to do so, to the satisfaction of the Engineer.

1.9. SETTING TO WORK

The sub-contractor shall instruct the Employer's Maintenance Engineer or his representative on the operation and maintenance of the various components forming the electrical installation and shall provide such drawings, diagrams and manuals to ensure the Maintenance Engineer or his representative is completely conversant with such installation.

The sub-contractor shall ensure that the Services installations are left in complete safe working order and operating to the satisfaction of the Engineer.

1.10. REGULATIONS AND STANDARDS

The installations must be carried out strictly in accordance with the following documents:-

- (viii) The current edition of the 'Regulations for the Electrical Equipment for Buildings' issued by the Institute of Electrical Engineers of the United Kingdom.
- (ix) Electric Power Act, 1997.
- (x) Relevant British Standard Specifications and Codes of Practice published by the British Standards Institution (hereinafter referred to as BS and CP. respectively).
- (xi) Regulations of the Government of Kenya.
- (xii) Any other duly constituted authorities regulations having jurisdiction over the works.
- (xiii) The Specification and accompanying documentation and drawings.
- (xiv) The Working Drawings produced by the sub-contractor and approved by the Engineer.

The sub-contractor shall undertake all modifications demanded by the authorities in order to comply with the regulations and produce all certificates, if any, for the authorities without extra charge.

1.11. QUALITY OF MATERIALS

All materials, fittings and accessories are to be new and in accordance with the requirements of the current rules and regulations where such exist, and with the relevant British Standard Specification.

Uniformity of type and manufacture of fittings or accessories is to be preserved as far as practicable throughout the whole work.

Wherever in this specification the practice is adopted of specifying a particular item as 'similar' to that listed in a particular firm's catalogue, it is to be clearly understood that this is to indicate the type and quality of the equipment required. No attempt is being made to give preference to the equipment supplied by the firm whose catalogue is quoted.

Where particular manufacturers only are specified herein no alternative makes will be considered without good reason.

All materials shall be good quality, suitable for the purpose specified, and to the approval of the Engineer.

1.12. WORKMANSHIP

The sub-contractor shall take into consideration, when pricing his tender, that there will be other sub-contractors working. Any disruptions to the new services must therefore be kept to an absolute minimum, and in this respect the sub-contractor shall include in his prices for carrying out work outside normal operating hours as may be directed by the Engineer. No claim will be entertained where abnormal working hours are required to meet this requirement and completion of the works within the specified contract period.

The sub-contractor shall be fully responsible for the co-ordination of all services, and in this respect, he shall ascertain that the installation of the service will not interfere with other new services. In all cases, services through risers, ducts etc. must be readily accessible for maintenance.

The sub-contractor shall be deemed to have included in his tender prices for locating switches, terminal points, ductwork, outlets and fixtures in positions and/or locations at least one metre both horizontally and vertically from those positions indicated on the contract drawings. Within these limits no variations in the sub-contract sum will be made unless the work has already been executed in accordance with previously approved Working Drawings.

All trade work shall be carried out by tradesmen fully competent and qualified in their respective trades, and the entire installation shall be performed in a neat and workman-like manner.

The sub-contractor shall take every precaution to avoid damage to all new property including roads, paved walkways, grassed areas, landscaping, cables, drains and other services, and he will be held responsible for and shall make good all such damage arising at his own expense to the satisfaction of the Engineer.

The sub-contractor will be responsible for the exact runs and placing of conduits, boxes, ductwork and accessories that are to be cased in concrete ceilings, floors, walls, columns and beams, and for the proper fixing of the conduit work and accessories to the shuttering and the steel reinforcement work.

Where conduit is to be concealed, the pipes etc. shall be in an exact position relative to the finished plaster or such other finishes as may be applied to enable adequate cover to be applied.

Where services are run above the false ceilings the sub-contractor shall ensure that access to all services is readily available such that future maintenance can be carried out without difficulty. Full details shall be included on the Working Drawings such that the Engineer can give consideration to the sub-contractor's proposals.

1.13. LAYING OUT OF WORK

The sub-contractor will be responsible for laying out his work and shall obtain all necessary information as may be required to carry out the work, and such information shall be obtained sufficiently in advance to avoid any possibility of delay to the works as a whole.

The sub-contractor shall be fully responsible, and shall inform himself of, the details of all work being carried out by the various trades on Site, particularly where such trades may interfere one with the other, or where co-ordination is necessary. No claims for extra costs will be met arising from omissions, oversights, or neglect in this regard.

The sub-contractor shall arrange for the supply, in advance of the delivery of the equipment, of all necessary foundation bolts, templates, nuts, plates, sleeves, anchorage, etc. as required and as may be directed by the Engineer.

1.14. ERECTION AND CHECKING OF WORK

The sub-contractor shall provide, and be solely responsible for, all skilled and unskilled labour, tools, lifting tackle and other equipment required for transport to the site, the handling and transport about the site and the erection of the plant and equipment.

As each part of the Works is erected, it shall be subject to approval by the Engineer.

All parts shall pass such tests on the site as required by the Engineer to prove compliance with the contract irrespective of any tests which may already have been carried out at the Manufacturer's Works. In particular all electrical pressure tests made at the Manufacturer's Works shall be repeated at voltages approved by the Engineer.

The sub-contractor shall supply and install all supports, fixing, brackets and similar items as may be necessary for the completion of the installation of the services as specified and as shown on the Drawings.

1.15. PERFORMANCE AND ACCEPTANCE TEST ON SITE

The sub-contractor shall give to the Engineer in writing at least five days notice of the date after which he will be ready to make the specified tests on completion of installation. Unless otherwise agreed, the tests shall take place within seven days after the said date on such day or days as the Engineer shall in writing notify the sub-contractor. The tests shall be carried out under normal working conditions to the satisfaction of the Engineer and shall extend over such continuous periods as he may direct.

All skilled labour, supervision, apparatus, power supply for tests and instruments required for carrying out the tests efficiently will be the responsibility and at the expense of the sub-contractor. The accuracy of the instruments shall be demonstrated if required.

If any part of the installation, plant or equipment fails to pass the specified tests, further tests of the said part shall, if required by the Engineer, be repeated. The sub-contractor shall, without delay, put in hand such modifications as are necessary to meet the requirements as described in the Contract and any expense which the Employer may have incurred by reason of such further tests shall be deducted from the sub-contract price.

Each completed system within the installation shall be tested as a whole under operating conditions to ensure that each component functions correctly in conjunction with the rest of the system.

1.16. TEST RECORDS

The sub-contractor shall make all necessary records of the tests carried out, and when the tests have been successfully completed, he shall provide the Engineer with tests records and reports in a form to be agreed.

The electrical services will be deemed to be complete when the following obligations have been fulfilled by the sub-contractor:-

- e) The satisfactory completion of the Performance and Acceptance Tests on Site.
- f) Test records and reports have been received.
- g) The handing over of two preliminary sets of Record Drawings. The supply of these preliminary Record Drawings shall not relieve the sub-contractor of his obligations to supply Record Drawings in accordance with the requirements of the Specification.
- h) The issue of a completion certificate as required by BS 7671:1992.

1.17. DUST, INSECT AND VERMIN PRODUCTS

All equipment which is affected by ingress of dust shall be effectively dust proofed and also vermin proofed where no protection is afforded in the normal manufactured form. All materials used shall be in general resistant to attack by insects, micro-biological life or other local fauna and such materials shall be to the approval of the Engineer.

1.18. PAINTING AND FINISHING

All mechanical and electrical equipment installed under this sub-contract shall be painted or otherwise finished to approval in accordance with B.S. Code for Standard Colours including all pipework and ductwork, etc. Such finish shall be entirely compatible with the conditions of heat, humidity, exposure to the weather, and other relevant factors arising from the materials, location and condition of operation of the equipment.

The Engineer may request examples of paint finishes, the cost of which shall be deemed to have been included within the tendered prices for all works.

All final painting of equipment, fixtures, and accessories shall be carried out by the sub-contractor, except where it is the usual practice of the manufacturer of items of plant, equipment, and switchgear etc. to apply a high standard of protective finishing paintwork in the shop before despatch. This will be acceptable provided any damage to paintwork which occurs before the plant is taken over, is made good by the sub-contractor at his own costs.

The interior of electrical switchboards, control panels, and similar items, where supplied by the sub-contractor shall be finished in approved enamel and shall comply with the appropriate B.S for enamel finish. The exteriors of such panels and enclosures shall be of British Standard Specification colour as specified by the Engineer.

1.19. LABELS

All items of plant, cables etc. shall be neatly and clearly labelled externally with identification marks corresponding with those on Drawings or in Specifications. Final details shall be agreed.

Identification labels shall be of laminated plastic material engraved, black or white, with no less than 6mm Lino style letters and shall be fixed on or adjacent to all items by means of at least two brass screws or to approval.

All main switches, circuit breakers, isolators, motors, switch-fuse, consumer's service units, distribution boards etc. shall be neatly and clearly labelled externally with identification marks corresponding with those on Drawings or in Specifications. Final details shall be agreed.

1.20. SPARE PARTS AND SPECIAL TOOLS

The sub-contractor shall submit his recommended list of spares covering a period of two years for all plant and auxiliary equipment supplied under this sub-contract. This list shall be priced individually, but not carried forward to the Bills of Quantities where provisional sums have been included for the purchase of spare parts. Before a Taking-Over Certificate is issued a full set of spares as agreed shall be handed over to the Engineer.

Complete sets of any special tools, as detailed in the Data Schedules, necessary for the operation, maintenance and dismantling of various sections of the plant and equipment shall be provided in a strong box or boxes each fitted with a suitable padlock and two keys. Such tools shall not be used by the sub-contractor during the erection of the plant or equipment. The cost of these tools shall not be carried forward to the Bills of Quantities where a provisional sum has been included for the purchase of these special tools.

1.21. SPECIALIST MANUFACTURERS AND SUB-CONTRACTORS

Where specialists are nominated by the Employer, the sub-contractor shall appoint specialist manufacturers and contractor for any sections of the Works described herein in which he is not himself an experienced, recognised and approved operator.

The Tenderer shall, on submission of his Tender, indicate the names of all proposed specialist manufacturers and contractors, together with the precise sections of the Works for which each will be responsible. The sub-contractor may be required to seek alternative manufacturers or contractors or to accept specialists nominated by the Employer, it shall be deemed that the prices entered include for this requirement.

The sub-contractor shall allow in his prices for phasing work to meet the requirements of the other sub-contractors and any specialists, and for varying his programme or otherwise, to comply with the erection programme of such specialists or sub-contractors. No additional costs will be allowed to the sub-contractor for any disruptions to his programme, or otherwise, in his compliance with the above requirements.

1.22. USE OF SITE

The lands and other places outside the Site which are the property of or under the control of the Employer shall not be used except with the approval of the Engineer.

The sub-contractor shall at any time remove any vehicle, wagon, or any other obstruction within his control that may be required to be moved by the Engineer for any purpose and the sub-contractor shall move such obstruction promptly on instruction being given and at his own cost, unless the Engineer shall decide otherwise.

The sub-contractor shall maintain access for the inspection, operation and maintenance of any of the Employer's plant or work which lies within the Site or elsewhere. The sub-contractor shall not use any portion of the site for any purpose not connected with the Works unless the prior written permission of the Engineer has been obtained.

1.23. POSSESSION OF SITE

It shall be deemed that the prices entered by the sub-contractor for the completion of the works are inclusive of all required temporary supplies as may be directed by the Engineer or the Employer. Other details shall be fully agreed as the works proceed to suit the operational situations as and when they arise.

1.24. INTERFERENCE WITH THE WORKS

The sub-contractor shall not interfere in any way with any existing Works whether the property of the Employer or of a third party and whether the property of the Employer or of a third party and whether the position of such works is indicated to the sub-contractor by the Engineer or not except where such interference is specifically described as part of the Works either in the contract or in any instruction from the Engineer.

1.25. WATER AND POWER FOR USE ON THE WORKS

Water for construction purposes and for use by the sub-contractor's staff during the contract period will be the responsibility of the main contractor. The sub-contractor will be liable for the cost of any water used. In this respect the sub-contractor shall liaise with main contractor who may be able to assist.

The main contractor shall be responsible for the supply of all electrical power for his own and the nominated sub-contractor's use prior to the issue of the Taking-Over Certificate. However, the individual sub-contractor shall be liable for the cost of any electric current used and any installations provided especially for their use.

1.26. TELEPHONE AND COMMUNICATIONS

The sub-contractor shall liaise with the main contractor for the provision of a telephone at the site, the sub-contractor being fully responsible for all charges and costs incurred in providing this facility.

1.27. SITE OFFICES, WORKSHOP AND STORAGE

An area of land will be provided by the main contractor for the sub-contractor's site offices, workshops and storage. The sub-contractor shall be responsible for providing all buildings, fencing, etc. that he may require and on completion of the Works shall be required to remove all such buildings, fencing etc. and to restore the land to its original condition.

The sub-contractor shall state, with the Tender, the areas that he requires for his site offices, workshops and storage. The areas of land available are limited and the Employer reserves the right to allocate areas of land smaller than the sub-contractor may require, in which case, the sub-contractor shall make such additional or alternative arrangements as may be necessary for his full requirements, all at his own cost.

1.28. HEALTH AND SAFETY OF WORKS

The sanitation of the works shall be the responsibility of the main contractor who shall arrange and maintain all required sanitation facilities to the satisfaction of the Local Authorities, Labour Department and Engineer.

The sub-contractor shall warn his employees and other specialists and sub-contractors that any employee found fouling the site shall be removed from the site immediately.

In this respect, the sub-contractor shall liaise with the main contractor for temporary toilet and ablution facilities, these facilities being connected, on a temporary basis, but to approval, into the existing foul sewage system. Full details shall be agreed. These temporary ablutions are a specific requirement of the Employer and shall therefore be provided for this duration of the contract, all items being removed at the completion of the Works and the existing system fully reinstated to its original condition.

1.29. PROTECTION OF WORKS

The sub-contractor shall carefully protect from injury by weather all work and materials which may be affected thereby and allow in his prices for all dams, pumping, shoring, temporary drains, sumps etc. necessary for the purpose, and shall clear away and make good at his own cost to the satisfaction of the Engineer all damage caused thereby.

1.30. SUNDRIES

The necessary holding down bolts, supporting brackets and templates, guards and screens, locks, piping, conduits, lamps and other requisite sundries whether specified in detail or not shall be provided, under the contract and it shall be deemed that the sub-contractor's prices, rates and the like include for all such items.

1.31. DELETION OF ITEMS FROM CONTRACT

Where Provisional Sum items have been identified within the Bills of Quantities these may be expended in whole, in part or may be totally deleted from the sub-contract works. In addition, certain items that have been designed, specified and included within the Bills of Quantities may finally be deleted from the sub-contract as the Employer may decide otherwise. It shall be deemed that the tender price entered by the sub-contractor has taken into account the possible deletion of

these items, and Provisional Sum items, as no claims for loss or profit or any other such claim will be entertained.

1.32. SCHEDULES OF TECHNICAL DATA

Where included in the Tender Documents, Schedules of technical data shall be completed by all Tenderers, otherwise the Tender may not receive full consideration, and will be liable to rejection.

1.33. COPIES OF ORDERS

Copies of all orders for major items of plant, equipment and materials places with suppliers shall be provided in triplicate to the Engineer.

UNINTERRUPTIBLE POWER SUPPLY

1 NO. 60kVA, 1 NO. 11kVA THREE PHASE OUTPUT, UNINTERRUPTIBLE POWER SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty Three-phase, solid-state, uninterruptible power supply system. The uninterruptible power supply system, hereafter referred to as the UPS, shall provide high-quality AC power for sensitive electronic equipment loads with battery power to maintain uptime. The UPS shall operate in conjunction with the existing building electrical system to protect electronic equipment from power disturbances that may occur with utility power, such as voltage fluctuations, frequency variations, brownouts, power surges and sags.

1.02 SYSTEM DESCRIPTION

Standard UPS System will include a minimum of (1) Rectifier, (1) Inverter, (1) Static bypass and (1) Battery system.

A. Components:

1. Rectifier
2. Inverter
3. Sealed Lead Acid Batteries
4. Battery Charger
5. Automatic Bypass
6. User Interface Panel
7. Communication Card Slots (1)
8. Relay output contact (1)
9. Hardwired Input, Output and Bypass

B. Modes of Operation: The UPS shall operate as a double conversion UPS with the following operations modes:

1. **Normal**

During the Double Conversion Mode the rectifier shall derive power as needed

from the commercial AC utility or generator source and supply filtered and regulated DC power to the on-line inverter. The inverter shall convert the DC power to highly regulated and filtered AC power for the critical loads.

2. Battery

Upon failure of the AC input source, the critical load must continue being supplied by the inverter without any switching. The inverter must obtain its power from the battery. There must be no interruption in power to the critical load upon failure or restoration of the AC input source.

3. Recharge

Upon restoration of the AC input source, the rectifier/battery charger must recharge the battery. The inverter shall with no interruption in power regulate the power to the critical load.

4. Bypass:

The static bypass switch has to be used for transferring the critical load to mains supply without interruption. Automatic re-transfer to normal operation must also be accomplished with no interruption in power to the critical load. The static bypass switch has to be capable of manual operation.

5. External maintenance bypass:

The external maintenance bypass switch is required and shall be as supplied by the client but installed by the electrical contractor. Integral to the UPS is the integral maintenance bypass. It shall be used for supplying the load directly from the mains supply, while the UPS is isolated for maintenance.

1.03 APPLICABLE STANDARDS

The UPS shall be designed in accordance with the applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.

Safety

- A. IEC 62040-1 or EN 62040-1
- B. IEC 60950-1 or EN 60950-1

Emission and Immunity:

- C. IEC 62040 (International Electrotechnical Commission) - Uninterruptible power systems (UPS) - Part 2: Electromagnetic Compatibility (EMC) Requirements.

- D. EN61000-4-2,-3,-4,-5
 - Slow high energy surges in input/output lines:
1 kV line/earth, 0.5 kV line/line (IEC 61000-4-5)
 - Fast low energy transients in power lines:
2 kV line/earth (IEC 61000-4-4)
 - Fast low energy transients (burst) in control and signal lines:
1 kV line/earth (IEC 61000-4-4)
 - Electrostatic discharge (ESD):
8 kV air discharge, 6 kV contact discharge (IEC 61000-4-2)
 - Electromagnetic field: IEC 61000-4-3 level 3
- E. IEC 62040 (International Electrotechnical Commission) - Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements.

Markings

- F. CE-Mark (Europe)
- G. CB-Mark

1.04 SUBMITTALS

- A. Submit one copy of a concise operation and maintenance manuals (i.e. User Manual).

1.05 QUALIFICATIONS

- A. The manufacturer of the UPS shall have a minimum of ten years experience in the design, manufacture and testing of Uninterruptible Power Supplies.
- B. The manufacturer shall be ISO9001 registered.

2.01 GENERAL

A. Model

The UPS system is initially provided as a parallel synchronized redundant system. The system can be configured with numerous options, including:

1. External Matching Battery Cabinets
2. Several Connectivity Options
3. Wall Mounted Maintenance Bypass Cabinets
4. External switchboards with paralleling busbars (by others)

2.02 UNINTERRUPTIBLE POWER SUPPLY

A. Converter (rectifier): Incoming power shall be filtered and converted to DC by a sine-wave rectifier. The DC power is then processed by a high-frequency converter to supply power to the inverter. The Converter corrects the input power factor to 0.99 and draws sinusoidal current (with less than 5% THD) from the utility. In the event of utility failure, the converter shall be supplied power without interruption from the internal or external batteries. During normal operation, the batteries will be charged through the rectifier.

1. Overload Capacity: The converter shall be capable of supplying up to 150% of rated load for at least 5 seconds if no bypass is available.

B. Inverter: The inverter converts the DC Power to regulated AC Power for critical loads.

1. Output Voltage: The inverter output voltage is specified in section 2.03.
2. Voltage Regulation: The inverter steady state voltage regulation is +/- 2% in steady state and +/- 5% for a 0 to 100% load step.
3. Frequency Control: The inverter steady state frequency regulation is +/-0.005 Hz free running in steady state. UPS is synchronized to mains in normal operation.

C. Batteries: The batteries shall be sealed, lead acid, maintenance-free, high-rate discharge cells. They will be kept fully charged by the battery charger. They have an expected life of 200-300 complete full load discharge cycles when operated and maintained within specifications.

D. Battery Charger: The battery charger (or rectifier) is responsible for charging the battery and maintaining full battery charge when AC is applied to the UPS.

- E. Automatic Bypass (Static bypass): The UPS shall provide an alternate path to the commercial AC or generator source in case of an overload, load fault or internal UPS failure. This input must match the output in voltage, frequency, and grounding in order to properly utilize this feature.
- F. User Interface Panel: The UPS shall provide a user-friendly interface panel, which allows the user to: change operating modes, set system parameters, check alarm logs, etc. This LCD display should have back light and languages consisting of English and the number of optional local languages.
- G. (1) Communication card slots: The UPS shall provide (1) Communication card slots in the front of the UPS allowing for additional connectivity options, including SNMP, AS400 relays, and Modbus/Jbus capabilities, etc.
- H. Disable Bypass Operation connection: If active the automatic transfer to the static bypass is prevented. Synchronization to bypass is not carried out (default).
- I. ABM resting connection: If active the batteries are disconnected from the UPS unit. The discharge of batteries is not prevented but charging will not start.
- J. Remote ON/OFF connection: If active the UPS output turns off regardless of mode of operation. Auxiliary power, communications and rectifier/battery charger shall remain functional.
- K. External Bypass connection: If active the UPS is forced to static bypass operation regardless of the bypass status.
- L. External Battery Breaker Status: If active the UPS knows that the batteries are connected.
- M. Remote Go To Bypass connection: If active the UPS transfers to bypass if bypass voltage, frequency and synchronization are ok.
- N. Remote Go To Normal connection: If active the UPS transfer to inverter operation if not prohibited by EPO or alarm condition.
- O. External Matching Battery Cabinets: 64 and 96 block (7 Ah 12V) matching battery cabinets for extended runtime requirements.

- P. Wall Mounted Maintenance Bypass Cabinets: Wall Mounted Make Before Break or Break Before Make Bypass Cabinets (supplied by client).
- Q. SNMP/Web Adaptor: Internal communication card providing network communication via SNMP protocol.

2.03 SYSTEM RATINGS AND OPERATING CHARACTERISTICS

A. System Input

- 1. Input Voltage Operation Range
 - a. Nominal Input Voltage range is 220-240VAC or 3x380-400VAC
 - b. Maximum Input Voltage range is 176-276VAC or 3x339-484VAC
- 2. Input Frequency
 - a. 45 to 65Hz
 - b. auto sensing
- 3. Input Power Factor is 0.99
- 4. Input Current Distortion: 5% THD maximum at full linear load.
- 5. Inrush Current: 100% of full load input current
- 6. Surge Protection: IEC62040-2

B. System Output, Normal Mode

- 1. Nominal Output Voltage
 - a. 380, 400 and 415 VAC with Three-phase input.
- 2. Voltage regulation: +/-3% of selected output voltage in steady state

3. Transient Voltage Response:
 - a. Voltage Transient Response: +/- 3% maximum while in Double Conversion mode with resistive step loads from 0% to 50%, 50% to 100%, 100% to 50% and 50% to 0%. Or, +/-5% maximum while in Double Conversion mode with resistive step loads from 0% to 100% or 100% to 0%.
4. Transient Recovery Time: To within 1% of steady state output voltage within 50 milliseconds
5. Voltage THD:
 - a. 3% Total Harmonic Distortion (THD) maximum into a 100 percent linear load
 - b. 5% THD maximum into a 100% non-linear load
6. Nominal Frequency: 50 or 60 Hz selectable
7. Frequency Regulation:
 - a. Sync with line within +/-3 Hz of nominal line frequency, or
 - b. Transfer to battery power with frequency at +/-0.1 Hz of the selected nominal frequency if out of +/-3 Hz specification.
8. Current Overload Capability without bypass:
 - a. 150% for 5 seconds
 - b. 220% for 300 ms
9. Bypass:
 - a. Automatic bypass shall provide an alternate path to power in the case of overload, inverter failure or other UPS failure.
 - b. Both integral standard internal and external Maintenance Bypass can be utilized with the UPS to all servicing of the UPS.
 - c. Transfer time to and from any internal bypass shall be no-break.
10. Efficiency:

- a. Typical of 98% while in bypass mode
- b. Nominal 93% in Normal Mode with full resistive load and fully charged batteries

C. System Output, Battery Mode:

1. Nominal Output Voltage: This shall be the user selected output voltage.
2. Voltage Regulation: +/-3% of selected nominal voltage
3. Transient Voltage Response
 - a. Voltage Transient Response: +/- 3% maximum while in Battery mode with resistive step loads from 0% to 50%, 50% to 100%, 100% to 50% and 50% to 0%. Or, +/-5% maximum while in Battery mode with resistive step loads from 0% to 100% or 100% to 0%.
4. Transient Voltage Recovery: To within 1% of steady state output voltage within 50 milliseconds
5. Voltage THD:
 - a. 3% Total Harmonic Distortion (THD) maximum into a 100 percent linear load
 - b. 5% THD maximum into a 100% non-linear load
6. Frequency Regulation: +/-0.005 Hz of selected nominal frequency
7. Overload Capacity:
 - a. 150% for 5 seconds
 - b. 220% for 300 ms

D. Mechanical Construction:

1. All materials and components making up the UPS shall be new, of current manufacture, and shall not have been in prior service except as required during

factory testing. The UPS shall be constructed of replaceable subassemblies.
All active electronic devices shall be solid-state.

2. The UPS unit comprised of: input rectifier/battery charger, inverter, bypass, and battery consisting of the appropriate number of sealed battery modules, shall be housed in a single freestanding enclosure. The UPS cabinet shall be cleaned, primed, and painted with the manufacturer's standard color. Casters and leveling feet shall be provided as standard.

2.04 BATTERY

- A. Battery Type: Valve Regulated Lead Acid (VRLA), minimum 10 year float service life at 25 degrees C.
- B. UPS Holdover Time (Runtime): Each UPS system, consisting of a minimum of one battery string for each power modules shall have a minimum holdover time of 5 minutes.
- C. Extended Holdover Time (Runtime): Each UPS system shall have capability for addition of extra matching battery cabinets (in two cabinet sizes) to increase the total holdover time to 31 minutes.
- D. Battery Recharge Time:
 1. Base UPS System consisting of one or more battery will have a recharge time of max. 10 hours to 90% usable capacity @ nominal line after a full load discharge.
- E. Bus Voltage: Nominal bus voltage is 432 VDC. This consists of 36 battery blocks with 7 Ah or 9 Ah capacity.
- F. Battery Protection:
 1. Short Circuit Protection: Over-current protection shall protect the batteries from all short circuit and reverse polarity fault conditions.
 2. Battery Module Fusing: Internal Battery string fusing shall be provided.
 3. Under-voltage Protection:
 - a. Inverter cutoff voltage: Battery operation shall be terminated when the battery voltage drops to the 1.75 VPC set point.
 - b. Protective shutdown voltage: Inverter shall shutdown after 1 min when the battery voltage drops below 1.75 VPC volts-per-cell typical.

4. Over-voltage Protection: If the UPS systems battery bus voltage exceeds the preset setpoint then the UPS will disable charger and alarm a high battery condition.

G. Advanced Battery Management:

1. Battery recharge: After recharging batteries to full capacity, the charger will enter the rest mode to increase the battery lifetime according the ABM cycle. Hence, continuous float charging of the battery shall not be allowed.

The active battery charger states are constant-current (charge mode), constant-voltage (float mode) and no-charge (rest mode).

2. Battery Runtime Monitoring: UPS shall monitor batteries and provide status to end user of battery runtime via front panel, serial communications, or both. Runtime calculations to be based on load demand and analysis of battery health.
3. Battery Health Monitoring: UPS shall periodically test&monitor battery health and provide warnings visually, audibly and/or serially when battery capacity falls below 80% of original capacity. Battery testing may also be user initiated via front panel or serial communications.

2.05 SYSTEM INPUT & OUTPUT CONNECTIONS

A. AC Input:

1. All UPS units shall be capable of utilizing Hardwired Input.

B. AC Output:

1. All UPS units shall be capable of utilizing Hardwired Output.

C. Extended Battery Connector: Ext. battery cabinets include cable kit to connect each battery cabinet to the UPS.

D. (1) Communication card slots: The UPS shall provide (2) Communication X-slots in the back of the UPS allowing for additional connectivity options, including SNMP/Web, AS/400 relays, Modbus/Jbus capabilities, etc.

- E. (1) Programmable Input connections: The UPS shall provide a built-in inputs for field connection (environmental input). The inputs shall be parameter programmable to suit the needs of the application to a generator.

2.06 USER INTERFACE

- A. Front Panel Display: The UPS shall include a front panel display consisting of a graphical LCD display with back light, four status LED's, and a four-key keypad.
1. Graphical LCD display: Basic Language (English and local selectable language), display of unit function and operating parameters. It shall be used to signify the operating state of the UPS, for indicating alarms, for changing operations control parameters and set points.
 2. Four status LED's, which indicate:
 - a. Alarms, with a Red LED
 - b. On Battery, with a Yellow LED
 - c. On Bypass, with a Yellow LED
 - d. UPS ok, with a Green LED
 4. Four-Key Multifunction Keypad: UPS shall have keypad to allow user to adjust UPS parameters, view alarm and inverter logs, change UPS operational modes, turn UPS on and off.
- B. Power Management Software Package: The UPS shall include serial communications interface that provides the following communication capabilities:
1. Monitor and graphically display input and output voltage and other operating characteristics.
 2. Notify end users in the event of a power anomaly via network, E-mail or page
- C. Communication Ports:
1. (1) Communication card slots: The UPS shall provide (2) Communication X-slots in the back of the UPS allowing for additional connectivity options, including SNMP/Web, AS/400 relays, Modbus/Jbus capabilities, etc.

2.07 ENVIRONMENTAL CONDITIONS

- A. The UPS shall be certified to the following safety standards:
 - 1. EN 62040-1, IEC 62040-1, EN 60950
- B. The UPS shall meet Category 3, IEC62040-2 for Emissions and IEC62040-2 (IEC610003-2) for Harmonics.
- C. Audible Noise: Less than 50 dBA (A weighted) at 1 meter from all sides in all system modes.
- D. Ambient Temperature
 - 1. Operating: UPS 0 deg C to +40 deg C; battery 20 deg C to 30 deg C for optimum performance.
 - 2. Storage: UPS -40 deg C to +60 deg C; battery 0 deg C to 32 deg C
- E. Relative Humidity
 - 1. Operating: 5 to 95% non-condensing.
 - 2. Storage: 5 to 95% non-condensing.
- F. Altitude
 - 1. Operating: To 1000 meters. De-rating or reduced operating temperature range may be required for higher altitudes.
 - 2. Storage: To 3000 meters.
- G. Electrostatic Discharge: The UPS shall be able to withstand a minimum 8 kV without damage and shall not affect the critical load.

3.01 INSTALLATION

- A. Install in accordance with manufactures instructions and associated User's and Installations Manual.

BILLS OF QUANTITIES

GENERAL NOTES

28. Unless stated otherwise in the tender documents, the Contract shall be for the whole Works, based on the unit rates and prices in the Bills of Quantities submitted by the bidder.
29. The bidder or tenderer shall fill in rates and prices for all items of the Works in the contract bills. Items against which no rate or price is entered by the bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the rates for other items and prices in the Bills of Quantities.
30. All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date for submission of bids, shall be included in the rates and prices and the total Bid Price submitted by the bidder. The bid rates and prices shall also include all associated costs to be borne by the Contractor including all overheads, profits and supervision costs.
31. The rates in the contract bills shall be used in the valuation of variations and for interim payments.
32. Unless otherwise provided in these bills of quantities, the rates and prices quoted by the bidder shall not be subject to adjustment during the performance of the Contract on account of price fluctuations or fluctuations in the rate of exchange of the various currencies.
33. There shall be no component of 'Preliminaries and General Items' as these have been captured in the bills of quantities for main works.
34. Rates shall be inclusive of all Labour, tools, overheads, profits etc. and all associated/ancillary costs necessary for completing the installations.

TENDER EVALUATION CRITERIA

After tender opening, the tenders will be evaluated in 3 stages, namely:

1. Preliminary evaluation
2. Technical evaluation
3. Financial Evaluation

1.1. PRELIMINARY EVALUATION

S/No	MANDATORY REQUIREMENTS(MR)
1	Valid Copy of certificate of incorporation/ Registration.
2	Valid Copy of current KRA Tax compliance certificate
3	Valid copy of NCA 4 and above registration certificate in the builders works.
4	Dully filled, stamped and signed Confidential business questionnaire
5	Tender Security of Kshs 700,000.00 (valid for 365 days from the date of Tender Opening) from a reputable Bank or reputable Insurance company as approved by IRA.
6	Current annual contractors practicing license from NCA 4 and for builders works.
7	Dully filled, stamped and signed Form of Tender.
8	Provide Power of attorney
9	Bank reference letter (valid for the last 6 months)
10.	Mandatory site visit form
11	Detailed work plan

Tender Bid Document submitted without ANY of the above-mentioned Mandatory documents shall be rejected by Evaluation Committee and will therefore not proceed to the technical and financial Evaluation

N.B.

They Authority may seek further classification/confirmation if necessary, to confirm authenticity or compliance of any condition of the tender.

1.2. TECHNICAL EVALUATION

(a) Technical/Vendor Evaluation Criteria

The following criteria will be used in the evaluation of all potential suppliers. The documents submitted will be evaluated for suitability and awarded marks. The cut off score shall be 42 and above out of 60 i.e. (70 %)

The scores shall be pro-rated to 100.

Tender No: KRA/HQS/NCB-073/2019-2020
Bill of Quantities

<u>Description of Criteria</u>	Maximum Score	Cut off Score
<p>Proof of qualified and experienced technical key personnel (qualifications considered will be Civil/Structural Engineering, Electrical Engineering, Mechanical Engineering, Architecture, Interior design, Quantity Surveying, Construction Management and other equivalent qualifications). Bidders must provide at least a minimum of Four (4) key technical staff to be involved in the project with at least five (5) years' experience. (CVS must be supported by Academic Certificates and submitted together with the bid). The authority reserves the right to determine the authenticity of the academic certificates submitted. Bidders who submit fake certificates shall be blacklisted forthwith.</p> <p>Degree10 Diploma8 Certificate6</p>	40	32
<p>Reference from at least Four (4) main past clients (Only for projects above KES 50 million in last 10 years) (attach reference letters on client letter head accompanied by copy of contracts/LSO and completion certificates) relevant to the procurement item and include a summary of the services rendered, value of contract, contact person and the email/telephone number. For a complete reference, all the items highlighted above must be presented. For each reference provided (5 Marks for each)</p>	20	10
<u>Total Score</u>	60	42

NB: Bidders will be required to meet the cut off score on every criteria under vendor evaluation in order to qualify for further evaluation

1.3 FINANCIAL EVALUATION

Bids that pass the Technical Evaluation shall be subjected to the Financial Evaluation in two stages as follows

1. Tender Rates and arithmetic errors
2. Tender Sums
3. Completeness of the BQ (provide quotes for all line items in the BQ)

NB: Examination of Arithmetic Errors. Bids arithmetic errors shall be disqualified.

According to Section 82 of the Public Procurement and Asset Disposal Act (2015) that 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 or by any person or entity, The committee will check the arithmetic errors and notify the winning bidder in case errors are found in the document, however no alteration of bid price will be done.

OVERAL EVALUATION CRITERIA

Criteria	Maximum Score/ Requirement	Cut-off Score
Tender Responsiveness	Mandatory	Provision of all Requirement
Vendor Evaluation	100	70
Financial Evaluation	Lowest evaluated responsive bidder	