# JARAMOGI OGINGA ODINGA UNIVERSITY

# OF SCIENCE AND TECHNOLOGY

## TENDER DOCUMENT

## FOR

**TENDER NUMBER JOOUST/ONT/C1/37/2019-2020: TENDER FOR ELECTRICAL WORKS; GENERATOR INSTALLATION, AUDIO VISUAL AND STRUCTURED CABLING INSTALLATION FOR THE RESEARCH CENTRE AT MIYANDHE CAMPUS - BONDO, SIAYA COUNTY**

**CLOSING DATE 24TH JULY 2020**

**OPENING DATE 6TH AUGUST 2020**

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# INTRODUCTION

1.1 This standard tender document for procurement of works has been prepared for use by procuring entities in Kenya in the procurement of works (i.e Electrical and Mechanical Works – Including Erection on Site)

1.2 The following guidelines should be observed when using the document:-

(a) Specific details should be furnished in the tender notice and in the special conditions of contract (where applicable). The tender document issued to tenderers should not have blank spaces or options.

(b) The instructions to tenderers and the General Conditions of Contract should remain unchanged. Any necessary amendments to these parts should be made through Appendix to instructions to tenderers and special conditions of contract respectively.

1.3 (a) Information contained in the invitation to tender shall conform to the data and information in the tender documents to enable prospective tenderers to decide whether or not to participate in the tender and shall indicate any important tender requirements

(b) The invitation to tender shall be as an advertisement in accordance with the regulations or a letter of invitation addressed to tenderers who have been prequalified following a request for prequalification.

1.4 This document is based on PART 1 of the third Edition of the International Federation of Consulting Engineers (Federation Internationale des Ingenieurs Con Seils – FIDIC) Conditions of Contract for Electrical and Mechanical Works, 1987 (reprinted May 1988 with Editorial Amendments).

1.5 The cover of the tender document should be modified to include:-

i. Tender number.
ii. Tender name.
iii. Name of procuring entity.
iv. Delete name and address of PPOA

# SECTION 1

## SECTION I INVITATION TO TENDER

**TENDER REF NO: JOOUST/ONT/C1/37/2019-2020**

**TENDER NAME: TENDER FOR ELECTRICAL, GENERATOR INSTALLATION, AUDIO VISUAL AND STRUCTURED CABLING INSTALLATION FOR THE RESEARCH CENTRE AT MIYANDHE CAMPUS - BONDO, SIAYA COUNTY**

1.1 Jaramogi Oginga Odinga University of Science and Technology invites sealed bids from eligible candidates for Tender for Electric Generator Installation, Audio Visual and Structured cable Installation for Research Centre at Miyandhe Campus - Bondo, Siaya County**.**

1.2 Tender documents with detailed specifications shall be downloaded free of charge at the University website **www.jooust.ac.ke** and Public Procurement Information Portal **www.tenders.go.ke.**Tenderers who download the tender document and intend to submit a bid are required to submit their particulars to the University through email: **proc@jooust.ac.ke** for the purpose of receiving any further clarification and\or addendum.

1.3 **THERE SHALL BE MANDATORY SITE VISIT TO BE HELD ON 10TH JULY 2020 FROM 10 AM AT THE ADMINISTRATION BLOCK SITE IN THE MAIN CAMPUS**

1.4 Dully filled tender documents are to be enclosed in plain sealed envelopes, marked with the tender number, tender description **and bearing no indication of the applicant**, clearly /marking each "**ORIGINAL TENDER**" and "**COPY OF TENDER**" should be deposited in the tender box at Jaramogi Oginga Odinga University of Science and Technology or be addressed to:-

The Vice Chancellor,
Jaramogi Oginga Odinga University of Science and Technology,
P.O. Box 210-40601
BONDO.

1.5 The tender document should reach on or before **24TH JULY 2020**

1.6 Due to COVID-19, the application documents will be open on **6TH AUGUST 2020** at the Assembly Hall, Main Campus in the presence of the candidates or their representatives who choose to attend.

**NB: Due to ministry of health instructions on social distancing, the number of bidders/representatives will be limited**

1.7 **BIDDERS MUST SERIALIZE THE BID DOCUMENT. THE UNIVERSITY SHALL NOT BEAR RESPONSIBILITY FOR THE LOSS OF ANY DOCUMENT.**

# SECTION II:

## INSTRUCTIONS TO TENDERERS

## TABLE OF CLAUSES

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AWARD OF CONTRACT

# INSTRUCTION TO TENDERERS

Note: The tenderer must comply with the following conditions and instructions and failure to do so is liable to result in rejection of the tender.

## GENERAL

### 1. Definitions

(a) "**Tenderer"** means any person or persons partnership firm or company submitting a sum or sums in the Bills of Quantities in accordance with the Instructions to Tenderers, Conditions of Contract Parts I and II, Specifications, Drawings and Bills of Quantities for the work contemplated, acting directly or through a legally appointed representative.

(b) **"Approved tenderer**" means the tenderer who is approved by the Employer.

(c) Any noun or adjective derived from the word **"tender"** shall be read and construed to mean the corresponding form of the noun or adjective **"bid".** Any conjugation of the verb "tender" shall be read and construed to mean the corresponding form of the verb "bid."

(d) **"Employer"** means a Central Government Ministry, Local Authority, State Corporation or any other Public Institution.

### 2. Eligibility and Qualification Requirements

2.1 This invitation to tender is open to all tenderers who are eligible as stated in the appendix.

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

2.3 To be qualified for award of Contract, the tenderer shall provide evidence satisfactory to the Employer of their eligibility under Sub clause 2.1 above and of their capability and adequacy of resources to effectively carry out the subject Contract. To this end, the tenderer shall be required to update the following information already submitted during prequalification:-

(a) Details of experience and past performance of the tenderer on the works of a similar nature within the past five years and details of current work on hand and other contractual commitments.

(b) The qualifications and experience of key personnel proposed for administration and execution of the contract, both on and off site.

(c) Major items of construction plant and equipment proposed for use in carrying out the Contract. Only reliable plant in good working

order and suitable for the work required of it shall be shown on this schedule.

The tenderer will also

(d) indicate on this schedule when each item will be available on the Works. Included also should be a schedule of plant, equipment and material to be imported for the purpose of the Contract, giving details of make, type, origin and CIF value as appropriate.

(e) Details of subcontractors to whom it is proposed to sublet any portion of the Contract and for whom authority will be requested for such subletting in accordance with clause 4 of the Conditions of Contract.

(f) A draft Program of Works in the form of a bar chart and Schedule of Payment which shall form part of the Contract if the tender is accepted. Any change in the Program or Schedule shall be subjected to the approval of the Engineer.

(g) Details of any current litigation or arbitration proceedings in which the Tenderer is involved as one of the parties.

**2.4 <u>Joint Ventures</u>**

Tenders submitted by a joint venture of two or more firms as partners shall comply with the following requirements:-

(a) The tender, and in case of a successful tender, the Form of Agreement, shall be signed so as to be legally binding on all partners.

(b) One of the partners shall be nominated as being in charge; and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the partners.

(c) The partner in charge shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture and the entire execution of the Contract including payment shall be done exclusively with the partner in charge.

(d) All partners of the joint venture shall be liable jointly and severally for the execution of the Contract in accordance with the Contract terms, and a relevant statement to this effect shall be included in the authorization mentioned under (b) above as well as in the Form of Tender and the Form of Agreement (in case of a successful tender).

(e) A copy of the agreement entered into by the joint venture partners shall be submitted with the tender.

**2.5 To quality for contract awards, the tenderer shall have the following:**

(a) Necessary qualifications, capability experience, services, equipment and facilities to provide what is being procured.

(b) Legal capacity to enter into a contract for procurement

(c) Shall not be insolvent, in receivership, bankrupt or in the process of being wound up and is not the subject of legal proceedings relating o the foregoing.
(d) Shall not be debarred from participating in public procurement.

## 3. Cost of Tendering

3.1 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, regardless of the conduct or outcome of the tendering process.

3.2 The price to be charged for the tender document shall not exceed Kshs.5,000/=

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

## 4. Site Visit

4.1 The tenderer is advised to visit and examine the Site and its surroundings and obtain for himself on his own responsibility, all information that may be necessary for preparing the tender and entering into a contract. The costs of visiting the Site shall be the tenderer's own responsibility.

4.2 The tenderer and any of his personnel or agents will be granted permission by the Employer to enter upon premises and lands for the purpose of such inspection, but only upon the express condition that the tenderer, his personnel or agents, will release and idemnify the Employer from and against all liability in respect of, and will be responsible for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused, which but for the exercise of such permission, would not have arisen.

4.3 The Employer shall organize a site visit at a date to be notified. A representative of the Employer will be available to meet the intending tenderers at the Site.

Tenderers must provide their own transport. The representative will not be available at any other time for site inspection visits.

Each tenderer shall complete the Certificate of Tenderer's Visit to the Site, whether he in fact visits the Site at the time of the organized site visit or by himself at some other time.

## TENDER DOCUMENTS

### 5. Tender Documents

5.1 The Tender documents comprise the documents listed herebelow and should be read together with any Addenda issued in accordance with Clause 7 of these instructions to tenderers.

a. Form of Invitation for Tenders
b. Instructions to Tenderers
c. Form of Tender
d. Appendix to Form of Tender
e. Form of Tender Surety
f. Statement of Foreign Currency Requirements
g. Form of Performance Security
h. Form of Agreement
i. Form of Advance payment Bank Guarantee
j. Schedules of Supplementary Information
k. General Conditions of Contract – Part I
l. Conditions of Particular Application – Part II
m. Specifications
n. Bills of Quantities
o. Drawings
p. Declaration Form

5.2 The tenderer is expected to examine carefully all instructions, conditions, forms, terms, specifications and drawings in the tender documents. Failure to comply with the requirements for tender submission will be at the tenderer's own risk. Pursuant to clause 22 of Instructions to Tenderers, tenders which are not substantially responsive to the requirements of the tender documents will be rejected.

5.3 All recipients of the documents for the proposed Contract for the purpose of submitting a tender (whether they submit a tender or not) shall treat the details of the documents as "private and confidential".

### 6. Inquiries by tenderers

6.1 A tenderer making inquiries relating to the tender documents may notify the Employer in writing or by telex, cable or facsimile at the Employer's mailing address indicated in the Invitation to Tender. The Employer will respond in writing to any request for clarification which he receives earlier than 7 days prior to the deadline for the submission of tenders. Written copies of the Employer's response (including the query but without identifying the source of the inquiry) will be sent to all prospective tenderers who have purchased the tender documents.

6.2 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.

6.3 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.

## 7. Amendment of Tender Documents

7.1 At any time prior to the deadline for submission of tenders the Employer may, for any reason, whether at his own initiative or in response to a clarification requested by a prospective tenderer, modify the tender documents by issuing Addenda.

7.2 Any Addendum will be notified in writing or by cable, telex or facsimile to all prospective tenderers who have purchased the tender documents and will be binding upon them.

7.3 In order to allow prospective tenderers reasonable time in which to take the Addendum into account in preparing their tenders, the Employer may, at his discretion, extend the deadline for the submission of tenders.

# PREPARATION OF TENDERS

## 8. Language of Tender

8.1 The tender and all correspondence and documents relating to the tender exchanged between the tenderer and the Employer shall be written in the English language. Supporting documents and printed literature furnished by the tenderer with the tender may be in another language provided they are accompanied by an appropriate translation of pertinent passages in the above stated language. For the purpose of interpretation of the tender, the English language shall prevail.

## 9. Documents Comprising the Tender

9.1 The tender to be prepared by the tenderer shall comprise:-

i. The form of tender and appendix thereto.
ii. A tender security.
iii. The priced Bill of Quantity and Schedule.
iv. The information on eligibility and qualification.
v. Any other materials required to be completed and submitted in accordance with the instructions to tenderers.

The Forms, Bills of Quantities and Schedules provided in the tender documents shall be used without exception (subject to extensions of the schedules in the same format and to the provisions of clause 13.2 regarding the alternative forms of Tender Surety].

## 10. Tender Prices

10.1 All the insertions made by the tenderer shall be made in INK and the tenderer shall clearly form the figures. The relevant space in the Form of Tender and Bills of Quantities shall be completed accordingly without interlineations or erasures except those necessary to correct errors made by the tenderer in which case the erasures and interlineations shall be initialed by the person or persons signing the tender.

10.2 A price or rate shall be inserted by the tenderer for every item in the Bills of Quantities whether the quantities are stated or not items against which no rate or price is entered by the tenderer will not be paid for by the Employer when executed and shall be deemed covered by the rates for other items and prices in the Bills of Quantities.

The prices and unit rates in the Bills of Quantities are to be the full [all-inclusive] value of the work described under the items, including all costs and expenses which may be necessary and all general risks, liabilities and obligations set forth or implied in the documents on which the tender is based. All duties and taxes and other levies payable by the Contractor under the Contract or for any other cause prior to the deadline for the submission of tenders, shall be included in the rates and prices and the total tender prices submitted by the Tenderer.

Each price or unit rate inserted in the Bills of Quantities should be a realistic estimate for completing the activity or activities described under that particular item and the tenderer is advised against inserting a price or rate against any item contrary to this instruction.

Every rate entered in the Bills of Quantities, whether or not such rate be associated with a quantity, shall form part of the Contract. The Employer shall have the right to call for any item of work contained in the Bills of Quantities, and such items of work to be paid for at the rate entered by the tenderer and it is the intention of the Employer to take full advantage of unbalanced low rates.

10.3 Unless otherwise specified the tenderer must enter the amounts representing 10% of the sub-total of the summary of the Bills of Quantities for Contingencies and Variation of Prices [V.O.P.] payments in the summary sheet and add them to the sub-total to arrive at the tender amount.

10.4 The tenderer shall furnish with his tender written confirmation from his suppliers or manufacturers of unit rates for the supply of items listed in the Conditions of Contract clause 47 where appropriate.

10.5 The rates and prices quoted by the tenderer are subject to adjustment during the performance of the Contract only in accordance with the provisions of the Conditions of Contract. The tenderer shall complete the schedule of basic rates and shall submit with his tender such other supporting information as required under clause 47 of the Conditions of Contract Part II.

## 11. Currencies of Tender and Payment

11.1 Tenders shall be priced in Kenya Shillings and the tender sum shall be in Kenya Shillings.

11.2 Tenderers are required to indicate in the Statement of Foreign Currency Requirements, which forms part of the tender, the foreign currency required by them. Such currency should generally be the currency of the country of the tenderer's main office. However, if a substantial portion of the tenderer's expenditure under the Contract is expected to be in countries other than his country of origin, then he may state a corresponding portion of the contract price in the currency of those other countries. However, the foreign currency element is to be limited to two (2) different currencies and a maximum of 30% (thirty percent) of the Contract Price.

11.3 The rate or rates of exchange used for pricing the tender shall be selling rate or rates of the Central Bank ruling on the date thirty (30) days before the final date for the submission of tenders.

11.4 Tenderers must enclose with their tenders, a brief justification of the foreign currency requirements stated in their tenders.

## 12. Tender Validity

12.1 The tender shall remain valid and open for acceptance for a period of ninety (90) days from the specified date of tender opening or from the extended date of tender opening (in accordance with clause 7.4 here above) whichever is the later.

12.2 In exceptional circumstances prior to expiry of the original tender validity period, the Employer may request the tenderer for a specified extension of the period of validity. The request and the responses thereto shall be made in writing or by cable, telex or facsimile. A tenderer may refuse the request without forfeiting his Tender Surety. A tenderer agreeing to the request will not be required nor permitted to modify his tender, but will be required to extend the validity of his Tender Surety correspondingly.

## 13. Tender Security

13.1 The tenderer shall furnish as part of his tender, a Tender Security in the amount and form stated in the Appendix to Instructions to Tenderers.

13.2 The tender security shall be 2 percent of the total tender price.

13.3 The tender security shall be valid for at least thirty (30) days beyond the tender validity period.

The format of the Surety shall be in accordance with the sample form of Tender Surety included in these tender documents; other formats may be permitted subject to the prior approval of the Employer. The Tender Surety shall be valid for thirty (30) days beyond the tender validity period.

13.4 Any tender not accompanied by an acceptable Tender Surety will be rejected by the Employer as non-responsive.

13.5 The Tender Sureties of unsuccessful tenderers will be returned as promptly as possible but not later than fourteen (14) days after concluding the Contract execution and after a Performance Security has been furnished by the successful tenderer. The Tender Surety of the successful tenderer will be returned upon the tenderer executing the Contract and furnishing the required Performance Security.

13.6 The Tender Surety may be forfeited:

(a) if a tenderer withdraws his tender during the period of tender validity: or

(b) in the case of a successful tenderer, if he fails

(i) to sign the Agreement, or
(ii) to furnish the necessary Performance Security

(c) if a tenderer does not accept the correction of his tender price pursuant to clause 23.

## 14. No Alternative Offers

14.1 The tenderer shall submit an offer which complies fully with the requirements of the tender documents unless otherwise provided for in the appendix.

Only one tender may be submitted by each tenderer either by himself or as partner in a joint venture.

14.2 The tenderer shall not attach any conditions of his own to his tender. The tender price must be based on the tender documents. The tenderer is not required to present alternative construction options and he shall use without exception, the Bills of Quantities as provided, with the amendments as notified in tender notices, if any, for the calculation of his tender price.

Any tenderer who fails to comply with this clause will be disqualified.

## 15. Pre-Tender Meeting

15.1 If a pre tender meeting is convened the tenderer's designated representative is invited to attend a pre-
tender meeting, which if convened, will take place at the venue and time stated in the Invitation to Tender. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

15.2 The tenderer is requested as far as possible to submit any questions in writing or by cable, to reach the Employer not later than seven days before the meeting. It may not be practicable at the meeting to answer questions received late, but questions and responses will be transmitted in accordance with the following:

(a) Minutes of the meeting, including the text of the questions raised and the responses given together with any responses prepared after the meeting, will be transmitted without delay to all purchasers of the tender documents. Any modification of the tender documents listed in -–Clause 9 which may become necessary as a result of the pre-tender meeting shall be made by the Employer exclusively through the issue of a tender notice pursuant to Clause 7 and not through the minutes of the pre-tender meeting.

(b) Non attendance at the pre-tender meeting will not be cause for disqualification of a bidder.

## 16. Format and Signing of Tenders

16.1 The tenderer shall prepare his tender as outlined in clause 9 above and mark appropriately one set "ORIGINAL" and the other "COPY".

16.2 The copy of the tender and Bills of Quantities shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the tenderer. All pages of the tender where amendments have been made shall be initialed by the person or persons signing the tender.

16.3 The complete tender shall be without alterations, interlineations or erasures, except as necessary to correct errors made by the tenderer, in which case such corrections shall be initialed by the person of persons signing the tender.

## SUBMISSION OF TENDERS

## 17. Sealing and Marking of Tenders

17.1 The tenderer shall seal the original and copy of the tender in separated envelopes, duly marking the envelopes as "ORIGINAL" and "COPY". The envelopes shall then be sealed in an outer envelope.

17.2 The inner and outer envelopes shall be addressed to the Employer at the address stated in the Appendix to Instructions to Tenderers and bear the name and identification of the Contract stated in the said Appendix with a warning not to open before the date and time for opening of tenders stated in the said Appendix.

17.3 The inner envelopes shall each indicated the name and address of the tenderer to enable the tender to be returned unopened in case it is declared "late", while the outer envelope shall bear no mark indicating the identity of the tenderer.

17.4 If the outer envelope is not sealed and marked as instructed above, the Employer will assume no responsibility for the misplacement or premature opening of the tender. A tender opened prematurely for this cause will be rejected by the Employer and returned to the tenderer.

## 18 Deadline for Submission of Tenders

18.1 Tenders must be received by the Employer at the address specified in clause 17.2 and on the date and time specified in the Letter of Invitation, subject to the provisions of clause 7.4, 18.2 and 18.3.

Tenders delivered by hand must be placed in the "tender box" provided in the office of the Employer.

Proof of posting will not be accepted as proof of delivery and any tender delivered after the above stipulated time, from whatever cause arising will not be considered.

18.2 The Employer may, at his discretion, extend the deadline for the submission of tenders through the issue of an Addendum in accordance with clause 7, in which case all rights and obligations of the Employer and the tenderers previously subject to the original deadline shall thereafter be subject to the new deadline as extended.

18.3 Any tender received by the Employer after the prescribed deadline for submission of tender will be returned unopened to the tenderer.

## 19 Modification and Withdrawal of Tenders

19.1 The tenderer may modify or withdraw his tender after tender submission, provided that written notice of the modification or withdrawal is received by the Employer prior to prescribed deadline for submission of tenders.

19.2 The tenderer's modification or withdrawal notice shall be prepared, sealed, marked and dispatched in accordance with the provisions for the submission of tenders, with the inner and outer envelopes additionally marked "MODIFICATION" or "WITHDRAWAL" as appropriate.

19.2 No tender may be modified subsequent to the deadline for submission of tenders.

19.3 No tender may be withdrawn in the interval between the deadline for submission of tenders and the period of tender validity specified on the tender form. Withdrawal of a tender during this interval will result in the forfeiture of the Tender Surety.

19.4 Subsequent to the expiration of the period of tender validity prescribed by the Employer, and the tenderer having not been notified by the Employer of the award of the Contract or the tenderer does not intend to conform with the request of the Employer to extend the prior of tender validity, the tenderer may withdraw his tender without risk of forfeiture of the Tender Surety.

# TENDER OPENING AND EVALUATION

## 20 Tender Opening

20.1 The Employer will open the tenders in the presence of the tenderers' representatives who choose to attend at the time and location indicated in the Letter of Invitation to Tender. The tenderers' representatives who are present shall sign a register evidencing their attendance.

20.2 Tenders for which an acceptable notice of withdrawal has been submitted, pursuant to clause 19, will not be opened. The Employer will examine the tenders to determine whether they are complete, whether the requisite Tender Sureties have been furnished, whether the documents have been properly signed and whether the tenders are generally in order.

20.3 At the tender opening, the Employer will announce the tenderer's names, total tender price, tender price modifications and tender withdrawals, if any, the presence of the requisite Tender Surety and such other details as the Employer, at his discretion, may consider appropriate. No tender shall be rejected at the tender opening except for late tenders.

20.4 The Employer shall prepare a tender opening register and minutes of the tender opening including the information disclosed to those present.

20.5 Tenders not opened and read out a tender opening shall not be considered further for evaluation, irrespective of the circumstances.

## 21 Process to be Confidential

21.1 After the public opening of tenders, information relating to the examination, clarification, evaluation and comparisons of tenders and recommendations concerning the award of Contract shall not be disclosed to tenderers or other persons not officially concerned with such process until the award of Contract is announced.

21.2 Any effort by a tenderer to influence the Employer in the process of examination, evaluation and comparison of tenders and decisions concerning award of Contract may result in the rejection of the tenderer's tender.

## 22 Clarification Tenders

22.1 To assist in the examination, evaluation and comparison of tenders, the Employer may ask tenderers individually for clarification of their tenders, including breakdown of unit prices. The request for clarification and the response shall be in writing or by cable, facsimile or telex, 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 arithmetical errors discovered by the employer during the evaluation of the tenders in accordance with clause 24.

22.2 No Tenderer shall contact the Employer on any matter relating to his tender from the time of the tender opening to the time the Contract is awarded. If the tenderer wishes to bring additional information to the notice of the Employer, he shall do so in writing.

## 23 Determination of Responsiveness

23.1 Prior to the detailed evaluation of tenders, the Employer will determine whether each tender is substantially responsive to the requirements of the tender documents.

23.2 For the purpose of this clause, a substantially responsive tender is one which conforms to all the terms, conditions and specifications of the tender

documents without material deviation or reservation. A material deviation or reservation is one which affects in any substantial way the scope, quality, completion timing or administration of the Works to be undertaken by the tenderer under the Contract, or which limits in any substantial way, inconsistent with the tender documents, the Employer's rights or the tenderers obligations under the Contract and the rectification of which would affect unfairly the competitive position of other tenderers who have presented substantially responsive tenders.

23.3 Each price or unit rate inserted in the Bills of Quantities shall be a realistic estimate of the cost of completing the works described under the particular item including allowance for overheads, profits and the like. Should a tender be seriously unbalanced in relation to the Employer's estimate of the works to be performed under any item or groups of items, the tender shall be deemed not responsive.

23.4 A tender determined to be not substantially responsive will be rejected by the Employer and may not subsequently be made responsive by the tenderer by correction of the non-conforming deviation or reservation.

## 24 Correction of Errors

Tenders determined to be substantially responsive shall be checked by the Employer for any arithmetic errors in the computations and summations. **Errors will NOT be corrected by the Employer.**

## 25 Conversion to Single Currency

25.1 For compensation of tenders, the tender price shall first be broken down into the respective amounts payable in various currencies by using the selling rate or rates of the Central Bank of Kenya ruling on the date twenty one (21) days before the final date for the submission of tenders.

25.2 The Employer will convert the amounts in various currencies in which the tender is payable (excluding provisional sums but including Dayworks where priced competitively) to Kenya Shillings at the selling rates stated in clause 25.1.

## 26 Evaluation and Comparison of Tenders

26.1 The Employer will evaluate only tenders determined to be substantially responsive to the requirements of the tender documents in accordance with clause 23.

26.2 The Employer reserves the right to accept any variation, deviation or alternative offer. Variations, deviations, alternative offers and other factors which are in excess of the requirements of the tender documents or otherwise result in the accrual of unsolicited benefits to the Employer, shall not be taken into account in tender evaluation.

26.3 Price adjustment provisions in the Conditions of Contract applied over the period of execution of the Contract shall not be taken into account in tender evaluation.

26.4 If the lowest evaluated tender is seriously unbalanced or front loaded in relation to the Employer's estimate of the items of work to be performed under the Contract, the Employer may require the tenderer to produce detailed price analyses for any or all items of the Bills of Quantities, to demonstrate the relationship between those prices, proposed construction methods and schedules. After evaluation of the price analyses, the Employer may require that the amount of the Performance Security set forth in clause 29 be increased at the expense of the successful tenderer to a level sufficient to protect the Employer against financial loss in the event of subsequent default of the successful tenderer under the Contract.

26.5 Firms incorporated in Kenya where indigenous Kenyans own 51% or more of the share capital shall be allowed a 10% preferential bias provided that they do not sub-contract work valued at more than 50% of the Contract Price excluding Provisional Sums to a non-indigenous sub-contractor.

26.6 The tender evaluation committee shall evaluate the tender within 30 days of the validity period from the date of opening the tender.

26.7 Persons not officially involved in the evaluation of tender shall not attempt in any way to influence the evaluation.

27. Preference where allowed in the evaluation of tenders shall not exceed 15%

## AWARD OF CONTRACT

### 28 Award criteria

28.1 Subject to clause 27.2, the Employer will award the Contract to the tenderer whose tender is determined to be substantially responsive to the tender documents and who has offered the lowest evaluated tender price subject to possessing the capability and resources to effectively carry out the Contract Works.

28.2 The Employer reserves the right to accept or reject any tender, and to annual the tendering process and reject all tenders, at any time prior to award of Contract, without thereby incurring any liability to the affected tenderers or any obligation to inform the affected tenderers of the grounds for the Employer's action.

### 29. Notification of Award and signing of contract

29.1 Prior to the expiration of the period of tender validity prescribed by the Employer, the Employer will notify the successful tenderer by cable, telefax or telex and confirmed in writing by registered letter that his tender has been accepted. This letter (hereinafter and in all Contract documents called "Letter of Acceptance") shall name the sum (hereinafter and in all Contract documents called "the Contract Price") which the Employer will pay to the Contractor in consideration of the execution and completion of the Works as prescribed by the Contract.

29.2 Upon the furnishing of a Performance Security by the successful tenderer, the unsuccessful tenderers will promptly be notified that their tenders have been unsuccessful.

29.3 At the same time the employer notifies the successful tenderer that his tender has been accepted, the employer shall notify the other tenderers that their tender s have been unsuccessful.

29.4 Within fourteen [14] days of receipt of the form of Contract Agreement from the Employer, the successful tenderer shall sign the form and return it to the Employer together with the required Performance Security.

29.5 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.

29.6 A tenderer who gives false information in the tender document about is 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.

**30. Performance Guarantee**

30.1 Within twenty eight [28] days of receipt of the notification of award from the Employer, the successful tenderer shall furnish the Employer with a Performance Security in an amount stated in the Appendix to Instructions to Tenderers.

30.2 The Performance Security to be provided by the successful tenderer shall be an unconditional Bank Guarantee issued at the tenderer's option by an established and a reputable Bank approved by the Employer and located in the Republic of Kenya and shall be divided into two elements namely, a performance security payable in foreign currencies (based upon the exchange rates determined in accordance with clause 35.4 of the Conditions of Contract) and a performance security payable in Kenya Shillings. The value of the two securities shall be in the same proportions of foreign and local currencies as requested in the form of foreign currency requirements.

30.3 Failure of the successful tenderer to lodge the required Performance Security shall constitute a breach of Contract and sufficient grounds for the annulment of the award and forfeiture of the Tender Security and any other remedy under the Contract the Employer may award the Contract to the next ranked tenderer.

**31. Advance Payment**

An advance payment, if approved by the Employer, shall be made under the Contract, if requested by the Contractor, in accordance with clause 33.1 of the Conditions of Contract. The Advance Payment Guarantee shall be denominated in the proportion and currencies named in the form of foreign currency requirements. For each currency, a separate guarantee shall be issued. The guarantee shall be issued by a bank located in the Republic of Kenya, or a foreign bank through a correspondent bank located in the Republic of Kenya, in either case subject to the approval of the Employer.

**31. Corrupt and fraudulent practices.**

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

# SECTION III

## APPENDIX TO INSTRUCTIONS TO TENDERERS

| INSTRUCTIONS TO TENDERERS | PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERERS |
|---|---|
| 1.1 | The employer is the **Vice Chancellor**, Jaramogi Oginga Odinga University of Science and Technology. |
| 1.7 | Qualification criteria as set out in the tender evaluation criteria |
| 1.8 | N/A |
| 1.9 | Joint venture or individual tenderers only. |
| 1.13 | N/A |
| 2.3 | Or through email address: proc@jooust.ac.ke |
| 3.2.(e) | N/A |
| 3.4 | N/A |
| 3.6 | Validity period of 90 days |
| 3.8 | Tender surety shall be valid for 30 days beyond the validity of tender from the date of tender opening. |
| 3.12 (b) | N/A |
| 3.14 | One original and a copy of the original |
| 3.18 | Bid security of 2% OF THE TENDER SUM from a reputable bank recognized by the Central Bank of Kenya |
| 5.2 | Alternative bids not allowed |
| 5.7 | N/A: PPAD 2015 Applies |
| 5.9 | N/A |
| 5.12 | N/A |
| 6.5 | Successful tenderer to provide performance security of 10% of the Sub-Contract sum from reputable bank recognized by Central Bank of Kenya prior to Sub-Contract signing. |
| 6.8 | N/A |
| 6.12 | -The word "valuation" should read "variation"<br>-Variation shall apply as prescribed by the Public Procurement and Asset Disposal Act, 2015 |
| 6.13 | Shall be 60 days from the date of receipt of the request |
| 8.0 | Due diligence shall be conducted before award in accordance with the Public Procurement and Asset Disposal Act, 2015 |
| 9.0 | Tenderer shall be required to provide litigation history which may be subjected to due diligence to ascertain the possibility of negatively affecting performance. |

# SECTION III

## CONDITIONS OF CONTRACT (Including erection on site)
## PART I – GENERAL CONDITIONS

PART I – General Conditions, shall be those forming Part I of the "Conditions of Contract for Electrical and Mechanical Works – Including Erection on Site, Thirth Edition 1987, re-printed 1988 with Editorial Amendments" prepared by the Federation Internationale des Ingenieurs – conseils (FIDIC). The Conditions are subject to variations and additions set out in Part II hereof entitled "Special Conditions".

## Note

i. The standard text of the General Conditions of Contract must be retained intact to facilitate its reading and interpretation by tenderers. Any amendments and additions to the General Conditions, specific to a given Contract, should be introduced in the Special Conditions or in the Appendix to Form of Tender.

ii. The Special Conditions take precedence over the General Conditions of Contract.

iii. Copies of the FIDIC Conditions of Contract can be obtained from:

FIDIC Secretariat
P.O.Box 86
1000 Lausanne 12
*Switzerland*
Fax: 41 21 653 5432
Telephone 41 21 653 5003

# PREABLE TO GENERAL CONDITIONS

## Commencement Date (Sub-clause 1.1.1.(I))

The date for commencement of the Works is _____**SEPTEMBER 2020**_____

## The Employer (Sub-clause 1.1.12.)

The Employer is **JARAMOGI OGINGA ODINGA UNIVERSITY OF SCHIENCE AND TECHNOLOGY**

The Engineer (Sub-clause 1.1.15)

The Engineer is _____

## Time for Completion (Sub-clause 1.1.35.)

The Time for Completion is __**12 months**_____ from the commencement Date.

## Contractor's Profit (Sub-clause 1.6.)

The percentage to cover profit entitlement, where appropriate, is _**N/A**_____%.

## Ruling Language (Sub-clause 5.1.)

The version in **ENGLISH** language (ruling language) shall prevail.

## Day to Day Communications (Sub-clause 5.2.)

The language for day to day communications is ENGLISH_____

## Programme to be Furnished (Sub-clause 12.1.)

The Programme must be submitted in the form of ____MICROSOFT PROJECT_____

## Electricity, Water, Gas and Other Services (Sub-clause 14.3.)

Supplies on the Site are:

a. Electricity**:_____KENYA POWER_____**

b. Water: _____**SIAYA BONDO WATER AND SANITATION**____

## Employer's Equipment (Sub-clause 14.4.)

The following Employer's equipment is available for use by the Contractor under the Employer's operation:
_____N/A_____
_____
_____
_____

Working Hours (Sub-clause 18.3.)

The normal working hours are _____**8.00AM-5.00PM AS PER NEMA GUIDLINES**_____
_____
_____

Delay in Completion (Sub-clause 27.1.)

Failure to meet the Time for Completion entitles the Employer to reduction in Contract Price as follows:

Amount per day _____N/A_____

Maximum _____N/A_____

**Prolonged delay (Sub-clause 27.2.)**

Maximum amount recoverable from the Contractor by the Employer:
_____N/A_____
_____

**Terms of Payment (Sub-clause 33.1.)**

In addition to the provisions under Clause 33, the terms of payment shall be:
_____
_____
_____

**Payment in Foreign Currencies (Sub-clause 35.1.)**

Payment in foreign currencies shall be arranged as follows:
_____N/A_____
_____
_____

**Rates of Exchange (Sub-clause 53.3.)**

The rates of exchange for the purpose of the Contract are:
_____N/A_____
_____
_____

**Payment against Provisional Sums (Sub-clause 36.4. (b))**

The percentage to be applied to Provisional Sums shall be _____%.

**Maximum Liability (Sub-clause 42.2.)**

The maximum liability of the Contractor to the Employer shall be _____N/A_____

Insurance of Works (Sub-clause 43.1)

The deductible limits in the insurance cover of the Works shall not exceed _____

Sub-clause 43.1. (a)
The additional risks to be insured are:
_____
_____
_____

**Third Party Liability (Sub-clause 43.3)**

The amount of insurance against third party liability taken out by the Contractor shall not be less than:
_____
_____

**Payment on Termination for Employer's Default (Sub-clause 46.3)**

The additional amount payable by the Employer on termination shall not exceed:
_____
_____

**Labour, Materials and Transport (Sub-clause 47.1.)**

The method of calculating adjustments for changes in costs shall be:
_____
_____
_____

**Notices to Employer and Engineer (Sub-clause 49.2.)**

The address of the Employer for notices is:
_____
_____
_____

The address of the Engineer for notices is:
_____
_____
_____

**Applicable Law (Sub-clause 51.1.)**

The applicable law is _____ law.

**Procedural Law for Arbitration (Sub-clause 51.2)**

The procedural law for arbitration is _____

**Language and Place of Arbitration (Sub-clause 51.3)**

The language of arbitration is _____ language.

The place of arbitration is _____

# PART II – SPECIAL CONDITIONS

(The Clauses referred to in Part II – Section A are those where the provision in the General Conditions (Part I) refer to an alternative solution to be stated in Part II. The provisions in the General Conditions will apply unless an alternative solution is given in Part II – Section A. The clauses in this section need therefore not be completed, but must be completed if alternative solutions to the relevant Part I provisions are necessary.)

**1.0 Conditions Precedent to Commencement (Sub-clause 1.1.1.)**

The following financial and administrative requirements are conditions precedent to commencement.

_____
_____
_____

**2.0 Defects Liability Period (Sub-clause 1.1.11.)**

The Defects Liability Period is _____ days.

**3.0 Engineer's Duties (Sub-clause 2.1.)**

The Engineer requires the consent of the Employer before exercising the following duties:

_____
_____
_____

**4.0 Operation and Maintenance Manuals (Sub-clause 6.6.)**

Operation and Maintenance Manuals shall be in English language.

**5.0 Manufacturing Drawings (Sub-clause 6.9.)**

The Contractor is required to disclose to the Engineer or the Employer confidential information as follows:

_____
_____
_____

**6.0 General Obligations (Sub-clause 8.1.)**

6.1 The following facilities will be provided by the Employer:

_____
_____
_____

6.2 The facilities will be provided at the following rates:

_____
_____
_____

**7.0 Performance Security (Sub-clause 10.1)**

The Contractor shall obtain a Performance Security of an amount Kshs.

**8.0 Contractor Equipment (Sub-clause 14.1)**

The following items of Contractor's Equipment will be provided free of charge by the Employer for the Contractor's use:

_____
_____
_____

**9.0 Price Variation**

**9.1** Contract price variations shall not be allowed for contracts not exceeding one year (12 months)

**9.2** Where contract price variation is allowed, the variation shall not exceed 15% of the original contract price.

**9.3** Price variation requests shall be processed by the procuring entity within 30 days of receiving the request.

**10.0 Extension of Defects Liability Period (Sub-clause 30.4)**

In the event of suspension the Defects Liability Period shall not last more than ____ days after the date the works would have been delivered but for the suspension.

**11.0 Method of Application (Sub-clause 33.2)**

Application for payment shall be made as follows:

_____
_____
_____

**12.0 Payment (Sub-clause 33.5.)**

11.1 The period for payment shall be:

_____
_____

11.2 The place for payment shall be:

_____
_____

**13.0 Delayed Payment (Sub-clause 33.6.)**

The interest rate for delayed payment is simple interest at a rate three percentage points above the Central Bank of Kenya's average rate for base lending prevailing as of the first day the payment becomes over due.

**14.0 Payment by measurement (Sub-clause 33.8)**

The provisions for measurement are:

_____
_____
_____

**15.0 Customs and Import Duties (Sub-clause 48.1.)**

The Contractor shall pay and be reimbursed by the Employer for the following customs, import duties and taxes in consequence of the importation of the Plant:

_____
_____
_____

**16.0 Arbitration (Sub-clause 50.2)**

The rules of arbitration shall be those contained in the Arbitration Act of the Laws of Kenya.

# SECTION V:

## 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 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.

2.0 Specifications from previous similar projects are useful and it may not be necessary to re- write specifications for every works contract for universal application.

3.0 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.

4.0 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 be used.

5.0 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.

# ELECTRICAL ENGINEERING SERVICES

# GENERAL SPECIFICATION

**PART B**

## ELECTRICAL ENGINEERING SERVICES GENERAL SPECIFICATION

I N D E X

# PART B

## ELECTRICAL ENGINEERING SERVICES

## GENERAL SPECIFICATION

## SECTION 1 - GENERAL

1.00 General

This section specifies the general requirements for plant, equipment and materials forming part of the Electrical Contract Works and shall apply except where otherwise specified. The Contract Works shall comply with the General Specification when read in conjunction with the Particular Specification and any other requirements of the Specification as previously defined.

1.01 Regulation and Standards

The Contract Works shall comply with the current Kenya Government Electrical Regulations, the current edition of the Institution of Electrical Engineers Regulations for the Electrical Equipment of Buildings, hereinafter referred to as the I.E.E. Regulations, and the By-laws of the Electricity Supply Authority. The Contract Works shall also comply where applicable to:-

Kenya Standards as published by Kenya Bureau of Standards, or current edition of British Standards and British Standards Codes of Practice where Kenya Standards have not been published.

1.02 Quality of Materials and Manufacturing Standards

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

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

Unless otherwise specified all materials, including equipment, fittings, cables, etc., shall be in new condition and manufactured to appropriate standards of the Kenya Bureau of Standards, the British Standards Institution, the I.E.E. Regulations or other equivalent and approved standards.

Defective equipment or that damaged in course of installation or test shall be replaced or repaired to the approval of the Engineer. Materials and apparatus supplied by the Contractor shall be as specified and no variations will be permitted without the written consent of the Engineer. Should any replacement be necessary the Contractor shall bear the cost of any associated Builder's Work and making good finishes.

1.03 Installation Requirements - General and Liaison

The starting currents of all electric motors and equipment supplied under the Specification shall be limited so as not to exceed the maximum permissible starting currents described in the Electricity Supply Authority's By-laws.

Attention is drawn to the fact that all the Contractor's work is subject to the Engineer's approval.

1.04 Installation and Commissioning

The Contractor shall be deemed to have included in the Contract Sum for the services of a specialist or manufacturer's Engineer or Technician to assist in the installation and commissioning of the Contract Works or any part thereof if the Contractor has not his own suitable and competent staff available at the site of the works to carry out such functions.

1.05 Labelling

All plant, equipment, apparatus, distribution boards, distribution cases, terminals and cable cores shall be securely and properly labelled to the approval of the Engineer. The labelling shall be such as to show clearly the identification of the item and if applicable its control function and the part of the system controlled.

## SECTION 2

## 2. H.V. SWITCHGEAR

2.01 General

The units which together comprise the switchboards are to be provided in accordance with the Contract Drawings and Schedules of equipment.

The switchboards shall be manufactured in accordance with B.S.162 and all equipment and material used in the switchboards is to be in accordance with the appropriate British Standards. The switchboards shall be flush fronted in appearance with the breaker operation mechanism easily accessible but behind the hinged door.

The switchboard shall have a mimic diagram on its fascia showing the incoming and outgoing circuits coded in different colours and showing the different electrical symbols. The mimic display diagram shall be made of self-adhesive aluminium.

The Sub-Contractor shall allow for the supply of a complete set of Record Drawings relating to the switchboard, made in ink on tracing cloth.

Four sets of instruction manuals are to be provided describing the method of operating the equipment together with instructions for maintenance and adjustment and giving full details of all connections brought out to the Test Link Blocks.

2.02 Supply System

11 kV, 3 phase, 50Hz, earthed system.

2.03 Type of Switchgear

The switchgear shall consist of SF6-filled or vacuum circuit breakers or SF6-filled or vacuum switches as indicated on the Contract Drawings. They shall be of the fully interlocked, metal clad, vertical isolation type, incorporating integral earthing facilities manufactured to the current condition of B.S. 5211 and B.S.5463. Circuit breakers shall be fitted with manually charged spring closing mechanisms.

2.04 Bus-Bars

The Bus-bars for each switchboard may be air insulated provided that all primary circuits in the fixed portion of the units are insulated with epoxy resin.

Bus-bars and current transformer joints and connections are to be insulated by epoxy resin shrouds which shall be mechanically jointed, or PVC sleeved and filled with encapsulating compound, otherwise the switchboard shall be compound insulated. The bus-bars and connections shall be constructed from high conductivity solid copper.

The bus-bars and bus-bar supports shall be arranged to withstand, without damage, the effects of any fault current up to and including the maximum rated breaking capacity of the switchgear.

Bus-bars and connections shall be suitably and adequately colour coded for phase identification.

2.05 Extensibility

The units shall be so designed and the bus-bars drilled so that further extension units can be added without difficulty. Space and full provision for fitting future units shall be allowed in accordance with the instructions in the Schedule of Equipment.

2.06 Cable Boxes

Where required, cable boxes manufactured from close grained cast iron to B.S. 2562, Part I where applicable, shall be provided suitable for the reception of the cable specified.

2.07 Special Tropical Finish

The switchgear shall be designed for use in the tropics and the following requirements shall be incorporated:

i) All parts of the switchgear shall be totally enclosed and enclosures shall be vermin-proof.

ii) Gaskets shall be neoprene or similar material.

iii) All steelwork shall be treated with a phosphoric base etching primer containing a resin bond and finished with two coats of paint.

iv) The interior of all gear not having oil, compound or other insulation, and all exposed current carrying metalwork (other than contact faces) shall be sprayed with an approved type of bakelite varnish.

The final coat of paint shall be of a colour taken from B.S 3810 or B.S. 4800 to be chosen by the Engineer.

2.08 Labels

Each switch shall have a designation label of traffolyte with 10mm high black lettering on a white background. They shall be screwed to the equipment-adhesive only is not acceptable. A small similar designation label shall also be fixed to the rear of each fixed portion.

2.09 Relays

Protection relays shall be of the type and number listed in the schedule of requirements for HV switchgear in the Particular Specification.

All relays shall be flush mounted, and where required, shall be provided with additional contacts for remote indication etc. Bezel shall be finished in black gloss.

2.10 Instrumentation

Instruments shall be fitted on the switchboard as shown on the drawings and in the schedules of requirements for HV switchgear in the particular Specification.

Ammeters shall be MICS 100mm square dial flush mounting pattern with rotary selector switch. Voltmeters shall be MICS 100mm square dial flush mounting pattern with rotary selector switch. The construction of the instruments shall be in accordance with B.S.89 and shall be of industrial grade.

2.11 Instrument Panels

Instrument panels shall be mounted at the same height on each unit and have suitably hinged front panels.

2.12 Test Link Blocks

Test link blocks shall be connected to all protection and instrumentation current transformer connections.

2.13 Small Wiring

All small wiring necessary for connecting the instruments, relays and other devices shall be included and shall have a conductor size of not less than 7/.085mm with a thermoplastic flame-retarding type of insulation. The wiring shall be distinctly coloured and marked with ferrules of an approved type at each end.

All wiring within each switchboard, not installed in conduits, shall be neatly laced and cleated to the panel structure of each switchboard and its auxiliary equipment.

Where wiring passes through a hole in the metal work, thermoplastic grommets shall be used and in no case shall cables be unprotected where they come into contact with the edge of a piece of metal work.

2.14 Current Transformers

Separate current transformers shall be provided for protection and instrumentation.

Current transformers shall have a secondary rating of 5A. The primary currents are indicated on the drawings.

Current transformers shall have over-current factors suitable for the prospective short circuit current system.

Current transformers required for operating relays shall have a one second rating as defined in B.S.3938, be suitable for the characteristics of the relay concerned and have a minimum output of 15VA.

Current transformers shall be of the bar primary or wound primary type according to the transformer ratio with jointless wiring core of either hot or cold rolled silicon iron.

2.15 Voltage Transformers

Voltage Transformers shall be of the dry type with hinge isolation and in accordance with B.S. 3941. The rated output and accuracy offered should be stated. Cartridge type fuses shall be provided for protection of both primary and secondary windings.

2.16 Drawings for Approval

The following drawings shall be submitted for each switchboard for approval as soon as possible after receipt of instructions from the Engineer to proceed:-

i) Plans and elevations showing position of instruments, relays, current transformers, voltage transformers, fuses, cable boxes and other accessories.

ii) Wiring and connection diagrams.

iii) Schematic diagrams.

Three copies of each drawing as finally approved shall be supplied to the Engineer.

In addition the Sub-Contractor shall provide any other drawings or information required by the Engineer in order that the Engineer may satisfy himself as to the design of the plant. Manufacture shall not be commenced until all relevant drawings have been approved by the Engineer.

2.17 Miscellaneous

A tinned copper bonding bar shall be provided for the full length of the switchboard to which each unit shall be bonded.

A wall chart mounted on metal, with instructions for the treatment of electric shock, shall be supplied and fixed in the switchrooms.

Six in number heavy brass non-interchangeable padlocks, for locking switchgear, spout covers and operating mechanisms, shall be provided each with two keys.

A framed diagram showing clearly the layout of the high voltage distribution system shall be provided and fixed in the switchrooms.

2.18 D.C. Tripping Equipment

A nickel cadmium type battery adequately rated to operate the D.C. tripping circuit of the breakers shall be supplied with each switchboard. The battery shall be complete with floor mounting stand and a suitable trickle charger having a 240 volt single-phase input.

From the output terminals of the battery unit wiring shall be taken to the trip terminals located at the rear of the switchboard.

## SECTION 3

### 3.00 POWER TRANSFORMERS

### 3.01 General

Power transformers shall be oil-immersed or dry type and of voltage ratio and rating called for in the Specification.

### 3.02 Oil Immersed Transformers

Oil immersed transformers shall have 'ON' method of cooling, windings vector group ref. DY.11, insulation Class 'A'. The delta connected primary windings shall have tappings to provide for an HV voltage variation of plus of minus 2.5% and plus of minus 5% operated by an off-load tap-changer switch.

The secondary windings shall be star-connected and the centre point brought out to provide an insulated neutral connection.

The transformer shall be suitable for indoor or outdoor sitting as stated in the specification and shall be continuously rated to conform with B.S. 171/59.

Temperature shall not exceed that listed in Table 14 of B.S. 171 with the reduction factor listed in Table 15 applied for the climatic conditions described in the Specification.

The transformers shall be capable of carrying overload within the limits recommended in the British Standards Code of Practice C.P. 1010:1959. Cable sealing boxes, manufactured in accordance with B.S. 2562 shall be fitted to both H.V. and L.V. terminals.

The transformers shall be complete with the following fittings:-

Rating plate,
Terminal Marking Plate
Earthing Terminal for Tank,
Lifting Lugs,
Dehydrating breather,
Oil filling hole and plug,
Oil Level indicator
Drain valve with plug or cover plate
Thermometer pocket, and
Jacking lugs.

The transformers shall be complete when installed with a first filling of oil to B.S. 148. The transport from overseas of transformers with or without oil may be subject to the method of preparation of shipment.

3.03 Dry-Type Transformers

Dry-Type Transformers shall have Class 'AM' cooling, windings vector group DY.11, insulation Class 'C'. The arrangements and connection of windings, tap-changing, loading and terminal boxes shall be as previously detailed in Clause 3.02.

Temperature rise shall not exceed that listed in Table 13 of B.S. 171 with the reduction factor listed in Table 15 applied for the climatic conditions described in the Specification.

The transformer shall be complete with the following fittings:-

Rating plate,
Terminal Marking Plate
Lifting Lugs,
Earthing terminal for frame.

3.04 Transformer Tests and Inspection

Where possible the Engineer shall be invited to inspect the transformers at the manufacturer's works during the erection of cores and windings, and to witness final tests when the transformers are fully assembled. It will be the Sub-Contractor's responsibility to inform the Engineer and give reasonable notice of the manufacturer's intention to carry out the above assemblies and tests. The tests shall be as described in Clause 1802 of B.S. 171:1959.

The Sub-Contractor shall submit three copies of all relevant test certificates (B.S 171 Clause 1802(a)) to the Engineer for approval prior to shipment of the transformers. Certificates of type tests (B.S 171 Clause 1802(b)) will be acceptable subject to the Engineer's approval except where specified elsewhere in the specification.

3.05 Transformer Test on site

The Sub-Contractor shall carry out all necessary tests to the satisfaction of the Engineer to ensure that the transformer has not been damaged in transit and is ready for service, such tests shall be made before setting to work and shall include but not be limited to:-

Continuity and Polarity Tests,
Insulation resistance tests,

Oil moisture and acidity tests.

## SECTION 4

### L.V. SWITCHBOARD AND GEAR

4.01 General

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

The switchboard shall be manufactured in accordance with B.S. 162 IEC 439.1 and B.S. 5486 which co-ordinates the requirements for electric power switchgear and associated apparatus. It is not intended that B.S. 162, B.S. 5486 or IEC 439.1 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 British Standards. Where more onerous conditions are specified the switchboard shall be in accordance with the definition contained in the BS 5420 and BS 5490.

Cable terminations and space for termination shall be suitable for the sizes of cable called for in the design and shall not be limited to mere compliance with BS 5486.

Circuit-breakers in switchboards shall comply with BS.4753: Part 1

Moulded case Circuit Breakers (MCCBs) shall comply with BS 4752: Part 1 and shall be of current-limiting type with inverse time delay, instantaneous short circuit and earth leakage trips.

Disconnectors and switch-disconnectors shall be to BS 5419 and shall be of ratings suitable for the equipment served and with fault capacities compatible with the remainder of the equipment on the switchboard.

All switchboards and so far as is practicable, all items of loose gear shall be of the same manufacture but, in any case, all items of like kind shall be of the same manufacture.

The supplier shall submit with his Tender a dimensioned outline drawing of each switchboard showing all leading dimensions and the estimated weight of the board.

The manufacturer's switchgear, fabrication, builders work and installation drawings shall show, in addition to the requirements previously stated, all significant details of each switchboard including:

i) Equipment incorporated in switchboard.
ii) Fuse, circuit-breaker and switch ratings
iii) Current and voltage transformer rations, class terminal markings and output.

iv) Instruments, including scale details and accuracy class.

v) Relay types and characteristics

vi) Position of switches, and details of function.

vii) All internal connections with terminal markings (note that circuit diagrams shall show all switches, relays, contactors, etc in the open or de-energized condition).

Viii) Arrangement of terminal boards.

ix) All plug contacts.

x) Wire numbers

xi) Size, type and colour of secondary wiring.

xii) Principal physical dimensions, including clearances required for removing covers, opening doors, operating handles, withdrawing equipment, or gaining admission for maintenance.

xiii) Position of all panel face equipment, including dimensions of all projecting apparatus.

xiv) Identification of all equipment, with type references and the appropriate label inscriptions.

xv) Foundation details, including weights, support points and any reinforcement of foundations needed to withstand dynamic forces arising from switchgear operations under normal service or fault conditions.

xvi) Cable entry details including gland and gland plate provisions.

Each switchboard shall incorporate all of the items of equipment detailed in the schedule and/or shown on the drawings.

4.02 Switchboard Cubicle Construction

Switchboards other than the industrial type shall be self-contained, free standing, floor-mounted, multi-cubicle Form 4 or multi-box, type as specified and shall be constructed in sections where necessary to facilitate transport and erection. It shall have ring bolts, lighting eyes or lugs or other approved means of transporting and lifting. The lifting devices provided shall be removed after the board is in place and replaced by screw-in brass plugs.

Each switchboard section shall be completed, fully wired and checked out at the factory and shall require a minimum of installation work at the site of the works.

Modular construction shall be used throughout and provision shall be made for simplifying servicing, replacement and maintenance without major dismantling.

When a switchboard is sectionalised for assembly on site, the sections shall be provided with adequate means of locating adjacent sections to ensure accurate alignment.

The switchboard shall be constructed from not less than 10 gauge welded bright mild steel for framework and structural sections and 16 gauge for doors and panels which shall be adequately stiffened by folding or welded stiffeners.

Switchboard compartments shall be fitted with hinged doors, neoprene or foam rubber gasketed and doors shall be provided with every type locking handles having integral cylinder locks. All locks shall be openable with a common key, the number of keys supplied being two per lock, upto a maximum of ten per switchboard. All doors shall be properly stiffened and fitted with heavily cadmium-plated concealed hinged and flush catches.

Removable stiffened steel covers shall be provided elsewhere on the switchboard for full access. All hardware and fastenings shall be heavily cadmium-plated. No self-tapping screws shall be used under any circumstances.

All steelwork shall be clean and free of burrs, scale and blemishes, with all raw edges hidden and shall be finished with a rust inhibiting treatment one primer or under coat and final coat of first quality spraying baking enamel the colour of which shall be to approval.

The switchboard shall be arranged to provide the maximum of safety to personnel and equipment. The switchboard shall be designed for live working so that cabling of outgoing circuits can be safely carried out without de-energising the switchboard. All electrical wiring and bus-bars shall be completely enclosed. Closure panels, isolating and insulating barriers and interlocks shall be provided as required for maximum safeguard. All disconnectors, switch disconnectors, switches and breakers shall be capable of being padlocked in the 'OFF' and the 'ON' positions when used as earthing switches and closed to the earth connection. Adequate supports shall be provided for all bus-bars. Wiring, incoming and outgoing cables shall be provided with glands, cable boxes and other necessary terminations in a cable area separate from the bus-bars.

The overall height of the switchboard shall not exceed 2.3 metres unless other otherwise specified. All switches shall be operable from floor level, all breakers shall be within 2000mm of the floor and flush mounted indicating meters within 1650mm.

The switchboard shall be capable of extension at both ends. Busbar chambers shall be fitted with removable end covers.

Where spaces on the switchboard are provided for future circuit components to be installed, as shown on the drawings, all ancillary parts shall be provided and installed so that future components may be installed and connected in the least time possible. Full safety precautions shall be provided with all such spaces.

The mild steel angle or channel forming the bottom rear edge of the switchboard shall be made up in sections and bolted into position such that any one section may be removed to facilitate installation of cables.

The individual cables from which Forms 3 and 4 cubicle type switchboards are built shall be rigidly constructed from folded steel panels and sections firmly welded together, and the required number of cubicles shall be bolted or welded to from the shell of the switchboard.

Switchboards shall not be constructed by attaching flat steel plates to a framework of rolled steel angle unless so specified in the schedules or on the drawings.

4.03 Bus-bars

Four-pole, air insulated busbars of uniform cross-section throughout their length, with a continuous current rating not less than that indicated in the schedules and/or drawings shall be arranged horizontally and vertically through each switchboard. Current ratings shall take account of reduction in section caused by drilling for connections and supports.

All bus-bars and the connections from them to the various items of switchgear shall be of high conductivity copper and shall be manufactured and tested in accordance with B.S 153 and B.S. 159. They shall be manufactured from tin-plated hard drawn high conductivity copper. They shall be mounted fully enclosed within the main enclosure of the switchboard in separate chambers in accordance with B.S. 162. The bus-bars shall be fully separated from the incoming and out-going cable areas.

Except for instruments, potential or current connections, which shall be clamped in position and be of minimum length, no circuit wiring shall be within the bus-bar chamber.

Bus-bars shall be sheathed in approved insulating material, in their respective phase colours, and secondary insulating shall be provided where bus-bars pass through supports to prevent tracing paths. Supports shall be such that the required clearance between phases neutral and earth are maintained under rated continuous current and provision shall be made for expansion and contraction of the busbars and connections, with variations in temperature.

Interconnections between bus-bars and switchgear shall be of minimum length, properly insulated and rigidly supported.

All contact areas of the busbars and the connections fastened to the bus-bars shall be heavily silver-plated. Joints and connections shall be rigidly made with clamps and high tensile steel bolts and nuts used with spring washers to maintain uniform pressure and connections shall be provided.

Busbars shall be housed in separate compartments, which shall not contain any wiring or apparatus other than that for connecting to the busbars.

Access to busbars and busbar connections shall be possible only after the removal of covers secured by bolts or studs. Such covers shall be identified externally by Formica engraving laminate labels bearing the inscription 'BUSBARS' in black lettering not less than 10mm high in a white background.

The cross-sectional area of the neutral busbar shall be equal that of a related phase bar.

Each cubicle or box section shall be provided with sufficient busbar links to enable cubicle sections to be easily joined. Facilities shall also be provided for extending the busbars to extra cubicle sections, if required at some later date.

All equipment which is not specifically earthed separately shall be bonded to the main earth bar by means of copper strip in accordance with CP 1013 with a minimum size of 25mm x 3mm.

4.04 Circuit Breakers

Air circuit-breakers shall comply with BS.4752: Part 1. For 3 phase circuits they shall be triple pole and suitable for the short-time withstand current given in the schedules. The short time current shall be supplied at 415V for 1.0 second. The short-circuit performance category shall be P-2.

Where circuit-breakers are required to break the neutral, details are given in the schedules; if no details are given then a bolted neutral link shall be fitted.

Air circuit-breakers shall be horizontal draw-out pattern, with full load current ratings for uninterrupted duly under standard service conditions, as detailed on the drawings and schedules.

Withdrawable circuit-breakers shall have automatic safety shutters for screening the fixed contacts when the circuit breaker is withdrawn to the inspection position. The action of withdrawing a circuit-breaker shall necessitate a deliberate action distinct from any other operation; it shall not be possible to withdraw a circuit-breaker from its housing inadvertently.

The number and combination of normally open and two auxiliary contacts shall be a minimum of two normally open and two normally closed unless otherwise detailed in the schedules.

The circuit-breakers shall be fitted with clearly visible mechanically operated ON/OFF indication as detailed in BS 4752: Part 1. Contact separation shall comply with the requirements of the IEE writing regulations.

A lock shall be fitted on the circuit-breaker closing mechanism so that only the key holder can close the breaker. Facilities shall also be available for the circuit-breaker to be locked in the open position. The operating mechanism shall be of the trip free type.
The specific method of closing the circuit-breaker mechanism shall be as called for in the schedules and shall be in accordance with the following:-

(i) Type MSO

Manual, spring operated closing arrangement with a handle for charging and releasing the spring in one stroke. or

BS 3871 Specification for miniature and moulded case circuit-breakers.

BS 4099 Colours of indicator lights, push buttons, annunciators and digital readouts.

BS 4727 Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms. Part 2: Group 06: switchgear and controlgear terminology (including fuse terminology).

BS 4752 Specification for switchgear and controlgear for voltage upto and including 100V a.c and 1200 V d.c.

BS 5419 Specification for an air-break switches, air-break disconnectors, air break switch disconnectors and fuse-combination units for voltages up to and including 100V a.c. and 12V d.c.

BS 5420 Specification for degrees of protection of enclosures of switchgear and controlgear for voltages up to and including 100V a.c. and 1200V d.c.

BS 5486 Low-voltage switchgear and controlgear assemblies.

BS 5490 Specification for classification of degrees of protection provided by enclosures.

BS 5992 Electrical relays.

BS 6121 Mechanical cable glands.

BS 6231 Specification for pvc-insulated cables for switchgear and controlgear wiring.

CP 1013 Earthing.

4.05 Miniature Circuit Breakers

Generally

Miniature Circuit Breakers (MCBS) shall be rated for uninterrupted duty at 240/415 volts and shall comply with BS 3871: Part 1 and IEC 898, plus any additional requirements of this specification.

MCBs shall be type tested by ASTA or an equivalent approved coordination testing authority. All MCBS shall be of the same manufacture. Manufacturer's tripping characteristics shall be provided for each type of MCB specified.

Service and ultimate short-circuit capacities, impulse withstand voltages and insulation levels shall be suitable for the location to the MCB in the system and the backup protection provided.

MCBs shall be fitted with fixed, non-adjustable, direct acting thermal and magnetic trips and shall trip instantaneously (within 0.1 seconds) at currents above 5 and up to 10 times normal current rating, (C+ type in IEC 898), unless otherwise specified.

Energy limiting MCBs shall break the circuit within 5ms. The $1^3$ energy let-through shall be stated for each energy limited MCB. In multi-pole MCBs, including 4-pole, all poles shall open, close and trip simultaneously.

Mechanism shall be quick-make, quick-break, over-centre type which are trip-free. The contact position shall be positively indicated by coloured hands and/or entering to show whether the contacts are open or closed. If the rating or the incoming supply to an MCB board exceeds 200A on any phase them moulded case circuit breakers shall be used in place of MCBs. As required by IEC 898 1987 plus amendments, the following information shall be provided for each MCB:-

1. Rated current
2. Rated operational voltage and rated insulation voltage.
3. Number of poles.
4. Rated services and ultimate short-circuit capacities.
5. Type according to tripping characteristics ie, Type B, C or D.
6. Method of mounting
7. Method of connection
8. Protection against external influence.
9. On request, the $1^3t$ tripping characteristic curve.

Each MCB shall be marked as follows:-

a) On the front of the MCB so that it is visible when mounted: Rated current, without the symbol 'A' preceded by the symbol of instantaneous tripping (B, C or D) eg B 16.

b) Rated voltage

c) manufacturer's name or trade mark.

d) Type designation, catalogue number of serial number

e) Rated service short-circuit capacity in amperes

f) References ambient temperature if different from $30^0$C.

When a switchboard is sectionalised for assembly on site, the sections shall be provided with adequate means of locating adjacent sections to ensure accurate alignment.

Switchboard compartments shall be fitted with hinged doors, neoprene or foam rubber gasketed, and doors shall be provided with every type locking handles having integral cylinder locks. All locks shall be openable with a common key, the number of keys supplied being two per lock up to maximum of 10 per switchboard.

4.06 Metering equipment

All integrating watt-hour (and kWh) and reactive volt-ampere-hour (and kVArh) meters shall be of the induction disc type and shall be housed in flush-mounting pressed steel or aluminium alloy or plastic cases with bezels finished matt black or semi-gloss black except as provided in the next clause.

Integrating watt-hour (and kWh) meters for mounting independently of other electrical equipment (as in domestic type installations) shall be generally as described above but shall be housed in surface-mounting, pressed steel, aluminium alloy, or plastic semi-gloss black cases.

Single-phase and three phase integrating watt-hour (and kWh) meters shall comply with all relevant requirements of BS 5685.

Single-phase and three phase integrating meters for reactive volt-ampere-hours (and kVArh) shall comply with all relevant requirements of BS 37: Part 1 and Part 9.

Polyphase meters for registering maximum demand in kilowatts (or MW) shall comply with Parts 1 and 5 of BS 37: they shall have long scales covering an arch of not less than 270 degrees, and shall operate on the basis of a 30 minute demand integration period.

All meters covered by the preceding clauses shall have an accuracy class designation as follows:-

| | |
|---|---|
| Tariff Metering | Class 1.0 |
| Non-tariff metering | Class 2.0 |

All three-phase meters shall be suitable for operation on a four-wire system with unbalanced load.

All meters shall be provided with means whereby they can be sealed to prevent unauthorised interference.

All integrating meters shall be the products of one of the following manufactures:-

Ferrant Ltd, GEC measurements Ltd,
Landis & Gyr Ltd, Sangamo Electricity Metering.

4.07 Current Transformers

Current transformers shall be of the type, rating and ration detailed in the schedules or on the drawings.

All current transformers shall comply with all relevant requirements or BS 3938 and shall have an accuracy class designation according to the following table.

| current transformer function | Accuracy Class designation |
|---|---|
| Tariff metering | 0.5 |
| Non-Tariff metering | 1.5 |
| Switchboard indicating instruments | 1.0 |
| Motor starter ammeters | 3.0 |
| Protection | 5P |

Unless otherwise stated in the schedules or on the drawings, the current transformers are required for use under conditions not more onerous than those set out in BS.3938.

Current transformers shall be designed either for measurement or for protection and shall not be used in dual-purpose role serving both instruments and protective gear.

Unless otherwise specified, all current transformers shall have 5A secondary windings.

So far as it is practicable, all current transformers shall be of the ring type, wound primary current transformers will only be accepted when the rated primary current is so low as to make the ring type impracticable.

All current transformers whether of the ring type or the wound primary type, for use at voltages exceeding 1000V shall be epoxy resin encapsulated.

Where dual-ratio current transformers are called for, they shall be provided with two separate secondary windings capable of being connected in series or in parallel to give the required ratio.

All current transformers shall be provided with a rating plate bearing the information set out in BS 3938.

Current transformers which are to be installed in reasonably accessible places shall be equipped with an adequate terminal board or block, terminals shall be marked in the manner laid down in BS 3938.

4.06 Air Break Switches

Air break switches shall be suitable for the system conditions, indicated and shall be in strict accordance with B.S. 5419 Class II Switches. Means of locking the switches in the 'Off' position shall be provided.

4.07 Fuse Switches

All fused switches shall be supplied and installed complete with B.S. 88, as shown on the drawings and shall be contained in metal clad, dust proof, gasket sealed individual enclosures with non-detachable steel operating handles which shall be capable of being locked in either the 'ON' of the 'OFF' position. The fuse switch units shall comply with B.S. 5419 and shall be withdrawable.

The fuse switch units shall have fault rating at least equal to the fault rating of the switchboard in which they are to be installed.

The fuse switch units shall be or fast make break design suitable for on load and shall be arranged to prevent operation of the switch when the cover is open and to prevent mechanism and shall be isolated from the line and load contacts when in the 'OFF' position.

In the 'ON' position a barrier shall be interposed between the fuse links. The switch contacts shall be separately and fully shrouded and shall be renewable.

Moving or fixed indicators shall use the works 'ON' and 'OFF' to indicate the fused switch condition. Indicators shall be mechanically locked with the moving contact assembly and shall operate in such a manner that all phases shall be broken before the 'OFF' position is indicated.

4.08 Earth Bars

A high conductivity copper earth bar of not less than 50mm x 6mm section, adequately rated for the anticipated earth fault current, shall be installed the full length of the switchboard in the outgoing cable area within the switchboard enclosure. Connection to the earth bar shall be made with approved cable lugs and high tensile steel nuts and bolts with washers as specified for the phase bus-bars. The points of contacts on the earth bars shall be silver plated.

4.09 Neutral Bars

A high conductivity copper neutral bar adequately rated and supported for normal and fault conditions shall be installed in the outgoing cable area in the switchboard enclosure. This bar shall be mounted on insulators and shall be divided into sections according to the design of the switchboard. The section shall be connected by copper links double bolted to each section. Voltmeters shall be MICS 150mm square dial, flush mounting pattern with rotary selector switch enabling phase to phase and phase to neutral volts to be read.

Voltmeters shall be protected by means of cartridge fuses, category of duty A.C.46 and fusing factor, 1.5. The construction of the instruments shall be in accordance with B.S 59 and shall be of industrial grade. The Sub-Contractor shall agree with the Engineer, the arrangements of the indicating of instruments, their scale deflections C.T. ratios and all information that the switchboard manufacturers may require, prior to manufacture of the switchboard.

4.10 Phase Failure Relays

Where the requirement is shown on the Drawings phase failure relays shall be installed for the operation of the emergency lighting. Phase failure relays shall be connected across each phase and neutral of the supplies as indicated on the distribution diagram. Relays shall be protected by means of cartridge fuses, category of duty A.C. 46 and fusing factor 1.5.

In addition, test buttons shall be provided. The test buttons shall be connected in series with each phase failure relay coil so that when any one of the test buttons is operated the emergency lighting shall come on automatically. Test buttons and relays shall be housed in the instrument section of the switchboard.

4.11 Air Break Switches

All individually mounted air-break switches shall be of 660 volt metal clad type, single pole and neutral, or triple pole and neutral as required, fitted with interlocking handles so that the cases cannot be opened when the handle is in the 'ON' position. All the insulating material employed in the construction must be on non-hygroscopic type and to the Engineer. The construction and performance of the airbreak switch shall be in accordance with B.S. 5419 Parts 1 and 2.

4.12 Switch Fuses

All individually mounted switch fuses shall be of the metal clad type, the number of poles with or without neutral, as required, fitted with interlocking handles so that the case cannot be opened when the handle is in the 'ON' position. All insulating material employed in the construction must be of non-hygroscopic type and the Engineer's approval.

The construction and performance of the switch fuses shall be in accordance with the relevant British Standard indicated below:-

i) Units rated not in excess of 100amps and for a system voltage not in excess of 250 volts to earth shall be in accordance with B.S.5419 unless specifically amended by the Engineer.

ii) Units rated in excess of 100 amps and for a system voltage not in excess of 380 volts to earth shall be in accordance with B.S.5419.

Fuses shall be of the cartridge type, to B.S.88 category A.C. 46, Class Q1 and fusing factor 1.5 graded to suit the loads carried.

Sub-Contractor's attention is drawn to the fact that all fusing in single phase circuits shall be on the 'Single pole' principle with solid link in the neutral unless otherwise noted.

4.13 Cabling

A cabling zone clear of busbars, fused switch and circuit breaker chambers, etc., shall be provided in such a manner to give minimum difficulty in connecting submain cables entering the switchboard for connection to fused switch units or circuit breakers.

The cabling zone shall be fully insulated from any live metal part so that future cabling and alterations can be carried out in complete safety without the necessity of shutting down the complete switchboard.

4.14 Distribution Boards

Distribution boards shall be metal clad, surface or recessed pattern with the number of ways, rating and phase arrangement (single or three phase) indicated on the Drawings.

Cases shall be zinc coated sheet steel of substantial construction with hinged lids fitted with foam rubber gasket, enamelled finish. Where called for in the specification the cases shall be provided with locks. For ratings of 60 amp. and over detachable drilling plates and soldering lugs for incoming cable terminations shall be provided.

Where the requirement for fuses is indicated on the Contract Drawing the Distribution Boards shall be fitted with high quality porcelain 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. The Distribution Boards shall be complete with HRC fuses to B.S. 88 1952, category 440 volts, A.C.5.

Where the requirement for miniature circuit breakers is indicated on the Contract Drawings, the Distribution Boards shall be fitted with moulded thermoplastic units of the combined thermal overload MCB's of all gratings shall have a minimum short circuit current breaking capacity of 3,000 amps.

Where the prospective fault current exceeds 2500 amps. or where specified, careful consideration shall be given to back-up protection or the installation of miniature circuit capacity in excess of 3000 amps. Although short circuit calculations were carried out when the Contract Drawings were prepared, the Sub-Contractor is advised to make his own calculations and assure himself that the prospective fault current at each protection level does not exceed the short circuit capability of the switch or distribution gear he intends to install as it is his responsibility to sign the appropriate declaration in accordance with the I.E.E. Regulations.

4.15 Labelling of Switchgear and Distribution Boards

All switchgear shall have engraved labels indicating the services fed from them. The inscription shall be in white 10mm. high letters on black 'Traffolite' sheet or equal and shall be fixed on adjacent to the apparatus by screws or rivets. Distribution Boards shall bear a number of inscription as called for on the Contract Drawings which shall correspond to that shown on the Record Drawings. The circuits fed from each Distribution Board shall be marked on a card or identification plate fixed to the inside of the Board or where provided for. This information must include the outlets (with cross reference to the reference numbers on Contract Drawings) fed from each fuseway or MCB and the size of the fuse or circuit breaker rating.

## SECTION 5

### 5.00 POWER CABLES

### 5.01 Paper Insulated Cables

These shall be 1100 volts, 3300 volt, or 11000 volt grade, according to operating voltage and manufactured and tested in accordance with B.S. 6480 for cables with copper conductors.

E.H.V. cables shall be suitable for operation on an earth system, and shall be of the belted type.

Multi-core cables shall be paper insulated, lead sheathed, single wire armoured and served with hessian or PVC or left bright as indicated on the diagram of distribution. Single core cables shall be of the fully impregnated non-draining type. Sizes of cables shall be in accordance with the details given on the Contract Drawings.

### 5.02 Jointing

Where possible the cores of the paper insulated cable shall be taken direct to the terminal of the apparatus. The conductor shall be sweated into a cast pattern cable socket that has been drilled to receive the conductor without excessive clearance. A cable spreader box shall be fitted to and below the apparatus and filled with compound after the cables have been installed. Alternatively, a system of compression jointing, approved by the Engineer may be employed. All cables tails shall be taped with double lapped empire tape and after lapping all cores shall be treated with two coats of first grade insulating varnish. VRL/PVC tails shall not be fitted without the approval of the Engineer in writing. If such approval is given the tails shall be of the same cross section as the PILC cable cores. The entire responsibility for the work involved in measuring, proper cutting, jointing and sealing paper insulated cables shall be borne by the Sub-Contractor who shall employ fully qualified, certified and experienced jointers for this work. This applies particularly to the jointers working on E.H.V. jointing.

Whenever a paper insulated cable is out prior to jointing the joint shall be commenced forthwith and completed without interruption. All necessary precautions shall be taken against the ingress of moisture and impurities during the preparation of the joint. Should the cable be cut and circumstances prevent a joint being made the ends shall be suitably sealed by means of plumbers lead caps pending the completion of the jointing work. The seals of the cables must not be removed until all preparations for jointing are complete and adequate protection from the weather arranged by the Sub-Contractor.

Before rejoining cable ends shall be tested for moisture content in an approved manner. If any moisture is discovered the wet cable or cables shall be cut out. Care should be taken when making off cable ends to phase out the cores to agree with the transformer terminals. No cross overs will be permitted in the leads. Phase colours shall be clearly indicated at all points of connections and shall comply with B.S. 158, Table 1. It shall be ensured that all times straight through joints are from A to a Z end. Under no circumstances will core cross overs resulting from joints of the same end of the cable be permitted.

5.03 PVC Insulated and Sheathed Single Wire Armoured or Unarmored Cables with Stranded Copper Conductors

PVC insulated, single wire armoured and PVC sheathed multi core cable shall be 660/1000 volt grade, manufactured in accordance with B.S. 6346. The cables shall be sized to comply with the current edition of the I.E.E. Regulations except where specific sizes of cables are shown on the Contract Drawings or detailed in other sections of the specification.

5.04 PVC Insulated and Sheathed Aluminium Strip Armoured or Unarmored Cables with Solid Aluminium Conductors

PVC insulated, aluminium strip armoured and PVC sheathed multi core cables shall be 660/1000 volt grade, manufactured in accordance with B.S. 6346. The cables shall be sized to comply with the current edition of the I.E.E. Regulations except where specific sizes of cables are shown on the Contract Drawings or detailed in other sections of the specification.

The cable cores shall be identified in accordance with B.S. 6346.

An approved system of compression terminations secured to the conductor by indentation made with a special die and a portable hydraulic compressor as recommended by cable manufacturer shall be used. Alternatively, in the appropriate conductor sizes and, where tunnel type terminals are used, connection may be made by means of "Swage" process whereby the shape of the conductor end is rounded to fit the terminal.

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. Aluminium armour may be used as the earth continuity conductor where the cross section is adequate for the purpose, but under no other circumstances shall be armour be used as a neutral conductor.

5.05 Gland for PVC Insulated Armoured and PVC sheathed cables

The cables shall be terminated on a mechanical type cable gland. The glands shall be complete with armouring clamp suitable for bonding the armouring to equipment by means of an earth continuity conductor of adequate cross section and the bend shall be carried out at the time of making the joint. PVC shrouds shall be fitted over terminal cable gland and clamp.

5.06 Installation

Cable routes were indicated on the Contract Drawings for tender purposes only. The exact final routing shall be agreed with the Engineer. All work except Builders Work shall be carried out by the Sub-Contractor, who shall include for the supply and installation of all jointing material, cable supports, steel racking shall be installed and tested in strict accordance with the appropriate clauses of the current edition of the I.E.E. Regulations, the Factories Act, B.S. 6480 - Paper Insulated Cables and B.S. 6346 - PVC Insulated Cables.

Cables shall at all times be handled with care and every effort made to avid damage. On loading, 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 tope of the drum and twisting shall at all times be avoided.

Adequate numbers of drum jackets, rollers and other handling accessories shall be used and make-shift arrangements will not be permitted. In all cases care shall not be frogged over loose earth, concrete or any surface but shall be adequately supported on rollers or manhandled into position.

The Sub-Contractor shall take particular care to avoid damage to other services which may run adjacent to or across the route to the cable being installed. Cables shall be installed with a minimum of 300mm clearance from an equipment or pipework 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 to the Engineer's satisfaction.

Cables passing through structural slabs shall be tightly wrapped with asbestos tape and grouted in. A hard wood surround below shaped to suit the cables passing through shall be fitted below the slab. Where cables are run vertical heavy gauge sheath 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 and dividing box or to a height of 1.mm above floor level.

Detailed drawings showing dimensions and method or manufacture of the cable guards shall be submitted for the approval of the Engineer. All cables shall be firmly and adequately supported from cable hangers for the whole of their length except when they are run through stoneware or pitch fibre pipes or are buried directly in the ground.

Continuity, phasing and insulation tests shall be carried out and the record of all tests shall be sent to the Engineer within 7 days of the cables being installed and joined.

5.07 Cable Supports

Where cables run through service ducts or cable trenches they shall be fixed by means of purposes made cable hangers which shall be of the Unistrut patter or equal and approved. Hangers shall be on non-ferrous metal or of steel and shall be treated with one coat of zinc primer and two coats of anti-corrosive paint and shall be suitable for horizontal and vertical mounting, either cased in, or secured to concrete structure using such brackets and adapters as are available from the manufacturers.

Hangers for the support of the cables shall be spaced according to the current edition of the I.E.E. Regulations, Table B. 2m or to the manufacturers recommendations as appropriate. The Sub-Contractor shall take particular care to avoid sagging of stress on any cable by wrong positioning or inadequately spaced hangers.

Single and multiway cleats shall be of cast alloy, interlocking pattern, for mounting either on the 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 cable.

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 be 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 service, 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.

5.08 Cable Identification Discs

Identification discs shall be supplied for cables installed within buildings and attached with galvanised wire to each cable at intervals not greater than 12m and at all conspicuous positions such as within cable trenches, manholes, and all cable terminations.

Discs shall be machine engraved from non-deteriorating black traffolite or similar material displaying white engraved indicating the design voltage, the description of load, and the number of cross sectional area of the cores.

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

5.09 Cable Ducts

The Sub-Contractor shall provide and lay asbestos cement or pitch fibre cable ducts under roadways or concrete walkways under which cables are to be routed. The Main Contractor will supply and install ducts where required in the footings of buildings, but it will be the Sub-Contractor's responsibility to provide accurate details to the Main Contractor of the required positions of these ducts, and to ascertain that they are laid to the correct falls. After the installation of all ducts shall be adequately sealed to restrict the ingress of moisture. The number of ducts to be provided shall be as follows:-

| | | |
|---|---|---|
| 1 cable | - | 2 ducts |
| 2 cable | - | 3 ducts |
| 3 cable | - | 4 ducts |
| 4 or 5 cable | - | 6 ducts |
| 6,7 or 8 cable | - | 9 ducts |

All cable ducts entering or within buildings including spare ways, shall be sealed at each and with Densoplast or other approved sealing substance to the satisfaction of the Engineer.

5.10 Terminal Sealing Boxes

All sealing boxes shall be of an approved make and design. The casting shall be of the split type secured together by bolts and nuts and treated inside and out with a suitable preservation compound and shall be complete with brass wiping gland.

The castings shall be made of close grounded cast iron glee from all holes and flaws. The halves of the casting shall be machined and so arranged to form an effective seal. The box shall be provided with an external armour clamp.

The Sub-Contractor shall ensure that the lead sheath and wire armouring is efficiently bonded to the metal parts of the apparatus served, with 300mm x 10mm copper tape. This bond shall be fitted at the time the joint is made.

An adequate compound filling gland shall be provided on each box and shall be so placed that the compound can be poured when the sealing end box is bolted into position.

Sealing compound shall be a blend of neutral bitumen base containing no coal tar derivatives of any kind and having no deleterious action whatever on the materials used in cable manufacture. The compound shall be in accordance with B.S. 1858.

5.11 Trenching

Trenching and backfilling will be carried out by the Main Contractor, but the Sub-Contractor shall be responsible for marking out the cable routes and for the supervision of the backfilling in so far as the prevention of damage to be cables in this process is concerned.

Cables in trenches shall be laid at a minimum depth of 600mm for L.V. cables and 700mm for 11KV cables and shall be on a 75mm pad of shift soil or sand and a further 75mm shall be added before placing cable covers in position. Where laid in trenches the cables shall be completely protected by inter-locking concrete or other approved cable covers indelibly marked "DANGER, HATARI"

Cable marker posts fabricated in precast concrete, shall be installed at each cable entry into the building, each change of direction, each road or pathway crossing and throughout the length of the cable at intervals not exceeding 40m. The marker posts shall indicate the voltage, depth and distance from the face of post of each cable installed.

Marker posts shall be provided at the position of all underground, through or tee joints and shall, in addition, to those functions detailed above, indicate the type of joint. The position of all marker posts shall be agreed with the Engineer before installation.

5.12 Testing

Before backfilling trenches and subsequent to all terminal jointing having been completed, H.V. cables shall be tested in accordance with B.S. 6480: 1966. L.V. cables shall be subjected to an insulation test at pressure of 1000 volts between cores and to earth and the results of these tests shall be recorded and communicated to the Engineer.

5.13 Cable Length, Types and Sizes

The Sub-Contractor shall be deemed to have allowed in the Sub-Contract Sum for supplying sufficient cable lengths of each type and size to complete the system and for making allowances for any additional lengths for cutting and waste.

5.14 Mineral Insulated Copper Sheathed Cables

Mineral insulated copper sheathed cables shall be manufactured in accordance with B.S. 6207 by an approved manufacturer. Where installed in corrosive situations, they shall be PVC sheathed. No cable shall have conductors less than 1.5mm$^2$ cross section. All main and sub-main cables shall be sized as shown on the Contract Drawings.

All final sub-circuit and control cables shall be sized in accordance with the current edition of the I.E.E. Regulations unless specifically noted on the Contract Drawings or the Specification

All mineral insulated copper sheathed cable glands shall be of the same manufacture as the cable glands shall be of the same manufacture as the cable and shall be of the compression type. The choice of cable seal type shall be based on the manufacturer recommendation for the particular application.

In areas where a flameproof installation is specified, the glands shall be of flameproof type.

The cable glands and seals for PVC covered mineral insulated copper sheathed cables shall be of the same type as those specified in the preceding paragraph. They shall, however, be fitted with rigid impact resistant hoods and shall be filled with plastic compound as used for sealing the $44^0$ C cables seals.

Connection of mineral insulated copper sheathed cables of 4mm$^2$ cross section and larger to apparatus shall in general by means of cone grip type cable lugs. At a termination, each core shall be identified by colour tapes or sleeves. Where this is not practicable, the Sub-Contractor shall advise the Engineer in writing and shall obtain his decision regarding the type of connection to be provided.

Where MICS cables are fixed to the structure of the buildings, the fixings shall be by means of copper saddles, brass screws and rawly plugs.

Where MICS cables are fixed to cable tray the fixings shall be by means of copper saddles, bolts and nuts. PVC covered copper saddles shall be used with PVC covered MICS cables.

Bare MICS cables shall only be fixed direct to painted structural steelwork and brackets or to painted PVC/Plastic coated steel cable trays as specified later.

All persons employed to make termination on MICS cables shall have attended a course of instruction approved by the Engineer. Prior to commencing work, they shall demonstrate to the Engineer. Prior to commencing work, they shall demonstrate to the Engineer their ability to make a satisfactory seal. The greatest care shall be taken at all times when terminating MICS cables and insulation tests shall be performed 24 hours after the cable has been sealed.

Where single core MICS cables are used, all necessary precautions shall be taken to prevent hysteresis and eddy currents.

Ferrous plates or structures through which cables pass shall be slotted and brass glands and sockets shall be used.

## SECTION 6

WIRING SYSTEMS

The system of wiring shall be as specified and shall be one or more of the following systems:-

6.01 System A - Cables in Concealed Steel Screwed Conduit or Trunking

The wiring shall be carried out in an approved type of single core, plastic insulated cable, enclosed in steel screwed conduit or trunking mechanically and electrically continuous throughout. Conduit shall be buried in the wall and floors of the building, and either run in roof space or buried in structural slabs.

6.02 System B- Cables Enclosed in Steel Screwed Conduit or Trunking fixed to the Surfaces of Walls and Ceilings

The wiring shall be carried out in an approved type of single core, plastic insulated cable enclosed in steel screwed conduit or trunking, mechanically and electrically continuous throughout.

Conduit and trunking shall be run on the surface of the walls and ceilings, or in a false ceiling spaces. Conduit shall be secured in position by means of spacer bar saddles, and counter sunk brass screws. Conduit shall be run horizontally on the walls or vertically to switches or outlets.

6.03 System C- PVC Insulated Cables with Insulated Earth Continuity Conductor Enclosed in Concealed Non Metallic Conduit or Trunking

Wiring shall be carried out in an approved type single core, plastic insulated cable with earth continuity conductor enclosed in high impact, heavy gauge, non-metallic conduit or trunking. Conduit shall be buried in the walls and floors of buildings, and either run in roof space or buried in structural slabs.

6.04 System D- PVC Insulated Cables with Insulated Earth Continuity Conductor Enclosed in Concealed Non Metallic Conduit or Trunking Fixed to the Surfaces of Walls and Ceilings

Wiring shall be carried out in an approved type single core, plastic insulated cable with earth continuity conductor enclosed in high impact, heavy gauge, non-metallic conduit or trunking. Conduit trunking shall be run on the surface of the walls and ceilings or in false ceiling spaces. Conduit shall be secured in position by means of spacer bar saddles. Conduit shall be run horizontally on the walls or vertically to switches or outlets.

6.05 Systems E - Mineral Insulated Copper Sheathed Cables

The wiring shall be carried out in single core or multi-core mineral insulated copper sheathed cables run on the surfaces of walls and ceilings, in the roof space or concealed in walls and floors.

6.06 System F - PVC Insulated and Sheathed Cables Clipped to the Surface of the Walls and Roof Members or to the ceilings.

The installation shall be carried out in an approved type twin or three core PVC insulated and sheathed cable. Cables shall be securely fixed to the surface of the walls and in the roof spaces, and shall be fixed to the underside of ceilings, only when there is no reasonable access from above. They shall be fixed to walls and the sides of roof members or in such other positions as may be approved by means of non-corrodible, saddles or bucker clips with non-corrodible fixings spaced at intervals not exceeding 25mm. Where cables pass through holes they shall be bushed.

Under no circumstances will joints will be permitted in the run of a cable. Wires shall be connected together only by looping into the terminals of accessories or by approved mechanical connectors in suitable joints boxes, under no circumstances will taped joints be permitted.

The cable sheathing shall be carried into the switch, ceiling rose or other accessories. Cables shall not be installed within 300mm of a metal roof, unless clipped to the lower side of wooden joints or otherwise protected from radiant heat.

6.07 System G - PVC Insulated and Sheathed Cable Clipped to Roof Members and Run in Metal or Plastic Conduit Drops Concealed in Walls.

The wiring shall be carried out as for System F except that cables shall be enclosed in steel or plastic conduit where drops are required to switches, distribution boards or accessories.

6.08 System H - PVC Insulated Single wire and PVC sheathed or paper insulated Lead Sheathed Single Wire Armoured and Serviced Cables Laid in Ducts, Trenches and saddled to Walls.

Cables shall be suspended on purposes made frame and hangers, drawn through ducts or laid in trenches. Cables suspended on multiple hangers shall be so arranged that one cable can be removed without disturbing the others. Frames and hangers shall be galvanised or non-ferrous material and shall not be fixed in contact with other metals with which they are liable to set up electrolytic action. All spacings of cable hangers and supports shall not exceed those laid down for the relevant size and type of cable in the current edition of the I.E.E. Regulations.

## SECTION 7

## CONDUITS, TRUNKING AND ASSOCIATED FITTINGS

7.01 Steel Conduits - Steel Trunking

Conduits shall be of welded gauge Clause B to B.S. Specification 31. In no case will conduits smaller than 19mm diameter be used on the Contract Works. Conduits installed within buildings shall be of black enamelled finish except where specified otherwise. Where installed externally, they shall be galvanised. Conduits fittings, accessories or equipment used in conjunction with galvanised conduits shall also be galvanised or otherwise as approved by the Engineer.

Metal trunking shall be fabricated from mild steel of not less than 18 swg. similar in pattern to that manufactured by M/S Wall Conduits Ltd. All sections of trunking shall be of the building at intervals of not less than 1200mm. Joints in trunking shall not overhand fixing points by more than 600mm. All trunking shall be made electrically continuous by means of 25mmx3mm copper links across each joint in the system. Connection shall be made by means of electro-tinned bolts (head inside trough) nuts (6mm dia minimum) flat washers and spring washers, and where the trunking is galvanised, the galvanising shall be removed within 6mm of the jointing strap, the area painted.

All trunking fittings (i.e. bends, tees etc) shall leave the main trough completely clear or obstruction and continuously open except through walls and floors, at which points suitable fire resisting barriers shall be provided as may be necessary. Where trunking passes through ceilings and walls the cover shall be solidly fixed 150mm either side of ceiling and floors and 25mm either side of walls. Screws and bolts securing covers to trunking, or sections of covers together shall be arranged so that damage to cables cannot occur either when fixing covers or when installing cables in the trough.

Where trunking is used to connect switchgear or fuseboards, such connections shall be made by trunking fittings manufactured for this purpose and not by multiple conduit couplings. Where boxes and bends or similar fittings are used, particular attention shall be given to avoid damage to cables on corners.

Where vertical sections of trunking are used which exceed 900mm in length, staggered tie off points shall be provided at 900mm internals to support the weight of cables. All trunking systems shall be painted as for conduit.

Where wiring system incorporate galvanised conduit and trunking, the trunking shall be deemed to be galvanised unless specified otherwise.

The number of cables to be installed in trunking shall be such as to permit easy drawing in without damage to the cables, and shall in no circumstances be such that a space factor of 45% is exceeded.

Conduit and trunking shall be mechanically and electrically continuous. Conduit shall be tightly screwed between the various lengths so that they butt at the socketed joints. The internal edges of conduit and all fittings shall be smooth, free insulating substances shall be removed from the screw threads. Where conduits terminate in fusegear distribution boards, adaptable boxes, non spouted switchboxes, etc., they shall be connected thereto by means of smooth bore male brass bushes, compression washers and sockets. All exposed threads and abrasions shall be painted (using an oil paint for black enamelled tubing and galvanising paid such as 'Rust Anodi' manufactured by C.P Development Co. (London) Ltd., for galvanised tubing immediately after the conduit are erected. All bends and sets shall be made cold without altering the section of the conduit, the inner radius of the bend shall not be less than 2 $^{1}/2$ times the outside diameter of the conduit. Not more than two right angle bends will be permitted without the inter-position of draw-in boxes shall be provided at distances not exceeding 12 metres. No tees, elbows, sleeves, either of inspection or solid type, will be permitted.

Conduit throughout shall be of sufficient section and so arranged with draw-in boxes to allow easy drawing in and out of any one or all of the cables in the conduit. All metallic and non-metallic conduit shall be swabbed out prior to drawing in cables, and they shall be laid so as to drain off all condensed moisture without injury to end connections. Conduit and trunking shall be run below and kept at least 150mm clear of cold water and other services otherwise approved by the Engineer.

Conduit installed and buried in walls shall allow a minimum of 10mm cover. These conduits and those cast 'in-situ' in concrete slabs shall be given one coat of rust prevention paid before installation of conduit and before concrete is placed. Sunk circular conduit boxes shall be provided with break joint rings of white moulded materials or metal. Surface conduit shall be run in square symmetrical lines and shall be marked on site for approval before

installation. Conduit shall be fixed by means of distance saddles spaced at not more than 1200mm, for 19mm and 25mm conduit and 1.5 metres for larger sizes. Conduit shall be fixed each side of conduit boxes at a distance not exceeding 600mm. Where conduit runs enter specified areas requiring flame proofs equipment, barrier boxes shall be inserted immediately before the conduit enters the flameproof area. All conduit 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, B.S. 889 and Code of Practice G.P. 1003.

In no case shall conduit from different distribution boards be connected at one junction box likewise cables from different distribution boards shall both be housed in the same conduit. All boxes shall conform to B.S. 31, shall be of malleable iron and black enamelled or galvanised according to the type of conduit specified. All conduit boxes, except loop-in pattern in concrete floors shall be fixed direct to the structure apart from the support provided by the conduit. Box lids where required shall be heavy gauge secured by means of brass screws.

Draw-in through boxes shall be provided in all conduit systems for the drawing in or out of any cables after installation is completed. All adaptable boxes and lids of the same size shall be interchangeable.

Boxes used on surface work shall be tapped or drilled to line up with the conduit fixed in distance type saddles allowing clearance between the conduit and wall without the need for setting the conduit.

Draw-in boxes in the floors shall be avoided except where they are essential when they shall be grouped in positions approved by the Engineer and covered by suitable floor traps, with non-ferrous trays and covers. The floor trap covers shall be recessed and filled in with a material to match the floor surface. The contractor shall take full responsibility for the filling in of all covers, but the filling in materials will be supplied and the filling carried out by the Contractor.

Where buried in the ground outside the building the whole of the buried conduit shall be painted with two coats of approved bitumastic composition before covering up. Paint damage and joints under screed or cast in-situ shall be similarly treated. 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.

7.02 Flexible Conduit

Conduit connection to motors and equipment shall be made using a minimum of 300mm waterproof flexible conduit. The solid conduit shall be terminated in a large BESA or adaptable box enclosing sufficient coils of motor cables to enable "Tong Test" readings be taken in each conductor. Earth continuity shall be maintained by means of a copper conductor sized in accordance with the appropriate table of current edition of the I.E.E. Regulations and insulated with Green and Yellow PVC. This conductor shall be run externally to the flexible conduit connecting apparatus to solid conduit and shall be secured to the connecting adaptors by an approved means.

All connecting adaptors shall be solid bronze or brass pattern with standard thread for conduit connection and a thread to receive the flexible conduit and the screw fully tightened.

7.03 Plastic Compound

All galvanised boxes and boxes in a situation where t he air flow is likely to cause excessive condensation shall be filled with a plastic compound which fulfils the following conditions:-

No effect on the physical properties of insulation at any temperature.

No effect on metals porcelain, synthetic resins, etc.
Unaffected by atmospheric and temperature extremes.
Remain placed indefinitely.
Has a high insulation value.

7.04 Telephone Conduit

The arrangement and size of telephone conduit shall be such as to accommodate the number of circuits as indicated on the Contract Drawings. Conduit shall terminate in standard metal boxes to B.S.1336 with flush fitting cover plate. Draw wires of piano quality steel wire of not less than 22swg. shall be left in all telephone conduit Draw-in boxes shall be provided in telephone conduit on the same basis as laid down for power and lighting conduit.

Telephone outlet boxes and the telephone distribution boxes shall be marked internally with yellow paint to distinguish them from boxes provided for other services.

7.05 Television Conduit

Television conduit shall be 19mm diameter thermo-plastic type installed vertically from each outlet point terminating 300mm above finished roof surfaces. A purpose made band shall be screwed on to the conduit at its roof termination. Outlet points shall be belling and Lee Type 1480 complete with plug type L734/pal or other similar and approved, fitted to a flush plastic box to B.S. 1363. Draw-in wires as provided for telephone conduit shall be installed.

7.06 Cable Tray

Cable tray shall be fabricated from perforated mild steel tray of 15mm minimum width and 14swg with returned flanges and coupling pieces for rigidity and strength similar to that manufactured by M/S H. Greening (Wolverhampton) Ltd Catalogue No.R.F.7 type. The cable tray shall be painted grey enamel for indoor use and shall be hot dipped galvanised for outdoor locations.

Cable tray shall be appropriately fixed on robust and substantial brackets fixed into the walls or shall be suspended on rods securely fixed to the structure together with a bracket arrangement as required to facilitate the support of the cable tray. Suspension rods shall be minimum 10mm dia mild steel. Brackets or suspension supports shall be provided as necessary, the spacing of which shall not exceed 1800mm.

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

7.07 Rising Main Bus-Bars

The rising main bus-bar system shall comprise a sheet metal enclosure containing copper bus-bars rising through the building via the riser duct, and supplying the distribution system at suitable tap-off position.

The bus-bars shall be contained in a trunking of not less than 16 gauge sheet steel with detachable cover plates providing a reasonably dustproof enclosure. The covers shall be in sections of length of which shall be approved by the Engineer prior to manufacture. Fixing Brackets for wall fixing shall be provided at not less than 1800mm intervals.

All steel work shall be given a rust preventative undercoat, and finished, in glass enamel in an approved colour. All screws, bolts, nuts and washers shall be rustproofed. Busbars shall be 4 pole 2 pole with full size neutral rated at the current indicated on the Contract Drawings, and shall consist of hard drawn, high conductivity copper bars. Current ratings shall comply with B.S. 159 for a temperature rise not exceeding $50^0$C

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Copper fishplates shall be used for connection between the lengths of bars, and high degree of conductivity shall be maintained. The bus-bars shall be anchored rigidly in the vertical run, and approved means of taking up the maximum expansion and contraction incorporated. The recommendations of the manufacturer's in this respect shall be closely observed. Phase colours shall be clearly marked.

Bus-bars shall be supported and anchored by means of suitable high grade non-hygroscopic and non-tracking insulation and designed to withstand the stress set up under fault conditions.

Where the rising bus bar systems are carried through floors, a barrier of fire resisting material shall be incorporated in the trunking at each floor level to prevent the possible spread of fire between floors. End covers shall be fitted at the top of the run.

A suitable cable entry with terminal type sealing end box shall be provided at the lower end of the system to accommodate the main cable, the size of which is shown on the Contract Drawings.

Tap-off units shall be of the type and current rating indicated on the Contract Drawings. All connections to bus-bars shall be made by means of bolted type clamps designed to ensure maximum conductivity at all times, and drilling of bus-bars will not be permitted.

A 25mm x 3mm copper tape shall be installed externally for the full length of the busbar trunking. The tape shall be bonded to each section at intervals not exceeding 1200mm, by means of 20mm brass bolts, washers and lock nuts.

7.08 Under Floor Ducting

Where under floor ducting is specified, it shall be of two or three compartment type manufactured from 16 gauge zinc coated steel with base plate and body welded together to make a single unit. The capacity of each section shall be adequate for the number of conductors to be drawn in and the space factor as required for compliance with the current edition of the I.E.E. Regulations shall not be exceeded.

## SECTION 8

### CABLES IN CONDUIT OR TRUNKING

8.00 Cables in Conduit or trunking

8.01 The wiring throughout shall be carried out by looping cables progressively from point to point and no tee or other joint will be permitted. Conductors of the same circuit shall be contained in the same conduit or trunking. At distribution boards, the neutral bar in the same sequence as the live conductors are connected to the fuses or circuit breakers so that they can be readily identified

8.02 PVC Cable in Conduits

Unless otherwise specified cables shall conform to B.S. 6004. They shall be 600/1000 volt grade, single core. No cable smaller than 1/1.38mm (1.5mm$^2$) shall be used. Cable sizes shall comply with circuit details as indicated on the Contract Drawings. Slack cable shall be left at all points of connection.

When used with pinch type terminals cable ends shall be prepared as follows:-

i) 1/1.38mm (1.5mm$^2$) and 1/1.78 (2.5mm$^2$)- the conductor doubled back on itself to present a double thickness.

ii) 7/0.85mm (4.0mm$^2$) to 7/1.70mm (16mm$^2$)- the strands well twisted together to make as solid a conductor as possible.

iii) 7/2.14mm (70mm$^2$) and above - the strands sweated solid or fitted with purpose made soldering thimbles.

Cables shall be delivered to the site with seals intact and offered to the Engineer for inspection prior to installation.

Care shall be taken when pulling PVC cables into conduit, to ensure that no crossed cables are allowed to enter the conduit. At all draw-in boxes, sufficient cable shall be left to allow an easy sweep from one conduit entrance to another. All cables shall be drawn in after erection of the complete conduit ant trunking system, or completed section if approved by the Engineer and all plaster has dried out. Draw wires, tapes of cables shall not be threaded in at the time conduit is being installed.

The live and neutral conductors of a circuit shall be drawn in the same conduit or enclosure. Cable sizes shall be selected to allow for a 20% increase in load on every final sub-circuit.

Space shall be left in conduit and trunking for drawing in at some future date two additional cables of size not less that the largest cable enclosed in the conduit or trunking being considered.

Not more than 6 final sub-circuit cables shall run in conduit feeding outlet boxes, without the approval of the Engineer. No board shall be enclosed in any one circuit. Flexible cords shall be of 300/500 volt grade VR or PVC insulated and shall comply with B.S. 6500. No flexible cord smaller than 0.75mm$^2$ shall be used. Flexible cords for pendant fittings shall be circular heat resistant type, white finish.

## SECTION 9

TESTING ON SITE

9.01 Installation Tests

The Contractor shall conduct during and at the completion of the installation and if required, again at the expiration of the maintenance period, tests in accordance with the relevant section of the current edition of the I.E.E. Regulations, the Government Electrical Specification and the Electric Supply Authority's By-laws. Tests shall be carried out to prove that all single pole switches are installed in the 'Live' conductor.

Tests shall be carried out to prove that all socket outlets and switched socket outlets are connected to the 'Live' conductor in the terminal marked as such, and that every earth terminal is effectively bonded to the earth continuity system. Tests shall be carried out to verify the continuity of all conductors of each 'ring' circuit. Phase tests shall be carried out on completion of the installation to ensure that correct phase sequence is maintained throughout the installation.

The Contractor shall prepare and handover to the Engineer within 14 days of the witnessed tests three copies of the results of the above tests. The Contractor shall be required to issue to the Engineer the requisite certificates upon completion as required by the current edition of the I.E.E. Regulations. Any faults, defects, omissions, faulty workmanship or incorrectly positioned or installed parts of the installation made apparent by such inspections or tests shall be rectified by the Contractor at his own expense.

9.02 Test Equipment

The Contractor shall provide accurate instruments and apparatus and all labour required to carry out the above tests. The instruments and apparatus shall be made available to the Engineer to enable him carry out such tests as he may require.

9.03 Attendance on Other Contractors

The Contractor shall generally attend on other Contractors employed on the Works and carry out such electrical tests as may be necessary.

9.04 Equipment, Plant, Apparatus and System

The Contractor shall test to the Engineer's approval and as specified, all equipment, plant and apparatus forming part of works and before connecting to any power or other supply and setting to work.

Where such equipment, etc, forms part, or is connected to a system whether primarily or an electrical nature or otherwise (e.g. Air Conditioning System) the contractor shall attend on and assist in balancing, regulating, testing and commissioning, or if primarily an electrical or other system forming part of the Works, shall balance, regulate, test and commission the system to the Engineer's approval.

## SECTION 10

EARTHING

10.1 Earthing

The extent of earthing equipment to be installed as part of the Contract Works shall be as follows:-

10.2 Earthing System for High Voltage Supply

A main earth busbar of 55mm x 6mm of high conductivity hard drawn copper shall be mounted on insulators on the wall of the Sub-station at the position indicated on the Contract Drawings. The following connections shall be made to this busbar:-

a) Insulated stranded cable connection to the transformer neutral.
b) Bare conductor to the transformer frame.
c) Bare conductor to H.V. switchgear frame.
d) Bare conductor to L.V. switchgear frame.
e) Insulated stranded conductor to sub-station earth electrode

The size of the earth continuity conductors shall be as follows:-

| Maximum Prospective Fault Current | Insulated Stranded Conductor | Bare Copper Conductor | |
|---|---|---|---|
| 14KA | 19/2.52 (95mm$^2$) | 25mm x 9mm | 9KA |
| 19/2.14 (70mm$^2$) | 25mm x 3mm | | |

Where necessary, earthing connections shall be protected against mechanical damage and corrosion.

Where connections are made to the earth busbars, containing surfaces shall be tinned.

The earth electrodes shall comprise of 8 earth busbars, contacting surfaces shall be tinned.

The earth electrodes shall comprise 8 earth rods, installed in pairs, each pair connected together and to the earth busbar by an insulated stranded conductor. The earth rods shall be 1.5m long by 15mm dia, extensible type as "copperweld" or other equal and approved, each pair of electrodes shall be located not less than 3m apart, the first paid being not less than 3m form the building.

The head of the earth rods shall be driven to 300mm below the surface of the ground and enclosed in a concrete box with a concrete inspection cover. The metal sheaths of all H.V. and L.V. cables shall be adequately bonded to the appropriate switchgear frame.

10.3 Earthing System for L.V Supply

Where the supply is taken at L.V. from either a substation on the site or a remote substation, the following earthing equipment shall be installed:-

1. In the main switchroom (supply intake):

   -A copper earth busbar, as described in Clause 10.01.
   -A bare 25mm x 3mm copper conductor from each item of isolated switchgear, connected to the earth busbar.
   - A complete earth electrode system, installed as specified in Clause 10.01, connected by an insulated earth continuity conductor to the earth busbar.

2. In the switchrooms of isolated buildings on the site:

   -A similar earthing installation to that described in (1) above.

3. -In the event of the KP & L Co. providing an earth terminal at the intake position, the earth continuity conductors, described in (1) and (2) above, shall be omitted.

10.4 Protective Multiple Earthing

Where protective multiple (PME) is provided by the supply undertaking, the earthing lead shall be connected to the consumer's earthing terminal and, together with the neutral conductor of the installation, shall be so arranged that connection to the neutral conductor of the incoming supply can be carried out by the supply undertaking.

The earthing of the installation shall comply with the requirements laid down in the current edition of the I.E.E Regulations. The earthing system for H.V. supply, described in Clause 10.01 shall be amended for the provision of separate earth electrodes for the H.V. and L.V. sides of the installation.

In addition, provision for earthing the neutral conductor shall be made for each distribution main at the end farthest from the transformer where it is connected to the main switchboard of an independent building or area of the site.

10.5 Consumer's Earth

The Consumer's earth is deemed to be the earthing terminal at:

1. The main L.V. switchboard
2. The L.v. switchboard at the intake position of an isolated building.

The consumer's earth will be bonded to the earth busbar in the sub-station in an approval manner.

10.6 Bonding

All conduit, trunking metal enclosures, the metallic sheathing of cables, the cases and enclosures of switchgear, fuse gear and apparatus of an electrical nature in each building shall be so bonded as to be directly connected to the respective consumer's earth. Earthing arrangements and the resistance of the earth continuity conductor shall comply with the current edition of the I.E.E. regulations.

In situations such as bathrooms, kitchens, laundries or any situation where there is exposed metal and socket outlets or fixed appliances are installed, all metal work including hot and cold water pipes, waste pipes, metal draining boards, the casing of electrical appliances, etc., shall be effectively bonded to the earth continuity conductor of the electrical installation to ensure that no difference in electrical potential can arise between these items.

Earthing systems shall be tested in accordance with the current edition of the I.E.E. Regulations, and if the minimum impedance required by the I.E.E. Regulations is not obtainable, the Engineer shall be informed. The Sub-contractor shall be responsible for rectifying any fault in the earth continuity conductor at his own expense.

i) 1/1.38mm (1.5mm$^2$) and 1/1.78 (2.5mm$^2$) – the conductor doubled back on itself to present a double thickness.

ii) 7/0.85mm (4.0mm$^2$) to 7/1.70mm (16mm$^2$) – the strands well twisted together to make as solid a conductor as possible.

iii) 7/2.14mm (70mm$^2$) and above – the strands sweated solid or fitted with purpose made soldering thimbles.

Cables shall be delivered to the site with seals intact and offered to the Engineering for inspection prior to installation

Care shall be taken when pulling PVC cables into conduit, to ensure that no crossed cables are allowed to enter the conduit. At all draw-in boxes, sufficient cable shall be left to allow an easy sweep from one conduit entrance to another. All cables shall be drawn in after erection of the complete conduit ant trunking system, or completed section if approved by the Engineer and all plaster has dried out. Draw wires, tapes of cables shall not be threaded in at the time conduit is being installed.

The live and neutral conductors of a circuit shall be drawn in the same conduit or enclosure. Cable sizes shall be selected to allow for a 20% increase in load on every final sub-circuit.

Spaces shall be left in conduit and trunking for drawing in at some future date two additional cables of size not less than the largest cable enclosed in the conduit or trunking being considered.

Not more that 6 final sub-circuits cables shall run in conduit feeding outlet boxes, without the approval of the Engineering. No board shall be enclosed in any one circuit. Flexible cords shall be of 300/500 volt grade VR or PVC insulated and shall comply with B.S. 6500. No flexible cord smaller than 0.75mm$^2$ shall be used. Flexible cords of pendant fittings shall be circular heat resistant type, white finish.

## SECTION 11

INSTALLATION OF LUMINAIRES

11.1 Fixings

Information on the proposed method of fixing each type of luminaire is included in Part C of the Specification.

11.2 Alignment

Care shall be taken that individual luminaires are aligned with the ceiling in all planes and that there is proper alignment in groups or was of luminaires.

Where necessary, cast iron extension rings shall be used to provide alignment between recessed point boxes and finished ceiling levels.

11.3 Enclosures

In situations where a luminaire is fitted to a ceiling of combustible material, the back plate or other accessory shall be so designed that the connecting cables are completely enclosed.

11.4 Earthing of Luminaires

At every lighting point an earthing terminal shall be provided and connected to the earth continuity conductor of the final sub-circuit.

11.5 Programme for Erection of Luminaires

The Contractor shall liaise with the Client in order that luminaires can be recited at such a time that:-

i) the work of other trades is not inhibited by the presence of the fittings in-situ.

ii) no damage is caused to finished ceilings or walls.

iii) where fittings are located in selected space left open in a suspended ceiling, there is adequate clearance for any other services in the ceiling void at that point.

No claims will be considered for costs of extra works or damages which arise out of the contractor's failure to comply with this clause.

## SECTION 12

### 12.1 GENERAL

The lighting switches, socket outlets, fused spur outlets and similar accessories shall be as specified. The type of accessory to be used in each location is related to the type of wiring system in that area.

In all cases where switches are grouped together, and are connected to the same phase they shall be ganged together and mounted in a multi-gang box and plate.

Where switches control points are not readily visible from the switching position the plates shall be engraved to indicate the points controlled.

All switches controlling maintained circuits shall have the word "MAINTAINED" engraved on the switchplate.

Multi-gang switch boxes, containing switches supplied from different phases shall have integral fixed separators segregating the switches on different phases. Each such segregated compartment shall have a separately fixed metal cover clearly marked 'Danger' 415 volts and the overall switchplate shall cover the whole.

### 12.2 Special Accessories

Accessories for special purposes such as speed controls for small motors, dimmers, flameproof or sparkless switches, etc., shall be as specified. Where special accessories are supplied as part of the Contract Works they shall have a finish to match the other accessories installed in the same area.

## SECTION 13

PLANT POWER WIRING

13.1 General

Wiring to motor outlets and control outlets in Plant Room Boiler Houses, etc., and to remote motor and control outlets forming part of the Mechanical Engineering Services installation, shall be carried out in one of the wiring systems described in the specification.

The approximate location of motor control outlets, distribution boards and control panels is shown on the Contract Drawings. Details of size and type of cables, and rating of fuseways or circuit breakers are shown on the diagram of connections.

Precise instructions on the contractor's responsibilities for the supply, fixing and connecting of equipment such as isolators, starters, control switches, sensing elements, annunciator panels etc., are given in the Particular Specification. Where such items of equipment are provided by others it will be their responsibility to issue schematic diagrams, diagrams of connections and details of any special requirements, such as the provision and specification of screed cables and to ensure that the equipment is suitable for the electrical characteristics of the supply available.

13.2 Power Outlets for Lifts

The outlet for each lift shall terminate on an isolator located at the position shown on the Contract Drawings. The rating of the isolator and the size and type of cables are shown on the diagram of connections.

The switch fuse controlling a Fireman's Lift shall be located on the main switchboard, and shall be provided with means for padlocking in the 'ON' position.

Where the installation includes a mains failure generator, the supply to the Fireman's Lift shall be connected to the 'essential Services' section of the main switchboard.

The isolating switch controlling each lift shall disconnect all supplied to the lift hoist and control equipment.

## SECTION 14

14.1 General

Non-metallic conduit shall be best quality new super high impact grade heavy gauge Class 'A' rigid PVC unplasticised conduit as manufactured by Ega Africa Ltd, suitable for plain connections.

14.2 Manipulation

The conduit shall be bent and formed strictly in accordance with the manufacturer's instructions.

i) Small sizes, i.e. 15mm, 19mm, shall be bent cold by inserting the correct size bending spring. It is essential for right angle bends that the conduit is bent past $90^0$C to allow for 'spring back'.

ii) Larger sizes of conduit shall be preheated before inserting rubber code to prevent kinking. Conduit badly formed or bent or damaged in any way, shall not be used.

14.3 Jointing of Plain Conduit

Joints shall be made water-tight by the use of 'Egaweld' cement applied with a brush or rag. 'Egaweld' 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 end fittings. 'Egaweld' shall not be permitted to enter into the conduit.

14.4 Conduit Fittings

All conduit fittings and accessories including couplers, reducers, stopping plugs, lock nuts and male and female bushes shall be manufactured to B.S. 4607 Part 1, 1970.

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 Engineer's approval.

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

14.5 Fixing of Conduit

Conduit shall be installed on the loop-in system and shall be either cast-in-situ in the main concrete structure concealed in chases case in concrete wall, or chases cut in solid partition walls, run in ceiling spaces or in hollow partitions of floors; concealed below the floor screed, whichever shall prove to be the most suitable method of installation for use in the building under construction. Unless it is clearly specified or shown on the drawing, the method of installing conduit shall be subject to the approval of the Engineer.

Sunken conduit run in chases in walls shall be fixed by means of mild steel pipes hooks or non-metallic saddles spaced not more than 900mm apart. Where conduit is concealed behind plaster it shall be sunk to a depth of either 6mm below finished plaster level or installed flush with the structural level before application of plaster, whichever is the lesser depth. Conduit fixed on the surface of walls or ceilings shall be fixed by spacer bar saddles fixed not more than 900mm apart.

Surface conduit shall also be fixed 125mm on both sides of all boxes, the box itself securely fixed. Where such an arrangement of boxes and saddles would prove to be both unsightly and unnecessary, short lengths of conduit not exceeding 900mm in length between boxes need not be secured further than by connection to the adjacent boxes. In such cases the Engineer reserves the right to insist upon additional fixings being provided, should he for any reason whatsoever consider additional fixings necessary.

Where two or more lines of conduit run parallel to each other, on the surface of walls, etc the distance between them shall be not less than 20mm and conduit shall not cross.

Conduit shall be installed in such a manner as to prevent interference with other services and shall be kept at least 150mm clear of gas or water pipes, and heat in excess of $68^0$ C.

A means of expansion shall be provided in conduit runs in excess of 6m without any bend or set, by the use of "Egatube" expansion couplings which shall also be used tat building expansion joints.

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

and all boxes shall be securely fixed to the shuttering with nails, or by means which shall be visible as marked on removal of the shuttering only where these marks can be concealed. Conduit shall be installed after the first gird 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.

Immediately prior to installing the wiring all conduit and fittings shall be dried and cleaned out by drawing through a cloth swab. Rawlplugs shall be used for fixing to brickwork, self-tapping screws 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.

14.6 Circular Inspection Boxes

Boxes will not be permitted in floors unless approved. Boxes cast-in-situ must face downwards from the ceiling/floor section. Small standard circular non-metallic conduit boxes, conforming dimensionally with B.S. 33/1940 with the standard circular non-metallic (3mm) lids and nylon fixing screws, shall be provided and fixed at all junctions.

The above circular boxes or equivalent looping boxes shall be provided and securely fixed for all ceiling points. When the conduit is run on the surface, all circular boxes for ceiling points. When the conduit is run on the surface, all circular boxes for ceiling points shall be fixed with screws.

Where ceiling boxes 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.

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

Where non-metallic outlet box of thermoplastic material is used for the fixing or suspension of a lighting fitting, care shall be taken to ensure that the temperature of the box does not exceed $60^0$C and the box shall be fitted with Egafrica steel insert clips.

14.7 Stopping Plugs

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

14.8 Continuity

Where fittings and accessories require earthing, an earth continuity conductor shall be run through the conduit. The earth continuity conductor shall be of copper minimum size 1.0mm$^2$ and shall be continuous between terminals. Where the earth terminal is formed by a brass screw and washer, 'Rose Courtney' terminations shall be used.

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.

## SECTION 15

MOTOR STARTERS

15.1 General

All starters shall comply with B.S. 587:1957, and shall be suitable for 'frequent' mechanical duty (clause 5.3 of B.S. 587 - 40 operations per hour). The starters shall comply with mechanical test requirements to B.S. 587:1957, clause 9.2.4 (2,000,000 operations).

15.2 Coils

Starter coils shall be wound on moulded formers and shall be vacuum impregnated.

15.3 Overload Relays

Overload relays shall be of the thermal type with each relay forming a single-pole unit containing a trip-switch operated by a bi-metallic blade under the influence of a heater carrying the line current. Each starter shall be fitted with an assembly of 3 similar relays in a mounting frame complete with hand reset facility.

15.4 Enclosures

Starter enclosures shall be of pressed steel or high impact polycarbonate. The enclosures shall be rust-protected and shall be fitted with a dust-protecting gasket between the two portions of the enclosure.

15.5 Single - phase AC Motor Switches

Single-phase AC Motor switches shall be double pole dolly operated through a trip free mechanism which ensures that the starter cannot be held ON against an overload. The non-adjustable trip mechanism shall be operated by a bi-metallic strip under the influence of a heater carrying the line current and shall reset automatically after tripping. The single phase motor switches shall comply with B.S. 587: 1957.

15.6 Push-Button Control Stations

The push button control station shall be rated a maximum working voltage of 550V. A.C and shall be fitted with single pole double break contacts.

Emergency stop buttons shall be fitted with a latching device which restricts the push button movement until the latch is released by counter clockwise rotation.

The enclosures for the control stations shall be dust-proof pattern with fabricated steel body and cast iron end plates.

# PARTICULAR SPECIFICATION

# AND

# CONDITIONS

INDEX

## SECTION 1

## 1.00 PARTICULAR CONDITIONS

### 1.01 Location of Site

The site of the proposed project shall be situated on the existing JOOUST , MIYANDHE CAMPUS, SIAYA COUNTY

### 1.02 Description of Project

The project comprises of the construction of a research centre and hostels

### 1.03 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.

### 1.04 Statement of Compliance

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

### 1.05 Discrepancies

It is deemed that, if in the opinion of the Sub-Contractor at the time of tendering, there existed a difference between the Specification and the Sub-Contract Drawings, that the Sub-Contractor shall clarify this difference with the Engineer before tendering.

### 1.06 Ordering of Materials

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

### 1.07 Scope of Works

The Sub-Contract works shall comprise the supply, delivery, erection, testing, commissioning and setting to work of the Electrical Engineering Services as detailed in this specification and accompanying Sub-Contract drawings.

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

It is deemed that if in the opinion of the Contractor at the time of tendering, there existed a discrepancy between the Specification and the Contract Drawings, that the Contractor clarified this difference with the Engineer before tendering.

The work to be undertaken under this Contract shall comprise **but not restricted** to the following:

- Main L.V Switchgear/PFC/Voltage Stabilizer
- Power Distribution feeder pillars
- Distribution Boards.
- Main and Sub-main cabling
- Artificial Lighting
- Single phase power installation.
- Structured cabling and active devices
- Earthing
- DSATV, UHF and VHF system duct and conduit work.
- Audio visual and sound system
- External and security lighting
- Street Lighting
- Electric fence

1.08 **Builder's Work Requirements**

All chasing cutting away and making good will be done by the Contractor and will be deemed to have allowed for the work in his tender.

The Sub-Contractor's attention is drawn to the fact that most of the conduit work shall be chased into walls and floor slabs. Surface conduit work shall be kept to a minimum and then only with the approval of the Project Engineer.

1.09 **Storage of Materials**

The Sub-Contractor shall be liable for the cost of any storage accommodation provided especially for their use. No materials shall be stored or stacked on suspended slabs without the prior approval of the Architect.

If the Sub-Contractor does not wish to use the storage space provided by the Client, he may, at the Engineer's discretion, be allowed to store these in his premises. In this case, the Sub-Contractor shall be required to provide a security bond specifically covering these materials intended for use on the Sub-Contract works.

1.10 **Labour Camps**

Labour camps will not be permitted on the site and the Sub-Contractor shall allow for all transport and other charges in moving labour to and from the site.

1.11 **Site Visit.**

The tenderer is strongly recommended to visit the site and shall be deemed to have satisfied himself with regard to conditions under which the Sub-Contract works shall have to be carried out.

## SECTION 2

### 2.00 INCOMING ELECTRICITY SUPPLY(ALREADY APPLIED BY CLIENT

### 2.01 General

The electricity supply shall be derived from the Kenya Power & Lighting Co. Ltd.'s network. The incoming under-ground and overhead cables will be supplied, installed and connected to the main L.V. switchboard by the Kenya Power & Lighting Co. Ltd. The Meterboards and main MCCBS shall be supplied and installed under this sub contract

A Prime Cost Sum is included in the appropriate Price Schedule of the Specification for the Client's capital contribution towards the Power Authority's service line and connection charges. The power supply shall be H.V. metered. The client would supply the transformer and H.T. equipment.

The Sub-Contractor shall ascertain the size and type of incoming L.V. supply line/cable that will be installed by the supply authority and thereby ensure that the correct glands and terminations for the service cables entries into the meterboard are provided.

**The Sub-Contractor shall ensure that the power supply is availed at site by the Power Authority in time for testing and commissioning of the installation.** The necessary application for the supply shall be submitted by the Project Engineer in good time.

### 2.02 Earthing

Earthing and bonding shall be carried out to comply with the regulations currently in force. An earth electrode system shall be installed adjacent to the Kenya Power & Lighting Co. Ltd.'s supply intake. The Sub-Contractor shall liaise with the Power Authority and ensure that the main L.V. switchboard earth is bonded to their earth and to the building's lightning protection system.

The Sub-Contractor shall carry out tests to ascertain the value of the soil resistivity and shall submit his proposals for the most practical arrangement of the earth rods to the Engineer for approval before commencing the installation of the earth electrode systems.

A Provisional Sum has been included in the appropriate Price Schedule of this Specification for any additional earthing that may become necessary to achieve an effective and permanent earth electrode system in accordance with Clause 10.02, Part B.

Provision shall be made for Protective Multiple Earthing with the final connection being effected by the Kenya Power & Lighting Co. Ltd.

### 2.03 Attendance

The Sub-Contractor shall pay all attendance and liaise fully with M/s. Kenya Power & Lighting Co. Ltd. in ensuring satisfactory completion of all their work.

## SECTION 3

## 3.00 MAIN L.V. SWITCHGEAR AND FEED PILLARS

### 3.01 Scope of Works

This section of the specification covers the following:

(i) The supply of the main moulded case circuit breakers and the ancillary equipment associated with the main meterboard for Back of House and new cabling and feeder pillars to new cottages and spa

(ii) Installation, tesing and commissioning of the Laundry main L.V switchgear and sub boards in Accordance with the contract drawings and specification.

### 3.02 Contract Drawings

The Tenderer's attention is drawn to the following contract drawings which are particularly relevant to this section of the works:
Main Schematic Diagram of Electrical Distribution Drawings No. MCE17/17.2/03E

Site Plan Drawing No. MCE17/17.2/02E
The tenderer shall be deemed to have studied all the contact drawings listed in Appendix 1 of this specification, and have allowed for any necessary provisions in this section of the works required thereby.

### 3.03 The Main L.V. Switchboard

The main L.V switchboard shall be free standing cubicle with front access incorporating the equipment as detailed in the Main Schematic Diagram of Electrical Distribution. The switch shall be manufactured to FORM 3 standards and powder coated.
The switchboard shall be complete with all internal connection, digital voltmeters and ammeters, instrument selection switches, cable glands or boxes and space for power factor equipment.
The switchboard shall have a separate compartment to house the metering equipment and shall be to the power Authority's approval.
The switchboard shall be constructed from not less than 10 gauge welded bright mild steel framework and structural sections and 16 gauge for doors and panels which shall be adequately stiffened by folding or welded stiffeners and grey and stove enameled. The main mccb shall have a minimum breaking capacity of 50 Ka r.m.s at 415V and shall be manufactured by Merlin Gerlin or Terrasaki makes no other make shall be approved.

### 3.04 Paint Finish

After de-greasing and preparation of the steel work shall be finished by a stoving process. The thickness of the final paint of coat being 20 microns minimum. This shall give a rust-free durable finish ideal for severe industrial or tropical environmental conditions. The standard finish colour shall be decided by the Engineer in charge of the project.

**3.05 Busbars**

Busbars shall be insulatedhard drawn high conductivity copper. The horizontal busbar system shall be supported on special insulators from the switchgear manufacturers which shall be factory tested for various short circuit levels.



The spacing of the insulators shall be as specified by the switchgear manufacturers with insulators spaced at every 250mm to brace 30Ka for 1 second. Busbar supported on toughnol only shall not be accepted under any circumstances.

The switchgear shall conform to BS 5486 FORM 3B classification of protection and separation.

The protection against foreign bodies shall be to BS 5420 IP54.

**3.06 Feeder-Pillars**

The feeder pillars shall be IP54 protection free from moisture ingress and water splash. The bus-bars shall be insulated hard drawn high conductivity copper. The horizontal bus-bar system on special insulators from the manufacturers which shall be factory tested for various short circuit levels.

## SECTION 4

### 4.00 ELECTRICAL DISTRIBUTION SYSTEM

### 4.01 Scope of Works

This section of the Specification covers the supply, installation, testing and commissioning of the main supply cable and sub-main cables, consumer units and distribution boards in accordance with the Contract Drawings and Specification.

### 4.02 Sub-main Cables

The main and sub-main supply cables and methods of installation shall be as shown on the Schematic and Layout Drawings and/or specified in Section 5 Part B of this Specification. The cables shall be as manufactured by BICC, East African Cables Limited or other equal and approved.

### 4.03 Consumer Units

The consumer units shall conform with the requirements of Clause 4.15, part of this specification and shall be as manufactured by M/S Merlin Gerlin. Each house unit shall have its own consumer unit.

Schematic of the individual MCB consumer units have been prepared as shown on the Contract Drawings.

All neutral conductors in a single phase consumer unit shall be connected in the same circuit sequence as its phase conductors i.e phase wire No.1 connected to No.1 terminal on the neutral bar.

In addition to this requirements every consumer unit each phase and neutral conductor shall have clipped to its sheath numbered tag corresponding to its circuit number. The tags shall be the type manufactured by M/S Critchley Brothers Ltd. A1 circuit numbering shall commence from left to right.

## SECTION 5

## 5.00 LIGHTING AND POWER INSTALLATION

5.01 **Scope of Works**

This section of the specification covers the supply, installation, connection, testing and commissioning of the lighting and powerinstallation in accordance with the Contract Drawing sand Specification. The tenderer shall allow for receiving, handling, storage installation of client supplied luminaires and accessories.

5.02 **Wiring Systems**

Final sub-circuit wiring shall be carried out using single core PVC insulated copper cables enclosed in high impact heavy PVC conduits cast in slabs in situ, embedded in fabric of the building or run on the roof space.

Single phase 13A socket outlets unless otherwise specified shall be wired using 30A ring main circuit system or radial circuits as shown on the Contract Drawings.

An insulated earth continuity conductor shall be enclosed in all non-metallic conduits.

5.03 **Lighting Luminaires**

Luminaires shall be of the type and manufacture as detailed in the schedule of luminaires Appendix II of this specification

All luminaires shall be supplied and installed complete with LED lamps and tubes of the wattage specified.

All fluorescent tubes shall be warm white as manufactured by Thorn/Philips Lighting or other equal and approved and shall conform to B.S. 1853

5.04 **Lighting Switches and socket Outlets**

In general areas lighting switches shall be flush mounted, single pole, 10A rating, rocker operated grid switches with ivory moulded plastic cover plates.

Socket outlets and spur units shall be flush moulded 13A rating with rocker operated switches and ivory plastic moulded cover plates.

All lighting switches shall be as manufactured by M/S Crabtree Ltd or M.K. Electrical Ltd. No other maker will be permitted.

5.05 **Water Heaters**

Water heaters shall be controlled via 20ADP switch from a local circuit. Water heaters switches shall be double pole, 20A rocker operated with neon indicators and ivory plates to BS 4662.

## 5.06 **Cooker Control Units**

Cooker control units shall be flush mounted with 45A DP switch 13A switched socket outlet and neon indicators. An appropriate connector block shall be installed at low level. The cooker control units shall comply fully with B.S 4177 and shall have ivory plastic cover plated.

## 5.07 **Connector Boxes**

Connector boxes for cookers and water heaters shall be flush mounted with moulded cover plates. The connector boxes shall be supplied complete with blocks and cord grips, terminals shall be capable of accommodating up to 2No. 10mm$^2$ stranded copper.

## SECTION 6

## 6.0 STRUCTURED CABLING AND PATCH PANEL

### 6.01 Location of Site

The site of the proposed project shall be situated **in in Miyandhe Cmpus , Siaya County**

### 6.02 Description of Project

The scope of works includes remodelling of a New building ground , first and Second Floor into a premises active switches and installation, testing and commissioning of client applied digital /IP enabled and ISDN ready PABX complete with necessary licenses extension cords and support software to support 20No. POE IP Phones

### 6.03 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.

### 6.04 Climatic Conditions

The following climatic conditions apply at the site of the works and all plant, equipment, apparatus, materials and installations shall be suitable for these conditions:

| | |
|---|---|
| Maximum temperature | $29.2^0$C |
| Minimum temperature | $15.6^0$C |
| Average temperature range | $14^0$C |
| Relative humidity range | 44% - 67% |
| Altitude | Approximately1173metres ASL |

The Sub-Contractor shall be deemed to have taken into account the above details in his prices and planning of the execution of the works.

Unless otherwise stated, all ratings of plant, equipment and apparatus shall be interpreted as site ratings and not sea level or other ratings

6.04 **Scope of Works**

The Sub-Contract Works shall comprise the supply and installation of equipment and plant, erection, testing, commissioning and setting to work of the Electrical Engineering Services as detailed in this Specification and the accompanying Contract Drawings.

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

It is deemed that if in the opinion of the Sub-Contractor at the time of tendering, there existed a discrepancy between the Specification and the Contract Drawings, that the Sub-Contractor clarified this difference with the Engineer before tendering.

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

The work to be undertaken under this Sub-Contract shall comprise but not restricted to the following:

1. Patch panels

2. UTP CAT 6E cabling and vertical fibre optic cabling.

3. Patch cords

4. RJ 45 DUOL outlet modules

5. Wiring closets (cabinets)

6. Cord organisers

7. Fibre optic cable

All equipment as far as is practicable shall be designed and manufactured by a single preferred manufacturer. In any case, equipment shall be of uniform standards compatible in operation and spare parts, trained support and maintenance facilities. In this regard the tenderer shall produce a letter of Product and Applications Assurance Warranty of at least15 years.

1.05 Ordering of Materials

The Sub-contractor shall order materials from quantities taken from his own approved working drawings and not from the quantities shown on the contract drawings or in the specification. The tenderer shall ensure that all correct parts are ordered and installed.

6.06 Builder's work requirements.

All chasing, cutting away and making good of walls and slabs will be by the principle Sub-contractor and will be deemed to have allowed for the work in his tender.

6.07 Orientation.

The Tenderer shall allow for the orientation of the Client's Representative to a level where they are sufficiently confident and proficient in managing, trouble-shooting and maintenance of the system.

The orientation shall be carried out immediately after installation and shall be taken into consideration in assessing the completion of the project and release of payments.

The Sub-contractor shall be deemed to allow for any costs associated with the orientation.

6.08 Tender Return Items.

The tenderer shall submit the following together with the tender.

a) Drawings and publications illustrating the systems being offered against the schedules.

b) A comprehensive description of the structured cabling system being offered to meet the requirements detailed elsewhere in the specification.

c) The manufacturers catalogues showing such details as dimensions, colours and configurations.

d) Other documents referred elsewhere in this specification.

6.09 Standards and Regulations.

The design, manufacture, selection, installation, testing, commissioning and subsequent maintenance of all equipment and materials described in this specification shall comply with the requirements of:

i) Institute of Electrical and electronic Engineers (IEEE)

ii) Communication Commission of Kenya (CCK) and Telkom Kenya (TKK).

iii) Kenya Bureau of Standards (KBS)

iv) CENELEC

v) International Standards Organisation/International Electro technical Commission (ISO/IEC) IS 11801.

vi) The following Electronic Industries Association/Telecommunications Industry Association (EIA/TIA) standards.:

a) 568B – Commercial Building Telecommunications wiring standards.

b) 569 – Commercial Building Standard for Telecommunications pathways and spaces.

c) TSB-67 – Transmission Performance specifications for filed testing of unshielded, twisted pair cabling systems.

d) 72 – Centralised Optical Fibre Cabling Guidelines.

e) 75 – Cabling practices for open offices.

vii) Underwriter's Laboratories (UL) cable Certification and follow up programme.

6.10 Site Visit

The tenderer must visit the site and shall be deemed to have satisfied himself with regard to conditions under which the Contract works shall have to be carried out.

6.11 Defects Liability, Spares and maintenance Contract.

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

The tenderer shall include details of a maintenance contract to provide regular maintenance from the start of the defects liability period, in accordance with this specification. The Sub-contractor should note that the client may wish to enter into a negotiation with him/her and is therefore not bound to accept the contract sum proposed.

1.12 Warranty

The sub-contractor shall submit an extended product Warranty and Applications Assurance of at least 15 years for the wiring system.

The extended product warranty from the Manufacturer shall include but not restricted to the following conditions:-

a) That the registered cabling installation shall be free from manufactured defects in material or workshop under normal and proper use.

b) That all approved passive cabling products of the registered installation meet or exceed the (Near End Cross Talk) NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, bandwidth and attenuation/loss specifications of the ISO/IEC IS 11801 (1995), CENELEC EN 50173 1995 and TIA/EIA 568-B and their approved amendments.

c) That the installation will meet or exceed the PSNEXT, ELFEXT, PSELFEXT, return loss, attenuation and NEXT requirements of ISO/IEC 11801 (1995), CENELEC EN 50173 (1995), CENELEC EN 50173 (1995) and TIA/EIA 568-B and their approved amendments for fibre cabling.

The applications Assurance shall cover but not restricted to the following conditions:-

a) That the registered structured cabling system will be free from failures, which prevent operations of the specific application(s) for which it was originally designed. This shall not include failures due to electronic hardware and/or software.

b) Applications specified in the current and future versions of the manufacturers structured cabling system performance specification.

c) Any application introduced in the future by standards or user forums that use the ISO/IEC IS 11801 or TIA/EIA 568-B UTP or fibre components and UTP or fibre link/channel specifications for cabling.

6.13 Workmanship

The installation and method of fixing of all device covered by this specification shall be co-ordinated with building fabrics and finishes to which they are fixed.

Work shall be done to the highest standards of care within the industry and shall be subject to inspection and acceptance by the Engineer.

Inspection by the Engineer shall not relieve the Sub-contractor from any responsibility for the proper supervision and execution of the work described in this specification.

All components of the structured cabling system shall be installed in a neat manner. Wiring colour codes shall be strictly observed and terminations shall be uniform throughout the system. Identification markings and systems shall be uniform. TIA.EIA 606 administration guidelines shall be used as standard for all structured cabling system wiring.

6.14 Documentation.

The Sub-contractor shall provide a theoretical and practical orientation prior to the final commissioning covering the following subjects:-

i) The generic cabling system (General Description, technical specifications, standardizations etc).

ii) Link performance measurements (what, how, test equipment etc).

iii) Network administration (purpose, needs etc.)

iv) Maintenance of the generic cabling system (Trouble shooting, spare parts etc).

v) Any other training found indispensable, desirable by the Sub-contractor to recommend by the manufacturers..

The Sub-contractor shall also provide a complete, organised and uniform documentation. Each document shall be technically correct and shall refer to the quoted equipment only. The contents shall be structured in a logical way. Computer based documentation shall be preferred.

The documentation shall contain but is not restricted to:-

i) General description of the installation and product specification. It shall contain general layouts per floor with locations of outlets, floor distributors and horizontal cabling. Backbone details, detailed layout of each distributor and its patch panel shall be included.

ii) Test and measuring reports.

iii) Connectivity diagrams.

iv) Network Administration documents.

v) Operation manuals.

6.15 **Inspection, Testing and Commissioning.**

The Sub-contractor shall inspect, test and commission the structured cabling system works in accordance but not limited to relevant IEEE, TIA/EIA, ISO/IEC, CENELEC, ASTM and Communication Commission of Kenya (CCK) and Telkom Kenya (TKL), the inspection, Testing and Commissioning section of the Main Contract and the equipment manufacturer's recommendations. The results of all tests shall be recorded on the standard test forms unless otherwise specified.

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

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

The Sub-contractor will provide a cabling management system for system administration. This will enable the Client to accurately identify and keep a record of all the components, which comprise the cabling system as well as pathways, telecommunication closets and other spaces in which it is installed.

The Sub-contractor shall provide the following to assist the Client in network administration:

i) Ensure consistent colour coding per telecommunication outlet, patch panel etc.

ii) A unique identifier assigned to every part of the cabling system (cables, outlets distributors etc).

iii) A label at each telecommunication outlet the numbering of outlets based on floor and work area numbers.

iv) A label at each cable end to indicate corresponding telecommunication outlet.

v) A cable schedule for each distributor indicating the cable number, its source and destination, its type and current use. This schedule shall be ordered both by cable number and destination.

vi) A complete patch list for all cross sections.

vii) A full set of "As built drawings.

The tenderer shall submit a list of equipment/tools for carrying out the installation and testing of the system.

## SECTION 2.0

### 2.1 SYSTEM OVERVIEW

The Site of the proposed project shall be situated IN MIYADHE CAMPUS, SIAYA COUNTY

Video conferencing and high rate data transmission is expected and so real time systems are expected.

The backbone for both voie and data will be fibre optic cable and the multicore copper cable will be for retardance voice only. The backbone will interlink all cabinets at every wing of floors as shown on the contract drawings.

## SECTION 3.00

### 3.1 TELECOMMUNICATION OUTLETS.

All faceplates shall be available in twin arrangement in a single gang configuration.

Voice and data communication outlets shall consist of two gang utility outlet boxes/plates equipped with 8-pin modular (RJ 45) jacks. All horizontal cabling shall terminate on termination blocks at their associated wiring closet.

All telecommunication outlets for 24AWG (American Wire Gauge) copper cable shall be modular 8-position/8-conductor outlets. The outlets shall be able to support universal applications in a multi-vendor environment accepting modular RJ 45 plugs.

All unused module locations shall be provided with blank module inserts.

All telecommunications outlets shall conform to TIA/EIA 586-B, ISI1801 and EN50173 requirements. Where an outlet is configured in worst-case of 100 metre channel, the telecommunication outlet shall be capable of delivering a minimum Guaranteed Channel Performance of class E.

Telecommunication outlets shall be backward compatible with CAT 6 – when the outlet is mated with a CAT 6 plug, the connection performance shall be CAT 6 or better.

The Sub-contractors shall supply the wiring and/or cords, connectors and extension cords.

## SECTION 4.00

### 4.1 Horizontal Cabling.

The horizontal cabling for telephone and data transmission shall be Unshielded Twisted Pair (UTP) copper cables. The data cables are to be terminated on patch panels mounted on MDF/IDFs at one end and RJ45 jacks at the other end.

The horizontal cabling shall extend from floor distributors to the telecommunication outlet.

Horizontal cabling shall be run in a star topology format and will not exceed 90 metres from the patch panel to the outlet.

All horizontal cables used for each outlet shall be 4-pair CAT 6 unshielded twisted pair (UTP) unless otherwise stated.

During handling and installation, the Sub-contractor shall observe the bending radius and pulling strength requirement of the 4-pair unshielded twisted pair (UTP) cable.

The cable run between the telecommunication outlet and the patch panel shall be continuous without any joints or splices.

In raised floors or suspended ceilings without cable trays/conduits, the Sub-contractor shall bundle the wiring with plastic cable ties at appropriate distances. Where appropriate 'J' hooks shall be used to support the cables.

All communication cabling used throughout this project shall comply with the requirements as outlined in the appropriate local codes. All cabling shall meet the relevant fire performance standards for the environment in which they are installed.

All cables shall be terminated testing and labelled in an alphanumeric sequence at all terminations. All copper cable terminations shall comply with and be tested to TIA/EIA 568-B, TSB-67 standards and TA/EYE 606 respectively for CAT 6 available and unused pairs shall be terminated and identified as spare at each location station. Cables shall terminate on the wall or trunking plates as shown on the contract drawings.

All cables used shall meet or exceed Guaranteed Class E Channel performance values when configured as worst-case channel.

Cables shall be tested for the following parameters:-

i) Characteristics impendence
ii) Cross talk attenuation.
iii) DC loop resistance
iv) Attenuation.
v) Propagation time
vi) Immunity to EMI
vii) EM radiation.

4.2 **Telecommunication Room**

The structured telecommunications cabling system shall utilize the Main Telecommunications ducts and server room.

The server room will accommodate the telephone and data equipment racks and grounding busbar, cable cross connect and termination hardware.

4.3 **Facility Backbone Cabling.**

The MDF physically shall be linked to various parts of the building distribution Frames (BDFs) via a multi core cable in a star configuration. The backbone cables are terminated on patch panels mounted on the Main Distribution Frame (MDF) and Building Distribution Frames (BDFs).

4.4 **System Protection.**

Telephone and data equipment, MDF, IDF, cables, metallic pathways and all metallic components of the telecommunications cabling system shall be protected by the telecommunications grounding system. The grounding system shall consist of ground bars, and grounding wires designed to achieve a minimum ground resistance of no more than twenty five (25) ohms and zero potential with power system ground. Ground resistance in manholes shall be no more than twenty five (25) ohms.

4.5 **Pathways.**

Backbone cables installed outdoors shall be are routed through underground conduit system. Data conduits are provided with innerducts for fibre optic cables. Horizontal cables are routed through trunking conduits and/or accessible ceiling space adequately supported by cable hangers.

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## SECTION 5.00

## FLOOR ADMINISTRATION

### 5.0 General

Administration centres shall be set up on each floor so that each floor network is autonomous. Wiring utilized for data and voice communications shall originate from the floor distributors in vertical freestanding equipment racks located at the Administration closet. Works at and between this designated demarcation points and outlet locations shown on the contract drawings shall be considered part of this sub-contract.

This sub-contract shall supply cross connect wires, patch cords and fibre patch cords for cross-connection and inter-connection of termination blocks and patch panels.

The Administration system shall consist of RJ45 modular stackable patch frames for termination of copper cables and/or 1U combination shelf for the termination of optical fibre as indicated in the Bills of Quantities.

### 5.1 Station Outlets and Drops.

All individual cable drops shall be terminated on faceplate with data connectors.

Sub-contractor shall terminate data pairs of each cable on distribution panels with design specified connectors.

### 5.2 Connecting hardware and Support.

Install termination hardware required for copper and fibre optic cable system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors (IDC).

### 5.3 Pathways.

Install pathways to comply with EIA/TIA-569. Conceal conduit under floor slabs and within finished walls, ceilings, and floors.

Keep conduit minimum 150mm away from parallel runs of electrical power equipment, flues, steam, and hot water pipes. Install conduit parallel with or at right angles to ceilings, walls and structural members where located above accessible ceilings and where conduit is visible after completion of project. Run conduits in crawl spaces and under floor slabs as if exposed. Install no more than two 90-degree bends for a single horizontal cable run.

All conduits shall be clearly labelled at both ends designated the closet by number, which includes the sequential numbering of the conduit originating at the closet. Conduit length shall also be indicated on the label.

No section of conduit run shall be longer than 30 metres and contain more than two 90 degree bends between pull points or pull boxes.
The inside radius of a conduit size is greater than 2 inches, the inside radius shall be at least 10 times the internal diameter of the conduit.

For fibre optic cable, the inside radius of a conduit bend shall be at least 10 times the internal diameter of the conduit.

Underground conduits shall not be smaller than 100mm in diameter unless otherwise specified. The conduit shall be provisioned with two(2) 38mm and one (1) 25mm inner ducts each installed with indexed pull cords. The concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 75mm of concrete cover for ducts.

Separate conduits by a minimum concrete thickness 0f 75mm. Provide plastic duct spacers between ducts every 1500mm. The top of the concrete envelope shall not be less than 760mm below grade. Duct lines shall have a continuous slope downward toward manholes and away from buildings with a pitch of not less than 100mm in 30 metres.

Pull boxes shall not be used for splicing cable. Boxes shall be placed in a straight section of conduit and not used in lieu of bend. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes. Pull-boxes shall be labelled on the exposed exterior.

5.4 **Manholes and Pull Boxes**.

Manholes and pull boxes shall be installed in paved areas wherever possible and each box shall be kept a minimum of 300mm clear of edge of paving. Top of box shall align with finish surface of paving, or 50mm above finished grade if installed in earth. Install boxes where runoff water will not drain to the box.

Provide pulling irons on opposite walls and below horizontal centre-lines of ducts and cemented openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.

5.5 **Clearances**

Telecommunications cabling and pathways with copper media shall be installed in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per metre (3.0 V/m) measured over the usable bandwidth of the telecommunications cabling.

Pathways shall be installed with minimum clearance distances of 120mm from motors, generators, frequency converters, transformers, x-ray equipment, uninterruptible power

system, 300mm from power conduits and cable systems, 130mm from fluorescent or high frequency lighting system fixtures.

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5.6 **Electrical Penetrations/Fire Stopping**

Sealing of openings between floors, through rated fire and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

Creation of such openings as are necessary for cable passage between location as shown on the drawings shall be the responsibility of the contractor's work. Any openings created by or for the contractor and left unused shall also be sealed as part of this work.

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## SECTION 6.00

## BACKBONE SYSTEM

6.01 **Voice Backbone**

This will link the main Distribution Frame (MDF) to the Internal Distribution Frame (IDF), on the ground floor, PABX and the Administration closets. The backbone cables shall include vertical runs of cables from the PABX at ne end terminating in the Administration closets on each wing at the other end. Cables from the PABX to the Telecommunication cabinets shall be as CAT 3.

Riser and tie cables shall be extended between the administration closets utilising the inter-floor riser service duct, trunking or sleeves. Voice backbone shall be installed to all floors.

Building (indoor) copper distribution cables shall be solid 24 AWG UTP 100 ohms Category 3 UTP consistent with TIA/EIA-568-B, FCC part 68. The cable shall be suitable for plenum or non-plenum application where required.

Outside plant copper distribution cables shall be single sheath, copper shield, foam skin filled PIC cable. Cable conductors shall be solid 24 AWG UTP 100 ohms category 3 UTP in accordance with TIA/EIA-568-B and TIA/EIA-758.

6.02 **Data Backbone**

The backbone with include vertical and horizontal runs of cables linking all the floors server room utilising the inter floor riser duct, trunking or sleeves.

This will be an outdoor multimode fibre optic cable.

6.03 **Type of Cable**

The Sub-contractor shall supply and install unshielded 24 AWG multi-pair copper CAT 6 cables or fibre optic cables for the backbone. The cable(s) shall support voice and data applications.

If proposed, the fibre optic cable should be an outdoor multimode riser cable 62.5 micron. The cable should be terminated on newly recommended SC fibre connectors.

Sub-contractors shall observe the bending radius and pulling strength requirements of all backbone cables during handling and installation.

## SECTION 7.00

## EQUIPMENT

### 7.1 Cabinet/Closets

Building and floor distributors shall be described in the Bills of quantities with lockable transparent door.

The Distribution unit will contain the patch panels with fibre optic and RJ45 connectors, distribution frames with Insulation Displacement Connection (IDC) modules and the auxiliary equipment (cable organizers, power distribution bar, lighting, earthing, fans e.t.c.).

Cabinet shall be model **32/42U** able to contain each type of active equipment with a view to future development. The tenderer shall take into consideration the active equipment at the administration point and shall allow space for this.

The Sub-contractor shall connect the trunk cross-connect and the distribution cross-connect the common equipment such as PoE switches or server computer in the computer room.

The mounting hardware must provide vertical and horizontal wire ways for cross-connect wires.

The 19" racks must be available in various heights of up to 42U. The minimum rack size shall be a standard 19" with sufficient rack space to allow Fibre Distribution Centre (FDC) to be placed at the top of the rack if proposed.

### 7.2 Modular RJ45 Patch Panel

The patch panel will have standard dimensions (19") in order to guarantee the fitting in a standard rack, box or cabinet. To avoid installation errors the insulation displacement connection (IDC) contacts shall be marked with the same colour code as the cables and the outlets.

Patch panels shall be full CAT 6 with more than 40dB NEXT measured at 200MHz between every pair combination thus capable of supporting applications of up to 200 MHz as specified in the ISO/IEC JTCI/SC25 IS 11801.

The patch cords will be arranged in a patch guide (Cord organizer) to achieve a well-ordered network management.

The RJ45 patch panel shall have RJ45 jack termination in front and Insulation Displacement Connector (IDC) at the rear of the module.

The panels shall be available in different standard port configurations. The modular jack panel will have an insertion life of 750 cycles minimum. When configured in worst case 100 metre channels with full cross-connects and consolidation points with other products proposed in this tender, the connecting block shall be capable of delivering the minimums Guaranteed Channel Performance.

**7.3** **Fibre Patch Panels**

The sub-contractor shall ensure that the rack provided at the distribution has sufficient space for installing the fibre distribution centre (FDC) on it.

The fibre patch panel shall be a one-unit combination shelf to provide for termination, cross-connection, interconnection, splicing and fibre identification for up to 6/12 fibres in the equipment racks. The shelf shall be capable of providing protection from mechanical stress on the cable and fibres and also from macro bending losses.

7.4 Patch panel/Active Device 42U Cabinet Specification.

- Heavy duty cater wheels
- Powder coated and spray painted.
- Lockable glass front door.
- Adjustable fixed trays.
- Lockable steel rear door
- 2 x removable side panels
- Earth grounding continuity kit
- Sufficient cable management rings/brush panes/rack mounting.
- Size 42U to serve all the three floors
- In built power supply system
- Colour coding for different patch cords
- Low noise fan with vent guard and air filter
- Adjustable levelling feet.

## SECTION 8.00

## EARTHING

The sub-contractor shall provide adequate earthing (Grounding) for both electrical safety and Electromagnetic Compatibility (EMC) performance, which are subject to national and local regulations.

It is the responsibility of the Sub-contractor to ensure that the cable raceways I.e. trunking, metal ducts are properly earthed to reduce EMI. The Sub-contractor is expected to earth all the cabinets, enclosures and racks.

It is the Sub-contractor's obligation to liaise with the Electrical Sub-contractor to establish the type of earthing used for this particular project.

All telecommunications racks, cables, splice cases, cable trays, metal cabinets and other metallic components shall be bonded and grounded in accordance with TIA/EIA-607 Telecommunications Bonding and Grounding Standard and applicable NEC articles.

All wires used for telecommunications grounding shall be identified with a green insulation. Non-insulated wires shall be identified at each termination with a warp of green tape.

## SECTION 9.00

## SYSTEM DOCUMENTATION

The Sub-contractor shall provide Certification, Testing and Documentation of the telecommunications system and its components consistent with TIA/EIA-568B, TIA/EIA-606, TIA/EIA-607 and other applicable standards.

### 9.1 As-built Drawings

The Sub-contractor shall provide the central drawing set to the Client at the conclusion of the project. The marked up drawing set shall accurately show the as-built status of the system. A narrative shall also be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

### 9.2 Test Reports.

Test documentation shall be provided in a three ring binder within three weeks after the completion pf the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words "Test Results", the project name and the date of completion (Month and year).

The binder shall be divided by major heading tabs. Each major heading shall be further sectioned by the test type. Within the horizontal and backbone sections, scanner test results, fibre optic attenuation test results, OTDR traces, and green test results shall be segregated by tab.

Test data within each section shall be presented in a sequence listed in the administration records. The test equipment by name, manufacturer model number and last calibration date will also be provided at the end of the document. The test document shall detail the test method used and the specific settings of the equipment during the test.

Scanner test shall be printed on 215 x 279 mm paper. Hand written test results (attenuation results and green light results) shall be documented on an excel spreadsheet. OTDR test results shall be printed or attached an d copied on 215mm x 279mm paper for inclusion in the tests documentation binder.

When repairs and re-tests are performed, the problem and corrective action taken shall be noted and both the failed and passed test data shall be collocated in the binder.

9.3 **System Inspection**

The Client's Representative will make periodic inspection of the project in progress. Upon completion of the project, the Client's Representative will perform inspection of the installed cable system with the Sub-contractor's Project Foreman to ensure that the cable system is installed in accordance with the contract drawings and specifications.

9.4 **System Verification**.

Sampling tests will be performed by the Engineer to validate contractor furnished tests results. The Client will also activate the network to validate the functionality of the cabling system.

9.5 **Acceptance Tests.**

Copper and fibre optic cables and its components shall be tested in accordance with the approved tests plan and consistent with TIA/EIA recommended standard tests. Tests shall be in accordance with test equipment recommended procedures and practices. Test equipment shall be properly calibrated to derive accurate test results.

The tests results printed on industry recommended test forms and formats shall be submitted to the Engineer. The Engineer may order changes, adjustments or further tests deemed necessary to assure that the systems is complete and functional.

9.6 **Warranty.**

The Sub-contractor shall warrant that all work executed and materials furnished shall be free from defects of material and workmanship for a period of 2 years from acceptance date of sub-contract completion.

Immediately upon receipt of written notice from the Client, the Sub-contractor shall repair or replace at no expense to the Client, any defective material or work that may be discovered before final acceptance of work or within warranty period; any material or work damaged thereby; and adjacent material or work that may be displaced in repair or replacement. Examination of or failure to examine work by the Client shall not relieve Sub-contractor from these obligations.

A fifteen (15) year Extended Product Warranty and System Assurance Warranty for the cabling system and connecting hardware components shall be provided. Theses warranties shall cover the replacement or repair of defective product(s).

The system Assurance shall cover the failure of the cabling system to support the network application(s) for a period of no less than fifteen (15) years.

The manufacturer shall warrant availability of spare parts for ten years common to proposed system.

9.7 **Completion**

The Sub-contractor shall be deemed complete with the work after the following have been accomplished:-

- All system testing has been completed, the Sub-contractor certifies that the entire system is in working order, and the cable test forms have been submitted to the Client.
- All trunking covers have been firmly put back in place.
- All construction debris and scrap materials have been removed from project site.
- All marked up, project record documents have been returned to the Client.
- All unused customer material has been returned to the Client.
- The Client has successfully completed acceptance testing of the network installation.
- The Engineer has inspected and accepted the installation
- The keys and locks for all the cabinets have been handed over to the client.

## SECTION 10

## 10.0 TELEPHONE SYSTEM

### 10.01 Scope of Works

The scope of works shall comprise but not restricted to supply, installation, testing and commissioning of the following:-

- 1No. 100 pair Krone main Telephone Distribution Frame (MDF) and 4No. 40 pair equipment Krone Boxes for Normal Telephone and Intercom system.
- Block wiring cabling including 4No. 40 pairs junction boxes.
- Pre-wiring (Internal) cabling to each block, including 32No. Tone/Pulse Handsets.
- Testing and Commissioning of TELKOM including the necessary statutory payments and approvals
- 32 zone Intercom System complete with wiring and 32No. Tone/Pulse handsets.

### 10.02 Type Approval

The offered equipment shall be type-approved by TELKOM. This is a mandatory requirement.

### 10.03. System Maintenance

The tenderer or his agent is required to maintain the equipment in accordance with TELKOM liberalization Regulations.

### 10.04 Compliance with Specification

The tenderer shall comply with the specification fully.

Any deviation from the specification requirements shall be supported by elaborate explanation for consideration during the evaluation.

### 10.05 Standards and Regulations

The equipment shall utilize components, materials and finishes that confirm to the following standards:-

- TELKOM Technical Specification.
- Kenya Bereau of Standards
- ICE and IEE Regulations
- IEC Standards
- TIS Standards

## SECTION 7

## 7.00 DSATV SYSTEM

### 7.01 Scope of Works

The contract shall provide materials and services required for a complete Digital Satellite master antenna television system capable of providing the following channels:-

| | |
|---|---|
| KCB 1 & 2 | MNET |
| KTN | MOVIE MAGIC |
| STV | BBC/CARTOON |
| NATION TV | CITIZEN |
| FAMILY TV | All multichoice DSATV channels upon rental |
| Multichoice channels | Of Decorder shall be available. |

The Sub-contractor shall also provide all material and services required for a complete DATV system to multichoice approval.

All equipment, except TV sets, shall be provided and installed by the Sub-contractor, individual tenants would provide their own video systems.

All required conduit, junction and pull boxes shall be provided by others, but the Sub-contractor shall provide and install all the required coaxial cable and wiring for systems specified, including wall outlets. The Sub-contractor shall pull cable into conduit and install all system equipment and make all necessary connections, tests and adjustments for satisfactory operation of the entire system.

### 7.02 DIGITAL SATELLITE MASTER ANTENNA

#### (a) System functions and Requirements

The system shall provide for the reception of monochrome and colour television transmission at every outlet equal to, or superior than, that obtainable on a single standard receiver connected directly to the system antennae.

Unless otherwise indicated, reception shall be provided from all VHF and UHF television signals available at the site.

The system headend transponder shall be designed to permit insertion of locally generated television signals by means of modulators.

The distribution system can be designed and equipped for all channel VHF and UHF distribution. Subsequent expansion with additional VHF and UHF channels shall require modification of headend equipment only.

Unless otherwise indicated, all signals shall be distributed on the same channels they are received on. Local transmitters must be converted to other channels to avoid ghost pictures caused by direct radiation. Adjacent channel operation is not allowed in the system.
The system shall be rated and capable of continuous twenty-four (24) hour operation.

(b) **System Performance Specifications.**

All outlets shall provide signal levels of all distributed signals within the limits indicated below: -

(60dBuV = 1000 microvolts across 75 ohms)
Operational level 70dBuV (10dB for TV channels)
Operational level for FM band is 6dB below operational TV level.

The channel frequency response across the visual portion of the activated channels shall be flat within plus or minus 1dB.

The carrier to noise ratio at any outlet, insofar as is due to the contribution of noise by the DSATV system, shall be at least 43dB.

The ratio, after demodulation, between the maximum level of the desired signal and the interference resulting from cross-modulation from all other channels shall be greater than 46dB.

The system shall provide a minimum of 25dB isolation between any two outlets.

Subjective evaluation of the picture quality on a standard television receiver connected to any outlet in the system shall be utilized. No visible components of cross-channel intermodulation, ghosting caused by the system, or beat interference shall appear when the receiver is tuned to each and every distributed signal.

(c) **Equipment and Materials**

**Antennae**
The antennae shall be individual, sturdily constructed and shall cover al VHF and UHF bands.

Each antenna shall maintain appropriate gain and directivity characteristics to provide optimum signal level and a minimum of signal reflections.

They shall be mounted on one or more masts, and shall be properly spaced to avoid interaction.

The antennae and masts shall be adequately supported and guyed to withstand wind and other environmental conditions prevalent at this location.

All antenna supporting structures shall be protected against lightning damage by grounding to the nearest approved ground system. Grounding method shall be in accordance with all applicable national and local codes.

All antenna down-lead cables shall be 75 ohm coax. If antenna outputs are not 75 ohms, weatherproof matching transformers shall be provided. All cable fittings to the antennae shall be covered with weather sealing devices and sealed with silicone compound.

**Headend Equipment**

The headend equipment shall be housed in a rigidly constructed metal cabinet, louvred for ventilation and provided with hinged door and lock. The location of the headend cabinet shall be in such a place that alignment and service can easily be realized.
The headend equipment shall consist of all required bandpass or reject filters, AGC-amplifiers, modulators, frequency converters, channel amplifiers, poer suppliers, power inserters and splitters.

All amplifying equipment at the headend shall be solid-state.

The headend amplifying equipment shall consist of individual amplifiers for each television channel.

The inputs to these amplifiers shall be from the individual antennae. In the event that the signal from any antenna is less than that required to drive the channel amplifier to the midpoint of the AGC dynamic range, a pre-amplifier for that particular channel shall be provided.

Space shall be provided in the headend equipment cabinet to allow the installation of at least two additional channel amplifiers in the future and an additional mains voltage output for connecting measuring equipment.

(d) **Distribution System**

Components in the distribution system shall have the following bandwidth capability.

**All Passive Devices**

(splitters, Taps, Couplers, cable etc) 10 to 860 MHz

**Amplifying Equipment** 40 to 860 MHz

Distribution and line amplifiers shall be broadband type to cover the range of VHF and UHF frequencies specified above.

The amplifiers shall be so rated and operated that the sync compression at any outlet is no more than 0.5dB.

The amplifiers shall be so rated and operated that the ratio, after demodulation, between the maximum level of the desired signal and the interference resulting from cross-modulation from all other channels shall be greater than 4dB.

The amplifiers shall have the appropriate power level capability and flatness of response that will enable the total system performance specifications (under section 2) to be met.

All amplifying equipment shall be sold-state.

All line splitters shall be of the passive type, incorporating 75 Ohm hybrid design. They shall be 75 Ohm back-matched units. Tap-ff ratio and insertion loss shall be chosen for each location to ensure the total system performance specifications.

The system coaxial cable shall be 75 Ohm impedance. It shall be sweep tested by the manufacturer and certification shall be available on request.

Acceptable cable is for instance coax 12 bamboo 6, or cable with identical specification.

## SECTION 7

7.01 **RECEIVING ANTENNAES**

The contractor will supply and install: -

4No. premium channel satellite dish antennas and complete with supporting masts.

**Note:**

a) Premium channels do not required a tacking antenna.
b) The sub Contactor will provide a list of all the premium satellite channels they can offer including their monthly (or other) subscription charges from which the tenants will make a selection.

**Note:**

KTN and STV can use the same antenna since transmitters for both channels are located at Ngong Hills and frequency separation is small.

7.02 **Cables and Accessories**

The sub Contractor will supply and install all the required cable and accessories.

11.03 **Satellite Receiver /Decorder**

Contactor will not supply and install a receiver/decorder for channels provided (individual tenants to supply the same).

7.04 **Distribution Equipment**

The sub Contractor will supply and install all necessary distribution equipment which may consists of; -
i) Distribution amplifiers
ii) Signal splitters
iii) Line amplifiers

Quantity will depend on the configuration the contractor adopts

The number of DISH LNB output ports will be a minimum of 12No.- No.1 for each block. Each flat shall be wired via radial circuit from the DSATV Dish at roof level to minimize blockage of some DSATV Channels

7.05 **Terms**

**Equipment Documentation**

For all equipment supplied and installed, the Contactor will provide installation, operation and repair manuals.

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7.06 **Training**

The Sub-contractor will install and commission all the equipment to the engineer's approval.

7.07 **Spares**

The Sub-contractor will state the recommended spares including a price list for the same at the time of tendering.

7.08 **Price Validity**

Price validity should not be less than 3 months (90days) from the date the tenders are opened.

7.09 **Delivery Period**

The Sub-contractor will state the delivery period.

7.10 **Projection Completion**

The Sub-contractor will state the period which the project will take from the date of notification of award.

7.11 **Pricing**

The Sub-contractor will give prices for all equipment, materials, labour as described in the Bills of Quantities.

**Mono-Block Comprising of:-**

Ground Floor

First Floor

Second Floor

## SECTION 7

## 7.0 EQUIPMENT TECHNICAL SPECIFICATIONS

Minimum specifications are as follows: -

7.1 Antennaes

**a) Satellite dish - 4No**

| | | |
|---|---|---|
| Type | - | Mesh (to reduce wind loading) |
| Tracking | - | none |
| Diameter | - | 2.4 meters |
| Frequency | - | As necessary |
| Band width | - | 500 MHz |
| VSWR | - | 3 |
| Gain | - | 45dbi |

**b) VHF Antennaes for KBC Channel 1**

| | | |
|---|---|---|
| Type | - | Yagi or equal and approved |
| Frequency band | - | VHF low band |

**c) UHF Antennaes for KBC Channel 2, KTN and STV**

| | | |
|---|---|---|
| Type | - | Yagi or equal and approved |
| Frequency | - | UHF |

7.2 **Cables**

For RF Satellite Signals:

| | | |
|---|---|---|
| Impedance | - | 75 Ohms |
| Type | - | Coaxial |

7.3 **Satellite Receiver / Decorder**

| | | |
|---|---|---|
| Power supply | - | Ac 240 Vrms (10%, 50 Hz) |
| Frequency range | - | As necessary |
| Input impedance | - | 50 Ohms |
| Output impedance | - | 75 Ohms |
| Output level | - | Maximum possible for good reception |

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## SECTION 8

## 8.00 CONFERENCE AND BOARDROOM SOUND SYSTEM

### 8.01 Work categories

The works of this Sub- Contract shall comprise of the supply, installation, testing and commissioning of equipment and accessories in the following sound transmission stages:-

a) Sound input system
b) Sound mixing and Amplification Stage
c) Sound Output Stage
d) Testing & Commissioning

### 8.02 Working drawings

The Sub- contract shall prepare detailed working Drawings for the approval of the Acoustic Consultant, before commencing the work. Both schematic and comprehensive working and assembly drawings shall be produced by the Sub-Contractor.

### 8.03 Use of Trade Names and Ctalogue Numbers

The names and Manufacturers catalogue numbers as used inthis specification are only intended as a guide to the type of article or quality of material required. The sub-contractor may use any equipment or material equal in type of quality to the described using trade names and catalogue numbers, provided that no such substation shall be done without the prior approval of the consultant. The Sub-Contractor shall be responsible for proving equivalence in quality and standard.

The Catalogue Numbers used in the specifications refer PASO Catalogue or equal and approved.

### 8.04 Sound Input Stage

Work for the Sound Input comprises of the supply, assembly into the system, testing and commissioning of sound input equipment's and related accessories. The equipments and accessories shall include:-

a) Paging Microphones
b) Microphones Cable
c) Microphone Socket and plugs
d) Microphone Stands and Boom
e) AM/FM Radio Tuner
f) 400w Mixing Amplifier
g) 6W Speakers recessed circular 8 "Type"
h) Line Transformers

The equipment accessories and materials shall be as specified in the Bill of Quantities and shall be installed as per the specifications in the Contract Drawings.

8.5 **Sound Mixing and Amplification Stage**

The works for Sound Mixing and amplification stage consists of the supply, assembly into the
System, testing and commissioning of sound mixing and amplification equipment and
accessories which shall include:-

a) A 1 X 200 W Power Amplifier
b) A Main Panel
c) Necessary Interconnecting Cables and Accessories

The equipment, accessories and materials shall be as specified in the Bill of Quantities and shall be installed in the sound equipment and control cabinet shown in the contract drawings and supplied by others.

8.6 **Sound Output Stage**

Works the Sound Output stage consists of the supply, assembly and integration into the
System, testing and commissioning of sound output equipment and accessories which Shall include:-

a) Switch modules for input lines for four (4) loudspeakers groups.
b) Volume control units for four (4) loudspeaker groups
c) Recessed ceiling loudspeakers
d) Loudspeaker Cable and other interconnection Accessories

The equipment accessories and materials shall be specified in the Bill of Quantities and shall be installed as shown in the contract drawings, approved Working Drawings as well
as in accordance to the following specifications

The switch Modules and Volume Control Units shall be installed such as to realize a Common on off and volume level for the following loudspeakers

| Group 1 | Group 2 | Group 3 | Group 4 |
|---|---|---|---|
| S-1 to S-11 | S-12 to S-19 | S-20 to S-27 | S-28 to S-40 |

The on and off and the volume controls shall be easily accessible to a sound controller who
Shall be seated at the reception but close to the Sound Equipment and Control Cabinet.

8.7 **Labelling of Equipment and Wiring**

Label all equipment with approved tags all cables with approved permanent ferrules.

8.8 **Testing and commissioning**

The testing and Commissioning shall involve the following tasks:-

a) Visual examination of the quality of workmanship and compliance with this specifications.
b) Electrical tests on main electrical components and equipment
c) Acoustic measurement to test on additive phase conditions, uniformity of room sound coverage, overall loudness when system is operating at normal response subsequent to equalization and system acoustic gain.

8.9 **"As installed" Drawing and Documentation**

This shall involve the production of comprehensive record of the system design, install

And test results. This shall include the following

a) "as Built" system block diagram with normal signal levels indicated
b) Sub-contractors working drawings including "as installed" details of the loudspeakers etc.
c) Copy of proof-of-performance measurement data as realized during tests.
d) Writing sheets showing equipment and sockets as well as their interconnections.
e) Comprehensive and appropriately bound instructions manual as furnished by the Sub- contractor.

8.10 **Equipment Specifications**

4.10.1 **Power amplifier**

This should be an AC/DC supplied amplifier which has been prepared for Professional sound installation and paging systemas per specification below:-

**SPECS**

| | |
|---|---|
| Power output | 400 watts RMS |
| Frequency response | 60-1700Hz + 3dB |
| Power requirements | 220/240 volts 50/60 Hz |
| DC power | 24 Volts |
| Loudspeaker output | 8 ohms , 70v , 100v |
| Booster output | 500mv, 600ohms |
| Signal to noise ratio | mic;600Db, Aux,1,2:75dB |
| Distortion (THD) | 2% at rated output |
| Mic. Input 1 | 1.5m V/600 ohms |
| Mic. Input 2 and 3 | 1.5m V/2k ohms |
| Aux. Input 1 and 2 | 100m V/47k ohms |
| Tone control | Base +10Db @ 100Hz |
| Treble | + 100dB @ 10KHz |
| Vox priority (Mic.1) | 40 dB reduction on Aux |
| Dimensions | 88mm (H) X430 mm (W) x 234mm |
| Weight approx. | 9.0Kg |

8.10.2 **AM/FM/RADIO TUNER**

This should be a AC/DC supplied continuous AM/FM Radio tuner with the Following specifications:

| | |
|---|---|
| Frequency responsence | (FM-20KHz- 130KHz)<br>(AM-300KHz- 1800KHz) |

8.10.3 **Paging Microphone**

This is a pre-amplified table stand with dynamic microphone with button for Remote control complete with chime

**SPECS**

| | |
|---|---|
| Sensitivity | 1m V @ 600 ohms 94Db SPL |
| Impedence | 1.2K ohms and 3Kohms |
| Frequency response | 60Hz to 15KHz |
| Polar response | Uni-directional |
| Cable 1.5metre fitted with a jack | |
| Battery requirement | 2"c" Type |

8.10.4 **Recessed ceiling speaker**

This should have 4 watts output c/w 100 volts line transformer.

## SECTION 9

### 9.00 EXTERNAL LIGHTING

### 9.01 Scope of Works

The works to be carried out under this section include the supply, installation, testing and commissioning of all external luminaires and any external security lighting as detailed in the relevant contract drawings.

### 9.02 Foundation for Security Lighting Poles

Foundations for poles shall be carried out as shown on the Contract drawings. The electrical sub-contractor shall be responsible for erection, marking of poles location for the main contractor, alignment of the poles and routing of street lighting cables.

### 9.03 Underground Security Lighting Cables

The Electrical Sub-Contractor shall be responsible for laying of cables, tiling and backfilling. The depth of the excavation for the street lighting cables shall be 600mm. All street lighting poles shall be provided with terminals able to accommodate not less than 3% 4mm$^2$ pvc copper conductors. Each pole shall be provided with 4 No. terminals plus a terminal for earth connection.

### 9.04 Security Lighting Columns

The Street lighting poles shall be of rigid steel and shall be 2000mm (i.e 2m) above the ground level. The poles shall be treated with two coats of paint after prime costing and with the final coating decided on site to Architect's and Engineer's approval. The pole shall be as shown on the Contract Drawing and shall include 1500mm length x 16mm diameter copper earth electrode, 6mm$^2$ pvc sc earthing lead and test clamps for the earth electrode. All shall be completely waterproof.

The security lighting shall be controlled via appropriately sized contractor controlled by photocells. The photocells shall incorporate an overriding manual switch for use in event of contractor failure.

## SECTION 10.0

10.00 **FIRE ALARM AND DETECTION SYSTEM**

10.01 **Scope of Works:**

This section of the specification covers the installation and commissioning of a conventional fire alarm and detection system in accordance with the Contract Drawings and Specification.

10.02 Operation

The fire alarm system shall function as follows:-

In the event of a fire breaking out in any part of the complex the alarm can be raised by an observer breaking the fireglass of the nearest break glass contact. As a result of this action the following signals will be initiated:-

a) All the alarm sounders within the building shall sound.

b) The lamp of the appropriate zone indicator on the annunciator panel will be illuminated.

c) A supervisory alarm buzzer on the annunciator panel will sound.

Such signals may be initiated similarly by a smoke or heat detector or by the sprinkler head sensors (if any).

The audible alarms may be silenced by a 'Mute' switch on the annunciator panel. The zone indicator will however remain illuminated until the broken glass or the fire alarm contact is replaced and the system reset.

The operation of the `Mute' switch shall not preclude the receipt of further alarm signals from other zones.

10.03 **Wiring System**

The equipment shall be wired using a 24 volt series fault monitoring circuitry from different zones.

Wiring shall be carried out using single core PVC insulated copper cables enclosed in heavy gauge high impact PVC conduits embedded in the fabric of the building.

10.04 **Annunciator Panel**

A 6 zone flush mounted micro/processor based conventional fire alarm annunciator panel shall be installed at the Ground Floor in each cottage and a main panel at the Main Reception Area

The panel shall comprise of a sheet steel cabinet with a stainless steel front plate containing 6 No. indicator lights, mains failure light, zone fault light, bell circuit fault light, red fire light, supervisory buzzer and alarm mute switch. The function of all indicator lights shall be clearly labelled.

The panel shall be as manufactured by M/s. Chloride Gent or menivier or other equal and approved.

10.05 **Break Glass Contacts**

Break glass contacts shall be mounted at a height of 1350 f.f.f.l. and shall be suitable for flush mounting.

The unit shall be complete with a black instruction plate engraved "FIRE - SMASH GLASS" and a test button mechanism.

The break glass units shall be as manufactured by Chloride Gent or other equal and approved.

10.06 **Alarm Sounders**

The alarm Sounders shall be electronic warbler type suitable for operation in the voltage range 12-14 volts DC as manufactured by M/s. Chloride Gent or other equal and approved.

The sounders shall be mounted at a height of 2250mm f.f.f.l. and shall be suitable for mounting on a standard BESA conduit box with terminals capable of accommodating 2 No. 4mm$^2$ PVC cables.

10.07 **Heat Detectors**

Heat detectors suitable for operation on an open circuit system shall be installed in the plant room areas as shown on the Contract Drawings.

The heat detectors shall be the "rate of rise" type and shall comprise of a bi-metal strip and tilting mercury switch tube mounted in a stainless steel body as manufactured by M/s. Chloride Gent Type FA20 or equal and approved.

10.08 **Smoke Detectors**

Smoke detectors shall be installed as shown on the Contract Drawings and shall be optical chamber type as manufactured by M/s. Chloride Gent or other equal and approved.

**SECTION 11**

## 11.00 LIGHTNING PROTECTION SYSTEM

### 11.01 Scope of Work

Under this section of the Specification the Sub-Contractor shall supply, deliver, Install and paint where necessary, a lightning protection system as shown on the Contract Drawings.
The Sub-Contractor shall include for the supply and installation of all bonding to down Conductors and other metal works and Earthing as indicated on the appropriate drawings.

### 11.02 Description of Installation

The installation is based on the recommendation of British Standard Code of Practice C.P. 326:1965 and the new Standard B.S.6651: (1985).
The Sub-Contractor shall take particular care whilst bonding aluminium and copper tapes to mild steel bars. The ends of the mild steel bars shall be suitably trimmed using a special solder and flux to the Engineer's approval. Special clamps to the Engineer's approval shall be used to bond the tapes to the trimmed ends of mild steel bars to avoid electrolytic action between the different metals.

### 11.03 Special Attendance on Main Contractor

The Sub-Contractor shall liaise fully with the Main Contractor to ensure proper termination and earth continuity of down conductors.

### 11.04 Bonding to Roof Tapes

All roof tanks and other metal work projecting from the roof shall be bonded to the lightning protection system.

### 11.05 Earthing Terminations

An earth termination shall be connected to a down conductor. The whole of the protective
system shall have a combined resistance to earth not exceeding 10 ohms before any bonding
is effected to any metal or services below ground.

### 11.06 Testing Joints

Each Down Conductor shall be provided with a Testing Joint in such a position that, while not inviting unauthorised interference, is conveniently situated for testing.

### 11.06 Earthing Continuity Tests

All conductors shall be tested for continuity before commissioning the system.

## GENERATOR PARTICULARS SPECIFICATION

## PARTICULAR SPECIFICATION AND CONDITIONS

## SECTION 1

1.0 PARTICULAR CONDITIONS

1.01 Location of Site

The site of the proposed development works situated within 20Km from the main campus Siaya County .

The following climatic conditions apply at the site of the above works and all plant, equipment, apparatus, materials and installations shall be suitable for these conditions:-

| | |
|---|---|
| Maximum temperature | $29.2^0$C |
| Minimum temperature | $15.6^0$C |
| Average temperature range | $14^0$C |
| Relative humidity range | 44% - 67% |
| Altitude | Approximately1173metres ASL |

1.02 Description of Project

The project comprises the supply and installation of 1No. 550KVA Accoustic Set Prime rated standby Generator at the Proposed Extension to Existing Warehouse for JOOUST.

1.03 Scope of Contract Works

The scope of work comprises the supply, erection, assembly, wiring connection, testing, commissioning and setting to work, 1No.550KVA Prime Rated standby Generator.

Automatic acoustic prime rated standby generators, together with a control panel in accordance with the Specification and Contract Drawings to provide a complete And operable installation.

1.04 Commencement of Works

The 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.

1.5 Duration of Contract

The Sub-contractor shall be required to phase his work in accordance with the main Contractor's programme (or its revisions). The programme is to be agreed with the Main Contractor.

1.6 Contract Drawings

The Sub-contractor shall be deemed to have studied all the relevant Contract

Drawings and to have allowed for any necessary provision of his Sub-contract Works required thereby.

## SECTION 2

## DIESEL ENGINE

2.0 Cylinder Block

The cylinder block shall be made of one-piece cast iron. It shall have full length water jacket with circulation around each cylinder. The cylinder block shall have wet liners with rubber seal at the bottom end.

2.1 Cylinder Head

The cylinder head for each bank of cylinders shall be of one piece and manufactured from cast iron. It shall be secured by studs of high tensile steel and be easily detachable. Valve seats shall be replaceable.

2.2 Pistons

The pistons shall be made of die cast aluminium alloy and tapered with a ground skirt. The pistons shall have at least three compression and two oil control rings. The combustion chamber and the valve recess shall be smooth contoured. the pistons shall have fully floating pins.

2.3 Valves

The valves shall have separate guides presses into the cylinder head. Operating shall be of the normal pushrod/rocket type with tappet adjustment at the rocker arm.

2.4. Fly-Wheel

The Fly-Wheel shall be of heavy cast iron with close coupling type cast iron flywheel housing and shall have a gear ring bolted onto it. The gear ring shall have heat treated teeth.

2.5 Crankshaft

The crankshaft shall be forget steel with induction hardened main and journals. It shall be statically and dynamically balanced and shall have replaceable, line steel shell bearings.

2.6 Connecting Rods

The connecting rods shall be of '1' Section forged steel.

2.7 Fuel and Air System

The engine shall have a mon-block injection pump which is gear driven through flexible coupling. The fuel pump shall be integral and shall incorporate a hand primer. The engine shall have a multi-core injector nozzle. A fuel filter shall be provided complete with a replaceable element and the engine shall have a heavy duty oil bath air cleaner.

2.8 Governor

The Governor shall be of the centrifugal type operating direct on the fuel line and shall be capable of maintaining the speed constant within 33/34 of nominal output in accordance with B.S.849:1958 Class A2.

2.9 Protection

The engine shall be provided with the following protective devices capable of providing audible and visible alarm signals at one or more remote locations.

(a) Low lubricating oil pressure.

(b) High lubricating oil temperature.

(c) High cooling water temperature.

(d) High engine speed.

2.10 Instrumentation

The engine shall be provided with the following instruments to indicate various speeds and temperatures:-

i) Tachometer indicating the engine speed.

ii) Instrumentation to indicate the temperature of the exhaust gases.

iii) Instrumentation to indicate the temperature of the lubrication oil.

iv) Instrumentation to indicate the pressure of the lubrication oil.

v) Instrumentation to indicate the pressure of the cooling water.

2.11 Ancillary Equipment

The Contractor shall be responsible for providing the following ancillary equipment required for the installation:

(a) Exhaust piping and heavy duty silencer including flexible piping off the engine exhaust manifold. The exhaust piping provided shall be

sufficiently long to cover the route shown on the Contract Drawings. The Contractor shall liaise with the Main Contractor for the final positioning of the exhaust pipe. A masonry duct has been provided to discharge exhaust fumes at roof level.

(b) Fuel along header tank for 3000 litres with contents gauge, drainpipe with cock, vent, gill connection and engine supply pipe with isolating valve.

(c) Basic set of tools and special tools or gauges required for maintenance, all contained in a steel, lockable box. The tools may include but not limited to the following:-

- set of open-ended spanners
- Set of ring spanners
- circlip pliers (internal and external)
- normal pliers
- insulated crocodile pliers
- set of insulated screwdrivers
- hammer
- valve spring compression tool
- piston band assembling set
- set of feeler gauges
- valve grinding tool
- cleaning outfit for injector nozzle

(d) Semi-rotary hand pump to be mounted adjacent to the header tank with necessary piping from pump to header tank.

2.12 Cooling System

Unless otherwise specified elsewhere, a suitable radiator shall be provided for the cooling water and lubricating coil requirements of the engine when operating under the site conditions stated. This shall be complete with engine driven fan and drive, guard for fan and drive, belt tensioner and all integral oil and water piping connections. The Engine shall Turbo-charged type.

A suitable duct from the radiator face flange, extending to the engine room wall, total distance one metre, shall be supplied incorporating a flexible section if required.

Circulation of both lubricating oil and primary water shall be catered for by means of geared or belt driven pumps, integral with the engine.

A thermostatic by-pass shall be fitted in the water outlet from the engine to give a quick warm up and even temperature control over the load range.

2.13 Lubrication

The engine components shall be lubricated via a pressure oil system from an integral oil pump driven by the engine. The system shall incorporate oil

filters, the secondary oil filter being of the changeable type. A suitable relief valve shall be provided to maintain the pump discharge pressure within safe limits.

2.14 Starting

The engine shall start up by means of a D.C motor which shall be supplied from a set of rechargeable batteries of an appropriate voltage and of such a capacity as to enable up to ten start-ups in one hour when fully charged.

2.15 Compliance

The equipment and installation shall comply with B.S. 5514 and EC marking which include 98/37/EC safety, 73/23/EC low voltage, 89/336/EEC, Electromagnetic compatibility.

The Contractor shall in his statement of compliance confirm that the engine would be capable of running fuel to BS 2869: 1988 Class A2.

2.16 Noise Level

The Contractor shall state in his statement of compliance the level of noise in decibels expected in the engine room. The noise level shall comply to s/2005/88EC.

2.17 Ancillary Power Requirements

In selecting the size of the diesel engine, the Contractor shall make suitable allowances for power requirements for the cooling system, the lubricating system and any other requirements that may be necessary for that set.

2.18 Ventilation

The Contractor must ensure that adequate ventilation in the generator room is provided by liaisoning with the respective Contractors.

## SECTION 3

## GENERATOR SET

3.0 Alternator

The alternator shall be of 12 wire re-connectable brushless type rated at 0.8.p.f lagging in accordance with B.S.2612:1975 and having a revolving field, a single self aligning roller bearing and solid half coupling to connect to the engine.

The alternator shall be screen protected, drip-proof and shall be wound with high temperature, tropicalized class B insulation of the stator and class F insulation on the rotor. The stator frame shall be barrel design with conventional two layer winding in semi-enclosed skewed slot, pitched to give a good wave-dorm with low harmonic content.

The rotor core shall be specially constructed with strip winding to obtain maximum cooling the rotor and stator.

3.1 A.C. Exciter

An A.C. exciter of direct-coupled flange mounted type shall be supplied. The exciter frame shall be of modular iron and shall serve additionally as the bearing housing. The exciter armature shall be mounted on a tub on the alternator shaft. Connections shall be taken to the rotating rectifiers, which shall be carried on aluminium castings, from the main room.

3.2 Automatic Voltage Regulator

A Thyristor type static electronic automatic voltage regulator shall be built into the machine. This regulator shall incorporate a zener diode bridge reference voltage circuit, thyristor drive reactor with series silicon diode and a further commutating diode. Under steady conditions, the automatic voltage regulator shall maintain the voltage within plus or minus 2 1/2% for all balanced loads between no load and full load at power factors between unity and zero lagging. The automatic voltage regulator shall be complete with hand-operated manual control potentiometer which shall be fitted in control panel.

The voltage level controls shall enable the terminal voltage to be adjustable within the range - 5% to +10%

The Voltage drop controls shall be adjustable for proper division in reactive kVA when operating in parallel with other alternators.

The voltage gain controls shall be adjustable to compensate for engine speed variations when operating with a speed-droop governor. After any change of load, the voltage shall not vary by more than plus or minus 15% the rated voltage, and shall return to within plus or minus 3% within 3 seconds, and to within plus or minus 2.5 % of rated voltage within 15 seconds. On starting, the voltage overshoot shall not exceed 15% and shall return to within plus or minus 3% within 3 seconds.

3.3 Terminal Box

Any suitably dimensioned terminal box suitable for conduit or cable entry shall be supplied with undrilled gland plate.

3.4 Rating

The machine shall be continuously maximum rated in accordance with B.S. 2613 and shall be so derated owing to site conditions - at the specified electrical output is obtained from the alternator. The Contractor shall provide additional labelling on the generator to distinguish clearly between the nameplate ratings and the actual ratings on site.

The tenderer's manufacturer's catalogue should indicate the percentage reductions from the nameplate rating resulting from altitude and inlet temperature for any of the following engine variations:-

(a) Naturally aspirated

(b) Turbo-charged without a charge air cooler.

(c) Turbo-charged with a charge air cooler.

3.5 Radio Interference Suppression

The generator sets shall be suppressed for radio interference in accordance with B.S.800 and VDE Class G/N.

3.6 Duty Performance

The generator will be used as a standby duty generator continuous rated.

3.7 Generator Set Specification

The 550KVA Accoustic Set Generator shall be rated for the following parameters after suitable derating for the site service conditions and allowing for power requirements for integral cooling system, lubricating system and any other integral parts of the set.

| | | |
|---|---|---|
| Generator output | 1No. x 450KVA | } Prime rated output at site |
| Power factor | 0.8 lagging | |
| No load voltage | 415 volts | |
| Phases | 3 | |
| Frequency | 50Hz | |
| Speed | 1500 r.p.m. | |
| Ambient Temperature | up to $45^0$ C. | |

3.8 Testing and Commissioning

The Contractor shall include for fully commissioning the set and its control equipment, and for the purpose of the required tests, shall provide all necessary instruments, tools, fuel and lubricating oil.

The tests and checks shall be carried out by the Contractor in the presence of the Engineer or his representative, as applicable.

i) Check that the main frame is level in all directions, engine and generator shafts are in proper alignment and the vibration absorbing devices are properly installed and located.

ii) Check water and sump oil levels and that the water jacket is in working order.

iii) Check the battery electrolyte levels and the specified gravity.

iv) Ensure that sufficient oil is in the fuel tank for a two hour test run.

v) Examine the containers in which the fuel and lubricating oils were delivered and check that the type of oils are recommended for the unit.

vi) Check that the engine block water drain points are free from sludge and other blockages.

vii) Check engine bolts, main drive coupling, valve clearance, fuel pumps section, governor settings, pipe line connections, water hose, exhaust couplings, flexible pipe-work etc. and the ball valve and overflow work.

viii) Check all out-going connections on the generator and at the control panel. All lugs for principal connections shall have clean and bright contact surfaces. A suitable abrasive material shall be used where necessary.

ix) Check access panels and doors for proper opening and closing and for the functioning of any interlocks fitted.

x) With the set isolated from the main supply and the selector switch in the 'Manual' position, start the engine by means of the 'start' push button and allow it to run up to normal speed. Check that during the time the engine starter

xi) Check instruments and gauges for normal operation and response and that the generator voltage is being maintained within the prescribed limits, making due allowance for no-load conditions. Compare the reading of the frequency meter with that of the engine tachometer.

xii) Stop engine by turning selector switch to "off" position and verify that generator contactor opens as between 95% and 85% normal voltage. Re-check water and oil levels.

xiii) Turn selector switch to 'Auto' position. Disconnect the sensing circuit supply and check that the set starts, the mains contactor opens, and the generator contactor closes in correct order. Reconnect the sensing circuit to verify that the engine stops on restoration of the mains supply and the contactors operate correctly. Check voltage sensing time delays on each phase in turn and also that the push buttons for mains failure simulation and engine stopping operate correctly.

NB Running of the engine for any length of time under-no-load conditions is undesirable and tests calling for such operation should be carried out in as short a time as is consistent with thoroughness.

xiv) Operate the necessary isolators and switches to put the set on stand-by for essential services network with the selector switch in the 'Auto' position, and using the mains failure simulation push, verify that the set operates correctly with the appropriate time delay for taking up load and that the carrying of the load and its distribution over the three phases are satisfactory.

(xv) Run the set at various loads for periods totalling at least 30 minutes. Check the voltage and current in each phase in turn and that the voltage and frequency are being maintained within the required limits with large alterations of load.

(xvi) Check the operation of the turbo-charger units and the colour of the exhaust gas at various loads.

(xvii) Check that the various engine safeguards operate satisfactorily.

(xviii) check the vibration absorbing devices for proper operation and that the performance of all flexible connections, both mechanical and electrical, is satisfactory.

(xix) Re-check the lubricating oil and water level, replenish the fuel oil tank and leave the set in normal operating order.

(xx) An initial supply of all lubricating oils and greases shall be provided by the Contractor.

## SECTION 4

## CONTROL CUBICLE

**4.0 General**

**The control panels shall be fully micro processor based with deep sea controllers and digital meters to indicate voltage current frequency shall be totally enclosed type plant mounted on an anti-vibration mountings on the alternators, fitted with removable covers giving access to the control gear, terminal and connection blocks and undrilled gland plates for cables entry and shall be finished in stove enamelled grey hammer paint. microprocessor based control panel and By-pass contactors for the 1No. 450KVA Generator shall be 800 Amperes 3 phase respectively.**

4.1. Function

The control cubicle shall house the start/stop buttons and protection systems and shall be complete with all the necessary relays and circuitry to the following requirements.

4.2. Control and Logic Section

Facilities shall be available with suitable circuit breakers protection for the following functions:-

(a) Manual start

(b) Manual stop

(c) Stall lock-out, i.e a lock-out to prevent recranking of an engine upon fuel failure, or stall conditions.

4.3 Protection Circuits

Suitably fused protection circuits, for oil, water, speed and one spare, shall be allowed for. The first stage protection shall be by means of fail-safe circuits while the second stage shall be energised on halt circuits. All circuits except overspend shall be commissioned after a delay following engine start-up.

The circuits for:-

(a) Lubricating oil pressure

(b) Water temperature

(c) Spare.

shall be either alarm, or alarm and shut-down. The latter shall be achieved by means of a link within the control panel.

The circuit for engine overspends shall give simultaneous alarm and shut down. When the engine has a faulty condition, the protection circuits shall still accept further faults. Once a shut-down signal has been given, the protection circuits shall be locked on as:

(i) Not to give further fault indication as engine stops.

(ii) To give indication of fault condition even when the engine has stopped.

The fault circuit shall be re-set by pushing the "Re-Set" button.

One audible alarm mute shall be provided for each fault channel. This shall mute the alarm for the fault causing the alarm, but shall leave the Klaxon prepared for further faults.

4.4 Switching Section

A suitably fused switching section foe engine functions as per list below shall be provided:

(a) Fuel rack solenoid (starts or stops)
(b) Starter motor solenoid via a repeater.

4.5. Indication

Indicator lamps as per list below shall be provided:

(a) Engine running and protection circuits commissioned - green.

(b) Fault parameters - all red.

The indication circuits shall have a lamp test pushbutton by means of which the lamp filaments can be tested.

4.6 Control Switching

A rotary switch with off/on positions, to switch the control circuit supplies. In the 'ON' position the engine shall be started by depressing a push button and stopped by depressing a 'Stop' push button.

The indicators, switches and push buttons shall be mounted on the front face of the chassis unit.

4.7 Alarm

The Contractor shall supply and install an alarm bell which is loud enough to be heard even when the engine is running. The supply for the bell shall be obtained from the control cubicle through suitably rated fuses or circuit breaker.

4.8 Mains Detection

A mains detection unit which can register a mains voltage failure under the following conditions shall be provided:-

(a) Failure of any one or more phases

(b) Incorrect phase sequence

(c) Low volts on any individual or all phases -
i.e. below 85% of normal voltage.

(d) Excessive frequency change i.e. minus or plus 3 Hz.

The failure condition shall be used to produce a start signal for the standby engine after a delay. The delay shall be adjustable and shall ensure the failure is not a transient condition.

Mains detection units shall receive their sensing supplied from the busbars feeding the load.

4.9. Switchgear, Instrumentation and Controls

The following equipment shall be provided by the Generator supplier:-

(a) Moulded case air circuit breaker, triple pole and neutral, with magnetic release to provide alternator short circuit protection, trip free handle and shunt trip.

(b) One bolted neutral link.

(c) Alternator voltage trimmer regulator

(d) 3 No. one per phase, flush mounting ammeters.

(e) 1 No. one flush mounting ammeters.

(f) 1 No. one voltmeter rotary selector switch

(g) One set of control circuit instruments and the accompanying fuses.

(h) All internal wiring, terminals, cable lugs, legends and one main earthing bar.

(i) One No. frequency meter.

(j) Cable boxes and glands to suit.

4.10 Terminations

All internal wiring terminations shall be numbered and marked with ferrules.

4.11 Earthing

The Contractor shall be responsible for ensuring that the earthing of the generator neutral is carried out efficiently and that the resistance of the generator neutral from the earth does not exceed one ohm.

The Contractor shall be responsible for the installation of a set of earth electrodes, the electrodes shall comprise four earth rods, installed in pairs, each pair connected together and to the earth bus-bar by an insulated stranded conductor. The earth rods shall be 2m long by 15m diameter, extensible type as "copperweld" or other equal and approved, each pair of electrodes shall be located not less than 3m apart, the first pair being not less than 3m from the building.

The head of the earth rods shall be driven to 300mm below the surface of the ground and enclosed in a concrete box with a concrete inspection cover.

The Contractor shall ensure that the earthing system of the generator is adequately bonded to the permanent earth system of the 'normal' supply.

All earthing shall be carried out in accordance with the appropriate section of the I.E.E. Regulations.

4.12 Trickle Charger

The trickle charger shall have rating and service parameters such as to keep the engine start batteries fully charged and ready for service whenever required. When the engine is running the batteries shall be charged from an integral dynamo.

4.13 Hours Counter

The Contractor shall allow for the installation of an hours counter on the control panel of the generator.

4.14 Automatic Changeover Contractor Unit and Manual By-pass switch

(a) A contactor unit shall be provided which on failure of the normal electricity supply will automatically initiate the starting of and effect the transfer of load to the stand-by generator. The unit shall contain power contactors and ancillary apparatus as specified.

(b) Failure of the normal supply shall mean complete loss of voltage or the falling below 85% of the normal voltage between any two phases or phase and neutral.

(c) The power circuit shall consist of two contactors feeding a common busbar to which the load will be directly connected. One contactor shall control the normal supply, the other standby supply they shall be electrically and mechanically interlocked so that they cannot both be closed at the same time.

(d) On failure of the normal supply, the unit shall operate in the following manner:-

(i) After a delay, adjustable from 0 to 5 seconds (to avoid operation by a transient dip in voltage) a signal shall be given to start the stand-by generating set.

(ii) On receipt of a signal from the stand-by generating set that it is ready to take the load and providing that the failure of the normal supply still persists, the normal supply contractor shall close. If the normal supply has been restored before the change-over has taken place, the contactors shall not operate and the starting delay contacts shall open to initiate the shutting down of the stand-by generating set.

(e) When the stand-by supply is in operation and the normal supply is restored and remains within 10% of rated voltage on all phases for a pre-set time (adjustable to 30 seconds) the stand-by contactor shall open and the normal supply contactors shall close; the starting relay contacts shall then open to shut down the stand-by generating set.

(f) Provision should be so made that automatic return to normal supply can be prevented if required.

(g) Once a start signal has been sent to the stand-by generating set, the engine starting sequence shall be allowed to continue until the set is ready to take the load before a stopping signal is sent.

(h) By addition of external connections the following facilities shall be available:-

(i) Remote starting of the stand-by generating set and transfer of the load to it.

(ii) Restoration of the normal supply on failure of the stand-by generating set.

(i) Each switch shall be labelled with its duty and each position shall be marked.

The following switches shall be fitted:-

(i) Contactor control switch, with make before break contacts and 'Hand' and 'Auto" positions. In the 'Hand' position the unit shall be controlled by the "Contractor Hand Control Switch". In the 'auto position the unit shall operate automatically irrespective of the position of the "Contactor Hand Control Switch".

(ii) A Contactor Hand Control Switch; with 'Stand-by" and 'Normal' position.

iii) An Auto Return Switch, having 'on' and 'off' positions. In the 'on' position the return to normal supply shall be automatic when the normal supply is restored.

(iv) Contactor By-Pass switches; shall be provided to enable the essential load circuits to be served direct from the normal supply to enable the generator and/or the control equipment to be serviced. The by-pass switches shall be provided with a suitable and conspicuous label warning against leaving the generator in the disconnected position.

(j) Indicating lamps shall be provided. They shall be appropriately labelled easily visible and shall give the following information.

(i) Normal supply available.

(ii) Stand-by supply available.

iii) Normal supply in use.

(iv) Stand-by supply in use.

A test push button shall be provided on the panel to test the lamps.

(k) A push button labelled 'Test' shall be provided to enable a failure of normal supply to be simulated. If the button is pressed and released the equipment shall complete the starting sequence and when the set is ready to take the load it shall be shut down. If the button is held depressed the equipment shall change-over to the stand-by supply when the set is ready to take load.

(l) The control circuit supply shall be either 12 volts or 24 volts d.c depending upon the starting battery and charger.

No current shall be drawn from the control supply when the unit is accepting the normal power supply.

# SECTION VI:

## DRAWINGS

Note 1. A list of drawings should be inserted here.

2. The actual Contract drawings including site plans should be annexed in a separate booklet.

# SECTION VII:

*BILLS OF QUANTITIES*

**Notes for preparing Bills of Quantities**

1.0 **Preamble To Bill of Quantities**

a) The Bill of Quantities shall form part of the Contract Documents and is to be read in conjunction with the Instructions to Tenderers, Conditions of Contract Parts I and II, Specifications and Drawings.

b) The brief description of the items in the Bill of Quantities is purely for the purpose of identification, and in no way modifies or supersedes the detailed descriptions given in the conditions of Contract and Specifications for the full direction and description of work and materials.

c) The Quantities set forth in the Bill of Quantities are estimated and provisional, representing substantially the work to be carried out, and are given to provide a common basis for tendering and comparing of Tenders. There is no guarantee to the Contractor that he will be required to carry out all the quantities of work indicated under any one particular item or group of items in the Bill of Quantities. The basis of payment shall be the Contractor's rates and the quantities of work actually done in fulfilment of his obligation under the Contract.

d) The prices and rates inserted in the Bills of Quantities will be used for valuing work executed, and the Engineer will measure the whole of the works executed in accordance with this Contract.

e) A price or rate shall be entered in ink against every item in the Bill of Quantities with the exception of items, which already have provisional sums, affixed thereto. The Tenderers are reminded that no "nil" or "included" rates or "lump-sum" discounts will be accepted. The rates for various items should include discounts if any. Tenderers who fail to comply will be disqualified.

f) Provisional sums (including Dayworks) in the Bill of Quantities shall be expended in whole or in part at the discretion of the Engineer in accordance with Sub-clause 52.4 and Clause 58 of part of the Conditions of Contract.

g) The price and rates entered in the Bill of Quantities shall, except insofar as it is otherwise provided under the Contract, include all Constructional plant to be used, labour, insurance, supervision, compliance, testing, materials, erection, maintenance or works, overheads and profits, taxes and duties together with all general risks, liabilities and obligations set out or implied in the Contract, transport,
electricity and telephones, water, use and replenishment of all consumables, including those required under the Contract by the Engineer and his staff.

h) Errors will not be corrected by the Employer for any arithmetic errors in computation or summation

i) The Bills of Quantities, unless otherwise expressly stated therein, shall be deemed to have been prepared in accordance with the principles of the latest edition of the Civil Engineering Standard Method of Measurement (CESMM).

j) "Authorised" "Directed" or "Approved" shall mean the authority, direction or approval of the Engineer.

k) Unless otherwise stated, all measurements shall be net taken on the finished work carried out in accordance with the details shown on the drawings or instructed, with no allowance for extra cuts or fills, waste or additional thickness necessary to obtain the minimum finished thickness or dimensions required in this Contract. Any work performed in excess or the requirements of the plans and specifications will not be paid for, unless ordered in writing by the Engineer.

l) (a) Hard material, in this Contract, shall be defined as the material which, in the opinion of the Engineer, require blasting, or the use of metal wedges and sledgehammers, or the use of compressed air drilling for their removal, and which cannot be extracted by ripping with a dozer tractor of at least 150 brake horse power (112 kilowatt) with a single, rear-mounted, hydraulic ripper. Boulders of more than $0.2m^3$ occuring in soft material shall be classified as hard material

(b) Soft material shall be all material other than hard material.

2.0 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 Bills of Quantities for use in the periodic valuation of Works executed.

In order to attain these objectives, Works should be itemized in the Bills 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 Bills of Quantities should be as simple and brief as possible.

**3.0 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 Bills 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 Bills of Quantities.

(ii) The brief description of the items in the Bill of Quantities should in no way modify or supersede the detailed descriptions given in the Contract drawings, Conditions of Contract and Specifications.

(iii) 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.

(iv) The following units of measurement and abbreviations are recommended for use.

| *Unit* | *Abbreviation* | *Unit* | *Abbreviation* |
|---|---|---|---|
| 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 | | |

(v) 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 Bills 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 Daywork 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 Daywork basis; and

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

**(d) Provisional Quantities and Provisional Sums**

(i) Provision for quantity contingencies in any particular tem or class of Work with a high expectation of quantity overrun should be made by entering specific "Provisional Quantities" or "Provisional Items" in the Bills 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 Bills of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a "Provisional Sum" in the Summary of the Bills 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 Bill 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.

(iii) Unless otherwise provided in the Contract, the Provisional Sums included in the Bills of Quantities should always be

expended in whole or in part at the discretion of the Engineer after full consultation with the Employer.

**(e) Summary**

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

**JARAMOGI OGINGA ODINGA UNIVERSITY.**

**SECTION: DW.1.O TITLE: MAIN SUMMARY OF PRICES**

| Item | Description | Rate | Kshs. | Cts |
|---|---|---|---|---|
| | **SECTION 1** | | | |
| DW 1.0 | Contractual Requirements | Sum | | |
| | **SECTION 2** | | | |
| DW 2.0 | Incoming Electricity Supply | Sum | | |
| | **SECTION 3** | | | |
| DW 3.0 | Main L.V. Switchgear | Sum | | |
| | **SECTION 4** | | | |
| DW 4.0 | Electrical Distribution System | Sum | | |
| | **SECTION 5** | | | |
| DW 5.0 | Lighting and Power Installation | Sum | | |
| | **SECTION 6** | | | |
| DW 6.0 | Structured cabling | Sum | | |
| | **SECTION 7** | | | |
| DW 7.0 | DSATV System | Sum | | |
| | **SECTION 8** | | | |
| DW 8.0 | Conference and boardroom sound system | Sum | | |
| | **SECTION 9** | | | |
| DW 9.0 | Incoming Mainroad street lighting | Sum | | |
| | **SECTION 10** | | | |
| DW10.0 | Fire Alarm and Detection System | | | |
| | **SECTION 11** | | | |
| DW 11.0 | Lightning Protection System | Sum | **2,000,000** | **00** |
| DW 13.0 | Allow a provisional sum of Kshs. 2,000,000.00 As contingency sum to be expended at the discretion of the Engineer/Architect | SUM | | |
| | **NB: ALL RATES TO BE V.A.T INCLUSIVE** | | | |
| **TOTAL CARRIED FORWARD TO FORM OF TENDER** | | | | |

**SECTION: DW 1.0 TITLE: CONTRACTUAL REQUIREMENTS**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| DW 1.0 | **CONTRACTUAL REQUIREMENTS** | | | | | |
| DW 1.1 | Provide Bond as stated in clause 31 of the published conditions of the sub contract | | | Sum | | |
| DW 1.2 | Provide insurance as required under clause 5 of the published conditions of sub-contract. | | | Sum | | |
| DW 1.3 | Preparation of "working Drawings" including printing complete as specified. | | | Sum | | |
| DW 1.4 | Allow Fabrication of store workshop lock-up as necessary. | | | Sum | | |
| DW 1.5 | Any other item to complete installation in this section (State) | | | Sum | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW2.0 TITLE: INCOMING ELECTRICITY SUPPLY**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| DW 2.0 | **INCOMING ELECTRICITY SUPPLY** | | | | | |
| DW 2.1 | Allow a prime cost sum of Kshs. 2,900,000.00 as capital contribution charges towards the Electricity supply at the site. | | | | **2,900,000** | |
| DW 2.2 | Allow for attendance to KPLC by the Sub-contractor | Sum | | | | |
| DW 2.3 | Allow 600 x 600 x 600 mm deep power man holes complete with E.A foundry cast iron cover engraved 'KPLC' property. | No | 20 | | | |
| DW 2.4 | Allow for type JF4 Telkom man holes complete with cast iron covers "ENGRAVED" TELKOM as manufactured by E.A. foundry Ltd. | No | 20 | | | |
| DW 2.5 | 150mm dia heavy duty KPLC ducts | M | 500 | | | |
| DW 2.6 | Allow for 100mm heavy duty Telkom PVC Ducts | M | 500 | | | |
| DW 2.7 | Supply and install the following main L.V switchgear for accommodation block(Hostels) as per contract drawings | Sum | | | | |
| DW 2.8 | Any other item to complete installation within Section | sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 3.0** **TITLE: MAIN L.V. SWITCHGEAR**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| DW 3.0 | **MAIN LOW VOLTAGE METERBOARDS** | | | | | |
| | Supply and install the following: | | | | | |
| 3.1 | Supply and install the main low Voltage switchgear complete as per contract drawings and specifications including all outgoing MCCBS as per specifications | No | 1 | | | |
| 3.2 | Allow for testing and commissioning of the main low voltage switchgear | Sum | | | | |
| 3.3 | 45KA surge arrestor on power line | No | 1 | | | |
| 3.4 | Supply and install 350 KVA the power factor switchgear comprising of 7steps and to suite Electrical load conditions | Sum | | | | |
| 3.5 | Allow for earthing of switchgear | Sum | | | | |
| 3.6 | Supply and installation of 450 KVA.50Hz voltage Stabilizer unit(630KVA)<br>Rating : 630 kva<br>Input : ±20% of 415/V | | | | | |
| 3.7 | Output voltage : 1% of 415<br>Natural air cooled stabilizer<br>MAKE : **IREM,ITALY ,ORTEA FRANCE or equally and approved** | Sum | | | | |
| 3.8 | Supply and install the Main L.V switchgear for accommodation Block (Hostels) as per contract drawings | Sum | | | | |
| | Any other item to complete installation in this section | Sum | | | | |
| **SUB TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION DW 4.0 TITLE: ELECTRICAL DISTRIBUTION SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| 4.0 | **ELECTRICAL DISTRIBUTION SYSTEM** | | | | | |
| | **GENERAL-ACCOMODATION BLOCK** Supply and install the following:- | | | | | |
| 4.1.1 | 150mm$^2$ PVC/SWA/PVC 4core cable from main SW/room to accommodation block feeder pillar complete with cable glands | M | 80 | | | |
| 4.1.2 | 70mm$^2$ PVC/SWA/PVC 4core cable from feeder pillar to sub-switch board 'A' | M | 80 | | | |
| 4.1.3 | Trenching 100mmØ PVC Ducts(heavy gauge) | M | 80 | | | |
| 4.1.4 | 600x600x600mm deep manhole PVC pre-cost concrete cover | No | 1 | | | |
| 4.1.5 | 70mm$^2$ WC/SWA/PVC 4Core cable to sub-switch board 'B'complete with cable glands | M | 80 | | | |
| 4.1.6 | Trenching back fitting plus 100mmØ heavy gauge PVC Duct. | M | 80 | | | |
| 4.1.7 | 600x600x600mm deep manhole PVC pre-cost concrete cover with angle frame | No | 1 | | | |
| 4.1.8 | 70mm$^2$ WC/SWA/PVC 4Core cable to sub-switch board 'C'complete with cable glands | M | 80 | | | |
| 4.1.9 | 100 dia heavy gauge PVC duct including trenching and back fitting | M | 80 | | | |
| 4.1.10 | 600x600x600mm deep manhole PVC pre-cost concrete cover with angle iron frame to engineer approval | No | 3 | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION DW 4.0 TITLE: ELECTRICAL DISTRIBUTION SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| 4.0 | **ELECTRICAL DISTRIBUTION SYSTEM GENERAL-ACCOMODATION BLOCK**<br>Supply and install the following:- | | | | | |
| 4.1.11 | The following sub switch boards complete with MCBS as specified | | | | | |
| | a) Sub- switch Board 'A' | No | 1 | | | |
| | b) Sub-switch board 'B' | No | 1 | | | |
| | c) Sub-switch switch board 'C' | No | 1 | | | |
| | d) Feeder pillar complete with sub- switch board and MCBS. | No | 1 | | | |
| | **WING 'A'** | | | | | |
| 4.1.12 | 4 x 16mm$^2$ PVCSC cables to DST/BD 'GAI' Ground floor | M | 160 | | | |
| 4.1.13 | 4 x 16mm$^2$ PVCSC Cables to DIST/BD 'FA2' 1$^{st}$ floor | M | 160 | | | |
| 4.1.14 | 6mm$^2$ PVCSC ECC to DIST/BD GAI & FA2 | M | 80 | | | |
| 4.1.15 | 4x 16 mm$^2$ PVCSC Cables to DIST/BD 'SA3' 2$^{nd}$ floor | M | 240 | | | |
| 4.1.16 | 6mm$^2$ PVCSC Cables to DIST/BD 'SA3' above | M | 60 | | | |
| 4.1.17 | 38mm dia heavy gauge conduits to DIST/BD'S GA1, FA1, SF/A1 | M | 260 | | | |
| 4.1.18 | 14 way TP/N DIST/BD complete with MCBS SPS schenider CRABTREE MEM as follows:- | | | | | |
| | a. DIST/BD G.A1 | No | 1 | | | |
| | b. DIST/BD F.A1 | No | 1 | | | |
| | c. DIST/BD SA1 | No | 1 | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION DW 4.0 TITLE: ELECTRICAL DISTRIBUTION SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| 4.0 | **ELECTRICAL DISTRIBUTION SYSTEM GENERAL WING 'B' AND 'C'**<br>Supply and install the following:- | | | | | |
| 4.1.19 | 4x 16 $mm^2$ PVCSC Cables to DIST/BD G.B1 | M | 160 | | | |
| 4.1.20 | 6$mm^2$ ECC MCSC to DIST/BD G.B1 wing 'B' | M | 40 | | | |
| 4.1.21 | 32mm Ø heavy gauge PVC conduits to DIST/BD G.B1 | M | 40 | | | |
| 4.1.22 | 4x 16 $mm^2$ PVCSC Cables to DIST/BD F.B2 | M | 160 | | | |
| 4.1.23 | 6$mm^2$ ECC MCSC to DIST/BD BF.B1 1st floor wing B | M | 40 | | | |
| 4.1.24 | 32mm Ø heavy gauge PVC conduits to DIST/BD | M | 40 | | | |
| 4.1.25 | 4x 16 $mm^2$ PVCSC Cables to DIST/BD 'GCI' from sub-switchboard | M | 360 | | | |
| 4.1.26 | 6$mm^2$ ECC PVCSC to DIST/BD 'GC1' | M | 90 | | | |
| 4.1.27 | 32mmØ heavy gauge PVC conduits to DIST/BD GC1 | M | 90 | | | |
| 4.1.28 | 4x 16 $mm^2$ PVCSC Cables to DIST/BD 'FC2'1st floor | M | 240 | | | |
| 4.1.29 | 6$mm^2$ PVCSC to 'FC2' 1st floor | M | 60 | | | |
| 4.1.30 | 32mm Ø heavy gauge PVC conduits to 'FC2' | M | 60 | | | |
| 4.1.31 | 4x 16 $mm^2$ PVCSC Cables to DIST/BD 'SC3' | M | 280 | | | |
| 4.1.32 | 6$mm^2$ ECC PVCSC to CU 'GC3' | M | 70 | | | |
| 4.1.33 | 32mm Ø heavy gauge PVC conduits to 'GC3 | M | 70 | | | |
| 4.1.34 | 14 way TP/N DIST/BD complete with MCBS as SPS schenider MEM or CRABTREE as follows:- | | | | | |
| | a. DIST/BD GB1 | No | 1 | | | |
| | b. DIST/BD GB2 | No | 1 | | | |
| | c. DIST/BD GB3 | No | 1 | | | |
| | d. DIST/BD GCI | No | 1 | | | |
| | e. DIST/BD GC2 | No | 1 | | | |
| | f. DIST/BD GC3 | No | 1 | | | |
| 4.1.35 | Any other item to complete installation in this section | Sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION DW 4.0 TITLE: ELECTRICAL DISTRIBUTION SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| 4.0 | **ELECTRICAL DISTRIBUTION SYSTEM**<br><br>Supply and install the following:- | | | | | |
| 4.1.36 | 4 way TP/N MCB DIST/BD 'SL' for solar panel DP switches complete with 12No. 20A SP/N MCBS.(WING A,B AND C) | No | 3 | | | |
| 4.1.37 | 3x2.5 mm2 PVCSC cables to 20A DP/Switches for water heaters enclosed in 20mm Dia PVC conduits | No | 24 | | | |
| 4.1.38 | 20A DP/switches for DSATV system complete with 3x2.5mm2 PVCSC cables in roof space | No | 3 | | | |
| 4.1.39 | 3x 4mm2 PVCSC cables to 30A SP/N isolator for hose Reel pumps at roof level | Sum | | | | |
| 4.1.40 | 25mm dia heavy gauge PVC conduits to Hose Reel | Sum | | | | |
| 4.1.41 | 2.5mm2 PVC /SWA/PVC 2core cable to water booster pumps including trenching Hatali Tiles and back filling complete with cable glands | M | 80 | | | |
| 4.1.42 | 20A SP/N isolator to water Booster Pumps | No | 2 | | | |
| 4.1.43 | Any other item to complete installation in this section | sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 4.0 TITLE: ELECTRICAL DISTRIBUTION RESEARCH BLOCK**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| | **RESEARCH BLOCK AND CONFERENCE CENTRE** | | | | | |
| DW | **GROUND FLOOR** | | | | | |
| 8.0 | Supply and install the following :- | | | | | |
| 8.1.1 | 70mm$^2$ PVC/SWP/PVC 4 core cable from the main LV Switch room to restaurant, kitchen complete with cable glands | M | 45 | | | |
| 8.1.2 | 2x 150mm dia. PVC Ducts to kitchen | M | 150 | | | |
| 8.1.3 | 450x450x450 mm deep cable manhole | No | 1 | | | |
| 8.1.4 | 14 way TP/N DIST/BD 'K' in kitchen | No | 1 | | | |
| 4.8.5 | As SCRABTREE or MEM complete with 42No MCBS | | | | | |
| 8.1.6 | 6No. 10 ASP/ 4No. 30 AS/P<br>1No. 63A TP ,2No. 30ATP<br>3No. 20ASP and as per contract drawings | | | | | |
| 8.1.7 | 12 way PVC DIST/BD G/ OF complete with MCBS for office board room complete with MCBS | No | 1 | | | |
| 8.1.8 | 25mm$^2$ PVC/SWA/PVC 4Core cable from main L.V switch room to DIST/BD complete with cable glands | M | 20 | | | |
| 8.1.9 | 100mm Dia. Heavy gauge PVC ducts to DIST/BD G/OF the above | M | 20 | | | |
| 8.1.10 | 600x25mm Heavy gauge cable rack fixed within ceiling void complete with heavy duct support breeder | M | 60 | | | |
| 8.1.11 | 10mm$^2$ PVC/SWA/PVC 2Core cable to CU.CL/G clean power complete with cable glands | M | 20 | | | |
| 8.1.12 | 10 way consumer SP/N MCB consumer unit CU.G complete with MCBS as specified | No | 1 | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 4.0 TITLE: ELECTRICAL DISTRIBUTION SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| 8.1.13 | Supply and install 2No. 18 way TP/N DIST/BD CFI and CF2 in conference complete with 42No. MCBS (single phase and 3 phase) as per contract drawings | No | 2 | | | |
| 8.1.14 | 50 $mm^2$ PVC/SWA/PVC 4 core cable from main LV switch room to DIST/BD CFI complete with cable glands | M | 25 | | | |
| 8.1.15 | 35$mm^2$ PVC/SWA/PVC 4core cable from main L.V switch room DIST/BD CF2 complete with cable glands | | | | | |
| 8.1.16 | 10$mm^2$ PVC/SWA/PVC 2core cable to consumer unit CL/G complete with cable glands | M | 50 | | | |
| 8.1.17 | 12 way SP/N CU complete CL/G2 complete with glands | No | 1 | | | |
| 8.1.18 | 300x 25mm cable heavy gauge tray for voice /data cabling to conference and adjacent offices complete with heavy duty support brackets at one meter intervals | M | 80 | | | |
| 8.1.19 | 600x25mm vertical cable in power and voice/DATA Riser Ducts (2 separate runs (power /DATA) | M | 30 | | | |
| 8.1.20 | Any other item to complete installation in this section | sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 4.0 TITLE: ELECTRICAL DISTRIBUTION SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| DW 9.0 | **RESEARCH CENTRE – FIRST FLOOR**<br>Supply and install the following:- | | | | | |
| 9.1.1 | 250ATP/N sub-switch (8 way) Board 'F' comprising of 6No. 63a TP/N MCBS and 2No. 30A TP/N spaces as per contract drawings. | No | 1 | | | |
| 9.1.2 | 4way TP/N DIST/BD RS/F1complete with MCBS as specified | No | 1 | | | |
| 9.1.3 | 16mm$^2$ PVC/SWA/PVC 2Core cable TO DIST/BD RS/F1complete with cable glands | M | 25 | | | |
| 9.1.4 | 6mm$^2$ PVC/SWA/PVC 2core cable to clean power CU.RS/CL.1 | M | 24 | | | |
| 9.1.5 | 6way SP/N clean power CU.CL.1 complete with 6No. 30a SP/N MCBS as CRABTREE/MEM | No | 1 | | | |
| 9.1.6 | 12way TP/N DIST/BD RS/F2 complete with MCBS for mechanical room as per contract drawings | No | 1 | | | |
| 9.1.7 | 6way SP/N clean power CU.CL.2 complete with 6No. 30a SP/N MCBS as CRABTREE/MEM | No | 1 | | | |
| 9.1.8 | 6mm$^2$ PVC/SWA/PVC 2core cable to clean power CU.RS/CL.2 complete with cable glands | M | 3 | | | |
| 9.1.9 | 70mm$^2$ PVC/SWA/PVC 4Core cable to mechanical room A/C system complete with cable glands from main switch room | M | 72 | | | |
| 9.1.10 | 6way SP/N MCB consumer unit RS.CL.3 clean power to resource library offices complete with 6No. 30a SP/N MCBS as CRABTREE/MEM | No | 1 | | | |
| 9.1.11 | 6mm$^2$ PVC/SWA/PVC 2core cable to clean power CU.RS/CL.3 above complete with cable glands | M | 22 | | | |
| 9.1.12 | 4way TP/N DIST/BD F.CL first floor clean power complete with 4No. 63A SP/N MCBS for RS.CL1- RS.CL3 | No | 1 | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| 9.1.13 | 35 $mm^2$ PVC/SWA/PVC 4Core cable complete with cable glands. | M | 10 | | | |
| 9.1.14 | Supply and install 4way TP/N DIST/BD RS/F3 complete with 10A, 20A, 30A SP/N MCBS as per contract drawings | No | 1 | | | |
| 9.1.15 | 16$mm^2$ PVC/SWA/PVC 4Core cable to level 03 LAB 1 A/C system No.1 complete with cable glands | M | 30 | | | |
| 9.1.16 | 16$mm^2$ PVC/SWA/PVC 4Core cable to level 03 A/C (duty) complete with cable glands LAB 1 | M | 30 | | | |
| 9.1.17 | 16A TP/N to level 03 /c unit No.1 & 2 LAB 1 isolator | No | 30 | | | |
| 9.1.18 | 10mm2 PVC/SWA/PVC 4core cable to level 03 LAB 2 (duty and stand by A/C unit | M | 60 | | | |
| 9.1.19 | 63A TP/N to level 03 ( LAB 2) isolator | No | 2 | | | |
| 9.1.20 | 30A TP/N 3Ø industrial socket outlet with plug tops for level 3 LABS 1 & 2 | No | 4 | | | |
| 9.1.21 | 600 x 25mm power cable tray | M | 80 | | | |
| 9.1.22 | 250 x50mm single compartment voice/DATA trunking in ceiling distribution system | M | 100 | | | |
| 9.1.23 | Any other item to complete installation in this section. | sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**TITLE: ELECTRICAL DISTRIBUTION SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| DW 5.0 | **RESEARCH CENTRE**<br><br>**SECOND FLOOR**<br>Supply and install the following:- | | | | | |
| 9.2.1 | 400A TP/N sub-switch Board 'SF' second floor RAW POWER complete with 6No. 63A TP/N MCBS and 2No. 30A TP/N MCBS | No | 1 | | | |
| 9.2.2 | 95mm$^2$ PVC/SWA/PVC 4core cable to sub-switch 'SF' complete with cable glands | M | 70 | | | |
| 9.2.3 | 4 way TP/N DIST/BD RS/SI seminar room area complete 12No. MCBS 10A, 20A, 30A SP/N | No | 1 | | | |
| 9.2.4 | 16mm$^2$ PVC/SWA/PVC 4Core cable from sub-switch 'SF' | M | 15 | | | |
| 9.2.5 | 16mm$^2$ PVC/SWA/PVC 2Core cable to CU.CL –S1 clean power complete with cable glands | M | 15 | | | |
| 9.2.6 | 10way SP/N MCB clean power CU.CL/S1 seminar room /offices complete with 30A MCBS | No | 1 | | | |
| 9.2.7 | 12 way TP/N DIST/BD SF 2 complete with 6No. 63A TP/N and 3No. 30A TP/N MCBS as CRABTREE OR MEM | No | 1 | | | |
| 9.2.8 | 70mm$^2$ PVC/SWA/PVC 4core cable to DIST/BD comple with cable glands | M | 70 | | | |
| 9.2.9 | 6way SP/N MCB CU.CL.S2 complete with 6No. 20A SP/N MCBS level 2 & 3 LABS clean power | No | 1 | | | |
| 9.2.10 | 6mm$^2$ PVC/SWA/PVC 2core cable to clean power CL/S2 complete with cable glands | M | 4 | | | |
| 9.2.11 | 4 Way TP/N MCB clean power BD | No | 1 | | | |
| 9.2.12 | 25mm$^2$ PVC/SWA/PVC 4core cable | M | 10 | | | |
| 9.2.13 | 4way TP/N DIST/BD 'S3' 10A, 20A, 30A SP/N raw power | No | 1 | | | |
| 9.2.14 | 16mm$^2$ PVC/SWA/PVC 4core cable from SUB DIST/BD RISER DUCT complete with cable glands | M | 45 | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**TITLE: ELECTRICAL DISTRIBUTION SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| 9.2.15 | 6 WAY SP/N CU.CL S3.3 clean power material reference offices complete with 6No. 20A SP/N MCBS | No | 1 | | | |
| 9.2.16 | 6mm$^2$ PVC/SWA/PVC 2Core cable complete with cable glands to CU.CL S3.3 | M | 45 | | | |
| 9.2.17 | 4mm$^2$ PVC /SWA/PVC 4Core cable to 4 No. 3Ø TP/N industrial socket outlet plus plug tops | M | 30 | | | |
| 9.2.18 | 30A TP/N S/O plug tops industrial type | No | 4 | | | |
| 9.2.19 | 20A DP/Switches complete with 3x25mm2 PVCSC cables in level 03- LABS and level 02 | No | 8 | | | |
| 9.2.20 | 3 x25mm PVCSC cables to level 03 special access suites BIOMETRIC identifier system complete with 20A SP/N DP /suit | No | 6 | | | |
| 9.2.21 | 20A SP/N DP /suit to A/C System plus 3x25mm PVCSC | No | 4 | | | |
| 9.2.22 | 600x25mm heavy duty cable tray including support brackets within ceiling card | M | 80 | | | |
| 9.2.23 | 250 x 50 single compartment trunking | M | 80 | | | |
| 9.2.24 | Any other item to complete installation in this section | sum | | | | |
| | | | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 5.0 TITLE: LIGHTING AND POWER INSTALLATION**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| | **RESEARCH CENTRE .CONFERENCE GROUND FLOOR** | | | | | |
| | Supply and install the following :- | | | | | |
| 5.1.1 | All lighting conduits points wired in 3x1.5mm2 PVCSC cables complete with lighting switches as per contract drawings | No | 192 | | | |
| 5.1.2 | Types of luminaries complete with lamp :- | | | | | |
| | a) Type J4 4 x 9W 600x600mm LED lamps mirror grid louvers complete lamps as Philips or thonor and equal approved | No | 76 | | | |
| | b) Type JE – 600x600mm LED panel with emergency kit Philips/thonor or equal and approved | No | 7 | | | |
| | c) 12W cylindrical recessed downlighter 150mm Dia LED panel. As Philips or liper or equal and approved | No | 52 | | | |
| | d) Type M 6W 100 Dia surface mounted LED panel as Philips or liper or equal and approved down lighter | No | 12 | | | |
| | e) Type Q PL 11bulkhead luminaire as Philips or approved | No | 14 | | | |
| | g) Type T-70W PIAZZA or Sodium wall pack as Philis or equal and approved | No | 24 | | | |
| | h) type R2 2x 18W LED lamps moisture resistance florescent fittings as Philips or equal and approved | No | 4 | | | |
| | i)Type Exit | No | 10 | | | |
| 5.1.3 | j)Type RE as type R2 | No | 2 | | | |
| | Supply and install the mounted power outlets on trunking complete with $4x25mm^2 + 2.5mm^2$ ECC ring main wiring excluding trunking as follows:- | | | | | |
| | a) 13A TWIN switched S/O M/K CRABTREE or equal and approved | No | 25 | | | |
| | b) 13A twin switched non-standard clean power switched S/O M/K CRABTREE make | No | 25 | | | |
| | c) 20A DP/switches M/K CRABTREE make | No | 6 | | | |
| 5.1.4 | All power outlets wall mounted complete with conduits wiring as per contract drawings | | | | | |
| | a) 13A TWIN switched S/O as M/K make | No | 12 | | | |
| | b) 13A twin switched non-standard switch S/O as Crabtree make | No | 12 | | | |
| | c) 20A DP/switches | No | 8 | | | |
| 5.1.5 | 250x50mm 3cmpartment powder coated trunking complete with cover and special bends as per contract drawing | M | 180 | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 5.0 TITLE: LIGHTING AND POWER INSTALLATION**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| 5.1.6 | 20A TP/N isolator plus 4x25mm$^2$+2.5mm$^2$ ECC to BAINE MARIE complete with conduits and wiring | No | 2 | | | |
| 5.1.7 | 20A SP/N isolator to tea urn complete with 3x25mm$^2$ PVCSC cables and 20mm conduit | No | 1 | | | |
| 5.1.8 | 20A SP/N isolator to milk urn complete with 3x25mm$^2$ PVCSC cables and conduits | No | 1 | | | |
| 5.1.9 | 63A TP/N isolator and 4x16mm$^2$+ 6 mm$^2$ ECC enclosed in 32Ø conduits to deep fryer | No | 1 | | | |
| 5.1.10 | 30A TP/N and 4x4mm$^2$+ 2.5mm$^2$ ECC including 25 Ø conduits to salmmander grilt | No | 1 | | | |
| 5.1.11 | 40A TP/N and 4x10mm$^2$+ 6 mm$^2$ ECC to baking oven plus 32Ø conduits | No | 1 | | | |
| 5.1.12 | 30A TP/N Isolator and 4x4mm$^2$+ 2.5mm$^2$ ECC plus 25 Ø conduits to kitchen extract | No | 1 | | | |
| 5.1.13 | 30A TP/N Isolator and 4x4mm$^2$+ 2.5mm$^2$ ECC boiling pan | No | 1 | | | |
| 5.1.14 | Any other item to complete installation in this section | Sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 5.0 TITLE: LIGHTING AND POWER INSTALLATION**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| 5.2 | **RESEARCH CENTRE**<br>**FIRST FLOOR**<br>Supply and install the following:- | | | | | |
| 5.2.1 | All lighting conduit points wired in 2x1.5 mm2 +1.5 mm ECC PVCSC cables including lighting switches | No | 75 | | | |
| 5.2.2 | Supply and install the following types of luminaires complete with lamps as follows:- | | | | | |
| | a) Type J4- 4x9W. 600x600mm recessed fluorescent luminaire with metal mirror grid louvers as Philips/ThornMake or equal and approved | No | 54 | | | |
| | b) 8W self-contained emergency luminaire | No | 6 | | | |
| | c) 6W LED panel square LED luminaire type J2 as Liper make or Philips | No | 8 | | | |
| | d) 9W LED panel cylindrical luminaire as liper | No | 4 | | | |
| | e) PL 11 switched bulkhead FTG as Thorn or Philips | No | 1 | | | |
| 5.2.3 | All power outlets mounted on trunking complete with 4x2.5mm$^2$+ 2.5mm$^2$ ECC ring main cable excluding trunking as follows:- | | | | | |
| | a) 13A standard twin switched S/O | No | 26 | | | |
| 5.2.4 | 250x 50mm 2 compartment + powder coated trunking complete with cover and special bends | M | 260 | | | |
| 5.2.6 | All power outlets wall mounted complete with 2x2.5mm$^2$ + 2.5mm$^2$ ECC complete with conduits as follows:- | | | | | |
| | a) 13A twin switched switch S/O as | No | 5 | | | |
| | b) 20A DP/switch | No | 9 | | | |
| 5.2.7 | Supply and install flush floor mounted 202x426mm x 68mm deep 4 compartment floor box voice/DATA clean RAW power as MK model 81607 or equal and approval complete with 3x2.5mm + 2.5mm$^2$ ECC including | No | 6 | | | |
| | a) 2No twin standard S/O | | | | | |
| | b) 2No twin switched non-standard switch S/O | | | | | |
| | c) 2No duct/voice/ Data outlet | | | | | |
| 5.2.8 | 63A TP/N isolator complete with 4 x 16mm$^2$ + 6mm$^2$ ECC including 32Ø PVC conduits | No | 2 | | | |
| 5.2.9 | 20A TP/N industrial socket outlet plus 4 x4mm$^2$ +2.5 mm$^2$ ECC including conduit | No | 2 | | | |
| 5.2.10 | Any other item to complete installation in this section | Sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 5.0 TITLE: LIGHTING AND POWER INSTALLATION**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| 5.3.0 | **RESEARCH CENTRE**<br>**SECOND FLOOR**<br><br>Supply and install the following:- | | | | | |
| 5.3.1 | All lighting conduit points wired in 2x1.5 $mm^2$ +1.5 $mm^2$ ECC PVCSC cables including lighting switches | No | 121 | | | |
| 5.3.2 | Supply and install the following types of luminaires complete with lamps as specified:- | | | | | |
| | a) Type J4- 4x9W. 600x600mm recessed fluorescent luminaire with metal mirror grid louvers | No | 95 | | | |
| | b) 8W self-contained emergency luminaire | No | 13 | | | |
| | c) PL 11 bulkhead in lift shaft – Type Q | No | 1 | | | |
| | d) 6W square LED lighting panel- Type J2 | No | 8 | | | |
| | e) Special studio "RED LIGHT" luminaire to Eng. approval as philips | No | 4 | | | |
| 5.3.4 | All power outlets mounted on trunking complete with 4x2.5$mm^2$+ 2.5$mm^2$ ECC ring main cable excluding trunking as follows:- | | | | | |
| | a) 13A twin standard twin switched S/O | No | 60 | | | |
| | b) 13A twin non-standard switched S/O for level 3 LAB ONLY | No | 10 | | | |
| 5.3.4 | All power outlets wall mounted complete with 2x2.5$mm^2$ + 2.5$mm^2$ ECC PVCSC cables plus 20mm PVC conduits as follows:- | | | | | |
| | a) 13A twin standard switched S/O | No | 4 | | | |
| | b) 13A non-standard switched S/O | No | 4 | | | |
| | c) 20A DP/switches | No | 15 | | | |
| 5.3.5 | 400x200x50mm 4compartment flush floor mounted power/voice/DATA Box as per detail as M/C comprising of :- | No | 10 | | | |
| | a) 2No twin standard S/O as MK Crabtree | | | | | |
| | b) 2No twin switched non-standard switch S/O as MK Crabtree | | | | | |
| | d) 2No dual/voice Data outlet | | | | | |
| 5.3.6 | 250 x 50mm 3compartment powder coated trunking + cover and bends | M | 250 | | | |
| 5.3.6 | Any other item to complete installation in this section | sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 5.0 TITLE: LIGHTING AND POWER INSTALLATION**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| DW5.4 | **ACCOMMODATION**<br>**GROUND FLOOR**<br>Supply and install the following:- | | | | | |
| 5.4.1 | All lighting conduit points wired in 2x1.5 $mm^2$ +1.5 $mm^2$ ECC PVCSC cables plus 20mm dia heavy gauge PVC conduit and lighting switches as per contract drawings | No | 129 | | | |
| 5.4.2 | The following types of luminaires complete with lamps as specified:- | | | | | |
| | a) Type 1 ceiling rose dependant + lamp | No | 44 | | | |
| | b) Type M- 12W . 2D LED surface mounted | No | 49 | | | |
| | c) Type Q PL 11-bulkhead luminaire to approval | | | | | |
| | d) Type K Mirrostrip light (fileanear lamp | No | 20 | | | |
| | | No | 16 | | | |
| 5.4.3 | All power outlets complete with 3x25$mm^2$ PVCSC cable and 25mm Ø PVC conduits as follows :- | | | | | |
| | a) 13A single switched S/O | | | | | |
| | b) TV outlet+ 25mm Ø conduit + draw wire | No | 64 | | | |
| | c) 20A DP/switch(instant heater omitted) | No | 32 | | | |
| | e) 240V. FA Bell | No | 6 | | | |
| | f) 240V. Bell push | No | 16 | | | |
| | **MAIN GATEHOUSE** | | | | | |
| 5.4.4 | All lighting conduit points wired in 2x1.5 $mm^2$ +1.5 $mm^2$ ECC PVCSC cables plus 20mm dia heavy gauge PVC conduit and lighting switches as per contract drawings | No | 15 | | | |
| 5.4.5 | The following types of luminaires complete with lamps as specified:- | | | | | |
| | a) Type B1 36W 1200mm BattenFluo | No | 2 | | | |
| | b) Type A1 36W 1500mm BattenFluo | No | 4 | | | |
| | c) Type Q PL 11-bulkhead luminaire to approval | No | 4 | | | |
| 5.4.6 | Any other item to complete installation in this section | Sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO PAGE** | | | | | | |

**SECTION: DW 5.0 TITLE: LIGHTING AND POWER INSTALLATION**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| DW5.5 | **ACCOMMODATION**<br>**FIRST FLOOR**<br>Supply and install the following:- | | | | | |
| 5.5.1 | All lighting conduit points wired in 2x1.5 $mm^2$ +1.5 $mm^2$ ECC PVCSC cables plus 20mm dia heavy gauge PVC conduit and lighting switches as per contract drawings | No | 129 | | | |
| 5.5.2 | The following types of luminaires complete with lamps as specified:- | | | | | |
| | a) Type 1 ceiling rose dependant + lamp | No | 44 | | | |
| | b) Type M- 12W . 2D LED surface mounted | No | 49 | | | |
| | c) Type Q PL 11-bulkhead luminaire to approval | No | 20 | | | |
| | d) Type K Mirrostrip light (fileanear lamp | No | 16 | | | |
| 5.5.3 | All power outlets complete with 3x2.5$mm^2$ PVCSC cable and 25mm Ø PVC conduits as follows :- | | | | | |
| | a) 13A Simgle switched S/O | No | 64 | | | |
| | b) TV outlet+ 25mm Ø conduit + draw wire | No | 32 | | | |
| | c) 20A DP/switch | No | 12 | | | |
| | d) 240V. FA Bell | No | 16 | | | |
| | e) 240V. Bell push | No | 16 | | | |
| 5.5.4 | Any other item to complete installation in this section | Sum | | | | |
| | **SUB-TOTAL CARRIED FORWARD TO PAGE** | | | | | |

**SECTION: DW 5.0 TITLE: LIGHTING AND POWER INSTALLATION**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| DW5.6 | **ACCOMMODATION**<br>**SECOND FLOOR**<br>Supply and install the following:- | | | | | |
| 5.6.1 | All lighting conduit points wired in 2x1.5 $mm^2$ +1.5 $mm^2$ ECC PVCSC cables plus 20mm dia heavy gauge PVC conduit and lighting switches as per contract drawings | No | 129 | | | |
| 5.6.2 | The following types of luminaires complete with lamps as specified:- | | | | | |
| | a) Type 1 ceiling rose dependant + lamp | No | 44 | | | |
| | b) Type M- 12W . 2D LED as Liper surface mounted | No | 49 | | | |
| | c) Type Q PL 11-bulkhead luminaire to approval | | | | | |
| | d) Type K Mirrostrip light (fileanear lamp | No | 20 | | | |
| | | No | 16 | | | |
| 5.6.3 | All power outlets complete with 3x2.5$mm^2$ PVCSC cable and 25mm Ø PVC conduits as follows :- | | | | | |
| | a) 13A Single switched S/O | No | 64 | | | |
| | b) TV outlet+ 25mm Ø conduit + draw wire | No | 32 | | | |
| | c) 20A DP/switch | No | 6 | | | |
| | e) 240V. FA Bell | No | 16 | | | |
| | f) 240V. Bell push | No | 16 | | | |
| 5.6.4 | Any other item to complete installation in this section | Sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO PAGE** | | | | | | |

**SECTION: DW 2.0 TITTLE: STRUCTURED CABLING AND PATCH PANELS**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| | **INCOMING SERVICES FIBRE** | | | | | |
| 6.1.1 | Supply and install fibre mode 8Core Cable from common service provider cabinet at gate house to research centre and accommodation block | M | 250 | | | |
| 6.1.2 | Allow a provisional sum of **Kshs 2,000,000.00** for WI-FI installation(Research centre and accommodation) | | | | | |
| 6.1.3 | Supply and install the following digital PABX system equipment:-<br>A) 64 extensions (AS PANASONIC) MODEL KX – TD 1264 complete with D S console (**Hostels and research centre)** | No | 2 | | | |
| | Supply and install telephone handsets compatible with item 7.1.13 above as Panasonic KXT 2310 ( **Research and Hostel blocks)** | No | 60 | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW6.0 TITLE: STRUCTURED CABLING AND PATCH PANEL**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts |
|---|---|---|---|---|---|---|
| DW 1.0 | **STRUCTURED CABLING AND PATCH PANEL**<br>**RESEARCH CENTRE- GROUND FLOOR**<br>Supply and install the following inclusive 14% V.A.T:- | | | | | |
| 6.1.1 | CAT 6 UTP DATA cabling (siemon) | Rolls (305)M | 300 | | | |
| 6.1.2 | 1 metre patch cords (siemon) | No | 100 | | | |
| 6.1.3 | 3 metre patch cords | No | 100 | | | |
| 6.1.4 | RJ 45 Single coupler Data outlets | No | 50 | | | |
| 6.1.5 | 48 port patch panel CAT 6E | No | 2 | | | |
| 6.1.6 | Horizontal cable managers | No | 2 | | | |
| 6.1.7 | Allow for testing and commissioning including test Manuals labelling. | Sum | | | | |
| 6.1.8 | Supply and install 32U patch panel cabinet including termination of all Data / voice cabling Including accessories. | No | 1 | | | |
| 6.1.9 | Supply and install 48port P.V.E 10/100/1000 base T CISCO | Sum | 2 | | | |
| 6.1.10 | Switch with fibre 3No termination port | No | 1 | | | |
| **TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW6.0 TITLE: STRUCTURED CABLING AND PATCH PANEL**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts |
|---|---|---|---|---|---|---|
| DW 2.0 | **STRUCTURED CABLING AND PATCH PANEL**<br>**RESEARCH CENTRE-FIRST FLOOR**<br>Supply and install the following inclusive 14% V.A.T:- | | | | | |
| 6.2.1 | CAT 6 UTP DATA cabling (siemon) | M | 10 | | | |
| 6.2.2 | 1 metre patch cords (siemon) | No | 24 | | | |
| 6.2.3 | 3 metre patch cords | No | 24 | | | |
| 6.2.4 | RJ 45 Single coupler Data outlets | No | 24 | | | |
| 6.2.5 | 48 port patch panel CAT 6E | No | 1 | | | |
| 6.2.6 | Horizontal cable managers | No | 2 | | | |
| 6.2.7 | Allow for testing and commissioning including test Manuals labelling. | Sum | | | | |
| 6.2.8 | Supply and install 32U patch panel cabinet including termination of all Data / voice cabling Including accessories. | No | 1 | | | |
| 6.2.9 | Supply and install 12 Port P.O.E Switch 10/100/1000 base T.AS D.LINK switch + 3No fibre termination ports | No | 1 | | | |
| 6.2.10 | Switch with fibre 3No fibre termination kits | No | 1 | | | |
| **TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 6.0 TITLE: STRUCTURED CABLING AND PATCH PANEL**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts |
|---|---|---|---|---|---|---|
| DW 6.0 | **STRUCTURED CABLING AND PATCH PANEL**<br>**RESEARCH CENTRE-SECOND FLOOR**<br>Supply and install the following inclusive 14% V.A.T:- | | | | | |
| 6.3.1 | CAT 6 UTP DATA cabling (siemon) | Rolls | 40 | | | |
| 6.3.2 | 1 metre patch cords (siemon) | No | 60 | | | |
| 6.3.3 | 3 metre patch cords | No | 60 | | | |
| 6.3.4 | RJ 45 Single coupler Data outlets | No | 60 | | | |
| 6.3.5 | 48 port patch panel CAT 6E | No | 3 | | | |
| 6.3.6 | Horizontal cable managers | No | 2 | | | |
| 6.3.7 | Allow for testing and commissioning including test Manuals labelling. | Sum | | | | |
| 6.3.8 | Supply and install 32U patch panel cabinet including termination of all Data / voice cabling Including accessories. | No | 1 | | | |
| 6.3.9 | Supply and install 48 Port P.O.E Switch 10/100/1000 base T.AS D.LINK switch | sum | 1 | | | |
| 6.3.10 | Any other item to complete installation in this section | sum | | | | |
| | **SUB-TOTAL SECOND FLOOR** | | | | | |
| **TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 6.0 TITLE: STRUCTURED CABLING AND PATCH PANEL**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts |
|---|---|---|---|---|---|---|
| DW 2.0 | **STRUCTURED CABLING AND PATCH PANEL**<br>**ACCOMMODATION- GROUND FLOOR**<br>Supply and install the following inclusive 14% V.A.T:- | | | | | |
| 6.4.1 | CAT 6 UTP DATA cabling (siemon) | Rolls (305)M | 4 | | | |
| 6.4.2 | 1 metre patch cords (siemon) | No | 13 | | | |
| 6.4.3 | 3 metre patch cords | No | 13 | | | |
| 6.4.4 | RJ 45 Single coupler Data outlets | No | 13 | | | |
| 6.4.5 | 24 port patch panel CAT 6E | No | 1 | | | |
| 6.4.6 | Horizontal cable managers | No | 3 | | | |
| 6.4.7 | Allow for testing and commissioning including test Manuals labelling. | Sum | | | | |
| 6.4.8 | Supply and install 9U patch panel cabinet including termination of all Data / voice cabling Including accessories. | No | 1 | | | |
| 6.4.9 | Supply and install 24port P.O.E 10/100/1000 base T D.LINK with fibre 3No. termination ports | Sum | 1 | | | |
| | **SUB-TOTAL GROUND FLOOR** | | | | | |
| **TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW6.0 TITLE: STRUCTURED CABLING AND PATCH PANEL**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts |
|---|---|---|---|---|---|---|
| DW 2.0 | **STRUCTURED CABLING AND PATCH PANEL**<br>**ACCOMODATION-FIRST FLOOR**<br>Supply and install the following inclusive 14% V.A.T:- | | | | | |
| 6.5.1 | CAT 6 UTP DATA cabling (siemon) | Rolls | 4 | | | |
| 6.5.2 | 1 metre patch cords (siemon) | No | 13 | | | |
| 6.5.3 | 3 metre patch cords | No | 13 | | | |
| 6.5.4 | RJ 45 Single coupler Data outlets | No | 13 | | | |
| 6.5.5 | 12 port patch panel CAT 6E | No | 1 | | | |
| 6.5.6 | Horizontal cable managers | No | 3 | | | |
| 6.5.7 | Allow for testing and commissioning including test Manuals labelling. | Sum | | | | |
| 62.5.8 | Supply and install 32U patch panel cabinet including termination of all Data / voice cabling Including accessories. | No | 1 | | | |
| 6.5.9 | Supply and install 12 Port P.O.E Switch 10/100/1000 base T.AS D-Link switch with fibre termination 3No. ports | No | 1 | | | |
| | **SUB-TOTAL FIRST FLOOR** | | | | | |
| **TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 6.0 TITLE: STRUCTURED CABLING AND PATCH PANEL**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts |
|---|---|---|---|---|---|---|
| DW2.0 | **STRUCTURED CABLING AND PATCH PANEL**<br>**ACCOMMODATION-SECOND FLOOR**<br>Supply and install the following inclusive 14% V.A.T:- | | | | | |
| 6.6.1 | CAT 6 UTP DATA cabling (siemon) | Rolls | 4 | | | |
| 6.6.2 | 1 metre patch cords (siemon) | No | 13 | | | |
| 6.6.3 | 3 metre patch cords | No | 13 | | | |
| 6.6.4 | RJ 45 Dual coupler Data outlets | No | 13 | | | |
| 6.6.5 | 12 port patch panel CAT 6E | No | 1 | | | |
| 6.6.6 | Horizontal cable managers | No | 3 | | | |
| 6.6.7 | Allow for testing and commissioning including test Manuals labelling. | Sum | | | | |
| 6.6.8 | Supply and install 32U patch panel cabinet including termination of all Data / voice cabling Including accessories. | No | 1 | | | |
| 6.6.9 | Supply and install 12 Port P.O.E Switch 10/100/1000 base T.AS D-Link switch fibre 3No. termination ports | sum | 1 | | | |
| | **SUB-TOTAL SECOND FLOOR** | | | | | |
| **TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 7.0 TITLE: DSATV SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| 7.0 | **SATELLITE DISH/ANTENNAE RESEARCH/ACCOMMODATION(GROUND,1ST AND 2ND )FLOORS**<br>Supply and install the following: | | | | | |
| 7.1 | 90cm dish complete with dual LNB feedhorn and mounting fixtures compatible with digital signal transmission. | No | 2 | | | |
| 7.2 | 4 element KBC 1 aerial complete with 3m aluminium mast and monting fixtures. | No | 2 | | | |
| 7.3 | 4 element KBC2 aerial complete with 3m aluminium mast and mounting fixtures | No | 2 | | | |
| 7.4 | 8 Element KTN/SKY/K24 / CITIZEN aerial complete with 3m aluminium mast and mounting fixtures | No | 2 | | | |
| | **HEAD END** | | | | | |
| 7.5 | Multiband mini head end as PHILLIPS 9210/11 or equal and approved. | No | 2 | | | |
| 7.6 | If Amplifier/Terrestial combiner as PHILLIPS 9210/11 or equal and approved. | No | 2 | | | |
| | **AMPLIFIERS/COMBINERS/SPLITTER** | | | | | |
| 7.7 | 4way Splitters | No | 4 | | | |
| 7.8 | 6 WAY Splitter Unit | No | 25 | | | |
| | **PROTECTION** | | | | | |
| 7.8 | 13A Volt guard | No | 2 | | | |
| 7.9 | 13A fused double plub adaptor | No | 2 | | | |
| 7.10 | 13A 4-way multi socket with voltage spike Suppression | No | 2 | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| | **CABLING AND ACCESSORIES** | | | | | |
| 7.11 | TV Outlet (suitable for DSATV terminations) | No | 60 | | | |
| 7.12 | 48Port switch 10/100/1000 base.T. | No | 4 | | | |
| 7.13 | 12 port switch 10/100/1000 | No | 1 | | | |
| 7.14 | Coaxil cable RG6 (screened) 75/0HMS | Roll | 12 | | | |
| 7.14 | Allow for signal testing and commissioning using specialist equipment | Sum | | | | |
| 7.16 | Any other item to complete installation in this section (STATE) | Sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 8.0 TITLE: CONFERENCE AND BOARDROOM- SOUND SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| | **CONFERENCE AND BOARDROOM-SOUND SYSTEM** | | | | | |
| 8.0 | Supply and install the following:- | | | | | |
| 8.1 | Zonal desktop paging microphone AS PASO make model P652m | No | 3 | | | |
| 8.2 | Radio AM/FM TUNER AS PASO make model p647u | No | 1 | | | |
| 8.3 | Connecting plug cables | Sum | | | | |
| 8.4 | 400 watts mixing amplifier AS PASO make complete with MIC facility | No | 1 | | | |
| 8.5 | 100 watts mixing amplifier AS PASO make complete with MIC facility | No | 1 | | | |
| 8.6 | Matching AS PASO MODEL MT3 impendence transformer | No | 25 | | | |
| 8.7 | Recessed ceiling speakers AS PASO make MODEL P 604 | No | 24 | | | |
| 8.8 | 20 mm dia 6W TWIN screened cables | Rolls | 6 | | | |
| 8.9 | 65 inch High resolution HDMI SAMSUNG TV'S Complete with mounting brackets | No | 6 | | | |
| 8.10 | Any other item to complete installation in this section | sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 9.0 TITLE: INCOMING MAINROAD AND EXTERNAL LIGHTING SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| DW 9.0 | **FOOTPATH AND STREET LIGHTING** | | | | | |
| 9.1 | Supply and install single 125W LED lantern mounted on 7.5m High Class 'C' street lighting column with 1.5m outreach arm to engineers detail | No | 50 | (Future) | | |
| 9.2 | Supply and install opal sphere gate pillar mounted complete with cable glands Type Z1 as per contract drawing and specification. | No | 2 | | | |
| 9.3 | 6mm$^2$ PVC/SWA/PVC 2Core cable complete with cable glands | M | 2500 | (Future) | | |
| 9.4 | 60TP/N photo cell and contactor | No | 1 | | | |
| 9.5 | 6way TP/N MCB DIST/BD complete with | No | 2 | | | |
| 9.6 | MCBS as specified | No | 10 | | | |
| 9.7 | 100W metal Halide low glare flood light as Thorn 0DW1000 | No | 10 | | | |
| 9.8 | Supply and install 250mm Dia city scape opal twin diffuser luminaire Type Z2 mounted on 3.5m High 50mm Dia circular steel column complete with 125W MBF lamp | No | 10 | | | |
| 9.10 | Feeder pillar To IP65 complete 6No. 30A MCBS and contractrors | No | 18 | | | |
| 9.11 | 6.5m Photocell column | No | 4 | | | |
| 9.12 | 4mm$^2$ PVC/SWA/PVC 2Core cable complete with cable glands | M | 4 | | | |
| 9.13 | Trenching, HATARI tiles and backfiling | M | 350 | | | |
| | Any other item to complete installation in this section. | Sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 10.0 TITLE: FIRE ALARM AND DETECTION SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| DW 10.0 | **FIRE ALARM AND DETECTION SYSTEM** | | | | | |
| 10.1 | Supply and install 2No 4 loop addressable CHLORIDE/MENVIEW/ZETA fire alarm panel for research centre and hostel block | No | 2 | | | |
| 10.2 | Supply and install 20AMP non switched spur unit for the fire alarm panel | No | 2 | | | |
| 10.3 | Supply and install addressable fire alarm sounder as shown on contract drawings complete with conduit and wiring | No | 19 | | | |
| | a) Research block | No | 18 | | | |
| | b) Hostel block | | | | | |
| 10.4 | Supply and install fire alarm breakglass contacts as shown on contract drawings | | | | | |
| | a)Research block | No | | | | |
| | b)Hostel block | No | 18 | | | |
| 10.5 | Supply and install heat detectors as shown on contract drawing complete with conduit and wiring | | | | | |
| | a)Research block | No | 2 | | | |
| | b)Hostel block | No | 36 | | | |
| 10.6 | Supply and install smoke detectors complete with conduit and wiring in corridors and stairways as follows:- | | | | | |
| | a)Research block | No | 85 | | | |
| 10.7 | Allow for Testing, Manuals and commissioning of Fire Alarm System. | Sum | | | | |
| 10.8 | Any other item to complete installation in this section | Sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**SECTION: DW 11.0 TITLE: LIGHTNING PROTECTION SYSTEM**

| Item | Description | Unit | Qty | Rate | Kshs. | Cts. |
|---|---|---|---|---|---|---|
| DW 11.0 | **LIGHTNING PROTECTION SYSTEM** | | | | | |
| 11.1 | Supply and install 25 x 3mm lightning protection copper tape complete with fixing saddles or clamps on ridge | | | | | |
| | a) Research block | No | 180 | | | |
| | b) Hostel block | No | 270 | | | |
| 11.2 | Supply and install all lightning spikes complete with base clamps and spike as shown on contract drawings | | | | | |
| | a)Research block | No | 8 | | | |
| | b)Hostel block | No | 11 | | | |
| 11.3 | Supply and install all test clamps as shown on contract drawings | | | | | |
| | a) Research block | No | 6 | | | |
| | b) Hostel block | No | 9 | | | |
| 11.4 | Supply and install 1500mm Ø copper earth electrodes as shown on contract drawings complete with concrete cover as follos:- | | | | | |
| | a) Research block | No | 6 | | | |
| | b) Hostel block | No | 9 | | | |
| 11.5 | Allow for welding selected mild steel rod down conductors as shown on contract drawings | Sum | | | | |
| 11.6 | Allow for bonding with copper tape all metallic projections on roof space | Sum | | | | |
| 11.7 | Allow for testing of the lightning protection system to the Engineers satisfaction | Sum | | | | |
| 11.8 | Any other item to complete installation in this section. | Sum | | | | |
| **SUB-TOTAL CARRIED FORWARD TO MAIN SUMMARY OF PRICES** | | | | | | |

**PROPOSED RESEARCH CENTRE AND HOSTELS FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

## SUMMARY PAGE

| | KSHS. | CTS |
|---|---|---|
| **BROUGHT FORWARD FOR ELECTRICAL ENGINEERING SERVICES PAGE D 3……..……** | | |
| **TOTAL CARRIED TO FORM OF MAIN SUMMARY PAGE** | | |

**D/36**

## PART D
## GENERATOR PRICE SCHEDULES

1. Listing of Schedules

| | |
|---|---|
| Schedule No.1 - | Summary of Information for Tenderer |
| Schedule No.2 - | Technical details of the set offered by the tenderers. |
| Schedule No.3 - | Deviation from the Specification |
| Schedule No.4 - | List of tools to be supplied with the set. |
| Schedule No.5 - | List of spare parts and lubricants to be supplied with the set. |
| Schedule No.6 - | Earthing. |
| Schedule No.7 - | Price Summary |

The tenderer shall base his tender on information which is given in Schedule 1. He shall complete schedule No.2 in full with details of the set he is offering. Any equipment which he wishes to offer but which does not comply with the Specification would be fully detailed in Schedule No.3 together with details of any other deviations or omissions which he may wish to make.

The tenderer shall also complete Schedule No.4, 5 and 6 and insert his price for these items in the Price Summary when he completes Schedule NO.7.

Any tender which is submitted without the Schedule having been fully completed may not be considered.

**SCHEDULE NO.1**

**SUMMARY OF INFORMATION FOR TENDERS**

The Tenderer is advised to read the relevant section of the Specification for full details of the items summarised below:

| Item | Requirements | Ref. Clause |
|---|---|---|
| 1. Operating conditions | Bondo | 1.2 |
| Site | JOOUST.MIYADHE | |
| Altitude | Approximately 1214 metres ASL | |
| Relative humidity range | 44 - 67% | |
| To operate in | Unheated building | |
| Dust conditions | Dust laden atmosphere | |
| 2. Duty | Mains failure unit and<br>Standby power<br>10 starts per hour | <br>3.7<br>2.14 |
| 3. Performance | 1No. 450KVA<br>Output 415 volts 3 Phase<br>50 HZ on site after derating factors. | <br><br>3.8 |
| 4. Set Arrangements<br>Weather proof roof canopy<br>and side panels | required | 2.8 |
| 5. Remote governor control | not required | 3.5 |
| 6. Aspiration | Natural | 4.2 |
| 7. Manual start | required | |
| 8. Sump heater | not required | |
| 9. Silencer: -details<br>of additional pipework<br>and fittings is required | | 2.11a |

| | | |
|---|---|---|
| 10.Daily service tank: capacity if other than 24 hours | ...litres/..hours | 2.11b |
| Transfer pump | hand pump | 2.11d |
| Auxiliary fuel tank: | | |
| sitting | required | |
| capacity | ..... | |
| 11. Fuel jettison cock for (a) Daily service tank (b) Auxiliary fuel tank | required | |
| 12. Engine instruments: | | |
| details if not as standard | | 2.10 |
| 13. Cooling system | required | 2.12 |
| 14. Electrical control panel: main switch | Circuit breaker | 4.9 |
| Provision for parallel running | not required | |
| 15. Lock-out remote indication circuit | required | 4.2 |
| 16. Fire service terminals | required | |
| 17. Earth fields | required | |
| 18. Building drawing | required | |
| 19. Maintenance period | 12 months | |

SCHEDULE NO.2A -

TECHNICAL DETAILS OF THE 1NO. SET 450KVA ACCOUSTIC SET PRIME RATED STANDBY GENERATORS OFFERED BY TENDERER

| Item | Details 450KVA |
|---|---|
| 1. Diesel Engine | |
| Make | ---------- |
| Type | ---------- |
| Bore | ---------mm-- |
| Stroke | ---------mm-- |
| Net continuous rating (B.S. 649)<br>(a) At sea level | ----------kVA |
| (b) at site | ----------kVA |
| Speed | ---------rev/min |
| Year this type put into service | ---------- |
| Total number sold | ---------- |
| (a) Worldwide | ---------- |
| (b) in East African | ---------- |
| (c) in Kenya | ---------- |
| Aspiration: | ---------- |
| Make | ---------- |
| Type | ---------- |
| Number in use | ---------- |
| Thermometers: | ---------- |
| Make | ---------- |
| Type | ---------- |

Pyrometers:

Make ----------

Type ----------

Air cooling:

Quantity of air required ----------$m^3$/sec

Details of ducting ----------

Water cooling ----------

details of water cooling circuits ----------

Radiator:- ----------

Make ----------

Type ----------

Length mm ----------

Breadth mm ----------

Height ----------

Aspiration:

Method ----------

Quantity of air required --------- $m^3$/s

| Item | | Details | | |
|---|---|---|---|---|
| 2. | Auxiliaries | Make | Type | Other Relevant |
| | Lubricants Oil Circuits | | | |
| | Filters | | | |
| | Coolers | | | |
| | Primary Pumps | | | |
| | Tachometer and drive Governor | | | |
| | Cold start devices | | | |
| | Running hours meter | | | |
| | Safety devices: | | | |
| | High temperature | | | |
| | Low pressure (lubricating oil) | | | |
| | Cooling water flow trip | | | |
| | Over speed trip | | | |
| | Speed sensing devices: | | | |
| | Lubricating oil Thermometers: Number Position. (s) Water thermometer | | | |
| | Starting Battery | | | |
| | Immersion heater | | | |

| 3. Lubrication | Grade | Quantity (litres) |
|---|---|---|
| Recommended oil (s) Sump | | |
| Elsewhere (State where) | | |

4. Alternator and exciter

Make and type

Bearings

Insulation class (BS.27 7 * ball/roller/plain

* delete as necessary

| Item | Details |
|---|---|
| | Make type rating |
| 4. Electrical Control panel | |
| Location of control panel: | ---------- |
| Confirm the following minimum instrumentation fitted: | |
| Alternator output ammeter: | ---------- |
| Alternator output voltmeter: | ---------- |
| Alternator output frequencymeter: | ---------- |
| Alternator output Kilowattmeter: | ---------- |
| Generator service hours records: | ---------- |
| Confirm the following minimum controls fitted: | |
| Ammeter selector swith: | ---------- |
| Voltmeter selector switch: | ---------- |
| Engine control manual/ auto selector: | ---------- |
| Generator test facility: | ---------- |
| Confirm the following sequence relays/timers are fitted: | |
| Phase failure detection circuit - any one or all three phase adjustable: | ---------- |
| | ---------- |
| Multi-attempt start: | ---------- |
| | ---------- |
| | ---------- |
| Mains return stop delay adjustable: | ---------- |

Engine cool-down off-
load delay: ----------
---
---

Confirm the following minimum protection circuits with automatic shut down and alarm indication are provided:

Engine failure to start:
---
---

Engine low oil pressure: ----------
---

Engine high temperature: ----------
Engine over speed: ----------

Type of indication provided
(LED or filament lamp): ----------

Lamp test push button: ----------

Details of Engine starter

Battery static charger: ----------

Alternator output circuit breaker: ----------

Make: _____

Rating in ampheres: _____

Number of poles: _____

Details of protection system: ----------

Mains/Alternator change over:

Contactors:

Make: _____

Rating in ampheres: _____

Number of poles: _____

Electrical Interlock: ----------

Mechancial interlock ----------

By-pass switch:

Make: _____

Rating in ampheres: _____

Number of poles: _____

Indicator lamps - No.....* ----------

Ammeter switch ----------

Voltmeter switch ----------

KWh meter ----------

Frequency meter ----------

Ammeter - No.....* ----------

Voltmeters No.....* ----------

Power factor meter ----------

Other equipment - give details ----------

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6. Performance data

| Fuel Consumption | Round output | Output |
|---|---|---|
| | % | Kg/KWh |
| | 110 | |
| | 100 | |
| | 75 | |
| 50 | | |

| Maximum output at site | Ambient Temp.($^0$C) | Output KVA |
|---|---|---|
| | | 40 |
| | | 30 |
| | | 20 |
| | | 10 |

Critical Speeds - rev/min ----------

Cyclic irregularity ----------

Voltage regulation ----------

Frequency regulation ----------

Time to accept 75% full load
from 5 degrees C. ----------

Time to accept 100 % full load
from 5 degrees C. ----------

7. Physical Details

Auxiliary Daily service tank for Litres
24 hour operation capacity ----------

mm long mm wide mm high
Size ----------

Total weight of set ----------

Overall dimensions of set ----------

Kg
Weight of heaviest component ----------

Weather Proofing ----------

8. Operational Details

Description of operation sequence
of the automatic control (where fitted)

Details of drawings, literature,
etc., included with tender

9. Delivery Details

Time in weeks from acceptance
of tender to delivery of all
equipment to site ----------weeks

Time in weeks from acceptance
of tender to commissioning tests ----------weeks

SCHEDULE NO. 3

DEVIATIONS FROM THE SPECIFICATION

The tenderer shall give below details of any equipment which does not meet the specification, or any other deviations, omissions, additions or alternatives in respect of the set which he is offering.

If none, write none.

**INDICATE DERATING FACTOR OF THE ENGINES OFFERED**:

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## SCHEDULE NO. 4

## LIST OF TOOLS TO BE SUPPLIED WITH THE SET 1No. 550KVA ACCOUSTIC PRIME RATED STANDBY GENERATOR

The following tools shall be handed over to the Engineer before completion of this contract.

| Item | Details | Price (KShs) |
|---|---|---|
| 1. | Metal tool box with lock and 2 keys | |
| 2. | Set (8 number) Chrome Vanadium ring spanners in sizes to suit the set. | |
| 3. | Ditto open ended spanners | |
| 4. | Set of 3 screw drivers, 75mm, 200mm and 300mm plus one 200mm philips type. | |
| 5. | One set of feeler gauges. | |
| 6. | One grease gun to suit greasing points | |
| 7. | One oil can, trigger type | |
| 8. | One hydrometer and plastic filler bottle with paring spout. | |
| | Total for 1No. 450KVA Generator carried forward to price summary schedule | |

The tenderer shall give below details of any other spares which he recommends should be purchased as an optional extra.

Details Price

Signed (as in tender) .....

Date: .....

## SCHEDULE NO. 5

## LIST OF SPARE PARTS AND LUBRICANTS TO BE

## SUPPLIED WITH THE SET (1No. 450KVA ACCUOSTIC PRIME RATED STANDBY GENERATOR)

The following items shall be handed over to the Engineer before completion of this contract. They shall not be used by the Contractor contrary to carry out his normal maintenance.

| Item | Details | Price (KShs) |
|---|---|---|
| 1. | Oil filters - 6No. for 450 KVA generator | |
| 2. | Air filters - 6No. for 450 KVA generator | |
| 3. | Fuel filters - 6No. for 450 KVA generator | |
| 4. | One set for generator of fan belts (1No.Gen Set) | |
| 5. | One set for each generator of indicator bulbs comprising..... bulbs.(1No. 450KVA Gen Set) | |
| 6. | One set for each generator of indicator lenses comprising ..... fuses. (1No.Gen Set) | |
| 7. | 2No. 20 litre of sump of oil grade..... | |
| 8. | 2No. 10 litre plastic container of distilled water ..... | |
| 9. | 500Litres Gen Set Diesel Fuel ..... | |
| | Total carried forward to price summary schedule | |

The tenderer shall give below details of any other spares which he recommends should be purchased as an optional extra.

## SCHEDULE NO. 6

## EARTHING

The tenderer shall insert his prices for the following items. The Configuration of the earth field shall be as directed by the Engineer on site.

| Item | Details | Price (KShs) |
|---|---|---|
| 1. | Supply and install 4No. steel cored copper earth rods, 1200mm x 12mm threaded for extension, connected by brass clamps to 30 metres of 25mm x 3mm copper earth tape laid in trenches of minimum depth 300mm and fixed to the wall of generator room with brass spacer bar saddles at 1 metre intervals, connected to the station earth bar via a brass test clamp.(1X450KVA)<br><br>Supply and install 4No. steel cored copper earth rods, 1200mm x 12mm threaded for extension, connected by brass clamps to 30 metres of 25mm x 3mm copper earth tape laid in trenches of minimum depth 300mm and fixed to the wall of generator room with brass spacer bar saddles at 1 metre intervals, connected to the station earth bar via a brass test clamp.(1X450KVA) | |
| | Sub-Total carried forward to price summary schedule | |
| | **Total for 1No. 450KVA Generator** | |

Price per additional earth .....Kshs.

Price per additional metre of earth tape.....Kshs.

Signed (as in tender)

.....

Date:

.....

**SCHEDULE NO. 7**
**PRICE SUMMARY**
**1No. 450KVA STANDARD ACCOUSTIC 3 PHASE PRIME RATED STANDBY GENERATORS**

| Item | DESCRIPTION | KSHS. | CTS. |
|---|---|---|---|
| 1. | Sub-Contract Preliminaries. | | |
| 2. | Supply of 1No.450KVA accoustic prime rated Generators complete with baseframe fuel tank and base frame shock absorbers and dampers. | | |
| 3. | Supply and installation of AMF Panel complete with controller module and manual by-pass switch | By Others | |
| 4. | Installation of 1No. 450KVA generator set including transport to site | | |
| 5. | Supply and install of 630mm$^2$ PVC /PVC 4 from generator to main meterboard via control panel 80M complete with cable glands. | | |
| 6. | Commissioning of the generator set | | |
| 7. | Supply of "AS FITTED" drawing and maintenance manuals. | | |
| 8. | Schedule 4 - supply of tool kit | | |
| 9. | Schedule 5 - supply of spares and lubricants. | | |
| 10. | Schedule 6 - Earthing. Copper Tape (25x3mm) | | |
| 11. | Supply, installation of exhaust pipe system complete with 2No. Silencers (Normal + Residential) 50d B Max including extensions and lagging complete with brackets). Maximum 30M each set Mechanical Ventilation Duct and Exhaust Hood | | |
| 12. | Supply and installation of inlet and exhaust sound absorption mufflers(Attenuators) using phono absorbent Panels to 40d B noise level | | |
| 13. | Supply and installation of 24hr daily fuel tank complete with fuel automatic pump system comprising of fuel, senders and necessary Electrical valves and relays to EEC standards | | |
| 15. | Provisional Sum (Contingency).Kshs.250,000.00 | 250,000 | 00 |
| 16. | Add 16% VAT( INCLUSIVE ABOVE) | | |
| | **TOTAL CARRIED FORWARD TO FORM OF TENDER** | | |

**Exchange rate fluctuations adjustment will be made to all the prices of imported materials to compensate for variations in the foreign exchange. For this purpose the tenderer is required to state the exchange rate in Kenya Shillings for the currency of the country of origin of imported materials as applied to the actual remittances affecting payment to manufacturers of the materials**

**Exchange Rate……**

**PROPOSED RESEARCH CENTRE AND HOSTELS FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

## SUMMARY PAGE

| | KSHS. | CTS |
|---|---|---|
| **BROUGHT FORWARD FOR GENERATOR INSTALLATION SERVICES PAGE D/51 ……..……** | | |
| **TOTAL CARRIED TO MAIN SUMMARY PAGE** | | |

**PROPOSED RESEARCH CENTRE AND HOSTELS FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

| MAIN SUMMARY PAGE – ELECTRICALAND ICT AND GENERATOR SERVICES | KSHS. | CTS |
|---|---|---|
| **1.0 BROUGHT FORWARD FOR ELECTRICAL ENGINEERING SERVICES FROM PAGE D/36 MAIN SUMMARY PAGE ……..……** | | |
| **2.0 BROUGHT FORWARD FOR GENERATOR INSTALLATION SERVICES PAGE D/52 MAIN SUMMARY PAGE ……** | | |
| **GRAND TOTAL –ELECTRICAL ENGINEERING SERVICES CARRIED FORWARD TO MAIN FORM OF TENDER PAGE (i) FRONT PAGE** | | |


**PAGE/ (D/53)**

## SECTION VIII

*STANDARD FORMS*

(i) Form of Invitation for Tenders
(ii) Form of Tender
(iii) Appendix to Form of Tender
(iv) Letter of Acceptance
(v) Form of Agreement
(vi) Form of Tender Security
(vii) Performance Bank Guarantee (unconditional)
(viii) Bank Guarantee for Advance Payment
(ix) Tender Questionnaire
(xi) Confidential Business Questionnaire
(x) Statement of Foreign Currency Requirement
(xi) Schedule of Materials;- Basic Prices
(xii) Schedule of Labour;- Basic Prices
(xiii) Schedule of Plant and Equipment
(xv) Details of Sub-Contractors
(xvi) Certificate of Tenderer's Site visit
(xvii) Form of Written Power of Attorney
(xviii) Key Personnel
(xix) Completed Civil Works
(xx) Schedule of Ongoing Projects
(xxi) Other Supplementary Information
(xxii) Request for Review Form

# FORM OF INVITATION FOR TENDERS

_____*[date]*

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

Dear Sirs:

**Reference: _____[Contract Name]**

***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].**

***Upon payment of a non-refundable fee of Kshs _____***

***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 _____*(time and date). *Tenders will be opened immediately thereafter, in the presence of tenderers' representatives who choose to attend.***

***Please confirm receipt of this letter immediately in writing by cable/facsimile or telex.***

***Yours faithfully,***

_____ ***Authorised Signature***
_____ ***Name and Title***

# FORM OF TENDER

TO: _____*[Name of Employer)* _____*[Date]*

_____*[Name of Contract]*

Dear Sir,

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

2. We undertake, if our tender is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Project Manager's notice to commence, and to complete the whole of the Works comprised in the Contract within the time stated in the Appendix to Conditions of Contract.

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

4. Unless and until a formal Agreement is prepared and executed this tender together with your written acceptance thereof, shall constitute a binding Contract between us.

5. 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 tenders for and on behalf of _____*[Name of Employer]* of_____[*Address of Employer]*

Witness; Name_____

Address_____

Signature_____

Date_____

**APPENDIX TO FORM OF TENDER**

**(This appendix forms part of the tender)**

| CONDITIONS OF CONTRACT | CLAUSE | AMOUNT |
|---|---|---|
| Tender Security (Bank Guarantee only) | | Kshs |
| Amount of Performance Security (Unconditional Bank Guarantee) | 10.1 | ___ percent of Tender Sum in the form of Unconditional Bank Guarantee |
| Program to be submitted | 14.1 | Not later than ___ days after issuance of Order to Commence |
| Cashflow estimate to be submitted | 14.3 | Not later than ___ days after issuance of Order to Commence |
| Minimum amount of Third Party Insurance | 23.2 | Kshs. |
| Period for commencement, from the Engineer's order to commence | 41.1 | _____ days |
| Time for completion | 43.1 | …… |
| Amount of liquidated damages | 47.1 | Kshs. per day |
| Limit of liquidated damages | 47.1 | ___% of Contract Value |
| Defect Liability period | 49.1 | Months |
| Percentage of Retention | 60.5 | ___ of Interim Payment Certificate |
| Limit of Retention Money | 60.5 | ___ % of Contract Price |
| Minimum amount of interim certificates | 60.2 | Contract value/Time for completion in months |
| Time within which payment to be made after Interim Payment Certificate signed by Engineer | 60.8 | _____days |
| Time within which payment to be made after Final Payment Certificate signed by Engineer | 60.8 | _____ days |
| Appointer of Arbitrator | 67(3) | Chief Justice of The Republic of Kenya |
| Notice to Employer and Engineer | 68.2 | The Employers address is:<br>Permanent Secretary,<br>Ministry of……, P.O.Box ……<br>NAIROBI<br><br>The Engineer's address is:<br>Chief Engineer(……),<br>Ministry of……, P.O.Box……<br>NAIROBI |

Signature of Tender……Date……

# LETTER OF ACCEPTANCE

**[letterhead paper of the Employer]**

_____*[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 of ……20……

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;
   (c) rejects a correction of an arithmetic error in the tender.

   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]*

**(Amend accordingly if provided by Insurance Company)**

**PERFORMANCE BANK GUARANTEE (UNCONDITIONAL)**

To: _____(*Name of Employer*) _____*(Date)*
_____(*Address of Employer)*

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 _____

**(Amend accordingly if provided by Insurance Company)**

## 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 figurers]* 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: _____

## 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*)

**ANTI – CORRUPTION POLICY IN THE PROCUREMENT PROCESS**

**UNDERTAKING BY BIDDER ON ANTI – CORRUPTION POLICY / CODE OF CONDUCT AND COMPLIANCE PROGRAMME**

The governments of Kenya is committed to fighting corruption in all its forms and in all its institutions to ensure that all the government earned revenues are utilized prudently and for the purpose intended with a view to promoting economic development as the country work towards actualizing Vision 2030.

Here at Jaramogi Oginga Odinga University of Science and Technology and also being one of the government entities mandated under the government to provide quality education and transforming lives, on behalf of the government, we are highly committed to fighting any form of corruption in our organization to ensure that all the monies that the government entrust with us, is optimally and prudently utilized for the benefits of all the people we serve.

**The following is a requirement that every Bidder wishing to do business with JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY must comply with:**

(1) Each bidder must submit a statement, as part of the tender documents, in the format given and which must be signed personally by the Chief Executive Officer or other appropriate senior corporate officer of the bidding company and, where relevant, of its subsidiary in Kenya. If a tender is submitted by a subsidiary, a statement to this effect will also be required of the parent company, signed by its Chief Executive Officer or other appropriate senior corporate officer.

(2) Bidders will also be required to submit similar No-bribery commitments from their subcontractors and consortium partners; the bidder may cover the subcontractors and consortium partners in its own statement, provided the bidder assumes full responsibility.

(3) a) Payment to agents and other third parties shall be limited to appropriate compensation for legitimate services.

b) Each bidder will make full disclosure in the tender documentation of the beneficiaries and amounts of all payments made, or intended to be made, to agents or other third parties (including political parties or electoral candidates) relating to the tender and, if successful, the implementation of the contract.

c) The successful bidder will also make full disclosure [quarterly or semi- annually] of all payments to agents and other third parties during the execution of the contract.

d) Within six months of the completion of the performance of the contract, the successful bidder will formally certify that no bribes or other illicit commissions have been paid. The final accounting shall include brief details of the goods and services provided that are sufficient to establish the legitimacy of the payments made.

e) Statements required according to subparagraphs (b) and (d) of this paragraph will have to be certified by the company's Chief Executive Officer, or other appropriate senior corporate officer.

(4) Tenders which do not conform to these requirements shall not be considered.

(5) If the successful bidder fails to comply with its No-bribery commitment, significant sanctions will apply. The sanctions may include all or any of the following:

a) Cancellation of the contract;

b) Liability for damages to the public authority and/or the unsuccessful competitors in the bidding possibly in the form of a lump sum representing a pre-set percentage of the contract value (liquidated).

(6) Bidders shall make available, as part of their tender, copies of their anti-Bribery Policy/Code of Conduct, if any, and of their-general or project - specific - Compliance Program.

(7) The Government of Kenya through Ethics and Anti-Corruption Commission has made special arrangements for adequate oversight of the procurement process and the execution of the contract. Those charged with the oversight responsibility will have full access if need be to all documentation submitted by Bidders for this contract, and to which in turn all Bidders and other parties involved or affected by the project shall have full access (provided, however, that no proprietary information concerning a bidder may be disclosed to another bidder or to the public).

**1. MEMORANDUM ( FORMAT )**

**(Clause 46 of Kenya Public Procurement and Asset Disposal Act 2015)**

This company _____*(name of company)* has issued, for the purposes of this tender, a Compliance Program copy attached -which includes all reasonable steps necessary to assure that the No-bribery commitment given in this statement will be complied with by its managers and employees, as well as by all third parties working with this company on the public sector projects or contract including agents, consultants, consortium partners, subcontractors and suppliers')"

Authorized Signature:_____

Name and Title of Signatory: _____

Name of Bidder: _____

Address: _____

**CONFIDENTIAL BUSINESS QUESTIONNAIRE**

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

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

*Part 1 – General*

Business Name ……

Location of business premises; Country/Town……

Plot No…… Street/Road ……

Postal Address…… Tel No……

Nature of Business……

Current Trade Licence No…… Expiring date……

Maximum value of business which you can handle at any time: K. pound……

Name of your bankers……

Branch……

*Part 2 (a) – Sole Proprietor*

Your name in full…… Age……

Nationality…… Country of Origin……

*Citizenship details ……

*Part 2 (b) – Partnership*

*Give details of partners as follows:*

| *Name in full* | *Nationality* | *Citizenship Details* | *Shares* |
|---|---|---|---|
| 1…… | | | |
| 2…… | | | |
| 3…… | | | |

***Part 2(c) – Registered Company:***

Private or public……

State the nominal and issued capital of the Company-

Nominal Kshs……

Issued Kshs……

Give details of all directors as follows:

Name in full . Nationality. Citizenship Details*. Shares.

1.
……
2.
……
3.
……
4.
……

***Part 2(d) – Interest in the Firm:***

Is there any person / persons in …… ……(*Name of Employer)* who has interest in this firm? Yes/No……(*Delete as necessary*)

I certify that the information given above is correct.

…… …… ……
*(Title)* *(Signature)* *(Date)*

* Attach proof of citizenship

## STATEMENT OF FOREIGN CURRENCY REQUIREMENTS

(See Clause 60[5] 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)

**SCHEDULE OF MATERIALS;-BASIC PRICES**
**(Ref: Clause 70 of Conditions of Contract)**

| MATERIAL | UNIT | ORIGIN AND PRICE | | | TRANSPORTATION COST FROM SOURCE OF ORIGIN | |
|---|---|---|---|---|---|---|
| | | COUNTRY OF ORIGIN | SUPPLIER | PRICE | MODE | PRICE (KSHS) |
| Cement | Mg | | | | | |
| Lime | Mg | | | | | |
| Sand | Mg | | | | | |
| Aggregate | Mg | | | | | |
| Diesel | L | | | | | |
| Regular Petrol | L | | | | | |
| Super Petrol | L | | | | | |
| Kerosene | L | | | | | |
| Structural steel | Mg | | | | | |
| Gabion Mesh | M2 | | | | | |
| Reinforcement Steel | Mg | | | | | |
| Explosives | Kg | | | | | |
| Oil and Lubricants | L | | | | | |
| Bitumen Emulsion A3 | L | | | | | |
| Bitumen Emulsion A4 | L | | | | | |
| Bitumen Emulsion K1 | L | | | | | |
| Bitumen Emulsion K3 | L | | | | | |
| Bitumen 80/100 | Kg | | | | | |
| Bitumen MC 30 | ML | | | | | |
| Bitumen MC 70 | L | | | | | |
| Bitumen MC 3000 | L | | | | | |
| Ammonium nitrate for blasting | Kg | | | | | |

I certify that the above information is correct.

…… …… ……

*(Title)* *(Signature)* *(Date)*

The prices inserted above shall be those prevailing 30 days before the submission of Tenders and shall be quoted in Kenya Shillings using the exchange rates specified in the Appendix to Form of Tender.

Prices of imported materials to be quoted CIF Mombasa or Nairobi as appropriate depending on whether materials are imported by the tenderer directly or through a local agent.

Transportation costs for imported materials to be quoted from Mombasa or Nairobi as appropriate to _____(Contract Site) depending on whether materials are imported directly by the tenderer or through a local agent.

**LETTER OF NOTIFICATION OF AWARD**

Address of Procuring Entity
_____
_____

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

**ANTI – CORRUPTION POLICY IN THE PROCUREMENT PROCESS**

**UNDERTAKING BY BIDDER ON ANTI – CORRUPTION POLICY / CODE OF CONDUCT AND COMPLIANCE PROGRAMME**

The governments of Kenya is committed to fighting corruption in all its forms and in all its institutions to ensure that all the government earned revenues are utilized prudently and for the purpose intended with a view to promoting economic development as the country work towards actualizing Vision 2030.

Here at Jaramogi Oginga Odinga University of Science and Technology and also being one of the government entities mandated under the government to provide quality education and transforming lives, on behalf of the government, we are highly committed to fighting any form of corruption in our organization to ensure that all the monies that the government entrust with us, is optimally and prudently utilized for the benefits of all the people we serve.

**The following is a requirement that every Bidder wishing to do business with JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY must comply with:**

(1) Each bidder must submit a statement, as part of the tender documents, in the format given and which must be signed personally by the Chief Executive Officer or other appropriate senior corporate officer of the bidding company and, where relevant, of its subsidiary in Kenya. If a tender is submitted by a subsidiary, a statement to this effect will also be required of the parent company, signed by its Chief Executive Officer or other appropriate senior corporate officer.

(2) Bidders will also be required to submit similar No-bribery commitments from their subcontractors and consortium partners; the bidder may cover the subcontractors and consortium partners in its own statement, provided the bidder assumes full responsibility.

(3) a) Payment to agents and other third parties shall be limited to appropriate compensation for legitimate services.

b) Each bidder will make full disclosure in the tender documentation of the beneficiaries and amounts of all payments made, or intended to be made, to agents or other third parties (including political parties or electoral candidates) relating to the tender and, if successful, the implementation of the contract.

c) The successful bidder will also make full disclosure [quarterly or semi- annually] of all payments to agents and other third parties during the execution of the contract.

d) Within six months of the completion of the performance of the contract, the successful bidder will formally certify that no bribes or other illicit commissions have been paid. The final accounting shall include brief details of the goods and services provided that are sufficient to establish the legitimacy of the payments made.

e) Statements required according to subparagraphs (b) and (d) of this paragraph will have to be certified by the company's Chief Executive Officer, or other appropriate senior corporate officer.

(4) Tenders which do not conform to these requirements shall not be considered.

(5) If the successful bidder fails to comply with its No-bribery commitment, significant sanctions will apply. The sanctions may include all or any of the following:

c) Cancellation of the contract;

d) Liability for damages to the public authority and/or the unsuccessful competitors in the bidding possibly in the form of a lump sum representing a pre-set percentage of the contract value (liquidated).

(6) Bidders shall make available, as part of their tender, copies of their anti-Bribery Policy/Code of Conduct, if any, and of their-general or project - specific - Compliance Program.

(7) The Government of Kenya through Ethics and Anti-Corruption Commission has made special arrangements for adequate oversight of the procurement process and the execution of the contract. Those charged with the oversight responsibility will have full access if need be to all documentation submitted by Bidders for this contract, and to which in turn all Bidders and other parties involved or affected by the project shall have full access (provided, however, that no proprietary information concerning a bidder may be disclosed to another bidder or to the public).

**2. MEMORANDUM ( FORMAT )**

**(Clause 46 of Kenya Public Procurement and Asset Disposal Act 2015)**

This company _____*(name of company)* has issued, for the purposes of this tender, a Compliance Program copy attached -which includes all reasonable steps necessary to assure that the No-bribery commitment given in this statement will be complied with by its managers and employees, as well as by all third parties working with this company on the public sector projects or contract including agents, consultants, consortium partners, subcontractors and suppliers')"

Authorized Signature:_____

Name and Title of Signatory: _____

Name of Bidder: _____

Address: _____

**NON-DEBARMENT STATEMENT**

I/We/Messrs……

of .....Street/avenue, .....Building, P. O. Box……Code ...…, of ..... (Town),

..... ..... (Nationality), Phone: ..... E-mail .....….

declare that I/We /Messrs ……

are not debarred from participating in public procurement by the Public Procurement Oversight Authority pursuant to section 115 of the Public Procurement and Disposal Act, 2005.

Dated this .....day of ..... 20.....

Authorized Signature.....Official Stamp .....

Name and Title of Signatory…….....

**STATEMENT OF COMPLIANCE**

a) I confirm compliance of all clauses of the General Conditions, General Specifications and Particular Specifications in this tender.

b) I confirm I have not made and will not make any payment to any person, who can be perceived as an inducement to win this tender.

Signed: ……for and on behalf of the Tenderer

Date: ……..

Official Rubber Stamp: ……

**DETAILS OF LITIGATIONS OR ARBITRATION PROCEEDINGS**
IN WHICH THE TENDERER IS INVOLVED AS ONE OF THE PARTIES

1. .
2. .
3. .
4. .
5. .
6. .
7. .
8. .
9. .
10 .

**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)* of ……dated the…day of ……..20…….in the matter of Tender No……..…of ……..20…

**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 of ……...20….……

SIGNED

Board Secretary

## EVALUATION CRITERIA

Technical Evaluation Form: The tenderer is expected to complete Part 1 and 3 of this form

**Part A: General Information**

Tenderer Name……..

Postal Address……...

Telephone (Office)……..Mobile……..

Physical Address……

**Part B: Evaluation Stages**

**Stage 1: Mandatory Requirements**

*Applicants **must** qualify in all the requirements below for them to proceed to the Evaluation Stage 2-Technical evaluation*

| S/No | Mandatory requirement |
|---|---|
| 1 | Must provide National Construction Authority (NCA) Category 6 and above registration certificate under the category of Electrical Installation. In the event of a joint venture, the certificate maybe submitted by any one of the members of the venture. |
| 2 | Electrical Installations Sub-Contractors must have a current Energy Regulatory Commission, (ERC) class B and above license. |
| 3 | Must provide Copy of current annual contractors practicing license from National Construction Authority (NCA). In the event of a joint venture, the certificate will be submitted by the holder of the NCA registration certificate. |
| 4 | Must provide Detailed Company profile. |
| 5 | Must provide certified copy of Certificate of Incorporation. If joint venture, ALL member of the venture shall submit their respective certificates. |
| 6 | Must attach proof of certified Company Ownership (CR12). |
| 7 | Must attach certified copy of Single Business Permit for the year 2020 |
| 8 | Must provide valid Certificate of Tax Compliance from Kenya Revenue Authority; (certified copy). If joint venture, ALL member of the venture shall submit their respective certificates. |
| 9 | Must Dully fill, sign and stamp the Form of Tender. |
| 10 | Must attach Certified Audited financial reports prepared by registered Auditors for the last three consecutive years for the years ended 2017, 2018 and 2019. |
| 11 | Must Dully fill, sign and stamp the Confidential Business Questionnaire |
| 12 | Must Provide Dully filled, signed and stamped Non-Debarment Declaration Form. |
| 13 | Must Provide Dully signed and signed/stamped Litigation Declaration Form.) |
| 14 | Site visit/ pre-tender conference is mandatory (as indicated in the advertisement) |
| 15 | Must provide a bid bond of 2% of the tender amount from a commercial bank recognized by CBK and must be valid for 120 days from the date of tender closing. |
| 16 | Must provide Manufacturers letter of Authority for the specified equipment |
| 17 | Must dully fill sign and stamp the Anti-corruption declaration form |
| 18 | Must Provide proof of Power of attorney of Tender Signatory in the event of a joint |

**Stage 2: Technical Evaluation**

Award of points for the Technical Evaluation shall be as shown in Table 1 below:

| Item | Description | Points Scored | Max Points | Total Points |
|---|---|---|---|---|
| 1. | Key Personnel (Attach evidence) | | | 25 |
| | a) Project Engineer qualification<br>• Holder of Degree ---------- 5 marks<br>• Holder of Diploma ---------- 3marks<br>• Holder of Certificate --------- 0 marks | | 5 | |
| | b) Project Engineer's experience<br>• Over ten (10) year relevant experience -- 5 marks<br>• Five (5) to ten (10) years relevant experience --------- 4 marks<br>• Under five (5) years relevant experience ---- 2 marks<br>• No experience ---------- 0 marks | | 5 | |
| | c) Works Inspector Qualification<br>• Holder of Degree in electrical engineering ---------- 5 marks<br>• Holder of Diploma in electrical engineering ---------- 3 marks<br>• Holder of Certificate in relevant engineering ---------- 1 mark<br>• No Qualification ---------- 0 marks | | 5 | |
| | d) Works Inspector's Experience<br>• Over 10 years' relevant experience---------- 5 marks<br>• Five (5) to ten (10) years' relevant experience ---------- 3 marks<br>• Under 5 years' relevant experience ---------- 1 marks<br>• No experience ----------0 marks | | 5 | |
| | e) Experience of Site Technicians with minimum of certificate qualification in relevant Engineering field<br>• Over 10 years' relevant experience ---------- 5 marks<br>• Five (5) to ten (10) relevant experience -------- 3marks<br>• Under 5 years' relevant experience ------ 1mark<br>• No relevant experience ---------- 0 marks | | 5 | |
| | | | | |

| Item | Description | Points Scored | Max Points | Total Points |
|---|---|---|---|---|
| 2. | Contracts completed in the last five (5) years; a max of 5 No. projects (Attach evidence in form of completion certificates or letters from clients/consultants.)<br>• Project of similar nature, complexity and magnitude of equal or higher value. ---------- 5 marks each<br>• Project of similar nature and complexity but of lower magnitude than the one in consideration ------ 3 marks each<br>• No completed project of similar nature ---- 0 marks | | 25 | 25 |
| | | | | |
| 3 | On-going projects (A max of 2 No. projects) (Attach evidence; Letters of Award/ Interim certificates/ Contracts)<br>• Project of similar nature, complexity and magnitude ---------- 5 marks each<br>• Project of similar nature, but of lower value than the one in consideration ---------- 2.5 marks each<br>• No ongoing project of similar nature ---------- 0 marks | | 10 | 10 |
| | | | | |
| 5. | Evidence of business physical address. (Offices/Workshops). Provide copies of ownership or lease agreement documents. | | 5 | 5 |
| | | | | |
| 6. | Financial report<br>Audited financial report (last three [3] years) - 2017-2019<br>• Average Annual Turnover equal or higher than to Kshs. 40.0 Million ---------- 15 Marks<br>• Average Annual Turnover between Kshs. 20 Million and Kshs 39.9 Million ---------- 10 Marks<br>• Average Annual Turnover between Kshs. 10 Million and Kshs 19.9 Million ---------- 5 Marks<br>• Average Annual Turnover below Kshs 10 Million ---------- 0 Marks | | 15 | 15 |
| | | | | |
| 7. | Evidence of financial resources (cash in hand, lines of credit, overdraft facility etc.)<br>• Amount equivalent to or above 25% of submitted tender sum ---------- 20 Marks<br>• Amount equivalent to 20% but below 25% of submitted tender sum ---------- 15 Marks<br>• Amount equivalent to 15% but below 20% of | | 20 | 20 |

| Item | Description | Points Scored | Max Points | Total Points |
|---|---|---|---|---|
| | submitted tender sum ---------- 10 Marks<br>• Amount equivalent to 10% but below 15% of submitted tender sum ---------- 5 Marks<br>• Amount below 10% of submitted tender sum -------- 0 Mark | | | |
| | **TOTAL** | | | 100 |

Any tenderer who scores 70 points and above in this Technical Evaluation shall be considered for further evaluation.

**Stage 3: Financial Evaluation**

Only tenderer's who score 70% and above of the overall marks on the technical evaluation shall qualify for financial evaluation.

This will be carried out only for those tenders that have passed BOTH mandatory requirements and Technical evaluation. The client will;

1. Undertake price comparison and ranking of prices.
2. The prices shall be compared and checked for completeness including all local taxes.

**Stage 4: Due Diligence and Recommendation for Award**

Particulars of post – qualification if applicable. The Client may inspect the premises due diligence to seek further clarification/confirmation if necessary, to confirm authenticity/compliance of any condition of the tender/qualifications of the tenderer in line with Section 83 of the Public Procurement and Asset Disposal Act, 2015.

The tenderer shall not be awarded the Sub-Contract if they fail to pass the compliance test. The second lowest tenderer shall be considered for due diligence.

Award Criteria: The firm achieving the lowest evaluated price will be awarded the Sub-Contract in line with Section 86 of the Public Procurement and Disposal Act, 2015

Particulars of performance security; 10% of Sub-Contract sum.