



JARAMOGI OGINGA ODINGA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

TENDER DOCUMENT

FOR

**TENDER NUMBER JOOUST/ONT/A5/31/2019-2020: TENDER FOR
COMMUNICATIONS/SECURITY AND CCTV INSTALLATION FOR
ADMINISTRATION BLOCK AT THE MAIN CAMPUS - BONDO, SIAYA
COUNTY**

CLOSING DATE 22nd JULY 2020

OPENING DATE 4TH 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/A5/31/2019-2020**

TENDER NAME: TENDER FOR COMMUNICATIONS/SECURITY AND CCTV INSTALLATION WORKS FOR THE ADMINISTRATION BLOCK AT MAIN CAMPUS - BONDO, SIAYA COUNTY

- 1.1 Jaramogi Oginga Odinga University of Science and Technology invites sealed bids from eligible candidates for Tender for Communications Security and CCTV Installation Administration Block at Main 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 8TH 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 **22nd JULY 2020**
- 1.6 Due to COVID-19, the application documents will be open on **4TH 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

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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 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.

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

24 Joint Ventures

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.

25 To qualify 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 to 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**

- 41 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.
- 42 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 indemnify 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.
- 43 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

- 61 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.
- 62 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.
- 63 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.

- 103 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.
- 104 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.
- 105 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 or persons signing the tender.

SUBMISSION OF TENDERS

17. Sealing and Marking of Tenders

- 171 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.
- 172 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.
- 173 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.
- 174 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 as follows:**

- (a) Where there is a discrepancy between the amount in figures and the amount in words, the amount in words will govern.
- (b) Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will prevail, unless in the opinion of the Employer, there is an obvious typographical error, in which case adjustment will be made to the entry containing that error.

- (c) The amount stated in the tender will be adjusted in accordance with the above procedure for the correction of errors and, with concurrence of the tenderer, shall be considered as binding upon the tenderer. If the tenderer does not accept the corrected amount, the tender may be rejected and the Tender Security may be forfeited in accordance with clause 13.

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 annul 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 tenders 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 his 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.

- 303 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 REFERENCE	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” -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 IV

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, Third 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

PREAMBLE 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 SCIENCE 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 GUIDELINES

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.

:PART A

**GENERAL SPECIFICATIONS
FOR ELECTRICAL INSTALLATIONS**

: GENERAL SPECIFICATIONS FOR ELECTRICAL INSTALLATIONS

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24.	AS BUILT DRAWINGS AND DOCUMENTATION

PART A:

GENERAL ELECTRICAL SPECIFICATION

1 GENERAL

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

1.1 Quality of Materials

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

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

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

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

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

1.2 Regulations and Standards

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

- a) The Kenya Government Regulations.
- b) The United Kingdom Institution of Electrical Engineers (IEE) Regulations for the Electrical Equipment of Buildings.
- a) The United Kingdom Chartered Institute of Building Services Engineers (CIBSE) Guides.
- d) British Standard and Codes of Practice as published by the British Standards Institution (BSI)
- e) The Local Council By-laws.
- f) The Electricity Supply Authority By-laws.
- g) Local Authority By-laws.
- h) The Kenya Building Code Regulations.
- i) The Kenya Bureau of Standards

1.03 Power Supply on Site

The supply voltage will be 240 volts single phase of 415 volts 3 phase 50 Hz. TN-S system, viz. separate neutral and protective conductor throughout the system.

2. INSTALLATION OF CABLES

2.01 General

Bending of cables shall be in accordance with table 52c of the IEE Regulations and no cable shall be bent to radius less than that specified by the cable manufacturers.

Cables shall be rated for the maximum connected load with due consideration to the following factors:-

- (i) Voltage drop not in excess of 4% of the nominal voltage.
- (ii) Ambient temperature.
- (iii) Degree of excess-current protection.
- (iv) Grouping.
- (v) Cables run under defined conditions.

2.02 Cables in conduits and Trunking

All cables shall be polyvinyl chloride (PVC) insulated to BS 6604, "PVC-insulated cables (non-armoured) for electric power lighting", 450/750 volt grade, unless an alternative is specified elsewhere in the contract documents. The quality and size of cables contained in any one conduit shall comply with IEE Regulation 529-7 and Appendix 12.

No cable with a cross-section area of less than 1.5mm² shall be used. All cables installed in a conduit or trunking system shall be PVC single insulated conductors and shall be colour coded in accordance with the IEE Regulation 524-3 and Table 52A.

Final sub-circuits shall be run in conduits separate from main or sub-main cables. All cables in conduit shall be drawn in simultaneously. All cables shall be drawn in without the use of excessive force, Without the use of lubricants and the wiring shall be easily withdrawable.

2.03 PVC/SWA/PVC Cable

These cables shall comprise copper conductors unless specifically detailed otherwise, laid up with PVC fillers bedded with an extruded inner PVC sheath, armoured with a single layer of galvanized steel wires, aluminium or strip as specified, and covered overall with PVC sheath.

Cables shall be manufactured to BS 6346 "PVC insulated cables for electrical supply" with conductor dimensions and resistances in accordance with BS 6360 1969, "copper conductors in insulated cables and cords", Armouring shall be galvanised steel to BS 1442.

Attention is drawn to Chapter 52 of the IEE Regulations and Appendix 9. Where the armour wires of cables are used to provide protective conductor they shall comply with the requirements of Chapter 54 of the IEE Regulations, particularly section 543; alternatively, additional cables with copper conductors shall be installed to reduce the impedance to a level which ensures compliance with Section 543 of the IEE Regulations.

Unless permission is given by the Engineer, no joints will be allowed. In the event of joints being authorized, they shall be made using plastic boxes of approved design filled with an approved cold pouring plastic or resin compound. The cable box shall incorporate suitable copper tapes and clamps to bond the armouring of the jointed cables.

The PVC/SWA/PVC cables should be terminated in the cable manufacture's approved glands. These shall be of the compression type providing controlled radial compression of the sheath seal. The gland shall incorporate an armour clamping ring and earthing ring and, where used outdoors, a lead washer shall be used to ensure a watertight joint between the gland and the unit to which it is fitted. The earthing ring shall be rigidly fixed to the item of equipment and terminated using brass nuts, bolts and washers. All gland terminations shall be protected by a PVC shroud which shall fit tightly over the cables.

The electrical Sub-Sub-Contractor is responsible for determining the true nature and extent of cable routes. No claim on the grounds of lack of knowledge will be entertained. All cable routes shall be agreed with the Engineer. After the cables have been installed and terminated, but prior to putting into service, they shall be subjected to an insulation test of 500 volts and the results of these tests (recorded on test sheets) forwarded to the Engineer.

3. CONDUIT AND CONDUIT FACILITIES - MILD STEEL CONDUIT SYSTEM

3.01 Conduits

Conduits shall be installed as required by the IEE Regulations and as detailed in this specification. All metal conduits must be heavy gauge, seam welded, steel tube screwed conduits manufactured to BS 31, "steel tube screwed conduits and fittings for electrical wiring", Class B, BS 4568, "Steel conduit and fittings with thread of ISO form for electrical installation", for metric conduit, unless specified otherwise. Conduits shall be finished black stove enamelled, except in positions exposed to water (other than water used in construction), steam condensation or the action of weather, where hot galvanised conduits shall be used.

Any conduits work rejected by the Engineer shall be replaced at no extra cost. No conduit smaller than 20 mm in diameter or longer than 50mm diameter shall be used.

All bends in conduit shall be in accordance with the IEE Regulation 529-5, and made in a conduit bending machine fitted with a former of the correct radius for each conduit size.

Conduits shall be secured in an efficient pipe vice whilst being screwed. Conduit system shall be installed so as to ensure compliance with requirements of IEE Regulations 529-7. Attention is drawn to Appendix 12 of the IEE Regulations.

3.02 Conduit Fittings

Conduit fittings shall have same finish as the conduits being used and shall comply with BS 31 or BS 4586. All conduit fittings shall be screwed or loop-in malleable iron circular type, fitted with covers secured by brass screws. Rectangular adaptable steel boxes may be used on multi-conduit runs.

All circular type boxes must be fitted with long screwed spout conduit entries with the screwed thread terminating within the spout and the edges of the internal orifice of the box rounded and smoothed to act as a bush except for the adaptable steel rectangular boxes and loop-in conduit boxes, in which case male bush and coupling must be used for conduit connections. In concealed installation, boxes shall be fixed with the rims flush with the finished surface, but when, for any reason whatsoever, the rims are below the surface, suitable extension rings of the required depth shall be provided and installed to finish flush with the surrounding surfaces and with the lids of sufficient oversize (7.5 mm minimum all round) to cover the junction between box and plaster. In no case will the use of site-manufactured bends, sets, elbows, inspection elbows or tees be permitted.

3.03 Fixing of Conduits

All conduits must be firmly and rigidly fixed to be entirely without whip or movement. Space-bar saddles, or strap saddles, must be used on the timbers in roof spaces and will be allowed when the conduits are run on the underside of exposed unsealed floor or ceiling joints. Pipe hooks or crumpets will not be allowed except for security conduits in chases, or screeds, when the top of the hook must at least be 10 mm below the finished surface of the wall, or 25 mm below the floor finish. Pipe hooks shall be galvanised.

The finish of the saddles must in all cases conform to the finish of the supported conduits. Galvanised, sherardised or cadmium plated screws shall be used in all cases where galvanised conduits are installed.

The standard cast iron distance saddle, (single fixing base and two-screw fixing top), must be used for all conduits run on the surface of walls and ceilings etc., fixed at intervals of not more than 1.2 metres.

3.04 Conduit Runs and Concealment

The routes of the conduit installation shall be agreed with the Engineer prior to commencing the installation. Conduits shall be installed at least 150 mm from, and preferably under, any hot water pipes and at least 50 mm from other surface pipes and cables. Conduits shall be bonded to other surfaces in accordance with the requirements of IEE Regulations 413-2 and 547-4 to 547-7 inclusive.

Each continuity test shall be applied to the system before plastering, screeding, or casting of concrete is commenced. Surface work will be allowed where certain pre-fabricated methods of construction preclude the concealment of the runs, and or fair-faced brickwork or block work or other unplastered walls.

Conduit runs shall be planned to obviate the need for draw-in boxes, but where the use of such boxes is unavoidable they shall be accessible at all times and be fitted with covers. When Conduits are specified as being installed on the surface the runs must be arranged to render the whole system as neat and inconspicuous as possible, having regard to the existing architectural features. All vertical and horizontal runs must be taken where conduits converge and run together near distribution centres to obtain a symmetrical layout. The distance between the conduits shall be maintained through bends and sets and shall not vary noticeably.

3.05 Flexible Metallic Conduit

Flexible Conduit shall comply with the BS 731 part 1. "Flexible steel conduit and adaptors for the protection of electrical cables." It shall be used for the final connection from a rigid conduit installation to the terminal boxes of all the equipment provided with a means of positional adjustment and /or where vibration may reasonably be expected to occur.

Flexible conduits shall be PVC sheathed and shall be terminated using approved glands. In all instances a separate PVC insulated green and yellow coloured protective conductor complying with table 41A1 or 41A2 and section 543 of the IEE Regulations shall be installed, terminating at each end into purpose-made earthing terminals.

Under no circumstances will flexible conduits be accepted in lieu of sets and bends in a rigid conduit installation.

In normal circumstances flexible conduits shall have a minimum length of 300 mm and a maximum unstretched length of 800mm. It shall permit a full range of withdrawal, adjustment or movement of the equipment.

3.06 Locking, Bushing and Coupling

All conduit ends must be filed square and reamed before erection to ensure freedom from internal burrs and roughness.

Running couplings shall only be used on black enamelled steel conduit installations, and the use of this shall be kept to the minimum. All running couplings shall be secured by means of the lock nuts or lock rings, and the exposed thread painted after installation.

Every conduit connection to the equipment, boxes, distribution boards, loop-in boxes, cable trunking etc, shall be made by means of a screw coupling and a male hexagonal headed smooth bore brass bush. The smooth bore shall be fitted to secure the conduit to the item connected via a purpose-made clear hole to be closed by the bush and coupling when fitted. Paint must be removed from the surface of the item connected to allow it to be covered by the end of the coupling which shall be filed, clean and square, to ensure a good mechanical and electrical metal to metal joint. Any exposed area of metal from which paint has been removed must be made good in a matching paint. Bushes shall be fitted and tightened by means of correctly fitting spanners. Mutilated bushes damaged whilst being fitted must be removed and replaced.

Conduits connecting via couplings shall be connected by a means of 15 mm long threaded section and shall have a gap of approximately 2 mm between them. No thread shall be exposed except running couplings.

3.07 Continuity and Earthing

The whole of the conduit installations shall be mechanically and electrically sound and continuous throughout their length in accordance with the IEE Regulations.

Where the conduit system is used to provide a protective conductor it shall comply with the requirements of Chapter 54 of the IEE Regulations particularly Section 543; alternatively, a separate protective conductor shall be installed in the conduit to comply with Section 543 of the IEE regulations.

4. CABLE TRUNKING-SHEET STEEL

Trunking shall only be installed in situations which will remain readily accessible throughout the life of the buildings. No cable trunking shall be installed behind a plastered ceiling or in other inaccessible situations.

All cable trunking shall comply with BS 4678, part 1 "Steel surface trunking" and part 2 for "Steel underfloor (duct) trunking".

Sheet steel cable trunking may be used on installations employing steel conduits, for connecting two or more switchboards together or where several conduits would otherwise have to run alongside each other. Proper allowance should be made for the derating of cables installed together in a container system. The cables must be capable of carrying the current imposed by the equipment connected. Attention is drawn to Chapter 52 of the IEE Regulations, particularly Section 522, and Appendix 9: the current carrying capabilities of cables indicated shall not be exceeded. The Engineer must be consulted as to precise details concerning trunking routes and applications.

All lengths of trunking shall be heavy gauge zinc coated steel connected together by internally fitted rectangular couplings of sufficient width to provide a minimum bearing face of 25mm, to which the lengths shall be bolted on site or welded at the factory.

Adequate provision shall be made to allow for expansion.

All Tee pieces and bends shall be formed with similar means of connection and the inner radii area shall be such that cables will not be bent through a radius less than that prescribed in the IEE Regulations. Only bends and tees of approved pattern will be accepted.

All fixing screws within the trunking shall be of the round head type. The trunking shall have an over-lapping well-fitted lid securely fixed to the trunking by approved means that will avoid damage to the cables. Self-tapping screws shall not be used.

All necessary accessories including long sleeve couplings, end piece, bends, sets, tees, reducers, branches, fillets, pinracks, cable retainers etc., shall be purpose-made units rather than being fabricated on site.

Where a change in direction of trunking run occurs, the deviation should be effected by a purpose-made unit manufactured on similar lines to the bends and tee pieces described above. Where this is not practical, changes in direction shall be fabricated in a neat workmanlike manner. All joints shall fit closely and gaps will not be permitted. All burrs and sharp edges shall be removed and no screw shall protrude into the trunking.

Trunking shall be firmly attached to its associated equipment either by bolted flanges or by male bushes and couplings.

Where trunking is connected to equipment by means of flange connectors, the entry into the equipment shall be of the same cross-section as the trunking.

Where trunking does not terminate in equipment, the otherwise open end shall be capped with a cover suitable bolted in position.

Where communications, extra low voltage circuits (category 1) etc., are contained in a trunking, the requisite number of separate compartments shall be provided to segregate the wiring. Where conduits are taken off such trunking they shall not pass through other compartments unless prior permission is obtained from the Engineer.

The entire trunking is required to be recessed in the structure of the building, the finished edge of the trunking is to be installed flush with the plasterwork.

Trunking runs shall be so arranged that the lid or cover plate is always on the top or side and not underneath, unless this cannot be avoided, in which case the Engineer's permission shall be obtained.

Wherever trunking passes through walls, vertical partitions etc., a fixed piece of trunking lid shall be fitted to the trunking extended 25 mm either side of the wall or other barrier, this is to allow removal of the adjacent lid without disturbing the building fabric. Care shall be taken to ensure that no opening is left between the trunking and the building structure through which fire might spread. In addition a suitable barrier of incombustible material shall be provided and fitted inside the trunking, in accordance with the IEE Regulations 528-1. On vertical runs of trunking internal incombustible barriers shall be fitted at the distance between floors or 5m, whichever is the less, in accordance with IEE Regulations 523-6.

All necessary trunking support work, hangers, brackets and fixing requirements shall be provided by the electrical Sub-Sub-Contractor.

Earth links of the appropriate size and type shall be installed at every jointing coupling, manufactured bend, etc., throughout the entire trunking system. Where trunking is used to provide a protective conductor it shall comply with the requirements of Chapter 54 of the IEE Regulations, particularly Section 543; alternatively, a separate protective conductor shall be installed in the trunking to comply with section 543 of the IEE Regulations.

In cases where sheet steel trunking is installed and there is danger of movement, a flexible earth conductor shall be installed bonding all joints in the trunking. This shall be fitted in addition to the standard earth links. Cable retaining strips shall be fitted at 1 m intervals. Insulated cable support pins shall be fitted at intervals of 4 m in vertical runs of trunking and at the top of the vertical trunking.

5 CABLE TRAYS

Cable trays shall be formed from perforated steel of not less than 0.9 mm thickness up to and including 100 mm width - 1.25 mm thickness from 150 mm up to and including 300 mm width - and 2.00 mm thickness above 300 mm width. They shall be galvanised unless otherwise specified. Tray shall be adequately sized to support the cable without bunching.

Support shall be by means of steel brackets installed at intervals necessary to provide a rigid fixing and ensure that no undue deflection occurs in the complete installation. The brackets shall be galvanised prior to fixing. Dome-headed bolts, nuts and washers of finish suitable to the tray shall be used between tray and brackets.

Fixing to the surfaces of walls, ceilings, etc. shall be by means of expansion-type masonry plugs or bolts. Fixings shall be galvanised unless otherwise stated. Cable trays shall be installed using factory-formed bends, elbows, tees, couplers and risers etc. Site fabrication of elbows etc., will only be permitted with prior approval of the Engineer and where it is not possible to obtain the necessary factory-made item.

Where cuts have been made, the tray shall be painted with zinc rich paint.

Holes which have been cut to allow cables to pass through shall be suitably bushed.

Suspension sets shall comprise threaded M12 cadmium plated hanger rods together with nuts and locking washers, vertical hanger brackets, support channel, tray hold-down clips etc., all of which shall have a galvanised finish.

All cables shall be securely fixed to traywork and the complete installation must be carried out in a neat and workmanlike manner without crossovers. A 25% reserve margin in size and weight shall be allowed for all cable tray works.

Cables of 30 mm diameter and above shall be fixed using the appropriate size cable straps of approved manufacture.

On light duty multi-cable runs, cable straps of plastic coated metal shall be used to secure cables.

Bunching of cables will not be permitted.

Cables shall be clipped by means of copper or brass saddles and clips where high temperature or humid conditions are likely to be experienced. In all cases, saddles, clips, straps, etc., shall be fixed to the tray by means of brass screws or bolts and nuts.

6. PROTECTION OF PVC/SWA/PVC CABLES

6.01 General

Cable routing shall be such that the maximum degree of protection against accidental damage is obtained by running cables along the inside of channels and beams, etc.

Cables shall be laid in performed trenches or duct throughout all paved areas. Ducts shall be installed for underground cables before the paving is constructed.

Cable ducts shall be sealed at both ends using materials which are resistant to any likely corrosive and insect attack in the area concerned.

All cables rising through floors and trench covers, except in switch rooms, shall be protected by a length of steel pipe which shall project at least 150 mm above the finished surface level.

The open end of the pipe shall be sealed with a suitable compound. Care must be taken that all phases of single core cables pass through the same protective steel duct.

6.02 Cables Direct in Ground

All excavation and backfilling of cable trenches will be carried out by the main Sub-Contractor unless otherwise specified, but the electrical Sub-Sub-Contractor shall in any case make sure that trenches are made to a depth as specified.

The electrical Sub-Sub-Contractor shall lay cables direct in the ground in the following manner:-

75 mm (3 inches) of dry fine sand shall be placed to form a bed for the cables. After cables have been laid they shall be covered with additional dry fine sand well punned over and around the cables to a level of 75 mm above the top of the uppermost cable. Mechanical punners shall not be used for this work. The electrical Sub-Sub-Contractor shall supply and install concrete cable tiles which shall be carefully placed over the cable forming each circuit.

Until all the cables have been laid in the trench and have been covered with their protective tiles, no sharp metal tools such as spades or fencing stakes, shall be used in the trench. Rollers used during laying of cables shall have no sharp projecting parts liable to damage the cables.

6.03 Cables above Ground

For main cable runs the cable shall be run on approved tray or ladder rack, and secured to it at intervals of not more than 400 mm horizontally and 600 mm vertically.

Cables shall be dressed together and fixed with a common saddle. If the number of cables is such as to require the tiering of cables, the number of tiers shall generally be two.

7 TERMINATION OF CABLES

Cables shall be terminated in accordance with Chapter 52 of the IEE Regulations, particularly Section 527.

Cables shall be terminated by one of the following methods:-

- (i) The cable conductors shall be sweated into lugs of the appropriate size for the cable and equipment terminal.
- (ii) The cable conductors shall be secured by compression type lugs of the correct size for the cable and equipment terminal.
- (iii) The cable conductors shall be secured in pinch screw terminals.
- (iv) The cable shall be secured by means of clamps.

Where cables are required to terminate at connectors, as at lighting points, such connectors shall secure all the strands of stranded cables. Care shall be taken to ensure that cables are not damaged during preparation for termination.

Cables terminating at pinch screw terminals shall be twisted together and single cables shall have the conductor doubled back to ensure adequate purchase for pinching screws.

Cables connected to lamp holders or other components at which heat is produced shall be insulated with heat resisting material capable of withstanding, without detriment, the temperature encountered.

All terminations on PVC/SWA/PVC insulated cables shall be by compression type glands of an approved design and manufacture with facilities for clamping the armouring the outer sheath of the cable.

Glands mounted outdoors shall incorporate a seal to prevent ingress of moisture into the gland, and all glands shall be fitted with a thermoplastic shroud.

Where circular terminations are to be made, these shall be completed using Ross Counterney terminals.

Where cables are terminated in "Klippon" type terminals with parallel faced jaws, the individual cores shall be terminated using the appropriate flat or hook blade crimped lugs. Where the terminal faces are concaved, the cores shall be terminated in wires pin crimped lugs.

The electrical Sub-Sub-Contractor shall avoid multiple connections under one screw or one pin. Where more than two wires are required, a common termination jumper bar shall be used.

Terminals shall be mounted on rails or supports. All internal wiring is to be clearly marked by markers.

8 SEGREGATION OF SERVICES

Cables of differing voltages shall be segregated so that there is no possibility of a fault in a power cable damaging any adjacent cables or imposing a different voltage upon them.

9 IDENTIFICATION OF CABLES

All cables shall be fitted with non-corrosive cable identification bands at each end, and at all changes of direction where they leave a group of cables. All cables cores connected to equipment having marked terminals shall be fitted with non-corrosive identification bands bearing markings corresponding to those of the terminals at both ends.

10. EARTHING

The whole of the metallic portion of the installation, other than current carrying parts, shall be electrically and mechanically bonded to the consumer's main earth terminal and also if applicable, to the lighting protection system or other points specified.

The installation shall be earthed in accordance with the Sixteenth Edition of the Regulations for Electrical Installation issued by the IEE, BS CP1013, "Earthing" and BS 6651 "The protection of structures against Lightning". The electrical Sub-Sub-Contractor's attention is drawn to Chapter 54 of the IEE Regulations.

A main earth terminal shall be supplied and installed adjacent to the electricity supply cable termination. The terminal shall be of ample size and capacity to suit the installation. All items of equipment, switchgear, etc., shall be bonded to this earth terminal using PVC insulated PVC sheathed cables, coloured green and yellow and sized in accordance with Tables 41A1 of the IEE Regulations. An invorine label reading **"SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE"** in engraved upper case characters not less than 4.75mm high, shall be permanently fixed immediately adjacent to or on the earth terminal.

A heavy duty copper clamp complying with BS. 951 shall be used to bond the main protective conductor to the electricity supply cable armouring or metallic sheath (where applicable the armouring and sheath shall be bonded together).

All protective conductors shall, where possible, be enclosed within metal trunking or conduit serving switchgear, distribution board etc., so as to provide mechanical protection. Where protective conductors are run on building surfaces they shall be properly fixed and supported by means of PVC coated metal saddles along selected routes.

Earth continuity between separate items of switchgear, distribution boards etc., mounted adjacent to one another shall be affected by means of high conductivity continuous copper tape, or PVC sheathed cable, coloured green and yellow, and sized in accordance with the Table 41A1 or 41A2 and Section 543 of the IEE Regulations, connecting all items to the earth terminal.

All items of switchgear, accessories, luminaries, conduits, and the outer sheaths of MICS cables, the armouring of all PVC/SWA/PVC cables together with all other items of electrical plant and equipment shall be effectively earthed by means of a protective conductor in accordance with Table 41A1 and 41A2 and section 543 of the IEE Regulations.

At every terminal point on the fixed wiring an integral earth terminal shall be provide e.g. BESA boxes, accessory boxes etc. A protective conductor shall be provided and installed between this terminal and the earth terminal on the associated switch, socket outlet, luminaire etc.

Each circuit protective conductor shall be connected to a multi-way earth terminal provided and fixed within each distribution board. The earth terminal shall be provided with an adequate number of ways such that not more than one conductor per terminal shall be installed and the earthing conductors shall be connected in the same sequence as the current carrying conductors.

All metal piped services, e.g., Heating, Water and Gas Services, metal wastes and piped services at sinks, baths and showers etc., shall be bonded to the earth terminal in accordance with the IEE Regulations 413-2.

A 50mm section of each gas and water pipe, at position close to their entry into the relevant building, shall be cleaned and made smooth. A copper earthing clamp designed to permit the connection of protective conductors shall be provided and sized in accordance with Table 41A1 and 41A2 and Section 543 of the IEE Regulations.

The clamp shall be a proprietary type or shall be fabricated from high conductivity copper strip, minimum size 40 mm x 4 mm which shall encircle the cleaned sections of the pipe. A permanent label indelibly marked with the words, "**SAFETY ELECTRICAL CONNECTION - DO NOT REMOVE**" in legible type not less than 4.75 mm high, shall be permanently fixed at the points of connections.

The final connection of bonding conductors from gas, water pipes and other services to the earthing terminal shall not be completed until earth electrode and earth impedance tests have been satisfactorily completed.

Bonding connections to pipework shall be as unobstructive as possible where practicable shall be made in service ducts or accessible voids and shall be readily on the Record Drawings. All materials and sundry item shall be provided whether or not specifically mentioned, necessary to completely and effectively earth the installation. The installation shall be fully protected against dampness and corrosion and the effect of electrolytic action between dissimilar materials. A completely permanent installation shall be provided which shall be fully accessible for regular testing and inspection.

The value of earth resistance from any point of an installation to the general mass of earth shall be low enough to ensure operation of circuit protective devices and shall in any case not exceed four(4) ohms for electrical equipment, seven (7) ohms for lighting protection. Each earthing cable shall terminate in an approved design of cable lug.

Where earth conductors are run upon structures or walls they shall be fastened by means of heavy gauge non-ferrous fasteners not more than 0.75 m apart on horizontal runs and not more than 1.2 m apart on vertical runs and to give a minimum clearance of 4 mm from the fixing face.

In the event of the electrical sub-Sub-Contractor not being able to establish a suitable earth connection to the electricity supply cable, earth electrodes shall be installed which shall be galvanised or copper clad steel extendable rods not less than 16 mm diameter and not less than 1.2 m in length. Connections to electrodes shall be made by means of solderless mechanical clamps.

To avoid corrosion, all earth system connections shall be cleaned bright and immediately covered with silicon MS4 compound or approved equal.

Earth pits, where required, shall be in accordance with the Sub-Contractor's relevant drawings, with the facility to disconnect the earth ring while measuring the electrode earth resistance.

11 LIGHTNING PROTECTION

Lightning protection shall be provided on high buildings/structures more than 10 m in height. such protection shall be effected by bonding each individual building/structures direct to the earthing system, in accordance with the BS CP 326, by a minimum size of 170mm² conductor.

12 FUSED-SWITCH UNITS, SWITCHFUSES AND ISOLATORS

The above units comply with BS 5419 and shall be 500 volt type and installed where specified and indicated on the relevant drawings.

All switchgear shall be provided with suitable locks for padlocking the switches in the 'OFF' position. The cover shall be interlocked with the operating mechanism to prevent it from being opened in the 'ON' position. This interlocking shall also prevent the switch from being closed with the cover open unless for maintenance purposes. The cover shall be gasketed to prevent ingress of dust.

The switch action mechanism shall be of the parallel operation (double break type having cartridge fuses mounted switches) and shall be ASTA certified to meet adequately all the duties specified.

The end plates shall be removable for drilling for conduit or cable entry and shall be fitted with additional distance pieces where necessary. Switchgear boards shall be fixed to the wall/floor by Rawl bolts or other approved fixings.

No building alteration shall be allowed when moving the switchboard into position, the switchboard being supplied in sections to be built in position, if so required.

Switchgear shall be delivered to site when required to suit the progress of the works. Care shall be taken to preserve the manufacturer's paint finish. Any refurbishing etc. shall be carried out, using paint obtained from the switchboard manufacturer, to the original standard of finish.

All fuses in switchgear shall be HRC fuses sized for the fused-switch units or switch-fuses etc., in which they are incorporated. They shall be ASTA certified for compliance with BS 88, Category of Duty 440 A.C 5 Class 01 and in all cases fuse links shall be selected to provide circuits discrimination.

13 CONTROL PANELS AND CUBICLES

The details specified in clause 4.11 shall apply as far as fused switches, bus-bars and rating etc are concerned. The panels shall be constructed from rolled steel channel minimum size 60 mm x 30 mm deep x 5 mm or equivalent angle section clad with sheet steel of 3 mm gauge. 2 mm gauge may be used for covers and doors of not more than 1 m square.

Terminals shall be of the "Klippon" standards rail-mounted feed-through type or approved equal. All terminals shall be identified by means of numbered or lettered marking tags, which shall be identical to the number of letter applied to the cables. Cables shall be identified as terminations by means of cable markers as manufactured by "Klippon" or approved equal. 25% spare terminals capacity within wiring duct shall be provided. All components motors, starters, relays, timers, etc. shall be labelled showing their reference and function and these shall relate to the panels' schematic wiring diagram provided with the "As-built" drawing and manuals.

All control panels shall be fitted with multi-pole isolating switches through which all electricity supplies shall pass. The door(s) of the control panel shall not open unless the isolating switch is in the "off" position. A facility to lock the control panel-isolating switch in the "off" position shall be included.

14 DISTRIBUTION BOARDS

14.1 General

All distribution boards, unless stated otherwise, shall be miniature Circuit Breaker Distribution Boards and shall be of surface or flush type, as specified. Facilities for local isolation of the distribution boards shall be provided by either a local fused-switch unit or an integral isolating switch, whichever is specified.

Where surface mounted on a flush installation, all conductors shall terminate behind the board in an adequate box. For surface mounting, trunking shall be fixed between the board and ceiling level, or conduits run directly into the board. Adequate earth continuity connection shall be made between the various components.

14.2 Fused Distribution Boards

All fuse boards shall be of 500 volt rating to BS. 5486 part 11 "Particular requirements for Fuse boards". The details specified in clause 4.12 shall apply as far as cabinet and construction, cabling arrangements, bus bars, neutral bars, earthing and isolating switches are connected.

Fuse banks shall be spaced so as to obviate the necessity for insulating barriers, but protection shall be provided by means of insulating shields to prevent accidental contact with the main bus bars and connections.

All fuses lighting and heating circuits shall be of the HRC cartridge type, ASTA certified, for compliance with BS. 88, category of Duty 440 A.C 5 class 01.

14.3 Miniature Circuit-Breaker Distribution Boards

MCB distribution boards shall comply with BS. 5486 part 12 'Particular requirements for miniature circuits-breaker boards'. The cases shall be constructed of heavy gauge sheet steel, in such a manner as to afford rigidity and maximum ease of wiring for full size circuit and main cables.

The cover shall be provided with an efficient gasket or alternatively designed with generous overlapping edges to prevent the ingress of dust. Components shall not be manufactured from zinc alloy in conjunction with sheet steel where they are relied upon for earth continuity.

Where the cover is required to be lockable, cylinder type locks shall be provided, having two keys per lock. All locked distribution boards shall be handed to the Engineering Supervisor on completion of the works. The cases shall be provided with detachable cable/conduit terminating plates, which shall be reversible and interchangeable from top to bottom.

All screws and nuts used in the construction of the case shall be fitted with shake proof washers and care taken to ensure efficient earth continuity. An external earthing terminal with cable socket shall be fitted.

All MCB banks shall be fitted to frames, with robust locking plates provided to ensure the frames rigidly in the fixed position.

The banks shall be so spaced to obviate the necessity for insulating barriers, but protection shall be provided by means of insulating shields to prevent accidental contact with main bus bars and incoming mains cable.

Bus-bars shall be of high conductivity, hard drawn copper conductors connected to the MCB contacts by means of spring washered screws or bolts, unless plug-in type MCBs are specified.

Neutral bars shall be similar to the main bus bars and shall have two screw terminals per way for rating of 30 amps or over. Single screw connections will be allowed for capacities up to 30 amps. The neutral bars shall have one terminal for each MCB within the board, and connection of conductors to the neutral bar shall be in the same order as the MCB ways.

Where installations are carried out with cables with a protective conductor, all distribution boards shall also contain internal earthing bars similar to the neutral bars detailed above, with one terminal for each MCB within the board. Earthing conductors shall be connected in the manner described for neutral conductors to neutral bars.

Where a main integral isolating switch is provided in an MCB case it shall be arranged to isolate incoming live and neutral main cables from the bus-bars. The isolator switch shall be rated at 500 volts and of the quick make-and break pattern with positive action. Incoming and outgoing terminals shall be fitted with two clamping screws and outgoing conductors to the bus-bars shall be high conductivity hard drawn copper rods.

Isolating switches shall comply with IEE Regulations, Part 537, and shall be capable of carrying their full rated load continuously and shall 'make' or 'break' their full rated load without undue burning of the contacts.

14.4 Miniature Circuits Breaker (MCB)

All MCBs shall have movements which are positive in both directions (make and break) so as to enable units to be closed decisively by the operation of the handle, and to be able to assume the 'OFF' position unless the contacts are definitely separated, to safeguard against false indications.

The handle shall be trip free to make it impossible for the operator to hold the breaker in the closed position under faulty conditions. The operating mechanism and arc chambers of the circuit breaker shall be separated from the terminals and fixing screws.

Terminal identification shall be readily discernable as viewed from the front of the board with automatic and clear signal identification for both 'ON' and 'OFF' position.

All terminals shall be readily accessible from the front and each wiring chamber shall be closed by a screw fixed cover which protects the terminals and prevents dust from settling on the insulation.

Where the full capacity of a distribution board is not required the electrical Sub-Sub-Contractor shall fix blanking plates in the vacant MCB housings. All MCBs shall be rated at 500 volts minimum, and comply with BS 3871. "Miniature and moulded case circuits breakers" and 4752 part 1, "Circuit breakers".

14.5 Moulded Case Circuit Breakers (MCCB)

Where specified, MCCBs shall be of the thermal/magnetic type, having a quick make, quick break, trip free mechanism which prevents the MCCB from being closed or held against short circuits or overloads. Tripping of every multi-pole MCCB shall be such that operation ensures simultaneous action in all phases.

Clear indication shall be provided for the three positions of operation of the mechanism - 'ON', 'OFF' and 'TRIPPED'. The operation shall be such that the MCCB shall trip automatically under fault conditions and, to reset, the dolly shall require first moving through the 'off' position. All MCCBs shall be provided with facilities for locking the breaker in 'OFF' position.

All MCCBs shall be rated at 500 volts minimum, be ASTA certified for this operational duty, and comply with BS. 3871 and BS. 4752 Part 1.

15 LABELLING AND ENGRAVING

15.1 Labelling

All fused-switch units, switch-fuses, switches, bus-bars chambers, distribution boards etc., and all items of equipment on the main panel shall be identified in accordance with section 514 of the IEE Regulations and shall have securely fitted externally a white 'Traffolyte', 'Formica' or other approved plastic laminate label engraved with 6 mm high black letters detailing the function of the equipment and any reference number.

Red, yellow, blue, plastic laminate phase discs shall be fixed inside all switchgear and distribution boards to indicate to which phase of the supply the various circuits are connected. The colourings shall comply with Part 524 of the IEE Regulations.

Each TP or TP & N item of switchgear shall have fitted on the cover a white plastic laminate label having 'CAUTION' - 415 VOLTS' engraved in 10 mm high red lettering.

5.2 Engraving

The electrical Sub-Sub-Contractor shall allow for engraving of all switched fused spurs, double pole switch accessories and any other accessories, which are customarily required.

The accessory plate shall be engraved in either black or red, capital letters 5 mm high, detailing and appliance or equipment being supplied by the accessory e.g., 'WATER PUMP' etc.

16 MOUNTING HEIGHTS

The approximate position of main switchgear, control equipment distribution boards, fittings and accessories shall be as indicated on the Drawings. Actual positions shall be determined on site by the Engineer.

Unless otherwise stated on the relevant drawings or directed by the Engineer the following mounting heights of all accessories above finished floor level shall be adhered to: -

Lighting Switches	1400 mm to centre
Socket Outlet and Spur	300 mm to centre (or 150 mm above work top level to centre)
Distribution Boards	1800 mm to lower edges.

All groups of accessories shall be in line either vertically or horizontally or as specified.

17 LUMINAIRES

All Luminaires shall be of the manufacture, size and type specified and shall comply in all respects to BS 4533 "Electric Luminaires".

The electrical Sub-Contractor shall supply and install all luminaires including lamps, lamp-holders, control gear, capacitors, glassware, diffusers or other attachments, heat resistant internal cables, fuses and terminals and all necessary suspension gear. In case where Luminaires are supplied by the client the Sub-Sub-Contractor shall deliver to site store, install, commission and set to work.

Unless otherwise stated, Luminaires shall be suitable for Class 1 normal indoor environments, giving a degree of protection against ingress of moisture or dust.

All Luminaires shall be assembled and installed in accordance with the respective manufacturer's instructions/recommendations, in the position and mounting heights specified.

Luminaires shall not be installed under dirty and hazardous site conditions, and any damage or deterioration to luminaires installed under these conditions shall be made good by the electrical Sub-Sub-Contractor.

The Luminaires shall be cleaned free of dust and dirt after completion of the installation. Where dirt, dust, corrosion or other conditions cause imperfections in the luminaires, they shall be replaced.

Luminaires, diffusers, attachments or glassware etc., shall be properly stored to final erection, in such a manner as to avoid damage of any kind.

Luminaires fixings shall generally be suitable for direct connection to conduit boxes or as otherwise specified. Luminaires not provided with suitable BESA box shall be modified as necessary.

Where a flexible cord supports, or partly supports, a luminaire the maximum mass supported by the cord shall not exceed the values set out in IEE Regulations 523-32.

The minimum cross-section area flexible core to the employed shall be 0.75mm^2 .

Specified attention shall be given to Chapter 52 of the IEE Regulations, particularly Regulation 521-5 and 521-6, Appendices 9 and 10.

Pendant tungsten luminaires shall be fitted with heat resistant flexible cord complying with BS 6500, capable of continuous operation with a conductor temperature of 150 degrees C. The cable shall be of the circular multicore type, finished white, if not otherwise specified.

Ceiling mounted tungsten luminaires, spotlights and other luminaires of the category 'hot' luminaires shall be wired internally with cable suitable for continuous operation at 185 degree C. Where cable tails are provided they shall be of the heat resistant type capable of operation at 185 degree C.

Exterior luminaires, fixed to the walls of buildings etc., shall be wired such that final circuit wiring terminates within the luminaire. All final circuit cables so installed shall be provided with heat resistant sleeves from the connection point within the luminaire for a distance of 300 mm.

All fluorescent and other discharge luminaires shall be provided with an integral fused connector block. The rating of the fuse shall be in accordance with the manufacturer's instructions to protect the internal wiring of the luminaire and to provide discrimination between final circuit protection and luminaire protection.

All recessed and semi-recessed luminaires in ceilings shall be connected by three core 0.75mm^2 high temperature flexible cord from the terminals of the luminaires to a plug-in ceiling rose fixed and connected to an accessible outlet box in the wiring system, within the suspended ceiling immediately above the luminaire. The ceiling rose shall be accessible via the opening provided in the ceiling.

The electrical Sub-Sub-Contractor shall ensure that the methods of suspension for luminaires are electrically and mechanically sound.

Luminaires suspended by means of tubes shall be fitted to ball joints allowing a swing of at least 20 degrees all round. Reliable earthing between the fixed and moving parts shall be provided by means of a flexible braided copper tape.

Fluorescent luminaires shall be provided with a minimum of two fixings, except in the case of recessed modular luminaires or surface-mounted luminaires exceeding 300 mm in width, where four number fixings (one from each corner) shall be provided by means of conduit drops or threaded rods.

Normally visible luminaires support shall be conduit. All fluorescent luminaires shall be solidly mounted with all assembly nuts, bolts and accessories made tight to prevent vibrations and noise. Anti-vibration packing shall be fitted where necessary. luminaires mounted direct to trunking shall be fixed by means of the manufacturer's recommended fixing assemblies.

Unless stated otherwise, all luminaire supports shall be fixed to the building primary structure. Luminaires shall not be supported from suspended ceiling unless otherwise specified. The electrical Sub-Sub-Contractor shall be responsible for mounting and fixing arrangements.

Break joint rings of approved colour shall be provided for all suspended luminaires and fluorescent battery luminaires where the batten is of insufficient width to cover completely the conduit box and its associated clearance hole in the ceiling.

The metalwork of all luminaires shall be effectively bonded to the earthing system in accordance with Chapter 54 of the IEE Regulations.

Care shall be taken to ensure that the internal wiring of luminaires and the cable of any fixed wiring shall not be in contact with high temperature areas in luminaires.

Lighting track shall be of the type, size, finish, number of circuits and manufacture specified and shall comply with the requirements of the relevant section of BS. 4533. The positions of luminaires as shown on the Drawings are approximate only and exact position shall be determined after reference to the Engineering supervisor.

18. CEILING ROSES

Surface mounted ceiling roses shall be of all insulated, high impact moulded plastic construction complying with BS. 67 and shall be suitable for direct attachment to conduit outlet boxes. Recessed or semi-recessed ceiling roses shall be manufactured from porcelain. Break joint rings shall be provided when used on flush conduit outlet boxes.

Ceiling roses shall not be connected to fixed wiring in such a manner that one of the terminals remains 'live' when the associated switch is in the 'off' position, unless that terminal is inaccessible to touch when the ceiling rose cover is removed, e.g. for replacement flexible cord.

Terminals shall be provided for switched live, neutral and protective conductors. Loop-in facilities shall also be provided.

19 LAMPS

Lamps shall be compatible with the luminaire for which they are intended and shall be of the wattage, type and colour specified. Lamps shall be of the correct voltage rating for the particular electricity supply concerned.

Tungsten filament lamps, unless otherwise specified, shall be of the 'PEARL' type and of the long-life type giving 2000 hours average life.

Luminaires designed to accommodate lamps with reduced physical dimensions shall be fitted with lamps of the mushroom type of approved equal.

20 EXTERNAL LIGHTING

External lighting system shall comprise the lighting points at the position shown on the Drawings and shall include the provision, erection and connection of all lighting columns, bollards, wall and ceiling luminaires and the provision and connection of all control gear together with the laying, jointing and connection of all necessary cables.

All excavation, trenching, backfilling etc., will be undertaken by the main Sub-Contractor.

All lighting columns shall be of the type specified, suitable for looping in and out three No.2 Core PVC/SWA/PVC cables of the specified size.

Where discharge lamps are specified the associated controlgear shall be mounted in the base of the column above the fused 'cut out', all on a timber board housed within the base of the column.

Each lighting column/bollard shall be completed with all adaptors, spigots, mounting brackets, luminaires, controlgear and lamps and shall be provided with a base compartment and locking door.

All column/bollards shall be fixed in the position specified.

Cable routes are shown on the relevant drawings and the electric Sub-Sub-Contractor shall lay the lighting cables in the trenches.

All connections shall be made in an approved manner, and the installations shall be finished complete and handed over in working order to the full satisfaction of the Engineer.

21 LIGHTING SWITCHES

Lighting switches shall be of the type, size and manufacture as specified.

Wall and ceiling switches shall comply with BS 3676. Wall and ceiling switches controlling A.C lighting circuits shall be rated 20 amp and be of the slow break quick make, type unless stated otherwise.

Where several switches on one phase are shown at one position, a ganged box shall be used.

Where switches at any location are connected to different phases, purpose-make phase barrier switches shall be installed. The phases shall be separated by means of rigidly fixed barriers and the cable for each phase shall be confined to the area enclosed by the barriers for that phase.

Switches connected to a particular phase shall have separate cover or covers fitted over each phase. The covers shall be engraved "CAUTION 415 VOLTS".

The switch plate of the specified finish shall be fitted over phase covers to render the switch unit indistinguishable from the switches that are not phase barrier switches.

Alternatively, each gang shall have its own piping and box for each phase, physically separated from other phases with similar arrangements.

For flush position on a plastered or equivalent finish wall, the switches shall have overlapping plates.

In any places where the finish is fair-faced brickwork, the wiring shall be installed on the back of the wall and make a back entry into the accessories. Each switch in these areas shall be neatly recessed and incorporate an overlapping plate.

For surface-mounted positions and such Plant Rooms, Electrical Switch room etc., employing a surface-mounted system or wiring, switches shall be surface-mounted, having metal front plates of an aluminium finish, mounted in matching metal boxes.

22 SOCKETS OUTLETS

All socket outlets and plugs shall be supplied and installed in accordance with the manufacture, type, sizes and finish specified.

All round pin 2A, 5A, 15A, and 30A socket outlets shall comply with the requirements of BS 546.

All sockets outlets shall be switched, unless otherwise specified.

All switched sockets outlets shall be complete with steel boxes of the same manufacture, complete with earth terminal.

Assemblies shall comply fully with the requirements of the IEE Regulations concerning the bonding of protective conductor terminals and each such terminal shall be connected by a conductor, having a minimum cross-sectional area of 2.5 mm², to a permanent earthing terminal incorporated in the associated box providing an effective, solid connection to the earth continuity conductor of the installation.

Where the assembly does not provide a reliable electrical contact between the cover plate and box with effective connection of metal operating bars and toggles, then an insulated earthing lead shall be provided, solidly connected to the metal plate and operating bar or toggle and terminating at the fixed earthing terminal incorporated in the associated box. 13 amp sockets will generally be installed using ring circuits in accordance with Appendix 5, Table 5A of the IEE Regulations.

All plugs shall be of moulded rubber or other resilient material complying with BS 1363 or BS 546. The plug shall have internal cord grip. 13 amp plugs shall be fitted with cartridge fuse links to BS 1362. The fuse rating shall be selected to give protection to the flexible cord or cable connected.

All fuses installed within 13 amp plug top, fused spurs, clock connections etc., shall be cartridge fuse links rated at 240 volts, ASTA certified for compliance with BS 1362 'General purpose fuse links for domestic and similar purposes', or BS 464 'Cartridge fuse links (rated at up to 5 amperes) for AC and DC service', or BS 2950 'Cartridge fuse-link for telecommunications and light electrical apparatus'.

All equipment, which is locally fused, shall have fitted fuses with characteristics, which are recommended by the manufacturer of the equipment.

If any appliance or equipment suffers due to incorrect fusing of the appliances, such appliances or equipment shall be repaired or replaced at the electrical Sub-Sub-Contractor's cost, to the satisfaction of the Engineer.

23 INSPECTION AND TESTING

A visual inspection shall be made in accordance with IEE Regulations 612-1. References shall be made to appendix 14 of the IEE Regulations, which is a checklist for initial inspection of installations.

The electrical installation shall be inspected and tested by the electrical Sub-Sub-Contractor in accordance with part 6 of the IEE Regulations.

Where any part of installation is to be concealed within a building, fabric tests shall be made to ensure that the installation is satisfactory prior to concealment.

Upon completion of the works the whole installation shall be subjected to the tests detailed hereafter and every defect shall be noted, corrected and brought to the notice of the Engineer.

All tests shall be witnessed by the Engineer to his full satisfaction and he shall be given at least one week's notice in writing of the proposed tests.

All labour and test instruments shall be provided by the electrical Sub-Sub-Contractor and the instruments shall be correctly calibrated and certified for the limits of accuracy required and shall be operated by competent person. If, in the Engineer's opinion, a particular instrument is not suitable, then an acceptable alternative shall be provided. The Engineer shall be at liberty to demand the use of any testing instrument or apparatus that he may reasonably consider to be necessary in the execution of the testing.

In the event of the installation failing to pass the test, the Engineer has the full authority of the Employer to deduct from the Contract Price all reasonable expenses incurred, due to him being required to attend a repetition of the test.

The following items, where relevant, shall be tested in the sequence indicated. Standard methods of testing, in respect of some of the following regulations of this section, are given in Appendix 15 of the IEE Regulations.

- i) Continuity of ring final circuit conductors.
- ii) Continuity of protective conductors, including main supplementary equipotential bonding.
- iii) Earth electrode resistance.
- iv) Insulation resistance.
- v) Insulation of site-built assemblies.
- vi) Protection of barriers or enclosures provided during erection.
- vii) Insulation of non-conducting floors and walls.
- viii) Polarity.
- ix) Earth fault loop impedance.
- x) Operation of residual current devices and fault voltage operated protected devices.

Upon completion of all tests and commissioning, two copies of detailed certificates shall be provided by the electrical Sub-Contractor to show that the equipment, materials, installation etc., have been tested and commissioned. One copy of each, duly completed and signed shall be submitted to the Engineer within 154 days of the results being obtained. The second copy of the certificates shall be retained to be included with operator and maintenance manuals.

The results of the test and details of completion for the electrical test shall be detailed on the Test and Completion Certificates respectively; issued by the National Inspection council for Electrical Installation Contracting or other approved authority.

24 AS BUILT DRAWINGS, AND DOCUMENTATION

Within one month of the date of completion the electrical Sub-Contractor shall provide 3 prints of all electrical drawings showing the electrical installations "As built". In case the electrical Sub-Contractor fails to provide "As Built" drawings as required, these will be prepared by others at the expense of the electrical Sub-Contractor.

PART B:
TECHNICAL SPECIFICATIONS
FOR
COMMUNICATION SERVICES

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TECHNICAL SPECIFICATIONS FOR COMMUNICATION SERVICES

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1.0 AN OVERVIEW OF CABLING STANDARDS

1.1 ANS/TIA/EIA-568-A and ISO/IEC 11801

The latest editions of the ANS/TIA/EIA-568-A (568-A) AND iso/iec 11801 ('11801) cabling standards were both published in 1995. The following overview provides some of the requirements and recommendations of each standard including differences between them.

1.2 ANS/TIA/EIA-568-A

Commercial Building Telecommunications Cabling Standard.

The Telecommunications Industry Association (TIA) TR42.1 (formerly TR41.8.1) working Group on telecommunications cabling published the ANSI/TIA/EIA-568-A standard in 1995.

1.3 ISO/IEC 11801

Information Technology – Generic Cabling for Customer Premises.

The International Organization for Standardization (ISO) SC 25/WG 3 Working Group on telecommunications cabling published the ISO/IEC 11801 standard in 1995.

Following are highlights of the '568-A standard and related Telecommunication Systems Bulletins (TSBs) with notes on differences in terminology and technical requirements with respect to '11801. For clarity and consistency, '568-A based terminology is used in the following overview.

Purpose

- To specify a generic voice and data telecommunications cabling system that will support a multi-product, multi-vendor environment.
- To provide direction for the design of telecommunications equipment and cabling products intended to serve commercial enterprises.
- To enable the planning and installation of a structured cabling system for commercial buildings that is capable of supporting the diverse telecommunications needs of building occupants.
- To establish performance and technical criteria for various types of cable and connecting hardware and for cabling system design and installation.

Scope

- Specifications are intended for telecommunications installations that are "office oriented".
- Requirements are for structured cabling system with a usable life in excess of 10 years.
- Specifications addressed:
 - Recognized Media
 - Cable and connecting Hardware
 - Performance
 - Topology
 - Cabling Distance
 - Installation Practices
 - User Interfaces
 - Channel Performance

Cabling Elements

- Horizontal Cabling:
 - Horizontal Cross-connect (HC)
 - Horizontal Cable
 - Transition Point (optional)
 - Consolidation Point (optional)
 - Telecommunications-Outlet/Connector (TO)
- Backbone Cabling
 - Main Cross-connect (MC)
 - Interbuilding Backbone Cable
 - Intermediate Cross-connect (IC)
 - Intrabuilding Backbone Cable
- Work Area (WA)
- Telecommunications Closet (TC)
- Equipment Room (ER)
- Entrance Facility (EF)
- Administration

2.0 HORIZONTAL CABLING SYSTEM STRUCTURE

The horizontal cabling system extends from the telecommunications outlet in the work area to the horizontal cross-connect in the telecommunications closet. It includes the telecommunications outlet, an optional consolidation point or transition point connector, horizontal cable, and the mechanical terminations and patch cords (or jumpers) that comprise the horizontal cross-connect.

2.1 Some points specified for the horizontal cabling subsystem include:

- Recognized Horizontal Cables:
 - 4 pair 100 Ω unshielded twisted-pair.
 - 2-fiber (duplex) 62.5/125 μm or multimode optical fiber 9note: 50/125 μm multimode fiber will be allowed in '568-B)
- A minimum of two telecommunications outlets are required for each individual work area.
 - First outlet: 100 Ω twisted pair (category 5e is recommended)
 - Second outlet: 100 Ω twisted pair.
 - Two-fiber multimode optical fiber either 62.5/125 μm or 50/125 μm .
- One transition point (TP) is allowed between different forms of the same cable type (i.e. where undercarpet cable connects to round cable)
- 50 Ω coax and 150 Ω STP-A cabling is not recommended for new installations.
- Additional outlets may be provided. These outlets are in addition to and may not replace the minimum requirements of the standard.
- Bridged taps and splices are not allowed for copper-based horizontal cabling. (Splices are allowed for fiber).

- Application specific components shall not be installed as part of the horizontal cross-connect (eg. Splitters, baluns).
- The proximity of horizontal cabling to sources of electromagnetic interference (EM) shall be taken into account.

3.0 BACKBONE CABLING SYSTEM STRUCTURE

The backbone cabling system provides interconnections between telecommunications closets, equipment rooms, and entrance facilities. It includes backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connections. The backbone also extends between buildings in a campus environment.

- Equipment connections to backbone cabling should be made with cable lengths of 30m (98 ft) or less.
- The backbone cabling shall be configured in a star topology. Each horizontal cross-connect is connected directly to a main cross-connect or to an intermediate cross-connect, then to a main cross-connect.
- The backbone is limited to no more than two hierarchical levels of cross-connects (main and intermediate). No more than one cross-connect may exist between a main and a horizontal cross-connects may exist between any two horizontal cross-connects.
- A total maximum backbone distance of 90m (295 ft.) is specified for high band-width capability over copper. This distance is for uninterrupted backbone runs. (No intermediate cross-connect).
- The distance between the terminations in the entrance facility and the main cross-connect shall be documented and should be made available to the service provider.
- Recognized media may be used individually or in combination, as required by the installation. Quantity of pairs and fibers needed in individual backbone runs depends on the area served. Recognized backbone cables are:

100 Ω UTP
150 Ω stp-a
625/125 μ Multimode Optical Fiber
Single mode Optical Fiber
- Multipair cable is allowed, provided that it satisfies the power sum crosstalk requirements.
- The proximity of backbone cabling to sources of electromagnetic interference (EMI) shall be taken into account.
- Cross-connects for different cable types must be located in the same facilities.
- Bridged taps are not allowed.

3.1 WORK AREA:

The telecommunications outlet serves as the work area interface to the cabling system. Work area equipment and cables used to connect to the telecommunications outlet are outside the scope of '568-A and '11801, but are expected to be specified in the next edition of these standards.

4.0 OPEN OFFICE CABLING:

Additional specifications for horizontal cabling in areas with moveable furniture and partitions have been introduced in TIA/EIA TSB75. Horizontal cabling methodologies are specified for “open-office” environments by means of multi-user telecommunications outlet assemblies and consolidation points. These methodologies are intended to provide increased flexibility and economy for installation with open office work spaces that require frequent configuration.

HORIZONTAL DISTANCES OF COPPER LINKS (OPEN OFFICE)

Copper work area cables connected to a MuTOA, shall meet the requirements of ‘568-A (sec. 10.5 and 11.5). The maximum length of copper work area cables shall be determined according to:

$$C = (102 - H)/12$$
$$W = C - 7 (<29 \text{ m})$$

Where:

C is the combined length of the work area cable, equipment Cable, and patch cord (m).

W is the length of the work area cable (m).

H is the length of the horizontal cable (m)

The above equations assume that there is a total of 7m (23 ft.) of patch and equipment cables in the telecommunications closet. Table 1 shows the application of these formulae. The length of work area cables shall not exceed 20m (66 ft). The MuTOA shall be marked with the maximum allowable work area cable length.

Length of Horizontal Cable	Maximum Length of Work Area Cable	Maximum Combined Length of Work Area Cables, Patch Cords, and Equipment Cable
H m (ft)	W m (ft)	C m(ft)
90 (295)	3 (10)	10 (33)
85 (279)	7 (23)	14 (46)
80 (262)	11 (36)	18 (59)
75 (246)	15 (49)	22 (72)
70 (230)	20 (66)	27 (89)

Table 1 – Maximum Length of Work Area Cables

5.0 HORIZONTAL DISTANCES OF OPTICAL FIBER LINKS (LONG WORK AREA CABLES)

For optical fiber cables, any length combination or length of the horizontal channel does not exceed 100m (328 ft).

When deploying a centralized fiber cabling topology, the general guidelines of TSB72 shall be followed.

6.0 TELECOMMUNICATIONS CLOSET

Telecommunications closets are generally considered to be floor serving facilities for horizontal cable distribution. They may also be used for intermediate and main cross-connects.

Some specifications related to the telecommunications closet:

- Closets shall be designed and equipped in accordance with ANSI/TIA/EIA-569-A.
- Cable stress from tight bends, cable ties, staples, and tension should be avoided by well-designed cable management.
- Only standards-compliant connecting hardware shall be used.
- Cables and cords used for active equipment connections are outside the scope of the standard (10m total allowed for patch cords, equipment cables, and work area cables for each link).
- Application-specific electrical components shall not be installed as part of the horizontal cabling.
- Horizontal cable terminations shall not be used to administer cabling system changes. Instead, jumpers patch cords, or equipment cords are required for re-configuring cabling connections

The two types of schemes used to connect cabling subsystems to each other and to equipment are known as interconnections and cross-connections.

DEFINITIONS:

Cross-Connection:

A connection scheme using patch cords or jumpers that attach to connecting hardware on each end.

Interconnection:

A connection scheme that provides for direct connections to building cabling from equipment without a patch cord.

7.0 TWISTED-PAIR (BALANCED) CABLING

The six categories of transmission performance specified for cables, connecting hardware and links are:

Designation	Transmission Characteristics	Description
3	Transmission characteristics are specified up to 16 MHz.	Meets applicable category 3 and Class C requirements of ISO/IEC 11801 (including amendments A.1 & A.2), ANSI/TIA/EIA-568-A (including addenda A-1, A-2, & A.3) and TSB67. Requirements are specified to an upper frequency limit of 16MHz.
4	Transmission characteristics are specified up to 20 MHz	Meets applicable category 4 requirements of ISO/IEC 11801 (including amendments A.1 & A.2), ANSI/TIA/EIA-568-A (including addenda A-1, A-2 & A-3) and TSB67. Requirements are

		specified to an upper frequency limit of 20 MHz. This classification is a superset of 3
5	Transmission characteristics are specified up to 100 MHz.	Meets applicable category 5 and class D requirements of ISO/IEC 11801 (including addenda A-1, A-2 & A-3), TSB67 and draft TSB95. Requirements are specified to an upper frequency limit of 100 MHz. This classification is a superset of 4.
5e	Transmission characteristics are specified up to 100 MHz.	Performs to category 5e and additional class D requirements of draft amendment 3 of ISO/IEC 11801, and draft addendum 5 to ANSI/TIA/EIA-568-A. Requirements are specified to an upper frequency limit of 100 MHz. This classification is a superset of 5.
6.	Transmission characteristics Will be specified up to 250 MHz.	Performs to category 6 and class E requirements under development by ISO/IEC and TIA. Requirements are expected to be specified to an upper frequency limit of at least 250 MHz. This classification is a superset of 5e
7.	Transmission characteristics will Be specified up to 600 MHz.	Performs to category 7 and class F requirements under development by ISO/IEC. Requirements are expected to be specified to an upper frequency limit of at least 600 MHz. This classification is an electrical superset of 6.

Category 6 and 7 industry are currently under development.

8.0 UTP TELECOMMUNICATIONS OUTLET/CONNECTOR

- 8-position modular jack per IEC 60603-7 (.568-A states that all pairs must be connected).
- Pin/pair assignment: T568A Optional assignment to accommodate certain systems: T568B.
- Durability rating 750 mating cycles minimum.

- Backward compatibility and interoperability is required.

9.0 FULLY SHIELDED TELECOMMUNICATIONS OUTLET/CONNECTOR.

- Entirely new interface design to support class F cabling.
- Will require a new wiring pin/pair assignment.
- Transmission measurement methods for category 7 are under study.
- Durability rating 1000 mating cycles minimum.

10.0 UTP CONNECTING HARDWARE VS. CABLE NEXT PERFORMANCE.

- Specifications cover all types of connectors used in the cabling system including the telecommunications outlet/connector.
- Does not cover work area adapters, baluns, protection, MAUs, filters, or other application-specific devices.
- Temperature range -10°C (14°F) to 60°C (140°F).
- Outlets shall be securely mounted. Outlet boxes with unterminated cables must be covered and marked.
- Transmission requirements are much more severe than cable of a corresponding category.
- Performance markings should be provided to show the applicable transmission category and should be visible during installation (for example 5e) in addition to safety markings.
- Installed connectors shall be protected from physical damage and moisture.

10.1 UTP LINK PERFORMANCE MARKING AND IDENTIFICATION

- Link category marking should be clearly visible on both ends (component markings are not sufficient).
- Labelling, markings, and color-coding shall be provided in accordance with ANSI/TIA/EIA-606.

11.0 SCREENED CABLING (ScTP)

As a result of the release of TIA/EIA/IS-729 and the maturity of the '568-A and '11801 standards, telecommunications groups recognize the presence of an overall shield over four twisted-pairs; a media hybrid termed Screened Twisted-Pair or ScTP cabling.

11.1 ScTP:

- Color-coding:
Pair 1 = White/Blue-Blue
Pair 2 = White/Orange-Orange
Pair 3 = White/Green-Green.
Pair 4 = White/Brown-Brown
- 0.51mm (24 AWG) 100 Ω 4-pair enclosed by a foil shield.
- A copper conductor drain wire of .040mm (26 AWG) or larger shall be provided.
- Should be marked "100 Ω ScTP", in addition to any safety markings required by local or national codes.
- Same mechanical and transmission requirements apply to backbone and horizontal cables.
- Additional performance requirements, including surface transfer impedance, is specified in the IS-729 standard entitled, "Technical Specifications for 100 Ω Screened Twisted-Pair Cabling".

11.2 ScTP Connectors:

- Interface and pair assignments same as IEC 60603-7 ('568-A states that all 4 pairs must be connected).
- Additional transfer impedance and shield mating interface requirements specified in the IS-729 standard entitled, "Technical Specifications for 100 Ω Screened Twisted-pair Cabling".

11.3 ScTP Patch Cords:

- Specifications call for 26 AWG (7 strands @ 0.15mm) or 24 AWG (7 strands @ 0.20mm) stranded conductors.
- Allows for an overall shield.
- Less severe attenuation than horizontal cable.

11.4 ScTP Installation Practices:

- Shield shall be bonded at both ends at the “Telecommunication Grounding Busbar”.
- The difference between the two grounds shall be no more than 1.0 V RMS.

12.0 FULLY SHIELDED CABLING (SSTP)

Fully shielded cabling requirements are under development by ISO. Cable and connector specification will extend to at least 600 MHz and are intended to support the pending class F cabling requirements.

12.1 Fully Shielded Cable:

- Color-coding:
Pair 1 = White/Blue-Blue
Pair 2 = White/Orange-Orange
Pair 3 = White/Green-Green
Pair 4 = White/Brown-Brown
- Four 0.51mm (24 AWG) or larger 100 Ω twisted-pairs each enclosed by an individual foil shield with an overall shield provided over the four-pairs.
- Mechanical and transmission requirements are under development by ISO.

12.2 Fully Shielded Connectors:

- Interface and pair assignments are under development by ISO and will be entirely different from the T568A and T568B assignments.
- Mechanical and transmission requirements are under development by ISO.

12.3 Fully Shielded Patch Cables.

- Mechanical and transmission requirements are under development by ISO.

12.4 Fully Shielded Installation Practices:

- Installation Practices are under development by ISO.-

12.5 TSB67

Transmission Performance Specifications for Field Testing of UTP Cabling Systems

This bulletin provides users with the opportunity to use comprehensive test methods to validate the transmission performance characteristics of installed category 5 and lower grade UTP cabling systems. The categories of UTP cabling systems in this bulletin also correspond with the UTP cabling categories of ANSI/TIA/EIA-568-A. Additional transmission performance and applicable field test requirements are referenced in TSB95, ‘568-A-5 and amendment 2 to ‘11801 (FDAM 2)

12.6 Some points specified for TSB67 transmission field testing for UTP Cabling Systems

- UTP cabling systems are comprised of cables and connecting hardware specified in TIA/EIA-568-A.
- Required test parameters include wire-map, length, attenuation, and crosstalk.
- Two levels of pass or fail are indicated, depending on measured margin compared to minimum specifications. Testing of NEXT loss is required in both directions.
- Level II equipment meets the most stringent requirements for TSB67 measurement accuracy. Level IIe equipment will be required to verify category 5e and FDAM 2 performance.
- Requirements are intended for performance validation and are provided in addition to ‘568-A requirements on components and installation practices.

13.0 OPTICAL FIBER CABLING

The current '568-A specification on optical fiber cabling consists of one recognized cable type for horizontal subsystems and two cable types for backbone subsystems:

Horizontal – 62.5/125 μm multimode (two fibers per outlet).

Backbone - 62.5/125 μm multimode or singlemode.

'568-B will allow the use of 50/125 μm multimode optical fiber in both the horizontal and backbone in addition to the types listed above.

All optical fiber components and installed practices shall meet applicable building and safety codes

13.1 Optical Fiber Patch Cords:

- Shall be a two-fiber (duplex) indoor cable Of the same type as the cables to which they connect.
- Shall allow for easy connection and reconnection and ensure that polarity is maintained (568SC configuration required).
- Shall perform a pair-wise cross-over of fiber positions A and B. (If provided in simplex form, one connector shall be identified as "A" and the other "B".)

13.2 Installation of Optical Fiber Connecting Hardware:

- Connectors shall be protected from physical damage and moisture.
- Capacity for 12 or more fibers per rack space [44.5mm (1.75 in.)] should be provided.
- Optical fiber connecting hardware shall be installed:
 - To provide well organized installation with cable management.
 - In accordance with manufacturer's guidelines.

13.3 Optical Fiber Cabling Installation:

- A minimum of 1m (3.28 ft.) of two-fiber cable (or two buffered fibers) shall be accessible for termination purposes.
- Testing is recommended to assure correct polarity and acceptable link performance. Informative Annex H of '568-A is provided for recommended optical fiber link performance testing criteria.

13.4 Optical Fiber Work Area Connector:

- A simplex or duplex SC connector shall be used at the work area.
- Recommended adapter and connector is the 586SC (a duplex SC that is capable of simplex operation).

13.5 Optical Fiber Connections:

- Connector designs shall meet the requirements of the corresponding TIA FOCIS documents.
- Telecommunications outlet/connector boxes shall be securely mounted at planned locations.
- The telecommunications outlet/connector box shall have:
 - The ability to secure optical fibers.
 - Cable management means to assure a minimum bend radius of 25mm (1.00 in.) and should have slack storage capability.
 - Provisions for terminating a minimum of two optical fibers into a 568SC adapter.
- Identification of fiber types:
 - Multimode connectors and adapters shall be identified with the color beige.
 - Single mode connectors and adapters shall be identified with the color blue.
- The two positions in a duplex connector are referred to as "position A" and "position B".
- The 568SC adapter performs a pair-wise cross-over between position A and position B of two mated connectors.
- Optical fiber runs intended for future connections shall be stored in a telecommunications outlet/connector box.

13.6 Small Form Factor (SFF) Connectors:

- Qualified SFF duplex and multi-fiber connector designs may be used in the main cross connect, intermediate cross-connect, horizontal cross-connect, and consolidation points.
- A TIA Fiber Optic Connect Intermateability Standard (FOCIS) shall describe each SFF design.

- The SFF design shall satisfy the requirements specified in Annex A of the proposed '568-B.3 standard.
- Some advantages of SFF connectors include compact size, modular compatibility with the eight position modular copper interface, and adaptability to high-density network electronics.

13.7 TSB72 Centralized Optical Fiber Cabling Guidelines

This Telecommunications Systems Bulletin (TSB) provides the user with the flexibility of designing an optical fiber cabling systems for centralized electronics typically in single tenant buildings. It contains information and guidelines for centralized optical fiber cabling.

Some points specified in TSB-72 for a centralized optical fiber cabling system include:

- Intended for single-tenant users who desire centralized vs. distributed electronics.
- Implementation allows cables to be spliced or interconnected at the telecommunications closet such that cables can be routed to a centralized distributor for total cable lengths of 300m (984 ft.) or less, including patch cords or jumpers.
- Allows for migration from an interconnection or splice to a cross-connection scheme that can also support distributed electronics.
- Pull-through implementations are allowed when total length between the tele-communications outlet/connector and centralized cross-connect and centralized cross-connect is 90m (295 ft.) or less.
- Connecting hardware required to:
 - join fibers by re-mateable connectors or splices,
 - connectors shall be 568SC interface,
 - provide for simplex or duplex connection of optical fibers,
 - provide means of circuit identification,
 - allow for addition and removal of optical fibers.

Note: Some multi-mode fiber implementations may be limited to an operating range of 220m to support 1000BASE-SX.

13.8 TIA/EIA-568-A-1

Propagation Delay and delay Skew

This addendum to '568-A describes propagation delay and delay skew requirements for all '568-A compliant 4-pair 100 Ω cables. Propagation delay and delay skew requirements of multipair cables are subject to additional study.

Propagation delay is equivalent to the amount of time that passes between when a signal is transmitted and when it is received at the other end of a cabling channel. Delay skew is the difference between the pair with the least delay and the pair with the most delay. Transmission errors that are associated with excessive delay and the delay skew include increased jitter and bit error rates.

The maximum propagation delay skew requirement for 4-pair 100 Ω cables is frequency dependent and is specified by the following equation:

$$\text{Delay (ns/100m)} \leq 534 + 36/\sqrt{f\text{MHz}}$$

Cable delay skew shall not exceed 45 ns/100m between 1 MHz and the highest referenced frequency for a given category.

It is anticipated that the requirements of '568-A-1 will also be applicable to pending category 6 cable propagation delay and delay skew specifications while more stringent performance criteria will be specified for pending category 7 cables.

13.9 TIA/EIA-568-A-2

Corrections and additions to TIA/EIA-568-A

This addendum to '568-A provides modifications and corrections to the content of '568-A as a result of advances in telecommunications research and development. Revisions are as follows:

1. Centralized optical fiber cabling is referenced in two locations (5.2.1 and 7.4.1) as an alternative to the optical cross-connection located in the telecommunications closet when deploying 62.5/125 μ m optical fiber cable in the horizontal. TIA/EIA TSB72 Centralized Optical Fiber Cabling Guidelines are also referenced.
2. The ANSI/ICEA reference in section 10.2.3 was updated to ANSI/ICEA S-90-661-1994 for specifying the physical and mechanical requirements of '568-A recognized cables.
3. Additional text was incorporated into section 10.4.3.4 specifying that the connecting hardware used for 100 Ω UTP cabling shall not result in or contain any transposed (e.g transposition of pairs 2 or 3) or reversed (also called tip/ring reversals) pairs. It is further noted that applications requiring transposed or reversed pairs shall utilize adapters, work area or equipment cords to swap pairs.
4. A reference to the TSB67 field test methodologies is added to section 10.6.4
5. The 568SC optical fiber connector axial pull off strength requirement was decreased from 22 N (5 lbf) to 19.4 N (4.4 lbf)
6. Globally, the word "polarization" was replaced with "polarity".
7. The initial contact resistance specified in Annex A for connecting hardware was increased from 1 m Ω to 2.5 m Ω and the contact resistance measurement method was re-written to be more user-friendly.
8. A provision for common mode terminations for testing connecting hardware NEXT loss and return loss was incorporated into Annex B. This revision accommodates telecommunications networking implementations that may employ common mode terminations in the active equipment.

13.10 TIA/EIA-568-A-3

Addendum 3 to TIA/EIS-568-A

As a result of the demand for open office architecture and the need to support multiple telecommunications applications in a shared sheath, this addendum to '568-A addresses revised performance specifications for hybrid cables. '568-A-3 also introduces a new term called "bundled cables" to describe 4-pair cable assemblies that are not covered by an overall sheath (as specified for hybrid cables), but by any generic binding method such as "speed-wrap" or "cable-ties"

The new hybrid and bundled cable requirements state that power sum NEXT loss between all non-fiber cable types within that cable shall be 3 dB better than the specified pair-to-pair NEXT loss for each cable type.

13.11 TIA/EIA-568-A-4

Production Modular Cord NEXT Loss Test Method and Requirements for Unshielded Twisted-Pair Cabling

TIA/EIA-568-A-4 defines a generic and non-destructive methodology for NEXT loss testing of modular plug cords. NEXT loss performance requirements for category 5 modular plug cords, when measured with the particular test head specified in the Standard, are provided. Note that, although the methodology may be used as the basis for determining the minimum NEXT loss performance requirements of other categories of modular plug cords, at present, the Standard does not define a test head or specific test limits for category 5e or category 6 patch cords. The methodology described in the Standard contains the detailed NEXT loss calculations (which are based upon patch cable NEXT loss, test head NEXT loss, and cable and connector

attenuation contributions) for the determination of the NEXT loss limits for any category patch cord and suitably designed test head.

13.12 TIA/EIA-568-A-5

Transmission Performance Specifications for 4-pair 100□ Enhanced Category 5 Cabling.

‘568-A-5 specifies enhanced category 5 (category 5e) performance requirements. These requirements are recommended for new category 5 cabling installations and are expected to become the de facto minimum standard for category 5 cabling. This document addresses the minimum equal level far-end crosstalk (ELFEXT) and return loss requirements necessary to support developments in applications technology and defines the minimum performance needed for a worst case for-connector channel to support applications that utilize full-duplex transmission schemes, such as Gigabit Ethernet. To ensure additional crosstalk headroom for robust applications support, this document also specifies power sum performance requirements for category 5e cables and cabling.

Addendum ‘A-5 is a normative document and, unlike TSB95, it provides mandatory requirements, not recommendations.

13.13 TIA/EIA TSB95

Additional Transmission Performance Guidelines for 100□ 4-pair Category 5 Cabling.

TSB95 outlines minimum recommendations for the new channel parameters of return loss and equal level far-end crosstalk (ELFEXT). These return loss and ELFEXT recommendations are specified to ensure the support of Gigabit Ethernet over installed or “legacy” category 5 cabling and were derived from worst case performances of channels with only two connection points. The two-connector channel topology is consistent with the IEEE committee’s assumption that cabling used to support Gigabit Ethernet systems will most likely utilize an interconnect instead of a cross-connect field and will not include a consolidation or transition point connection. Existing installed category 5 cabling should be verified to ensure that performance meets the minimum recommendations of this document. Channel configurations with three or four connectors that meet the specified ELFEXT and return loss recommendations will also support Gigabit Ethernet. Because the specifications of this document are applicable for the qualification of existing, installed cabling only, they are not recommended to be used As the minimum performance criteria for new category 5 cabling.

13.14 TIA/EIA/IS-729

Technical Specifications for 100□ Screened Twisted-Pair Cabling.

IS-729 is an interim standard that supplements TIA-568-A and ISO/IES 11801 screened twisted-pair cabling specifications by describing additional technical requirements on the outlet interface, shield effectiveness, installation practices, and performance relative to ScTP links and components.

13.15 ISO/IEC 11801:1995 FDAM 2

Draft Amendment 2 to ISO/IEC 11801

The performance specifications in ISO amendment 2 provide new requirements for return loss and ELFEXT loss to compliment the existing ISO class D requirements. The new specified return loss and ELFEXT loss requirements are in harmony with the values proposed in ‘568-A-5, however, the document does not specify additional NEXT loss margin over and above the existing class D requirements. FDAM 2 also includes propagation delay and delay skew requirements for channels and permanent links that are in harmony with the requirements of TIA/EIA-568-A-1

The requirements of amendment 2 to ISO/IEC 11801 are normative and this document will become the governing international standard for new class D cabling installations.

14.0 CABLING SPECIFICATION CROSS-REFERENCE CHART (ANSI/TIA/EIA-568-A AND ISO/IEC 11801)

The following chart provides a side-by-side comparison that highlights many of the fundamental similarities and differences between ANSI/TIA/EIA-568-A and ISO/IEC 11801.

ANSI/TIA/EIA-568-A (and addenda)
Commercial Building Telecommunications
Cabling Standard

ISO/IEC 11801 (and amendments)
Generic Cabling for Customer
Premises

14.1 HORIZONTAL UTP CABLE

- Solid 4-pair 0.51mm (24 AWG) specified (0.64mm (22 AWG) solid also allowed). An overall shield ((ScTP) is optional.
- Performance marking should be provided to show the applicable performance category. These markings do not replace safety markings.
- Colour-coding:

White/blue-blue
White/orange-orange
White/green-green
White/brown-brown.

14.2 HYBRID AND BUNDLED CABLES

Hybrid/Bundled cables:

- Hybrid/bundled cables that contain multiple units of recognized horizontal copper cables are subject to additional NEXT loss requirements between cable units. These requirements assure a minimum of 3 dB additional power sum crosstalk isolation between applications that may operate on adjacent binder groups.
- All detailed specifications for the individual cable units used in the hybrid assembly still apply.
- Hybrid bundled cables shall meet the transmission requirements specified in TIA/EIA-568-A-3.

14.3 UTP PATCH CORDS AND CROSS-CONNECT JUMPERS.

- Patch cords must use stranded cable for adequate flex life
- Standard cables must meet the minimum performance requirements for horizontal cable except that 20 percent more attenuation is allowed by '568-A and 50 percent more attenuation is allowed by '11801.
- Color-code for cross-connect jumpers: One conductor white, the other a visibly distinct color such as red or blue.
- Performance markings should be provided to show the applicable transmission category in addition to safety markings.
- Insulated O.D of stranded wires should be 0.8mm (0.032 in.) to 1mm (0.039 in.) to fit into a modular plug.
- Production performance specifications for plug cord assemblies are addressed in '568-A-4
- Color codes for stranded, 100 Ω UTP patch cord:

Option 1	Option 2
White/blue-blue	PAIR 1 green-red
White/orange-orange	PAIR 2 black-yellow
White/green-green	PAIR 3 blue-orange
White/brown-brown	PAIR 4 brown-slate

Note: Because of their identical pair groupings, patch cords terminated with either T568A or T568B pair assignments may be used interchangeably, provided that both ends are terminated with the same pin/pair scheme.

14.4 BACKBONE UTP CABLE

- Performance markings should be provided to show the applicable performance category. These markings do not replace safety markings.
- Services with incompatible signal levels should be partitioned into separate binder groups. Guidelines for shared sheaths are provided in Annex D of '568-A.
- Transmission requirements are equivalent to horizontal cables except that NEXT loss performance is based on power-sum rather than worst-pair characterization to allow for multiple disturbing signals (of the same type) in the same sheath.
- Note: Tip conductors have colored insulation that corresponds to that of the binder group. Ring conductors have colored insulation that corresponds to that of the pair.
- Backbone UTP cables consist of solid 0.51 mm (24 AWG) cables that contain more than four pairs (typically multiples of 25-pairs are used). An overall shield is optional.
- Color-coding (specified by reference to ICEA)

15.0 MODULAR WIRING REFERENCE

Modular Jack Styles:

There are four basic modular jack styles. The 8-position modular outlets are commonly and incorrectly referred to as "RJ45". The 6-position modular jack is commonly referred to as RJ11. Using these terms can sometimes lead to confusion since the RJ designation actually refer to very specific wiring configurations called Universal Service Order Code (USOC). The designation 'RJ' means Registered Jack. Each of these basic jack styles can be wired for different RJ configurations. For example, the 6-position jack can be wired as an RJ11C (1'-pair), RJ14C (2-pair), or RJ25C (3-pair) configuration. An 8-position jack can be wired for configurations such as RJ61C (4-pair) and RJ48C. The keyed 8-position jack can be wired for RJ46S, and RJ47S. The fourth modular jack style is a modified version of the 6-position jack (modified modular jack or MMJ). It was designed to eliminate the possibility of connecting DEC data equipment to voice lines and vice versa.

15.1 MODULAR PLUG PAIR CONFIGURATIONS

It is important that the pairing of wires in the modular plug match the pairs in the modular jack as well as the horizontal and backbone wiring. If they do not, the data being transmitted may be paired with incompatible signals.

Modular cords wired to the T568A color scheme on both ends are compatible with T568B systems and vice versa.

15.2 STRAIGHT THROUGH OR REVERSED?

Modular cords are used for two basic applications. One application uses them for patching between modular patch panels. When used in this manner modular cords should always be wired "straight through" (pin 1 to pin 1, pin 2 to pin 2, pin 3 to pin 3, etc). The second major application uses modular cords to connect the workstation equipment (PC, phone, FAX etc) to the modular outlet. These modular cords may either be wired "straight-through" or "reversed" (pin 1 to pin 6, pin 2 to pin 5, pin 3 to pin 4, etc.) depending on the system manufacturer's specifications. This "reversed" wiring is typically used for voice systems. The following is a guide to determine what type of modular cord you have

15.3 HOW TO READ A MODULAR CORD

Align the plugs side-by-side with the contacts facing you and compare the wire colors from left to right. If the colors appear in the same order on both plugs, the cord is wired "straight-through". If the colors appear reversed on the second plug (from right to left), the cord is wired "reversed".

15.4 COMMON OUTLET CONFIGURATIONS

Two wiring schemes have been adopted by the '568-A and '11801 standards. They are nearly identical except that pairs two and three are reversed. T568A is the preferred scheme because it is compatible with 1 or 2-pair USOC systems. Either configuration can be used for Integrated Services Digital Network (ISDN) and high speed data applications. Transmission categories 3, 4, 5, 5e, and 6 are only applicable to this type of pair grouping.

USOC wiring is available for 1-, 2-, 3-, or 4-pair systems. Pair 1 occupies the center conductors, pair 2 occupies the next two contacts out, etc. One advantage to this scheme is that a 6-position plug configured with 1, 2, or 3 pairs can be inserted into an 8-position jack and still maintain pair continuity. A note of warning though, pins 1 and 8 on the jack may become damaged from this practice. A disadvantage is the poor transmission performance associated with this type of pair sequence. None of these pair schemes is cabling standard compliant.

10Base-T wiring specifies an 8-position jack but uses only two pairs. These are pairs two and three of T568A and T568B schemes.

The MMJ is a unique wiring scheme for DEC® equipment.

16.0 RECOMMENDED CABLING PRACTICES

Do's

- ☐ Terminate each horizontal cable on a dedicated telecommunications outlet.
- ☐ Locate the main cross-connect near the center of the building to limit cable distances.
- ☐ Maintain the twist of horizontal and backbone cable pairs up to the point of termination.
- ☐ Tie and dress horizontal cables neatly and with a minimum bend radius of 4 times the cable diameter.

Dont's:

- ☐ Do not use connecting hardware that is of a lower category than the cable being used.
- ☐ Do not create multiple appearances of the same cable at several distribution points (called bridged taps)
- ☐ Do not over-tighten cable ties, use staples, or make sharp bends with cables.
- ☐ Do not place cable near equipment that may generate high levels of electromagnetic interference.

17.0 UTP CONNECTOR TERMINATIONS

- Pair twists shall be maintained as close as possible to the point of termination.
- Untwisting shall not exceed 25mm (1.0 in) for category 4 links and 13mm (0.5 in) for category 5, category 5e, and category 6 links. Follow manufacturer guidelines for category 3 products, if no guidelines exist, then untwisting shall not exceed 75mm (3.0 in).
- Connecting hardware shall be installed to provide well-organized installation with cable management and in accordance with manufacturer's guidelines.
- Strip back only as much jacket as is required to terminate individual pairs.

17.1 UTP CABLING INSTALLATION PRACTICES.

- To avoid stretching, pulling tension should not exceed 110N (25 lbf) for 4-pair cables.
- Installed bend radii shall not exceed:
 - 4 times the cable diameter for horizontal UTP cables.
 - 10 times the cable diameter for multi-pair backbone UTP cables.
- Horizontal cables should be used with connecting hardware and patch cords (or jumpers) of the same performance category or higher.

- Avoid cable stress, as caused by:
 - cable twist during pulling or installation
 - tension in suspended cable runs
 - tightly cinched cable ties or staples
 - tight bend radii.
- Important Note: Installed UTP cabling shall be classified by the least performing component in the link.

18.0 ANSI/TIA/EIA-569-A

Commercial Building Standard for Telecommunications Pathways and Spaces.

The TIA TR42.3 (formerly TR41.8.3) Working group on Telecommunications Pathways & Spaces published the ANSI/TIA/EIA-569-A ('569-A) Standard in 1998. Following are highlights of the '569-A Standard:

Purpose

- Standardize design and construction practices.
- Provides a telecommunications support system that is adaptable to change during the life of the facility.

Scope

- Pathways and spaces in which telecommunications media are placed and terminated.
- Telecommunications pathways and spaces within and between buildings.
- Commercial building design for both single and multi-tenant buildings.

Elements

- Horizontal
- Backbone
- Work Area
- Telecommunications Closet
- Equipment Room
- Main Terminal Space.
- Entrance Facility

18.1 HORIZONTAL

Pathways from telecommunications closet to work area.

Includes:

Pathway Types:

- Underfloor-Network of raceways embedded in concrete consisting of distribution and header ducts, trenches, and cellular systems.
- Access Floor-Raised modular floor tile supported by pedestals, with or without lateral bracing or stringers.
- Conduit-Metallic and nonmetallic tubing of rigid or flexible construction permitted by applicable electrical code.
- Tray & Wireway-Prefabricated rigid structures for pulling or placing cable.
- Ceiling-Open environment above accessible ceiling tiles and frame work.
- Perimeter-Surface, recessed, molding, and multichannel raceway systems for wall mounting around rooms or along hallways.

Space Types:

- Pull Boxes-Used in conjunction with conduit pathway systems to assist in the fishing and pulling of cable.
- Splice Boxes-a box, located in a pathway run, intended to hold a cable splice.
- Outlet Boxes-Device for mounting faceplates, housing terminated outlet/connectors, or transition devices.

Design Considerations:

- Grounded per code and ANSI/TIA/EIA-607 ('607)
- Designed to handle recognized media as specified in ANSI/TIA/EIA-568-A ('568-A)
- Not allowed in elevator shafts.
- Accommodate seismic zone requirements
- Installed in dry locations

18.4 BACKBONE

Pathways routed from closet-to-closet.

Building Backbone Types:

- Ceiling
- Conduit
- Sleeves-An opening, usually circular, through the wall, ceiling, or floor.
- Trays

Typically the most convenient and cost effective backbone pathway design in multi-story buildings, is to have stacked closets located one above the other, connected by sleeves or slots.

Design Considerations:

- Grounded per code and '607
- Accommodate seismic zone requirements
- Water should not penetrate the pathway system
- Tray, conduits, sleeves, slots penetrate closets minimum 25mm (1 in.)
- Designed to handle all recognized media (as specified in '568-A)
- Integrity of all fire stop assemblies shall be maintained.

18.3 WORK AREA

Primary location where the building occupants interact with dedicated telecommunications equipment.

Design Considerations:

- At least one telecommunication outlet box location shall be planned for each work area.
- This location should be coordinated with the furniture plan. A power outlet should be nearby.
- Control center, attendant, and reception areas shall have direct and independent pathways to the serving telecommunications closet.
- Furniture System design:
 - Cable access via walls, columns, ceilings, or floors. Fittings that transition between building and furniture pathways require special planning.
 - Furniture pathway fill capacity is effectively reduced by furniture corners, and connectors mounted within the furniture pathway systems.
 - Furniture pathways bend radius shall not force the installed cable to a bend radius of less than 25 mm (1 in.)
 - Furniture spaces designed to house slack storage, consolidation points, or multi-user telecommunications outlet assemblies shall provide space for strain relieving, terminating, and storing slack for the horizontal cables.

- Slack storage and furniture pathway fill, shall not affect the bend radius and termination of the cable to the connector.
- Furniture pathway openings shall comply with either of two sizes:
 - 1) Standard NEMA opening (NEMA OS 1 (Ref D. 14), WD-6 (Ref D. 15))
 - 2) Alternate opening:

Power/telecommunication separation requirements is governed by applicable electrical code for safety. Minimum separation requirements of Article 800-52 of ANS/NFPA 70 (National Electric Code) shall be applied.

18.4 TELECOMMUNICATIONS CLOSETS

Recognized location of the common access point for backbone and horizontal pathways.

Design:

- Dedicated to telecommunications function.
- Equipment not related to telecommunications shall not be installed, pass through or enter the telecommunications closet.
- Multiple closets on the same floor shall be interconnected by a minimum of one (78 (3) trade size) conduit, or equivalent pathway.
- Minimum floor loading 2.4 kPA (50 lbf/ft²).

Design Considerations:

- Minimum one closet per floor to house telecommunications equipment/cable terminations and associated cross-connect cable and wire.
- Located near the center of the area being served.
- Horizontal pathways shall terminate in the telecommunications closet on the same floor as the area served.
- Accommodate seismic zone requirements.
- Two walls should have 20mm (0.75 in.) A-C plywood 2.4m (8ft.) high.
- Lighting shall be a minimum of 500 lx (50 foot candles) and mounted 2.6m (8.5 ft.) above floor.
- False ceilings shall not be provided.
- Minimum door size 910mm (36 in.) wide and 2000mm (80 in.) high without sill, hinged to open outwards, or slide-to-slide or removable, and fitted with a lock.
- Minimum of two dedicated 120V 20A nominal, non-switched, AC duplex electrical outlet receptacles, each on separate branch circuits.
- Additional convenience duplex outlets placed at 1.8m (6 ft.) intervals around perimeter, 150mm (6 in.) above floor.
- Access to the telecommunications grounding system as specified by ANSI/TIA/EIA-607.
- HVAC requirements to maintain temperature the same as adjacent office area. A positive pressure shall be maintained with a minimum of one air change per hour or per code.

18.5 EQUIPMENT ROOM

A centralized space for telecommunications equipment that serves specific occupants of the building. Any or all of the functions of a telecommunications closet or entrance facility may alternately be provided by an equipment.

Location

- Site locations should allow for expansion.
- Accessible to the delivery of large equipment.
- Not located below water level.
- Away from sources of EMI
- Safeguards against excessive vibration
- Sizing shall include projected future as well as present requirement.

- Equipment not related to the support of the equipment room shall not be installed in, pass through, or enter the equipment room.

Design Considerations

- Minimum clear height of 2.4m (8 ft.) without obstruction.
- Protected from contaminants and pollutants.
- Access to backbone pathways.
- HVAC provided on a 24 hours-per-day, 365 days-per-year basis.
- Temperature and humidity controlled range 18° C (64° F) to 24° C (75° F) with 30% to 55% relative humidity measured 1.5m (5 ft.) above floor level.
- Separate power supply circuit shall be provided and terminated in its own electrical panel.
- Minimum lighting 500 ix (50 foot candles). Switch location shall be near entrance door to room.
- Minimum door same as telecommunications closet. Double doors without center post or sill is recommended.
- Access to ground per ANSI/TIA/EIA-607.

18.6 MAIN TERMINAL SPACE

Centralized space that houses the main cross-connect. Commonly used as a separate space in multi-tenant buildings to serve all tenants.

- Location considerations are as specified for equipment room.
- Provisioning area as specified for telecommunications closets except power is reduced to convenience receptacles.

18.7 ENTRANCE FACILITY

Consists of the telecommunications service entrance to the building and backbone pathways between buildings.

Location

- Providers of all telecommunications services shall be contracted to establish requirements.
- Location of other utilities shall be considered in locating the entrance facility.
- Alternate entrance facility should be provided where security, continuity or other special needs exist.
- Equipment not related to the support of the entrance facility should not be installed in, pass through, or enter the telecommunications entrance facility.
- Dry location not subject to flooding and close as practicable to building entrance point and electrical service room.

Design Considerations.

- Accommodate the applicable seismic zone requirements.
- A service entrance pathway shall be provided via one of the following entrance types: Underground, buried, Aerial, Tunnel.
- Minimum one wall should be covered with rigidly fixed 20mm (0.75 in.) A-C plywood.
- Minimum lighting same as telecommunication closet.
- False ceilings shall not be provided.
- Minimum door same as telecommunications closet.
- Electrical power same as telecommunications closet. No convenience receptacles mentioned.
- Grounding same as telecommunications closet.

18.8 MISCELLANEOUS

- Fire stopping per applicable code
- Horizontal pathway separation from Electromagnetic interference (EMI) sources:
 - Separation between telecommunications and power cables (Article 800.52 of ANSI/NFPA 70)
 - Building protected from lightning (ANSI/NFPA 780 (Ref D.4)
 - Surge protection (Article 280 of ANSI/NFPA 70 and 9.11 of ANSI/IEEE 1100 (Ref D.1)
 - Grounding (ANSI/TIA/EIA-607)
 - Corrected faulty wiring (Section 7.5 of ANSI/IEEE 1100)
- Reducing noise coupling:
 - Increase separation from noise sources
 - Electrical branch circuit line, neutral, and grounding conductors should be maintained close together.
 - Use of surge protectors in branch circuits
 - Use fully enclosed grounded metallic raceway or locate cabling near grounded metallic surface.

19.0 TIA/EIA-569-A-1

Perimeter Pathway Addendum

This addendum deals with the construction, applications, premises design and installation of perimeter pathways also known as surface raceway systems.

It describes both single and multi channel systems mounted on walls at a variety of heights and directions. The sizing of such pathways are based on 40% fill for initial installations but allows up to 60% fill for moves adds or changes to the installed cabling system during its life cycle. Fitting for perimeter raceway systems must allow for the bend radius requirements of the installed cable.

20.0 TIA/EIA-569-A-2

Furniture Pathway Fill Addendum.

The sizing of such pathways are based on 40% fill for initial installations but allows for up to 60% fill for moves, adds and changes to the installed cabling system during its life cycle. Furniture fittings such as outlets and connectors used to terminate the installed cables need to be considered when determining the percentage of fill. Fish and pull techniques may result in reduced capacity of the pathway as compared to furniture manufacturers which allow placing cables into the pathways.

20.1 SP-4198

Revision to subclause 4.3, “Access Floor”, of TIA/EIA-569-A

Introduces low profile floors as compared to standard height floors. Low profile floors are 6” or lower while standard height floors are 6” or greater. This revision describes the use of access floors as it refers to guidelines and installation.

20.2 SP-4517

Addendum 4 to ANSI/TIA/EIA-569-A Poke-Thru Devices

A poke-thru is a device for routing cables through a floor while maintaining the fire-rating integrity of the floor. These devices are an option for routing horizontal cables when other pathway types are not typical. Types include flush floor mount and those that rise up above floor level, also known as pedestal, raised, tombstone or monument.

PART C: TECHNICAL SPECIFICATIONS FOR PABX.

1. SYSTEM INFORMATION

1.1. *Specification*

- 1.1.1. This specification details the minimum technical requirements for a Digital Private Automatic Branch Exchange (PABX) to be supplied and installed at the Jaramogi Oginga Odinga University Administration Block.
- 1.1.2. The PABX technical and operational characteristics not mentioned in this specification shall comply with the current Communications Authority of Kenya (CA) specification for PABX's for connection to Kenya's Public Switched Telephone Network (PSTN).
- 1.1.3. The Provision of Clause 6.1.2 shall also apply to issues pertaining to installation and commissioning of the offered PABX, maintenance and administration, documentation and compliance with this specification.

1.2. *Type approval*

- 1.2.1. The offered PABX's shall be those that are already type approved by CA.

1.3. *Capacity*

- 1.3.1. The PABX shall have an equipment capacity as shown here at the time of commissioning:-
 - 300 extension,
 - 50 exchange lines (20 outgoings, 30 direct inward dial-in lines),
 - 50 out-of-area extensions.
- 1.3.2. The PABX shall have an ultimate capacity of 300 ports providing for at least fifty (50) exchange lines, 20 outgoings, 30 direct inward dialling lines, and 50 out -of area-extensions
- 1.3.3. It shall be possible to extend the capacity of the PABX in modular steps. The preferred units of growth are:-
 - (a) Extension –4, 8, or 16
 - (b) Trunks – 2, 4
- 1.3.4. The PABX shall have two (2) operator consoles but shall have provision of extending up to four (4) operator consoles.

1.4. *Operator's console*

- 1.4.1. The operator consoles (s) shall be cordless. It shall be possible to site them with or remotely from the PABX equipment.
- 1.4.2. The bidder shall state the maximum distance (in metres) that a console can be sited remotely from the PABX.
- 1.4.3. The consoles shall be powered from the PABX.
- 1.4.4. The console shall be designed to cater for visually handicapped operators.

1.5. Technology

- 1.5.1. The design and construction of the PABX shall employ the latest technology, and shall be of the state of the art and of high reliability.
- 1.5.2. The PABX shall be fully digital and shall employ stored program control and pulse code modulation (PCM) techniques, or other more modern and proven switching techniques.
- 1.5.3. The design shall be modular in concept, and plug-in type (no physical individual wiring on the PABX) to allow for ease of installation, step-by-step expansion and for a maintenance philosophy of on-site card/module replacement.
- 1.5.4. Expansion of the system should be by simply inserting additional modules in existing expansion slots pursuant to 6.5.3 above and configuring the system to recognise the additional capabilities. The processor installed initially should be able to handle the ultimate capacity requirements.
- 1.5.5. The PABX shall provide various and flexible facilities to enable transparent interworking with digital local area networks (LAN's), and integrated voice and data communications.
- 1.5.6. The PABX shall have provision for interconnection to the public packet switching network.
- 1.5.7. The PABX system shall be capable of providing radio paging facilities.
- 1.5.8. The PABX shall be able to provide 2Mb/s digital trunks and ISDN facilities.
- 1.5.9. Non-volatile ROM/PROM memories shall be used for the system-operating programme. Data held in RAM memories shall be protected against erasure during periods of power failure.

1.6. Types of Traffic

- 1.6.1. The PABX shall be capable of handling internal traffic, external traffic to and from the public telephone network, and traffic to and from other PABX's. It shall be capable of switching both analogue and digital traffic.
- 1.6.2. The PABX shall be capable of functioning as a tandem exchange for satellite PABX's.
- 1.6.3. The PABX shall be capable of operating with or without operator consoles.
- 1.6.4. The PABX system shall be capable of switching traffic associated with Clauses 6.5.5, 6.5.6, 6.5.7 and 6.5.8

1.7. Components, Materials and Finishes

- 1.7.1. The components, materials and finishes used in the equipment shall comply with the standards of Kenya Bureau of Standards. In absence of the same, other internationally recognised standards shall be applied. These standards shall be stated.
- 1.7.2. The performance of the equipment shall meet the relevant latest ITU Recommendations. Compliance with these recommendations shall be stated.
- 1.7.3. Electrical wiring used for the PABX and associated equipment shall meet IEE wiring regulations. The wires shall be of sufficient current rating and able to withstand high accidental short-circuit voltages.
- 1.7.4. The parts and components used in the PABX and accessories shall preferably be available in the world market from more than one manufacturer.
- 1.7.5. For future system expansion, the same or compatible or equivalent equipment shall be readily available.
- 1.7.6. The bidder shall guarantee the availability of all spare components, parts and cards for at least ten (10) years.

1.8. Protection

- 1.8.1. The PABX system offered shall be protected from internal and external power source hazards and shall prevent injury to users, operators, installation and maintenance staff and serious damage to the equipment and accommodation.

It is mandatory that the PABX installed is protected against over-voltage situation of the lines. Specifically all the lines (exchange and extension) running to points outside the building of installation shall be protected. The Bidder shall state how protection of the PABX offered is achieved and where the units are installed e.g. on card, MDF. etc.

- 1.8.2. Adequate protection must be provided on mains units and line units connected to the local network against lightning and any other high voltage surges. Under no circumstances shall the presence of high voltage cause damage to any common control equipment.
- 1.8.3. Rare gas discharge protectors shall be employed for primary over voltage protection between the extension and trunk lines and the PABX, and these shall be located preferably in the PABX cabinet or in a distribution or connection box close to the PABX.
- 1.8.4. The PABX system shall conform to the IEC DIN 68-2-6 and DIN IEC 68-2-36, standards of sinusoidal and random vibration.

1.9. Noiseless Operation

- 1.9.1. The PABX offered shall be noise-free as it will be installed in an office environment.

1.10. Environment

- 1.10.1. The equipment shall be fully protected against dust, corrosion and shall be designed to operate normally at 90% humidity.
- 1.10.2. Where air-conditioning is required, it shall be quoted for separately. The PABX will be expected to withstand failure of air-conditioning equipment for a minimum period of twelve (12) hours without degradation in service.
- 1.10.3. Ambient operative conditions:-
 - Outdoor ambient temperature: 5°C to 50 °C.
 - Outdoor relative humidity: up to 90% RH
 - Altitude: up to 3500 m.a.s.l.

Normal tropical conditions of strong sunshine, insects, fungus growth, etc, must be withstood.

2. FUNCTIONS AND FEATURES

2.1. General

- 2.1.1. The PABX shall include features in Sub-Section 7.2.
- 2.1.2. It shall be possible to programme or configure the PABX so that three hundred (300) extensions shall be capable of offering additional features given in Sub-Section 7.3.
- 2.1.3. It shall be acceptable if the additional features in Sub Section 7.2.5 are offered at the expense of at most a similar number of features in Sub-Section 7.2.4. The provision of this clause shall only affect those extensions indicated in Clause 7.1.2.
- 2.1.4. In Sub-Sections 7.2.4 and 7.2.5, the first and second columns indicate the clause number and the feature respectively.
- 2.1.5. Where the definition of a feature differs from the provisions of Clause 7.1.4, the bidder shall provide a concise description of such feature and include any condition or limitation applicable to it. The description shall also indicate the manner in which the feature operates and, where a user feature is involved, the method by which the facility is invoked and cancelled.
- 2.1.6. The bidder shall clearly indicate any deviations or omissions from the list of functions and features which are not mentioned in this specification but which can be provided by the PABX offered.

2.2. *Features of the offered system*

2.2.1. Selection of Trunks

The PABX shall be equipped with a capacity to determine the most economic (least cost) call routing. For example, calls to a particular cellular network shall be routed through the appropriate air interface trunk, and calls to a particular fixed network routed through an appropriate trunk, etc, such that the cost of the call shall always be always minimum.

The Tenderer shall indicate how this function is implemented in the offered system.

2.2.2. Voice Messaging

2.2.2.1.

The PABX system offered shall be able support voice messaging and processing. The Bidder should state whether the Voice Messaging and Processing system is an integral part of the PABX or a stand-alone unit connected to the PABX.

The Bidder shall quote separately the cost of hardware and software required to implement voice messaging and processing system. Detailed system description shall be presented.

The following are some of the mandatory features and facilities:

- i) Voicemail with the following features.
 - a) Announcement service.
 - b) Day and time stamp of messages.
 - c) Auto calling.
 - d) Message redirection.
 - e) Message archiving.
 - f) Message editing.
 - g) Message rewind, pause, and fast forward.
 - h) Fax mail and fax on demand.
 - i) Broadcast lists.
 - j) Remote access
- ii) Automated Attendant.
- iii) Voice Response.
- iv) Audio text.

2.2.3. Multi-tenant

2.2.3.1.

The system offered shall be able to support multi tenancy in order to cater for different CA departments and organisations and/or individuals who may be accommodated in the CA Headquarters building.

2.2.3.2.

It shall be able to assign group of extensions to a group of lines exclusively.

2.2.3.3.

It shall be able to assign consoles to particular individual users.

- 2.2.3.4. It shall have the capability to carry out billing as per assigned group representing different organisations and individual tenants.

2.2.4. List of Required Features

Column 3 indicates the classification of the feature – whether standard (S) or optional (O).

Column 4 indicates the equipment on which the feature should be available – whether on the main PABX system (M), on the operator console (C) and on the extension telephone (E).

Clause Number	Feature	Classification	Available on
7.2.4.1.	Alarm indication		
	a) Major Alarm	S	M, C
	b) Minor Alarm	S	M, C
	c) Console Alarm	S	M, C
	d) System on Reserve Power	S	M, C
	e) UPS	S	M, C
	f) Complete and computerized diagnostic equipment.	O	M
7.2.4.2.	Automatic Call-Back		
	a) Busy extension	S	C, E
	b) No reply from extension	O	
	c) Trunk Busy	S	E
7.2.4.3.	Abbreviated dialling		
	a) System lists	S	C, E
	b) Personal lists	S	C, E
7.2.4.4.	Automatic Night Switching	S	M
7.2.4.5.	Automatic Supervision	S	C
7.2.4.6.	Brokers Call	O	E
7.2.4.7.	Busy Line Display	S	C
7.2.4.8.	Call Diversion No Reply (Extension)		
	a) To a nominated Extn	O	E
	b) To Operator	O	E
7.2.4.9.	Call Diversion No Reply (DDI Trunk)	S	M
7.2.4.10.	Call Diversion, Extension Busy		
	a) To a nominated Extn	S	E
	b) To Operator	S	E
7.2.4.11.	Call Diversion Busy (DDI Trunks)	S	M
7.2.4.12.	Call Diversion Follow Me	S	E
7.2.4.13.	Call Diversion All calls		
	a) To nominated Extn	S	E
	b) To operator	S	E
7.2.4.14.	Call Hold	S	E

7.2.4.15.	Call Information Logging	S	M
7.2.4.16.	Call Metering		
	a) Operator controlled	S	C
	b) Individual metering	S	C
	c) Printed statement	S	M
7.2.4.17.	Call Progress Indication	S	C
7.2.4.18.	Call Queuing and Supervision	S	C
7.2.4.19.	Call Splitting	S	C
7.2.4.20.	Call Storage and Retrieval	S	C
7.2.4.21.	Call Transfer		
	a) Extn free	S	E
	b) Extn busy	O	E
7.2.4.22.	Call Waiting Information	S	C
7.2.4.23.	Camp-on Extensions	S	E
7.2.4.24.	Camp-On Trunk Lines	S	E
7.2.4.25.	Class of Service	S	M
7.2.4.26.	Common Answering	S	C
7.2.4.27.	Call Restriction	S	E
	a) Restricted access	S	E
	b) Restricted dialling		
7.2.4.28.	Conference		
	a) Extn controlled 3-party	S	E
	b) Extn controlled Add-On	S	E
	c) Operator controlled conference	S	C
	d) Meet-me conference	O	E
7.2.4.29.	Console Answering of Incoming Calls	S	C
7.2.4.30.	Console-less Operation	S	M
7.2.4.31.	Control of Trunk Group Access	S	C
7.2.4.32.	Data Transmission	S	M, E
7.2.4.33.	Data Line Security	S	E
7.2.4.34.	Dial Call Pick-Up (Group Pick-Up)	S	E
7.2.4.35.	Directed Call Pick-Up (Individual Extensions)	S	M
7.2.4.36.	Dial tone Detection	S	M
7.2.4.37.	Diary Service	O	E
7.2.4.38.	Direct Dial-In		
	From Public Exchange	S	M

	From Inter PABX Trunks	S	M
7.2.4.39.	Direct Dial-In Calls Barred	O	E
7.2.4.40.	Direct Outward Dialling	S	E
7.2.4.41.	Direct-In Lines	S	M
7.2.4.42.	Discriminatory Ringing		
	a) Internal Calls	S	M
	b) Trunk and Operator controlled Calls	S	M
	c) Diverted back Calls	S	M
7.2.4.43.	Distinctive Dial Tone on a diverted extension (Reminder dial tone)	S	M
7.2.4.44.	Distinctive Ringing Tone on diverted calls (Diverted ringing tone)	O	M
7.2.4.45.	Delayed Answer Supervision	S	C
7.2.4.46.	DTMF To DP Conversion	S	M
7.2.4.47.	Emergency Transfer of Exchange Lines	S	E
7.2.4.48.	Enquiry Call	S	E
7.2.4.49.	Executive Intrusion	S	E
	Executive Intrusion Barred	S	E
7.2.4.50.	Extension Group Hunting		
	a) Hunt Group number	S	M, E
	b) Cyclic hunting	S	M, E
	c) Sequential hunting	S	M
	d) Secretarial hunting	S	M
7.2.4.51.	Extension Line Lock Out	S	M
7.2.4.52.	Extension Assured Access to outgoing trunks	O	E
7.2.4.53.	Extn to Extn Call – Auto	S	E
7.2.4.54.	Extn to Extn Call – via Operator	S	E
7.2.4.55.	Extn to Trunk connections via Operator	S	E
7.2.4.56.	Extn to Trunk connections via Operator Barred	O	E
7.2.4.57.	Fault Type Display	S	M, C
7.2.4.58.	First Party Release on Internal Calls	S	M
7.2.4.59.	Immediate Ringing	S	M
7.2.4.60.	Immediate Ringing Tone	S	M
7.2.4.61.	Individual Trunk Line Selection	S	C
7.2.4.62.	Lamp Check	S	C
7.2.4.63.	Line Lock-out Display	S	C
7.2.4.64.	Mixed DTMF/DP signalling on same Extn Line	S	M
7.2.4.65.	Music on		

	a) Hold	S	M
	b) Camp-On	S	M
7.2.4.66.	Multi-Console Operation	S	M
7.2.4.67.	Night Service		
	a) Dial Answer Night	S	M
	b) Designed Extn Night Service	S	M
	c) Individual Night Service	O	M
	d) Night Service Intrusion	S	M
7.2.4.68.	Number Unobtainable Tone (on spare and barred numbers or codes)	S	M
7.2.4.69.	Operator Assistance	S	C
7.2.4.70.	Operator Call-In	S	C
7.2.4.71.	Operator Camp-On	S	C
7.2.4.72.	Operator Intrusion	S	C
7.2.4.73.	Paging Service		
	Audio	S	C, E
	Visual	O	C, E
7.2.4.74.	Paged Call Pick-Up	S	E
7.2.4.75.	Reserve Power		
	a) PABX	S	M
	b) For volatile memories	S	M
7.2.4.76.	Selective Answering	S	C
7.2.4.77.	Series Call	S	C
7.2.4.78.	Tie Lines	S	M
7.2.4.79.	Time and Date Display	S	C
7.2.4.80.	Tone Demonstration	S	M, C
7.2.4.81.	Traffic Recording	S	M
7.2.4.82.	Trunk Busyng By Operator	S	C

2.2.5. Additional Features

Clause Number	Feature	Classification	Available on
7.2.5.1.	Auto Alarm	S	C, E
7.2.5.2.	Controlled O/G call	S	C
7.2.5.3.	Do not Disturb	S	C, E
7.2.5.4.	Local call Restriction	S	C, E
7.2.5.5.	Manual Line Service	S	M
7.2.5.6.	Message waiting	S	C, E
7.2.5.7.	Single Digit Dial	S	C, E

2.3. *Activation of Features*

- 2.3.1. Where it is necessary on an established call to invoke a certain feature, the use of either auxiliary or digit buttons to effect this shall not interfere with the call already established. Where this is not possible, then the call will automatically or otherwise be put on hold. Music-on-hold will automatically be extended to the other party while feature accessing signals are extended to the user. Preference will be given to systems whose features can be accessed using both DP and DTMF extension instruments.

2.4. *Classes of Service*

- 2.4.1. It shall be possible to restrict access to the public and private networks to individual extensions or groups of extensions.
- 2.4.2. It shall be possible to restrict use of data services to individual extensions or groups of extensions.
- 2.4.3. The minimum required call restriction categories shall be the following:-
- a) International
 - b) National
 - c) Local
 - d) Internal

Item (d) provides for some extensions to be 'receive' only. The restriction of the various categories of calls shall be possible on individual extensions or designated groups of extensions.

2.5. *C.P.U. Failure Transfer*

- 2.5.1. In case of total system or power supply failure, selected lines shall be automatically switched over to pre-determined extensions. The maximum number of such selected lines shall be stated. All lines not switched through to extensions shall automatically be busied.
- 2.5.2. The return of the system shall not result to established calls being lost.

- 2.5.3. Failure of one CPU (or any key part) should result in automatic switchover to the standby without loss of already established calls or data received for establishing calls.

2.6. Operator Console Features

- 2.6.1. The provision of this sub-section shall complement those already provided in Sub-Section 7.2. Provisions under this Sub-Section shall not be taken to override or replace those in Sub-Section. 7.2.
- 2.6.2. The operator console shall have an information screen showing at least the following:-
- a) the dialled number (s)
 - b) date and time
 - c) status of number dialled
 - d) calls on queue
 - e) type of call (internal/external) alarms
- 2.6.3. Incoming calls should be presented to all consoles simultaneously
- 2.6.4. Two lightweight headsets shall be supplied for each console.
- 2.6.5. The bidder shall state all other functions and features available to the operator via the console.

3. TRUNKING, GRADE OF SERVICE AND NUMBERING

3.1. Trunking

- 3.1.1. The offered PABX shall be able to handle at least 0.12Erl of originating plus terminating traffic per extension, with the grade of service quoted under Clause 8.2.1.

3.2. Grade of Service

- 3.2.1. The average busy hour grade of service required after local dial tone is 0.02. This grade of service applies to the following types of calls:-
- Internal calls.
 - Incoming exchange calls to extensions via the operator.
 - Outgoing exchange calls from extension (automatic access).
 - Outgoing calls from operator positions, but reverted to extensions.
 - Calls barred access to exchange lines.
 - Assistance calls
- 3.2.2. Different grades of service shall apply to the following type of calls:-
- Direct inward Dialling (DID) = 0.02
 - Outgoing from operator position, but reverted to extensions that have access to exchange lines = 0.03
 - Outgoing to another PABX via tie lines = 0.03
 - Incoming from another PABX via tie lines = 0.02
- 3.2.3. The probability of a call being blocked before dial tone is provided shall not exceed 0.005. Also, the probability of a dial tone connection being delayed for more than two seconds after lifting the handset shall not exceed 0.01.

The bidder shall provide a detailed grade of service applicable in the offered PABX.

3.3. Numbering Plan

- 3.3.1. The PABX shall provide flexible numbering allocations within the plan shown here below:-

PABX NUMBERING PLAN		
	Local Extension	Out-of-area extension
Access to Extensions	2 * *, 3 * *	8 * *
Access to O/G Exchange lines	9	Barred
Operator assistance calls to Service	0	0
Common Answer Night Service	8	8
Access to special features e.g. paging, data network etc.	1 * *	1 * *
Legend: * = 0 to 9 inclusive, A = Extension number		

- 3.3.2. The numbering scheme shown in Sub-Section 8.3.1 is standard. The PABX shall be capable of different numbering arrangements to be adopted for special cases such as hotels and private networks.
- 3.3.3. Extension numbers shall not be tied to specific equipment positions, but shall be capable of allocation freely to line circuits by maintenance personnel.

4. CHARGING SYSTEM

- 4.1. The PABX shall contain or include a detailed charging/telephone management system.
- 4.2. Where the charging system is not an integral unit of the PABX, the bidder shall propose details of hardware and software necessary for such a system.
- 4.3. The bidder shall give details of the charging system showing among other standard charge information, the flow of data process, file arrangement, sample input/output format and menus on a VDU.
- 4.4. It shall be possible to input and store data containing information on charging and tariffs to allow for automatic calculation of call charges for various type of calls.
- 4.5. The system shall be capable of outputting data on a VDU, and on a hard copy. It shall also be possible to output and store the data on computer external disks or tapes. It shall be possible to recall and display on a VDU and hard copy, billing data as given in Clause 9.5 for a specified period of time. Such recalled data may be resident in the charging system or in external storage devices.
- 4.6. The data output given in Clause 9.5 shall show the following minimum information in respect of all calls routed over trunks to the public exchange.
- Calling extension number.
 - Where the call was transferred to another extension and identity of the second extension.
 - The dialled number. The system shall be capable of recording a minimum of 16 digits.
 - The date and time at which the call was originated.
 - The total duration of the call.
 - The charges with respect to each call.

- 4.7. In addition to billing calls for each extension, the charging system shall be capable of billing designated groups of extensions related to Departments or Sections within Kisumu County Government, or other tenants (multi-tenant facility).
- 4.8. Data, as provided in Clause 9.6, that has not been output on a hard copy or other external storage devices shall be protected from accidental or malicious erasure. The bidder shall give details on how such protection is achieved.
- 4.9. It shall be possible to pre-set the maximum call charges per extension. The system shall give an indication, either by automatically lowering the class of service of an extension or otherwise, that an extension has attained its maximum call charges. It shall not be possible, by use of a special security code, to re-set charges accrued by an extension.
- 4.10. The charging system shall be capable of periodically outputting billing data automatically and in hard copy format after pre-determined intervals of time. It shall also be possible to output billing data by system interrogation.

5. TRANSMISSION

5.1.	<i>Attenuation</i>	The attenuation loss measured on any exchange line connection through the PABX shall not be more than 1.0 dB at 1000 Hz –terminated at 600 Ω . A maximum of 6.0 dB loss shall be acceptable for inter-PABX connections.
5.2.	Inter-channel cross-talk attenuation	Interchannel cross-talk attenuation between extensions shall be greater than 70 dB over the frequency range 300 – 3400Hz
5.3.	Nominal Impedance	The nominal impedance of extension and exchange lines shall be 600 Ω .
5.4.	Impedance Imbalance to Earth	The impedance imbalance to earth shall not be worse than 40dB over the frequency range 300 – 600Hz and 46 dB over the frequency range 600-3400Hz measured at the Main Distribution Frame (MDF).
5.5.	Return Loss	The return loss measured against the nominal impedance shall not exceed –65 dBmOp with the channel terminated in the nominal impedance.
5.6.	Idle Channel Noise	The idle noise (weighted) shall not exceed –65 dBmOp with the input and output ports of the channel terminated in the nominal impedance.
5.7.	Group Delay	The group delay shall be less than 100 micro seconds over the frequency range 300 – 3400 Hz.

6. SIGNALLING AND PUBLIC NETWORK INTERFACE

6.1. General

The bidder shall provide comprehensive details on the signalling and interface characteristics of the offered PABX

6.2. Trunk line circuit

The trunk line circuits to be used as both-way non-DDI circuits shall have the following functions and hardware specifications.

6.2.1. *Idle state*

6.2.1.1. The nominal impedance shall be 600 ohms.

6.2.1.2. In the idle state the trunk shall be compatible with a Remote line and Automatic Line test equipment. The exchange Line Termination seen from the public exchange shall appear electrically as follows: 1.8 μ F in series with 1000 ohms.

6.2.2. *Exchange Line Characteristics*

The offered PABX shall be able to interface with the public exchanges with the following characteristics:

6.2.2.1. Have nominal impedance of 600 ohms.

6.2.2.2. Have varying loop resistance of up to 1500 ohms, with a minimum insulation resistance of 30,000 ohms between line to line or line to earth.

6.2.2.3. The exchange lines can be programmed for both ways or unidirectional working.

6.2.2.4. Both loop disconnect pulsing and dual tone multi-frequency signal is employed in the public exchange lines but one at a time. The trunk line circuit shall be capable of interfacing with exchange line with the above characteristics.

6.2.3. *Seizure-Incoming Calls*

The calling signal from the public exchange will be interrupted ringing as specified below. The trunk line circuit shall apply a low resistance loop of less than 300 ohms to the exchange line as an answer signal. Ring Trip shall occur either during the silent period or the ringing interval.

6.2.3.1. *Ringing Detector:*

The trunk line ringing detector connected across 'a' and 'b' wires shall respond to the following signal applied on the exchange line by the public exchange.

- a) The calling signal provided on the exchange line by the public exchange shall be sinusoidal AC signal which consists of earthed interrupted ringing applied on the 'b' wire and a -48V battery on the 'a' wire.
- b) On ring trip the public exchange reverses the conditions to provide -48V battery on the b and earth on the a wire.
- c) Immediate ring is available on all crossbar and digital public exchanges installed in Kenya.
- d) The ringing supply is 75V rms +/- 20%
- e) The ringing signal frequency is 25 Hz +/- 2 Hz.
- f) The ringing cadence is 1000 ms ON 3000 ms OFF +/- 100ms.

6.2.3.2. *Detector Sensitivity:*

The ringing detector shall respond to ringing signal with the following characteristics:

- Ringing voltage : 20V rms
- Ringing frequency : 23-27 Hz

- Duration of signal : 500 msec.

6.2.3.3. *Detector Response:*

The detector shall respond to the incoming ringing signal in the following manner:

- to follow the incoming cadence
- to respond within 100 ms of the presence of the incoming signal
- to respond for less than 100 ms due to DC transients at the end of each call.

6.2.4. *Busy Status*

6.2.4.1. During speech as well as during the hold condition, the trunk shall provide a DC loop to the public exchange line without any disconnection.

6.2.4.2. Each trunk circuit card shall have LED to indicate busy status (and/or trunk lock out).

6.2.4.3. A busy trunk line circuit shall be provided by a guard signal to protect it against subsequent seizure by other users.

6.2.4.4. The trunk shall remain busy for a period after call termination in order to give incoming calls priority over originating.¹

6.2.4.5. The trunk circuit shall not be damaged by polarity change nor shall it respond to this change.

6.2.5. *Line Seizure and Line Current*

During line seizure for outgoing calls, the PABX trunk line circuit shall be capable of applying the following seizure conditions to the public exchange:

6.2.5.1. A low resistance loop – typically 300 ohms.

6.2.5.2. An earth potential applied to the ‘b’ of the exchange. On receipt of an earth potential on the ‘a’ wire from the public exchange, the PABX seizing condition will change from earth to a low resistance loop.

6.2.5.3. The minimum line current of 20 mA through a feed bridge of 2x200 ohms (400 ohms) will flow through the line under extreme conditions.

6.2.5.4. During the shortest line condition, a maximum of 80 mA will flow (at 0 ohms line resistance).

6.2.5.5. The trunk line shall not be sensitive to polarity change on the line nor be damaged by the same.

6.2.6. *Dial Tone Detection*

The public exchange supply a dial tone with the following specifications:

- Frequency: 400 – 450 Hz
- Signal level: – 15 to – 20 dBm

The PABX dial tone detector shall therefore be able to detect dial tone under the following conditions:

- Frequency 400 – 450 Hz.
- Signal level –35 dBm.
- Dial tone must be present for 1 sec. or more.

- When dial tone disappears as the detector must respond within 50 msec.

6.2.7. *Dial (Loop) Pulses*

6.2.7.1. Dialling signal shall be sent as loop disconnect pulses. These could be generated in response to the timed driving signals.

6.2.7.2. Loop disconnections shall be equal to the number of pulses necessary for a particular digit.

6.2.7.3. Impulse distortions within PABX due to the operate and release time lags shall be less than 5 msec.

6.2.7.4. The PABX shall send pulse to the public exchange with the following specifications:

- Dial speed 10 pps
- Make/Break : pulse ratio : 2:1
- Break time : 66 msec.
- Make time : 33 msec.
- Interdigit pause (min) : 250 msec.

6.2.7.5. To avoid the influence of the inductances of the transmission path during pulsing, it is desirable that provision shall be made to either short circuit or open the transmission coil in conjunction with dialling pulse signals.

6.2.8. *Dial Tone Multi-frequencies*

The Dual Tone Multifrequency (DMF) signalling to ITU-T recommendation Q23 is applicable on some exchange lines in Kenya. The PABX shall therefore be capable of transmitting DTMF signals having the parameters shown below.

6.2.8.1. *DTMF signals: Allocation of frequencies to digits and symbols.*

LOW FREQUENCY	HIGH FREQUENCY			
	1209	1336	1477	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

6.2.8.2. *DTMF Tone Limits:*

- Frequency deviation : +/- 1.5%
- Duration of pulse : 60 msec.
- Duration of interval between pulses: 60 msec.
- Signal amplitude into a 600 ohm Load at zero:
 - High frequency group : -6dBm +/-2dBm
 - Low frequency group : -8dBm +/-2dBm

- e) Amplitude differential: High group signal amplitude relative +2dB +/- 1dB
- f) Distortion of DTMF signals. The total power level of Harmonic and Inter Modulation components shall be at least 20 dB below the level of individual signalling frequency.
- g) The level of the two frequencies must be within 1 dB of the final value within 7 msec.

6.2.9. *Answer and supervision*

6.2.9.1. It is not mandatory for public exchanges to provide answer supervision on exchange lines. On some public exchanges, and depending on the type of call, a reversal of the exchange line polarity may occur when a call is answered, the PABX signalling arrangement should not depend on such reversals and should if necessary ignore it when it does occur.

6.2.9.2. The PABX shall provide answer supervision on DDI lines from the public exchange and on inter-PABX tie lines.

6.2.9.3. Through clearing shall be provided on all outgoing calls where the signalling system permits. When PABX extension or PABX operator clears, the PABX switching equipment and circuit to the public exchange or distant PABX shall be released.

The PABX shall maintain a guarding condition on the trunk to prevent further seizure until the equipment at the distant end has fully released from the previous call. The PABX shall connect the idle state conditions to the PSTN line for a minimum period of 2 seconds after the end of the PSTN disconnect clear signal, before seizing it for a new outgoing call. During this time, the PABX shall be capable of recognising a new incoming call.

6.2.9.4. On incoming exchange and inter PABX calls, if the caller clears first and external circuit has been released at the far end, the PABX switching equipment shall be released. If the called extension fails to clear, it shall receive PABX dial tone for the normal time out period after which it shall be placed on extension line lock out.

If the called extension clears first, the PABX switching equipment shall be released.

6.2.10. *Protection*

6.2.10.1. The trunk line circuit shall be protected against any external electrical interference. The protection provided shall meet the requirements as described in the section dealing with PABX protection. In general the trunk line circuit shall be protected against the following:

- Lightning strikes
- 240V rms
- Any other over voltages.

6.2.10.2. The transversal AC voltages which do not disturb proper functioning of trunk line circuit shall not cause any damage to other circuits.

6.2.10.3. The construction of the trunk line circuit shall be such that any external interference to the circuit shall not effect the common control circuits. The supplier of the PABX is required to provide a committal statement on the above.

6.2.10.4. The trunk line circuit shall be protected against mishandling. To achieve this safety requirement, it may be necessary to:

- provide an earth strap on the PABX to be worn by anyone handling the PABX to avoid electrostatic damages
- provide a clear warning in a conspicuous position on the PABX of the possible dangers resulting in mishandling.

6.2.11. *Metering Signal Detection*

6.2.11.1. Signal Characteristics. The signal from public exchanges is 12 kHz +/- 1% generated at 1 V rms +/- 5%.

6.2.11.2. The Detector. The detector circuit shall be connected between 'a' and 'b' wire and able to indicate by periodic pulses the charge for a particular call. The circuit shall be able to detect a signal of the following characteristics:

- Signal frequency 12 kHz +/- 1%.
- Pulse duration min 100 msec, e.m.f. min 60 mV.

6.2.11.3. The circuit shall cause an insertion loss of at least 16 dBn.

6.3. *Direct Dialling In From Public Exchanges*

6.3.1. *Impedance*

The nominal impedance shall be 600 ohms. Loop disconnect pulsing and DTMF signals according to ITU-T Q23 shall be applied by the public exchange.

6.3.2. *Idle State*

During idle state, the public exchange shall apply -48V battery on the *b* (ring) wire, and earth on the *a* (tip) wire. The battery feed shall be via a supervisory circuit consisting of a 200 ohm + 200 ohm balanced feed. The DDI circuit should draw some idle current from public exchange voltage of -48 V DC. This current enables the public exchange to check the availability of DDI trunk.

This minimum current shall be between 5 mA and 35 mA. Because this is a supervisory current, it must flow in a specific direction as follows: 'b' wire through the trunk and back to a wire.

6.3.3. *Seizure*

DDI trunks are incoming only. Seizure shall be by battery reversal from the public exchange occurring on the line. At the same time the public exchange impedance becomes 400 – 500 ohms. The polarity reversal should result in change of direction of current flow. The DDI circuit should detect this reversal and interpret it as a seizure signal. The public exchange shall expect a seizure acknowledgement in the form of high current ranging between 15 mA to 80 mA.

6.3.4. *Answer Signal*

The answer signal returned by the PABX DDI circuit shall be a low resistance loop resulting in high current. PABX shall not effect reversal of line polarity.

6.3.5. *Operating Loop Limit*

The resistance of the external circuit shall be 1500 ohms or more. The minimum insulation resistance shall be 30,000 ohms between line to line and line to earth.

6.3.6. *Backward Busying*

The public exchange shall block the DDI trunk if loop or ground or battery on *a* wire and/or *b* wire are detected during idle condition. It shall therefore be possible to busy the outgoing end of the circuit by applying any of the above busying signal at the PABX.

6.3.7. *Clear Signals*

Public exchange clears first: When the public exchange clears first, a reversal of potential is placed on 'a' and 'b' terminals of the DDI circuit. The PABX shall detect this reversal and interpret it to mean "clear signal from public exchange".

PABX clear first: When PABX clear first, the DDI trunk should go from a low impedance loop (operating) to a high impedance loop (idle). The public exchange will recognise this high impedance and will send a polarity reversal on *a* & *b*. This is the signal the PABX should recognise as a clear signal from the public exchange.

6.4. *Both –way Inter-PABX Circuits(Tie Lines)*

6.4.1. Tie lines are inter-PABX circuits which is in Kenya are allowed to interconnect different switching equipment of the same organisation. Therefore, calls on ties should not be programmed to access public lines. PABX offering tie line must be able to meet this requirement.

6.4.2. *Signalling Method*

6.4.2.1. Loop calling with loop disconnect dialling or DTMF shall be employed between PABXs where a continuous metallic path between PABXs exists.

6.4.2.2. Outband (E&M) signalling shall be employed where a dc signalling path between PABXs is not available.

6.4.2.3. Supplier shall provide details of signalling system for use on dc circuit whose resistance is beyond the limits of a loop disconnect dialling.

6.4.3. *Dial Tone Detection*

6.4.3.1. The PABX shall detect dial tone as specified in this document. To avoid confusion with busy tone, the detector shall operate only to tones supplied continuously for a period in excess of 600 msecs.

6.4.3.2. The dial tone detector shall operate to a tone at a minimum power level of –35 dBm.

6.4.3.3. It shall be possible to arrange for the automatic cancellation of the call if dial tone is not detected within 20 seconds of seizure of the trunk and for the return of busy tone to the caller.

6.4.4. *Loop Signalling Trunk*

Impedance	The nominal impedance shall be 600 ohms.
Low Resistance Loop	The low resistance loop applied by the trunk termination shall be less than 300 ohms

Operating Loop Limits	The resistance of the external circuit shall be 1500 ohms or more. The minimum insulation resistance shall be 30,000 ohms between line to line and line to earth.
Trunk conditions	The trunk shall be fully described during the following conditions: – idle state – seizure – answer supervision – pulsing
Outband Signalling Trunk.	The conditions of the equipment shall be stated for the signalling limits and conditions of the E&M signalling wires, stating the signalling conditions at calling and called PABXs for the following signals: – idle – seizure – hold – digit pulse – answer – clear forward – call held – clear back – forward held – clear forward – backward busy – forward busy

6.5. *Interface to Digital Trunk*

6.5.1. *Definition*

A digital trunk is defined as an interface between various E1 digital trunk formats and the PABX transmission format.

A digital trunk shall provide a transmission/switching interface requirement and shall perform the following functions:

- a) Provide HDB- to binary coding
- b) Retiming
- c) Frame alignment and supervision
- d) Channel mapping
- e) Provide various signalling schemes
- f) Alarm detection
- g) Presents test condition

6.5.2. The digital trunk shall be able to carry:

- a) Voice,
- b) Data,
- c) Common Channel signalling

6.5.3. The digital trunks shall be capable of operating in synchronous or asynchronous environments.

6.5.4. *Interfaces*

The digital trunk shall provide digital receive and transmit connections between the outside plant and the PABX at 2Mb/s.

6.5.5. *Characteristics of Signal at the Output Port*

The signal at the output port shall be as specified in the ITU-T Rec G703 and summarised below:

PULSE SHAPE		NORMALLY RECTANGULAR
PAIRS IN EACH DIRECTION	COAXIAL PAIR	SYMMETRICAL PAIR
Test Load	75 ohms resistive	120 ohms resistive
Nominal peak of a space	2.37 V	3V
Peak voltage of a space	0+/- 0.237V	0 +/- 0.3 V
Pulse width (nominal)	244 ns	244 ns
Ratio of amplitude of Positive & negative pulse at nominal half amplitude	0.95: 1.05	0.95 :1.05

6.5.6. *Return Loss*

The return loss at the input port shall comply with the figures shown below. The percentages are for frequencies of the nominal bit rate.

2.5% to 5%	:	12 dB
5% to 100%	:	15 dB
100% to 150%	:	14 dB

The nominal bit rate : 2048 kbit/s +/- 50 ppm

6.5.7. *Man-Machine interface*

The digital trunk interface board shall be equipped with a serial asynchronous interface to connect a terminal or modem. The interface will comply with the following ITU-T V24 standards as shown below:

CIRCUIT	TERMINAL	
	DTIB	MODEM DCE
102	GND	GND
103	TX (output)	RX
104	RX (input)	TX
105	RTS (output)	CTS

106	CTS (input)	RTS
107	DSR (input)	DTR
108	DTR (output)	DSR
109	CD	CD

The electrical signals TX, RX, RTS, CTS, DSR, DTR and CD shall comply to ITU-T Rec. V28.

7. INSTALLATION, COMMISSIONING AND TRAINING

7.1. General

- 7.1.1. The Contractor shall propose a typical layout plan of the proposed PABX equipment.
- 7.1.2. The successful Bidder (Contractor) shall install, test and commission the PABX system, including all internal cabling and strapping.
- 7.1.3. The connection from the PABX trunk lines and extensions to the external network will be at the MDF.
- 7.1.4. The PABX and all associated equipment shall be installed and commissioned in the presence of a project engineer appointed by Jaramogi Oginga Odinga University.

7.2. Installation Materials

- 7.2.1. The Contractor shall include in his offer a list of materials necessary for the installation such as irons, cables, jumper wires etc.
- 7.2.2. The contractor shall supply all the necessary materials for the completion of installation work and for cut-over work on a turn-key basis.
- 7.2.3. The contractor shall supply all the necessary materials for earthing connection.
- 7.2.4. The Contractor shall propose to supply the Main Distribution Frame (MDF), or a suitable flexibility point where the external lines will interface with the internal network. Detailed electrical, and mechanical characteristics of the offered flexibility point including cabling and jumpering arrangements, capacity and terminal blocks shall be provided. The type and dimensions of the MDF (where applicable) and terminal blocks shall also be given.
- 7.2.5. The proposed flexibility point shall contain protector modules with test jacks, break springs, over-voltage gas tube arrestors. The type, dimensions and line capacity of the protector unit and rates of voltage and current for the fuses and arrestors shall be stated.

7.3. Cabling and Wiring

- 7.3.1. All wires and cables interconnecting the various PABX sub-systems shall be installed on/in cable runways and/or ducts in the building.
- 7.3.2. The conductors carrying power, control, supervisory, and audio and digital signals shall be shielded to avoid undesirable mutual interference.
- 7.3.3. High voltage and low voltage conductors shall be physically separated to avoid accidental high voltage contact.
- 7.3.4. Openings made in the building and holes on floor and walls for any passage of cable runways shall be sealed with non-inflammable material to prevent the ingress of dust, water and fire after installation of the equipment.

7.4. Cut-over

- 7.4.1. The contractor shall confirm the proper functioning of all the equipment installed at site such as individual functions of each item specified in this specification, overall through-connection between any inlet and outlet, interworking operations with the local public exchange and other facilities as well as the detailed charging system.
- 7.4.2. It shall be the responsibility of the contractor to carry out extension line pre-testing before cutover.
- 7.4.3. The Contractor shall provide Jaramogi Oginga Odinga University with the procedures and other information required for successful cutover at least two weeks before the start of commissioning of the PABX.

7.5. Simulation of Failure

- 7.5.1. The contractor shall simulate partial and total failure of the system to test compliance with the requirements set forth in clause 3.2.4.

7.6. Acceptance Test

- 7.6.1. Kisumu County Government shall implement the Acceptance Test about the following items:-
 - i) That the installation work has been completed and the installed system is suitable for operation.
 - ii) That the installation work has been completed and the installed system is suitable for operation.
 - iii) That the maintenance spares, units, components, tools and test equipment has been supplied.
 - iv) That all manuals, computer media, drawings and documents have been supplied.
 - v) That the required training has been completed.
- 7.6.2. Acceptance tests shall be carried out by the Contractor in the presence of and under the direction of the Jaramogi Oginga Odinga University appointed project engineer.
- 7.6.3. A function test shall be conducted and shall comprise check-up of the functions of the equipment on the specified items according to the facilities required in this specification.
- 7.6.4. A call-through performance test shall be performed. It shall aim to confirm performance figures submitted by the contractor and shall comprise of generating artificial automatic calls in both normal and overloaded conditions.
- 7.6.5. A PABX service test shall be carried out to confirm service requirements such as service restriction, routing and signalling.
- 7.6.6. Call charge processing test shall be carried out to ensure the performance of software and hardware by using actual call charge data obtained by generating test calls.
- 7.6.7. The Contractor shall submit within three (3) months after the signing of the contract the target performance figures for acceptance test for approval by Kisumu County Government.
- 7.6.8. After commissioning, service quality of the PABX facilities installed shall be given for live calls as follows:-
 - i). The percentage of calls judged as faulty due to faults existing in the PABX facilities against all calls in twenty four (24) hours shall be less than 0.1%.
 - ii). The service quality in (i) above shall be maintained for one (1) year from the date of issue of the Acceptance Certificate.

7.6.9. Jaramogi Oginga Odinga University shall accept all facilities upon confirmation by the project engineer that the service quality has been achieved and all defects and faults have been cleared.

7.6.10. If within one (1) year from the date of issue of the Acceptance Certificate, any part of the system breaks down or becomes defective or fails, under proper use of the system, due to faulty or improper design, defective materials, poor workmanship, defective manufacture and fabrication, the contractor shall replace every such defective part and re-deliver new ones complying with the requirements of this specification, at no extra cost to Jaramogi Oginga Odinga University.

7.7. Training

7.7.1. The Contractor shall provide necessary training to Jaramogi Oginga Odinga University personnel to obtain sufficient theoretical and practical knowledge for operation, maintenance and administration of the PABX and its associated facilities.

7.7.2. Training shall be given to Jaramogi Oginga Odinga University technicians and operator console operators who will participate in the operation, maintenance and administration of the installed equipment and shall consist of two parts; classroom training and on-the-job training. Prior to training the contractor shall submit a training syllabus to Jaramogi Oginga Odinga University for approval.

7.7.3. Classroom training shall be before or during the installation period. The following shall be included in this training:-

- a) Outline of the installed system.
- b) Fault localisation.
- c) Routine maintenance and operation.
- d) System administration including man-machine communication operations.
- e) Fault and statistics recording.

7.7.4. On job training shall aim at giving participants the necessary practical exercises on site

7.7.5. The number of trainees and duration of courses shall be determined by both the contractor and Jaramogi Oginga Odinga University.

7.7.6. The contractor shall furnish to each trainee all textbooks, drawings and lecture materials for the respective training course. All printed and lecture materials shall be in English language.

8. POWER

8.1.1. The contractor shall furnish to each trainee all textbooks, drawings The Contractor shall provide a comprehensive and detailed proposal for the power system for the offered PABX.

8.1.2. The PABX will be expected to work in the absence of commercial power for a period of up to one hour.

9. MAINTENANCE AND ADMINISTRATION

9.1. General

9.1.1. Maintenance staff shall not be required to carry out preventive maintenance and routine testing on the system, except for the standby batteries.

- 9.1.2. The operation of the system shall be monitored by range of continuously run automatic diagnostic functions.
- 9.1.3. On site repairs shall be limited to the replacement of faulty printed circuit cards or assemblies.

9.2. Automatic Diagnostic Function

- 9.2.1. The automatic diagnostics shall include tests on:
- a) *Speeches paths*
 - b) *Signalling paths*
 - c) *Supervisory tones*
 - d) *Receivers/Registers*
 - e) *Dial Pulse Generating equipment*
 - f) *Memories*
 - g) *MF tone generators*
 - h) *Power supplies*
- 9.2.2. The automatic diagnostic will normally be continuously running but shall be suspended when the processor loading exceeds 60 per cent.
- 9.2.3. Faulty items or speech paths shall be automatically busied out of service. To ensure that malfunctioning of the fault detection circuits does not cause a shut down of the system, not more than 50% of any group of equipment or of the speech paths shall be taken out of service. Should this happen, a major alarm shall be indicated.

9.3. Alarms

- 9.3.1. Malfunctions shall be indicated to operating and maintenance staff by alarms appearing on the panels in the equipment cabinet and operator consoles.
- 9.3.2. A major alarm shall indicate that a fault has occurred resulting in a system failure, and that the PABX is operating on standby or in the Emergency Transfer of Exchange lines mode.

An audible signal shall accompany visual alarms.

Alarms shall be categorised as follows:-

- a) Major
 - b) Minor Alarm
 - c) System on reserve power supply
- 9.3.3. A minor alarm shall indicate that a fault has been detected which is insufficiently serious to cause a system failure.

9.4. Fault Location

- 9.4.1. By the use of simple, built-in aids such as cabinet, shelf, card alarms or indicators, and by following clearly defined test procedures a maintenance engineer shall be able to locate a fault down to a printed circuit board level.
- 9.4.2. The maintenance engineer shall be able to select speech paths, trunks, receivers, registers etc., for test or monitoring purposes with the PABX operating normally.

9.4.3. It is expected that in the majority of cases a fault condition can be remedied by the change of a circuit board or assembly. In cases where such action is ineffective it shall be possible to apply additional diagnostic procedures using portable test equipment.

9.4.4. As an aid to fault location maximum possible use shall be made of LED's on circuit boards and maintenance panels etc., to indicate the status of a circuit and the location of faulty cards.

9.5. *Spares*

9.5.1. The Contractor shall guarantee the supply of spare parts for a period of at least 15 years following the supply of the PABX system.

9.5.2. The Contractor shall provide recommendations for determining the number of spare printed circuit boards assemblies and consumable spares to be held on site. In addition the Contractor shall provide a priced schedule of spares containing the qualities of spare parts recommended by the manufacturer for correct maintenance of PABX for the first two (2) year.

9.6. *Test Equipment*

9.6.1. The equipment shall, as much as possible, operate on the basis of Built-In Test Equipment (BITE). If any additional test equipment will be necessary to augment the built-in facilities available on the PABX, these will be also quoted for by the supplier..

9.7. *Tools*

Contractors shall provide details and prices of tools and their purposes required by maintenance engineers.

9.8. *Programming*

9.8.1. The methods adopted for programming the system for the initial installation and subsequent re-arrangement and/or additions shall be as simple as possible and suitable for use by non-specialist staff.

9.8.2. Programming shall be secure against interference by unauthorised persons. Contractors shall state the measures employed to achieve this security.

9.8.3. It shall be possible to perform a system dump-load to and from an external storage device. Contractors shall provide information on a suitable device for such use.

9.8.4. It shall be possible to program the system from an external device such as teletype, maintenance test panel, and (to a limited extent) from an extension user's telephone instrument.

9.8.5. Contractors shall provide a table listing the programming instructions/commands that may be applied.

9.8.6. It shall be possible to identify the programme (generic, issue etc) provided by a key-activated display on the equipment panel.

9.8.7. Contractors shall provide a priced schedule of the complete programming equipment.

9.9. *Traffic Recording*

9.9.1. Facilities shall be provided for measuring the PABX traffic. The data obtained from the measurements shall be sufficient to enable a check to be made on the adequacy of equipment provisioning and also to observe whether effective use is being made of the features available in the system.

9.9.2. Two types of records shall be provided:-

- a) Call count – the number of times a device or a feature is taken into use.
- b) Occupancy – the duration for which a circuit is in use.

9.9.3. The data shall be printed on hard copy in a format that will allow immediate interpretation of the information. It is desirable that '*Occupancy counts*' be converted into either CCS or Erlangs before output.

9.9.4. It shall be possible to select any of the following methods for obtaining traffic data:-

- a) Automatic modem. The system shall be capable of providing records automatically at pre-determined intervals.
- b) On a local printer on request from the test line/test set.

9.10. Peripheral Devices

Connections between the PABX and external peripheral devices shall be via a standard ITU-T V24 interface.

9.11. Remote Maintenance and Administration

9.11.1. It shall be possible to access satellite PABX's from the HQ PABX system in Waiyaki Way for the purpose of:-

- a) Interrogating the satellite PABX's and obtaining data for maintenance purposes and busying out faulty equipment.
- b) Programming the satellite PABX's.

9.11.2. It shall be possible for communication between the main PABX programming equipment and the remote satellite PABX's to be established via the public switched telephone network.

9.11.3. The Remote test/programming system shall be secure against access by unauthorised persons.

10. TELEPHONE SETS

10.1. General

10.1.1. The Bidder shall offer to supply the following types and quantities of telephone sets:-

- i). Ordinary push button telephone sets – quantity 400
- ii). Feature phone telephone sets

10.1.2. The telephone sets shall be type-approved by CA.

10.1.3. Both types of telephones shall be capable of both DP and DTMF signalling.

10.1.4. The supplied telephones shall have the capability to be wall-mounted when desired.

10.1.5. The ordinary telephone sets shall comply with CA specifications. Complete and detailed information on characteristics and all aspects of the offered sets shall be provided to Jaramogi Oginga Odinga University.

10.1.6. Each telephone set shall be marked to indicate that it belongs to Jaramogi Oginga Odinga University. Details concerning the marks shall be provided by Jaramogi Oginga Odinga University to the contractor.

- 10.1.7. The Bidder shall state the available colours of the proposed telephone sets.
- 10.1.8. The Bidder shall state if spare parts or tools shall be needed for maintenance. He shall specify recommended types and quantities of the same.

10.2. Feature Phones

- 10.2.1. The offered feature phones shall include the following facilities:-
- i. An LED or LCD display unit
 - ii. The display unit able to indicate current time and date, dialled numbers, call duration.
 - iii. Speed dialling
 - iv. Hands free operation
 - v. Telephone number storage and auto-dialling
 - vi. Capability to connect to a data port.
- 10.2.2. The feature phones shall be modular with handset, handset cord and base unit all interconnected by means of play.

11. DOCUMENTATION AND SOFTWARE

11.1. Documentation

- 11.1.1. The Contractor shall supply one set of documentation on the PABX and other facilities written in English covering the following information:-
- i. Technical description including circuit diagrams.
 - ii. Traffic calculations and dimensioning data.
 - iii. Detailed description of features.
 - iv. Identification of components for ordering purposes.
 - v. Installation instructions.
 - vi. Programming instructions.
 - vii. Test procedures
 - viii. Maintenance data including procedures for location of faults.
 - ix. Administration of the system
 - x. Extension users hand books.
 - xi. Operating instructions for the operator consoles.
- 11.1.2. The documentation shall be sufficiently detailed and comprehensive to enable a competent technician to install, programme, commission and maintain the system. Maximum use should be made of flow charts to describe step by step the procedures to be followed during installation, testing and maintenance operations.

11.2. Software

- 11.2.1. The Bidder shall include in his proposal the price quotation for system software, and software for the itemised charging, as well as telephone management system software.
- 11.2.2. The Bidder shall also include the price quotation for the software necessary for additional services but not required at the initial stage, if any.
- 11.2.3. The Contractor shall provide the software of the PABX and all other related facilities. The software shall include all the necessary programmes and data required for a complete and satisfactory operation, maintenance and administration of the proposed system.
- 11.2.4. The Contractor shall provide appropriate capability for back-up of all operational and system data.

- 11.2.5. The software shall be licensed to Jaramogi Oginga Odinga University and shall include updates from time to time.
- 11.2.6. The Contractor shall provide the software support upon request for at least fifteen (15) years after the date of issue of the Acceptance Certificate.

12. QUOTATIONS AND DELIVERY

- 12.1. The Contractor shall provide price quotations for all equipment and facilities contained in this document. The quotations for different sub-systems or facilities like power system, charging system (where separate from the PABX), subscriber telephone sets, training etc. shall be clearly itemised.
- 12.2. The Contractor shall indicate the terms of payment in conformity with the Conditions of Contract.

13. COMPLIANCE

- 13.1. The Contractor shall provide a signed "*Statement of Compliance*" with this specification, clause by clause and shall provide a cross reference to the relevant section of the manufacturer's literature for each clause.
- 13.2. Where the tendered system cannot meet any clause in this specification, the Contractor shall indicate whether a similar feature or characteristic is available. Details of such alternatives or deviations shall be given in a separate signed statement "*Particulars of Deviation from the Specifications*".

PART D:
TECHNICAL SPECIFICATIONS FOR
AUDIO VISUAL EQUIPMENT

PART D: TECHNICAL SPECIFICATIONS FOR AUDIO VISUAL EQUIPMENT

A) Multimedia LCD Projectors

- a. should be at least 9600 Lumens of brightness, SXGA (1024 x 768) resolution, Network Ready Projector
 - ~ At least 9600 Lumens
 - ~ Minimum XGA + (1024 x 768) NATIVE Resolution
 - ~ Network Capable RJ45
 - ~ Multiple interface – 2x RGB, 5x BNC & HDMI, RS232 port, Network RJ45, Video-in, S-video and composite video
 - ~ 3LCD Technology
 - ~ Flexible installation-ceiling; 90 degrees upwards/downward tilts
 - ~ Dynamic detail enhancer – generates high quality images of outstanding clarity.
 - ~ Digital keystone adjustment
 - ~ Easy lamp replacement
 - ~ Whisper quiet operation
 - ~ Horizontal/vertical picture shift
 - ~ Include Anti Theft Projector Ceiling Mount
 - ~ Provide 50m VGA Cable with floor box

B) Projection Screen

- ~ Electric type – Motor Driven
- ~ Wall/Ceiling mountable
- ~ Size 7.2m x 5.4m viewing angle
- ~ Matte white surface
- ~ Black border
- ~ Wall mount switch
- ~ Optional wireless remote control

C) Mixer Amplifier

- ~ At least 4 microphone inputs
- ~ 600w Amplifier
- ~ Individual Volume Controls for each mic/aux input
- ~ Master volume control
- ~ Table top type
- ~ Power surge – AC mains 50/60HZ

- ~ Frequency response – 50-20,000 Hz
- ~ 5 input – 4XLR/Jack input
- ~ 4RCA Pinjack – record speaker- 100V line

D) Loudspeakers

- ~ Ceiling/Wall recessed
- ~ 100w Rated input
- ~ Impedance – 100v//70 Volt Line
- ~ Sensitivity – 90db
- ~ Vented 2 way bass reflex type
- ~ CD-Horn for large directivity angle of $60^0 \times 40^0$
- ~ Durable low foam polypropylene enclosure with superb acoustics
- ~ Overload protection circuitry
- ~ Parallel input push in terminals with ¼” phone jacks

E) Wireless Microphones – Lapel/Handheld

- ~ UHF type
- ~ Electric Condenser unit – condenser
- ~ Frequency range 690 – 750 MHz UHF
- ~ 16ch selectable channels
- ~ Battery type – AA

F) Digital Modular Mixer

Fully modular digital mixer featuring a 12 input; 8bus, 8 output ch configuration (12 x 8 matrix) with easy operation that can be expanded as applications require

- ~ all in one design
- ~ build in feedback suppressor
- ~ automatic mixing function
- ~ sound processing
- ~ ease of Control from front panel
- ~ LCD Display
- ~ Digital buttons for control/operation

G) Power Amplifier

- ~ 2ch stereo Power Amplifier – rack mountable
- ~ 2 x 600w Rated input
- ~ Built in protection circuitry
- ~ Selectable stereo, bridge or parallel operation
- ~ Forced air – cooling system with variable speed
- ~ Rotary volume controls

PART E:
TECHNICAL SPECIFICATIONS
FOR
ACCESS CONTROL SYSTEM

PART E:

TECHNICAL SPECIFICATIONS FOR COMMERCIAL ACCESS CONTROL SYSTEM

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1.0 GENERAL TENDER REQUIREMENTS

- 1.1** The tenderer shall include for the design, cost estimation, supply and commissioning of a complete, integrated access control and alarm point monitoring system, compliant with the technical and performance criteria set out in this document.

The system shall broadly comprise the following:

- a) A central administration computer (PC) for the system administration, addition and editing of tokens/cards, report generation and acknowledgement of system alarms.
 - b) Door controllers and door functions.
 - c) Readers, door monitoring contacts and exit switches.
 - d) Alarm control functions on fire doors and other auxiliary alarm points.
- 1.2** The tenderer shall supply a complete and functionally working system including all control equipment, hardware and software, cabling and ancillary services. The tenderer is to make himself familiar with all matters related to the system, its requirements and installation.
- 1.3** The tenderer shall seek clarification of any relevant matters (insert a suitable contact name and telephone number).
- 1.4** After the tender has been awarded there shall be no price variation without prior agreement.
- 1.5** A complete clause by clause compliance response is required.
- 1.6** The systems control software and hardware shall be designed, manufactured and originate from reputable manufacturers, who shall comply with BS EN ISO 9002 or such equivalent standard in the country of origin.
- 1.7** The tenderer shall demonstrate his competence with the equipment he is tendering by either:

The tenderer shall obtain a letter signed by a company director or head of training from the original equipment manufacturer. The letter must state the name of tendering company and a statement to the effect that the tenderer is of sufficient competence to install the tendered equipment.

The tenderer shall provide proof in the form of training certificates from the original equipment manufacturer. Certificates will contain named individuals and the course applicable to the equipment being tendered. The named individuals must be employed by the tenderer and play an active part in the installation of equipment.

2.0. GENERAL SYSTEM FUNCTIONALITY

2.1 Electronic Key

- 1.0 The access control system shall be based on a non-contact proximity reader technology. The method of operation shall be based on electro-magnetic induction.
- 1.1 Each electronic key or card (token) shall have a unique pre-programmed code. The code shall be set at the time of manufacture and must not be capable of being reproduced. Programmable tokens are not acceptable. The token shall have a code that produces no less than sixty-eight (68) thousand million different possible combinations.
- 1.2 Any token can be enrolled on to any system in the world. Tokens that contain a facility or site code are not acceptable. Existing tokens must be able to be enrolled on to the system.
- 1.3 The token shall be capable of being attached to a key ring and shall be read when held amongst mechanical metal keys. The token shall carry a minimum of 15 years manufacturer's guarantee against electronic failure.
- 1.4 The token shall be a credit card sized flat card and have a thickness of no greater than 1.3 mm. The card shall have an option of a high coercivity magnetic stripe and shall allow the printing of a photo ID directly on to the surface of the card. The card shall carry a lifetime manufacturer's guarantee against electronic failure.
- 1.5 The token shall not contain a battery.
- 1.6 If the system uses "Master" or "Editor" then these tokens shall not be different from any of the other tokens. Any token shall be able to be selected and used as a Master or Editor token. If a Master or Editor token is lost then the system must accept a new master or editor from any of the existing tokens.

3.0 READER AND READER HOUSING

3.1 The readers shall be designed for general purpose use and be suitable for interior or exterior installation. They shall be slim units with a pleasing appearance that blend in with most installation requirements. Ideally the units shall be made of flame retardant plastic. All readers will carry a lifetime warranty against electronic failure.

3.2 Two sizes of standard reader are required:

a) Surface mounted to fit a standard UK single gang electrical back box with 60 mm screw spacing. The reader shall have dimensions no greater than:

86 mm (H) x 86 mm (W) x 15 mm (D)

b) A slimline reader to be mounted on door mullions is also required. It shall have dimensions no greater than the following:

130 mm (H) x 40 mm (W) x 15 mm (D)

3.3 The readers shall be capable of internal or external mounting without additional environmental protection and shall operate from -20 °C to +50 °C. All reader types must be of a fully potted assembly and capable of being mounted on exterior walls without additional weather protection.

3.4 All readers shall be capable of being mounted on a metallic surface or behind non-metallic materials without any adverse effect on the ability to read the token.

3.5 Reading of the token shall be 100% reliable with no misreads. There shall never be a need to present the token to the reader a second time.

3.6 The reader cabling shall use multi-stranded unscreened six core cable and the reader shall be capable of operating up to 1,000 metres from its control unit without the need of an additional power supply. Cable from the reader shall be permitted to run next to mains carrying conductors without adverse effect.

3.7 The reader shall incorporate tamper detection to signal that the connecting wires have been broken. This shall be achieved without the use of a tamper switch.

3.8 The reader shall incorporate an LED(s). The LED(s) will operate in the following manner:

- LED is constant red when door is closed and secure.
- LED turns green on successful access and remains green until the door lock is re-secured.
- LED(s) flash when an unsuccessful access attempt has been made.

and/or

Vandal Resistant Readers

3.9 Vandal resistant readers are to be manufactured from brushed finished stainless steel. The stainless steel shall be of no less than 16 gauge (1.6 mm) and to BS 1449 grade 304.

3.10 The reader shall be fixed with a key symbol on its front and its dimensions shall be no greater than the following:

100 mm (H) x 100 mm (W) x 16 mm (D)

3.11 It shall be secured with non-standard tamper proof screws.

and/or

Vandal Resistant Brass Readers

3.12 Vandal resistant readers are to be manufactured from lacquered brushed finished brass. The brass shall be of no less than 12 gauge (2 mm) and of CZ 108 half hardened to BS 2870.

3.13 The reader shall be fixed with a key symbol on its front and its dimensions shall be no greater than the following:

100 mm (H) x 100 mm (W) x 16 mm (D)

3.14 It shall be secured with non-standard tamper proof screws.

and/or

Token and PIN Reader

3.15 For more sensitive areas a higher security level may be required. In these areas a token and personal identification number (PIN) reader shall be used. The mode of operation shall be such that a token only can be used or token and PIN. This shall be automatic and programmable from the reader's door controller or the administration PC.

3.16 The reader shall be finished in stainless steel surround and shall be flush mounted with the following maximum dimensions:

144 mm (H) x 100 mm (W) x 35 mm (D) and protrude no more than 5 mm from flush.

OR

3.17 The reader shall be finished in lacquered brushed finished brass surround and shall be flush mounted with the following maximum dimensions:

144 mm (H) x 100 mm (W) x 35 mm (D) and protrude no more than 5 mm from flush.

OR

3.18 The reader shall be finished in stainless steel and shall be surface mounted with the following maximum dimensions:

200 mm (H) x 100 mm (W) x 30 mm (D)

OR

3.19 The reader shall be finished in lacquered brushed finished brass and shall be surface mounted with the following maximum dimensions:

200 mm (H) x 100 mm (W) x 30 mm (D)

4.0 DOOR CONTROLLERS

- 4.1** The access control system must be of high integrity and therefore must employ door controllers with fully distributed intelligence with no degraded mode of operation. There shall be no loss of functionality in the event of communications interruption. The relationship of door contact inputs, auxiliary inputs and system alarms to relay outputs must be maintained at all times. Systems that have a degraded mode of access in the event of communications interruption, especially any that will allow access by site code only will not be accepted.

OR

- 4.2** The door controller shall store up to 1000 transactions and have the ability to be connected to a modem via a built in serial port. The door controller shall have the ability to have keys added and deleted by a remote PC over the public telephone network.
- 4.3** The door controller shall unlock the controlled door within 0.3 seconds from the completion of a valid access attempt. It should be possible to lengthen others, or shorten, this time duration through the
- 4.4** The door controller shall report the following to the PC administration system:

Access Authorised
No Access - Level
 - Locked Out
 - Time
 - Unknown ID
 - Visit Time

No Entry - Passback
No Exit - Passback
Entry Authorised (for anti-pass back doors)
Exit Authorised (for anti-pass back doors)

PIN Reader Duress
Incorrect PIN

Exit Out of Hours

Repeated Key Use
Request For Exit
Request For Entry

- 4.5** The reader technology offered shall be proximity. The principle of operation shall be electro-magnetic induction. The door controller must also support other reading technologies.
- 4.6** The door controller shall have an option of an in-built user interface comprising of a keyboard, display and administration reader. The keyboard shall have at least 40 individual keys consisting of the ten numeric and 26 alphabetic characters. The display shall be of at least 16 characters and shall be clearly visible in darkness.
- 4.7** The user interface shall display the state of any attached auxiliary inputs and any alarms that occur within the door controller. If communications are interrupted to the controller then an audible sounder will sound and a short English language description of the alarm displayed. The sounder may be silenced by a nominated editor or master token being presented to its administration reader.

- 4.8** All events must be DATE and TIME stamped at the door controller as they occur.
- 4.9** The system must maintain a system clock and all door controllers must be automatically synchronised for DATE and TIME at least once a day.
- 4.10** To ensure the integrity of the system if power to the door controller is lost (both mains supply and back-up battery) then the controller's data must be maintained in non-volatile memory. If communications are interrupted before power failure then all events must be maintained.
- 4.11** The door controller must have a minimum of a 2,500 event transaction log that stamps the time and date at source and not when received by the central controller.
- 4.12** To increase reliability, the lock outputs shall be a solid state device and not a relay. The solid state device must have a selectable output, capable of sourcing power to its attached lock at 12V DC at 1 Amp or 24V at 0.5 Amps continuous.
- 4.13** The solid state lock output must be protected against short circuit and overload.
- 4.14** The door controller shall control no more than eight doors. When anti-pass back is implemented the controller shall control no more than two doors.
- 4.15** Anti-pass back shall be implemented within the controller. Pass back between the two doors shall not be affected by communication interruptions.
- 4.16** Timed anti-pass back shall be available so that a token holder violating the pass back rules shall be refused access for a minimum of ten minutes after his next attempt to gain access.
- 4.17** When turnstiles are used the door controller set-up shall be selectable so that the IN reader can operate one lock output and the OUT reader another lock output and yet be reported as the same turnstile. Alternatively the door controller set-up shall be selectable so that both readers can operate the same lock output.
- 4.18** The door controller shall include an integral power supply. This power supply shall have sufficient capability to deliver power to the controller and up to four readers. It shall also provide power for up to four locks continuously rated at 12V DC at 1 Amp or 24V DC at 0.5 Amps. The power supply shall in addition provide sufficient charge for two 6.0 Amp hour standby back-up batteries.
- 4.19** The controller shall monitor its readers for cable tamper.
- 4.20** The door controller shall be networked on to a data bus whose maximum length is not less than one thousand metres. The data bus shall be a single unscreened cable of no more than eight multi-stranded conductors.
- 4.21** The door controller shall have a card holder data base of at least 10,000 token holders on systems of up to 32 doors and at least 18,000 token holders on larger systems.
- 4.22** Visitor tokens are required. These shall be the same as personnel tokens but be allocated a start and finish date for their validity on the system.
- 4.23** The door controller shall have a minimum of four auxiliary output relays. These relays shall be programmed via the PC administration system to respond to auxiliary inputs or door controller alarms. Each relay may be operated according to a time profile.

- 4.24** Each of the door controller's four doors shall have a door contact input. This input shall be used to indicate the following:

Unauthorised Access
Door Left Open
Door Closed

The door contact shall also indicate to the system when the door has been opened and closed after an authorised access or request to exit operation. Closing the door shall cancel any unused lock release time.

If anti-pass back is being used on a door, then an authorised access transaction is not reported until the door has actually opened.

- 4.25** The door controller shall be mounted in a secure metal cabinet of sufficient size to enable easy cable handling and room for at least two 6.0 Amp hour back-up batteries. It shall have dimensions no greater than:

450 mm (H) x 450 mm (W) x 100 mm (D)

- 4.26** The door controller shall be programmable so that any controller can be configured to be a network master controller, a network slave controller, a dial-up remote master, or a stand alone door controller. The stand alone door controller shall have a serial RS232 printer output to print transactions and its database set-up. It shall also have a 2,500 event log with time and date stamping with individual token reporting.

- 4.27** The master door controller shall have the ability to be assigned an IP address so that it may function on a TCP/IP network as part of a LAN or WAN.

- 4.28** The door controllers shall have the capacity of being assigned one token as a master and at least 32 other tokens as editor tokens. The editor tokens can have restrictions placed on what functions they can carry out on the door controllers.

4.29 Remote sites with dial-up connection to central network controller

The door controllers shall if required have the ability of being connected to the system by a dial-up connection over public switch telephone network (PSTN) lines. The central network controller shall dial-up remote sites at least twice a day to download any changes to the system set-up and to receive all event information from the door controllers. You should also be able to utilise an X25 network using X28 PADs.

4.30 Alarm dial-back on remote dial-up sites

Sites that are connected by dial-up modem shall have the ability to call the central network controller at any time in the event of an alarm occurring at the remote site.

5.0 ALARM MONITORING

- 5.1** Alarm Event Managers (AEMs) shall be supported and shall be attached to the door controllers from which they derive their power. There shall be at least one AEM per reader channel. The AEM shall manage all auxiliary alarms and auxiliary relay outputs.
- 5.2** The AEM shall have a minimum of eight, four state inputs and eight switchable relay outputs. The relay contacts shall have a rating of no less than 2 Amps at 30 VDC or 0.4 Amps at 125 VAC. The inputs shall be selectable to be normally open or normally closed. The AEM must distinguish four states for each input. The input states are: Normal, Active, Open circuit and Short circuit.
- 5.3** Any of the door controllers 36 possible relay outputs (four AEMs and four onboard relays) can be activated by any event within the door controller.
- 5.4** Each relay output shall be programmed so that it can be operated by at least four separate events.
- 5.5** The AEM shall be fitted with a test button and an LED display so the states of each of the eight inputs can be displayed. The LED display shall indicate if each input is normal, active, short or open circuit. It shall also display the state of the case and reader tampers.
- 5.6** Each input shall have a name field of 45 characters and a description of each input that shall be no less than 300 characters long.
- 5.7** Alarm Inputs shall be able to be grouped according to area and will be able to be manually disabled via the central administration system, or alarms can be automatically activated or de-activated by the use of a time profile.
- 5.8** Alarm Inputs shall be able to be grouped according to area and can be enabled and disabled
- 5.9** An input shall also be able to be configured as a 24 hour input and will always be active.
- 5.10** Each input must have the ability of being configured as normally open or normally closed. Inputs will usually have four states, but may also be required to have two state inputs. Further alarm functions shall include "Acknowledge Required" and "Relay Follows Input". A graphic bit map may also be attached to each input and displayed when the alarm is being accepted.
- 5.11** To prevent the system being flooded by erroneous alarms a re-arm count shall be available. This shall be programmable so that from one to five alarm activation's within a time period will be transmitted as an alarm but and any alarm activation's after that will be ignored and the input described as being in an alarm state. The re-arm count will be reset once the alarm input is dis-armed and re-armed either manually or automatically by a time profile.
- 5.12** The AEM shall be housed in a 1.2 mm mild steel enclosure painted with an epoxy coating complete will tamper switch. It shall have dimensions no greater than 184 mm x 148 mm x 38 mm.
- 5.13** The AEM shall have a maximum cable distance from its door controller of no less than 500 metres.

6.0 ACCESS CONTROL / ALARM INTERFACE

- 6.1** Alarm interface managers (AIMs) shall be attached to the door controller and alarm panel. There shall be at least one AIM per two reader channels.
- 6.2** The AIM shall allow assigned security tokens to arm or disarm the linked alarm panel.
- 6.3** Ordinary keyholders shall be able to gain entry at the main entrance to the premises once the security keyholder has disarmed the alarm.
- 6.4** There shall be the facility to disable perimeter doors when the panel is armed by the use of reader inhibitor modules.

7.0 CENTRAL NETWORK CONTROLLER

- 7.1** The Central Network Controller (CNC) shall be located with the PC Administration system. It shall manage all communications to the door controllers. Connection to the local door controllers shall be via a six wire data bus. Remote sites shall use dial-up modems via the PSTN. The CNC shall manage all local and dial-up communications independently of the PC Administration system.
- 7.2** The CNC shall communicate with up to 128 sites. One of the sites shall be local and of at least 128 doors. At least 32 other sites shall be of at least 32 doors. The remaining sites shall be of at least 4 doors. The CNC shall have at least three communications ports each of which maybe connected to a dial-up modem.
- 7.3** The CNC shall have a buffer of at least 10,000 events. It shall annunciate all alarms if the PC is off-line. Annunciation of the alarms will be via a scrolling display of at least 16 characters. It shall also have an audible warning alarm.
- 7.4** The time clocks of all controllers on the system, whether local or remote, shall be synchronised by the central network controller automatically at least once a day or manually by an authorised operator as required.
- 7.5** It shall be possible to connect up to twenty CNCs to the system. The system shall have the possibility of expanding to at least 2560 sites with at least 30,640 doors.
- 7.6** It shall be possible to connect door controllers directly via serial RS232 rather than with the use of dial-up PSTN lines. In this case the system shall have a capacity of at least 4,480 doors.
- 7.7** As resilience and integrity of the system are of paramount importance the system shall have a distributed topography so that not more than four CNCs or master door controllers are connected to any work station or file server of the PC administration system. If the PC network fails then CNCs or masters connected to its associated work station will continue to function, gather transactions and announce alarms.

8.0 PC ADMINISTRATION SYSTEM

- 8.1** The administration system shall be based on PC's running under Windows NT4.0, Microsoft® Windows™ Version 3.11 or Windows 95 operating systems. In general the system shall be simple to use and to operate.
- 8.2** The PC shall not be solely dedicated to running the access control software. It must be possible to run other Windows programs such as word-processing or database programs on the PC at the same time. However any alarms that occur on the access control system must be presented over those other applications without delay. Other programs that are running will be put into the background, but data and information must not be lost.

8.3 The PC shall meet the following specification:

- PC Pentium 800 Mhz processor, 128 Mb RAM, 4.0 Gb disk drive, 3.5 inch disk drive, CD Drive, PC sound card and speakers, Colour SuperVGA (800x600) display, with 256 colours, 32,000 colours when used with Photo, parallel, mouse and two serial ports, Windows 3.11, Windows 95 or Windows NT 4.0.
- One year on-site maintenance agreement for the PC.

8.4 The system shall archive all events and transactions to the PC hard disk. The hard disk shall store no less than 18,000 and up to 40,000 transactions per mega byte of hard disk.

8.5 The software shall be simple to upgrade and easy to expand from a small single site to a large multi-site, multi-PC system.

8.6 Multiple Workstations

The system shall have the capacity for at least 50 workstations including the main administration PC. These PC's shall be connected by a network.

8.7 System Divisions

The system may be split into 'divisions'. A division shall be a set of one or more sites. Each division will have its own personnel records, token and access information which will be stored in the door controllers on the site. The system shall have between 1 and 128 divisions, to administer independent installations from a central point.

Using divisions will simplify the administration of systems with a large number of sites and token holders. Token holders shall be able to exist in more than one division with the same ID device.

The administrator shall be able to restrict system operators as to which divisions they can edit and view database information. The system shall allow each PC on the system to be configured so as to only display transactions and alarms from designated divisions.

8.8 Detailed on-line Help

The system offered must have an on-line help facility. This shall provide details of all functions that the system can perform. It is considered imperative that the Help facility is context sensitive in that the Help menu or information given is relevant to the task the operator is performing.

8.9 Editing and Administration reader

Each PC or workstation on the system shall have an administration reader. This shall be provided either as part of the CNC or a PC interface kit. Operators must use their proximity token to log onto the system and to accept alarms. The use of an operator password may also be required. The administration reader shall also be used to enrol new tokens into the system and to identify tokens that are already in the system database.

8.10 Operator Privileges

Operators of the PC administration system must be uniquely identifiable. There shall be a minimum of 128 operators. Each operator shall have independent system privileges. The system shall record which operator is currently logged on. When system alarms require acceptance, regardless of which operator is currently logged on, the system shall ask for the operator's name and password. If authorised the operator should present their token to the administration reader to accept the alarm.

8.11 Personnel Database

The personnel database shall have at least 10,000 token holder records and on larger system configurations at least 18,000 token holder records per division. There shall be a capacity of at least 750 visitor records per division. There shall be up to 128 separate divisions on the system.

8.12 Import and Export

The system shall have a facility for importing or exporting the personnel database. The import and export shall be achieved via an ASCII text file with field separators.

8.13 Card Trace

The system shall have a facility to tag or track the use of a token. This facility shall be able to cause an alarm on PC. Access privileges of the token holder will remain the same and the token holder will be unaware that they are being traced.

8.14 Extra information fields

The personnel database shall have at least twenty extra information fields. The titles of these fields must be user definable. Each information field must be at least 120 characters in length. Each division shall have its own unique extra information fields.

8.15 Departments and Work groups

When adding new token holders it shall be possible to assign a Department and a Work Group to the token holder. Departments restrict the access groups that can be selected for each token holder record. There shall be at least 128 Departments per division. Work Groups are a subset of Departments and further restrict the number for access groups that can be chosen. There shall be at least 128 Work Groups per division. It shall also be possible to generate reports by Department and Work Group.

8.16 ASCII transaction file

The PC security administration system shall provide the facility of a data file that contains all personnel access transactions in ASCII data format. This is separate and additional to the system event log. The format of each record shall consist of personnel identification number, date (DD/MM/YY), door number, time (HH:MM), site number and transaction type. The file should contain at least 15,000 transactions.

8.17 Start and End Dates

It is required that all ID devices may have the option of a start and end of validity date.

8.18 Alarm Monitoring and Graphics maps

An alarm manager program shall allow the operator to see any alarms that occur easily and clearly. A text message shall be attached to each alarm and shall tell the operator what action should be taken for each individual alarm.

It must be possible to attach a graphic illustration in the form of a bitmap to specific alarms. There shall be the optional facility to record sounds, including spoken messages, which can be linked to specific alarm events.

The alarm manager program shall keep track of all alarm events, which operator acknowledged them and what action was taken.

8.19 Real-time transaction window and real-time printer

The system shall have a window where it is possible to display all transactions. It must also be possible to route transactions to a real-time printer. The types of transactions that are displayed or printed may change throughout the day and on different days of the week. For example, some transactions will be displayed only during normal working hours. Outside normal working hours those same transactions may be required to be displayed and printed. It shall be possible to fix the transaction window so that it is always "on top" of all other windows.

8.20 Time Profiles

The system shall have a minimum of 128 time profiles per division. Each time profile shall consist of at least three time periods. Each time period shall have a start time and end time and the days of the week it will operate. This shall include system holidays.

8.21 Access Groups

The system shall have at least 128 access groups per site and shall have at least 128 divisional access groups per division. An access group shall consist of two lists of access areas each of which may have a time profile for when access is authorised to those areas. An access area is an area of common security, i.e. a door or number of doors that lead in to a physical area.

There shall be an extra access facility to provide for over 128 access groups in each site by assigning individuals their own access privileges.

8.22 Transaction Reporting

The system shall have the capability of extensive transaction searching and reporting. Reports must be able to be generated by, but not limited to the following:

- Area
- Doors
- Department
- Access group
- Transaction type
- Token holder

- Start of period date and time
- End of period date and time.

8.23 There shall be the facility to report on tokens that have not been used over a specified period of time.

8.24 There shall be the facility to produce a "Presence" report. This report shall provide information on which cardholders are currently on site.

9.0 OPTIONAL MODULES

- 9.1** The system shall have an attendance report facility. This report shall be flexible and provide the total time a selected cardholder or cardholders have been on a site over a selected period.

9.2 DDE Transaction Routing

The system shall have Dynamic Data Exchange (DDE) output that conforms to Microsoft® Windows™ standards for DDE linking. It shall be possible to route system transactions and events to the DDE output. The system shall be able to change which types of transactions are sent to the DDE according to time of day and week.

9.3 Elevator Control

The system shall allow different combinations of relay outputs on Alarm Event Managers to be activated, dependant on the access privileges of individual token holders, when token holders use their tokens at a designated reader. An example would be a reader fitted inside a lift car (elevator). When the relay outputs of the Alarm Event Managers are connected to the floor select buttons of the lift controller, token holders may be restricted to which floors they can select dependent on their access group privileges.

9.4 Photo ID

The system shall have an optional facility that allows a token holder's photograph to be captured, stored and displayed with each personnel record. Identification cards shall also be designed and printed from the same menu.

When a token has been presented to a specified reader the recorded image of the token holder shall appear on the screen. The system shall provide the operator with the ability to either allow or deny access if the token is not valid.

9.5 Audit Trail

A facility shall be available that enables specified operators to conduct searches of previous operator changes to the system. This facility shall allow searches between specified dates for changes made by specified operators or all operators. The system shall also be able to search for specified types or all types of change.

9.6 Pager Interface

An optional facility should be available that enables messages detailing the nature and location of alarm events to be sent from the PC administration system via a paging system to designated hand-held pager units.

9.7 Guard Tour

A facility should be available to monitor security guards as they travel around a building.

9.8 Alarm Graphic Interface (AGI)

The facility should be available that enables alarm points to be deposited as icons onto a bit map of a building. Icons must change state as alarms are received onto the system.

9.9 Alarm Prioritisation

The facility should be available that enables alarms to be prioritised.

10.0 CABLING

10.1 All cables connecting slave door controllers, including to the master door controller must utilise multi-stranded unscreened six or eight core cable. The use of screened cable on door controller clusters and specialist cables is not acceptable. For door controller network cable runs of up to 500 metres, 0.22 mm² multi-stranded six core cable (standard intruder alarm cable) is to be used.

10.2 Master door controllers shall have the ability to use existing CAT 5 structured cabling so that TCP/IP communications may be used.

10.3 For the connection of readers to door controllers then the following sized cables shall be used:

For distances up to 250 metres	-	0.22 mm ²
up to 500 metres	-	0.5 mm ²
up to 1000 metres	-	1.0 mm ²

11.0 WARRANTIES

11.1 The access control equipment, including door controllers, readers, central network controllers shall be warranted by the manufacturer against electronic failure for at least five years. The access control tokens shall carry a lifetime warranted against electronic failure. ("Lifetime" means that if the token electronics should fail at any time it will always be replaced).

11.2 It is accepted that the security system will require preventative maintenance.

12.0 COMMISSIONING AND TRAINING

12.1 The system shall be programmed with the information supplied. The system must be fully working with all system parameters and token holder's information. It is the tenderer's responsibility to ensure that all the necessary information is obtained before commissioning the system.

12.2 At least two and up to four members of staff will be nominated as operators of the system. These operators must receive sufficient training on the operation and configuration of the system to enable these operators to train others. The training shall be conducted by the manufacturer's own training staff or by other certified training staff.

12.3 A copy of the final database of the PC administration system, held on 3.5" floppy disks, shall be included at the final hand over of the system.

12.4 The tenderer shall supply detailed "as installed" drawings of the entire system.

PART F

**PARTICULAR AND TECHNICAL
SPECIFICATIONS OF CCTV
INSTALLATIONS**

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PARTICULAR SPECIFICATIONS OF MATERIALS AND WORKS

1.1 Location of site

The location of the proposed works is in **Bondo, Siaya County**

1.2 Extent of the Works

The works to be carried out include the supply, delivery, installation, testing, commissioning and leaving in servicing condition the Closed Circuit TV network systems in the proposed works at the **Jaramogi Oginga Odinga University of Science and Technology** as described in this specification. The works shall include, but not limited to the supply and installation of the following:-

- Digital Signal Processing Camera
- Colour TV Monitors
- Colour Digital Multiplexing Video Recorder

1.3 Regulation and Standard

The works shall comply with the provisions of the following as necessary and relevant:

Electric Power Act

Kenya Bureau of Standards (K.E.B.S)

Institution of Electrical Engineers (I.E.E) Wiring Regulations

Current recommendation of CCITT and CCIR

1.4 ELECTRICAL REQUIREMENTS

The equipment to be supplied shall be capable of being operated from 240V AC 50Hz power supply.

1.5 TECHNICAL SPECIFICATIONS FOR CLOSED CIRCUIT COLOUR TELEVISION SYSTEM

1.5.1 Fixed Colour Digital Television Cameras

Fixed type colour television cameras shall be located and installed in selected areas as indicated in **clause 1.5.1.2** of this section. They shall be linked to the Television Monitors and the Control Equipment through CCTV coaxial cables RG59.

The mounting height and position of cameras shall be such that the desired coverage shall be achieved as distinctly as possible.

The digital signal processing (DSP) camera shall be aesthetically styled. The DSP chip will enable advanced video processing and manipulation to be carried out in the camera head. The camera shall be capable of operating at all times, i.e 24 hours a day.

1.5.1.1 Technical Specifications

The works to be carried out include the supply, delivery, installation, testing, commissioning and leaving in servicing condition the Closed Circuit TV network as herein described in this specification. The works shall include, but not limited to the supply and installation of the following:-

- Fixed Color Digital Signal Processing Camera
- Color TV Monitors
- Color Digital Video Recording multiplexer

The Digital Surveillance system shall support the following:-

- Digital based recording system
- Support analogue cameras through video servers adapters
- Recording resolution: 1280 x 1024 pixels for J-PEG, M-PEG and wavelet images.
- Multi-level password protection and logging facilities
- Integrates with access control, burglar control, burglar alarms and fire alarm system
- Image compression for remote web live and playback viewing incase of IP
- Multi display monitors
- Automatic daily archiving to hard drive or optical drive.
- Fully adjustable digital video motion detection with exclusion /inclusion multi regions per camera.
- Efficient video collection, storage and retrieval.
- Advanced and instant search capability
- Digitally signed recordings, with audit trails of all operator actions and system event.
- At least one Terabyte storage space to provide back up and redundancy
- Infra red illuminators in poor lighting conditions
- Able to interface with other systems on the ground
- Support various alarm and subnet options including VSAT, IP, GSM/GPRS and Radio.

1.5.1.2 DAY/NIGHT, WDR, COLOUR MOTORISED CCD PTZ DOME CAMERA –FULLY IP

The **high resolution Camera** shall meet or exceed the following design and performance specifications:-

1. Image Sensor 1/4-inch
2. Scanning System 2:1 interlaced output
3. Effective Pixels PAL – 724 X 582
4. Horizontal Resolution PAL – >550 TVL
5. Lens F1.6 (f=3.6-82.8 mm optical, 23X optical zoom, 10X electronic zoom)
6. Programmable Zoom Speeds 2.9, 4.2, or 5.8 seconds
7. Horizontal Angle of View 54° at 3.6 mm wide zoom – 2.5° at 82.8 mm telephoto zoom
8. Focus Automatic with manual override.
9. Sensitivity at 35 IRE PAL, color: 0.08 lux at 1/1.5 sec shutter speed
B-W: 0.013 lux at 1/1.5 sec shutter speed
B-W: 0.3 lux at 1/50 sec shutter speed
10. Synchronization System Internal/AC line lock phase adjustable via remote control, V-sync

11. White Balance Automatic with manual override
12. Shutter Speed PAL – 1/1.5-1/30,000
13. Iris Control Automatic with manual override
14. Gain Control Automatic/ off
15. Video Output 1 volt peak to peak, 75 ohms
16. Video Signal-to-Noise >50 dB
17. Type of Lighting Menu selection of indoor or outdoor lighting for optimum camera performance
18. Wide Dynamic Range 80X
19. Motion Detection User-definable motion detection settings for each preset scene; can activate auxiliary outputs; three sensitivity levels per zone

1.5.1.3 Dome type Video color camera –FULLY IP

Type:	Varifocal Fixed Dome.
Lens sensor:	1/3"
Signal system:	PAL Standard.
Lens focal length	4-9mm DD F 1.6-2.4
Line resolution	480 TV Lines
Backlight Compensation	on/off switch
Maximum illumination	1.2 Lux
Video output	1 V peak-peak PAL compatible
Shutter speed	Automatic, 1/60 to 1/100,000s
Tolerance	Bright tolerant with minimum blooming and transfer smear
White balance:	Automatic.
Operational temperature	-10°C to -45°C
ATW range	3000K – 9000K
Signal to Noise ratio:	More than 50 dB
Auto Gain Control:	On 32dB, off 8dB
Aperture correction:	Horizontal and vertical

Contrast: Shall feature automatic white balance capable of adjusting for variations in scene lighting for consistent time colors from one scene to the other.

Picture quality: The picture produced shall have minimum lag and image Retention.

A continual adjustment feature to facilitate C or CS mount lenses will be incorporated, together with a side mount plug for direct drive Lenses and screw terminals for auto iris lenses. The camera shall be capable of being line locked with phase adjustment.

Contained under a flap will be a bank of switches which will enable the selection of the following features:

- Electronic iris · AGC on/off
- Back light compensation
- Gamma correction select between 0.45 and 1.0

1.5.1.4 External view (EXview) Video color camera –FULLY IP CAMERAS

Type:	Solid state color coupled charged device (CCD)
Lens sensor:	1/3" Interline image format
Line resolution	480 TV Lines.
Signal system:	PAL Standard.
Maximum illumination	0.5 Lux
Video output	1 V peak-peak PAL compatible
Shutter speed	Automatic, 1/60 to 1/100,000s
Tolerance:	Bright tolerant with minimum blooming and transfer smear.
Signal to Noise ratio:	More than 50 dB
Auto Gain Control:	On 32dB, off 8dB
Aperture correction:	Horizontal and vertical
Contrast:	Shall feature automatic white balance capable of adjusting for variations in scene lighting for consistent time colors from one scene to the other.

Picture quality:

The picture produced shall have minimum lag and image Retention. A continual adjustment feature to facilitate C or CS mount lenses will be incorporated, together with a side mount plug for direct drive Lenses and screw terminals for auto iris lenses. The camera shall be capable of being line locked with phase adjustment. Contained under a flap will be a bank of switches which will enable the selection of the following features:

- Electronic iris · AGC on/off
- Back light compensation
- Gamma correction select between 0.45 and 1.0

1.5.1.5 Lens

The lens shall be glass optical vertical 1/3" format with direct driver operation.
Have a standard CS mount.
Have variable focal length of between 4mm and 9 mm and aperture of F 1.6 – 2.4

1.5.1.6 Mounting Brackets

The Brackets shall:
Be suitable for wall or ceiling mounting of a single camera.
Be at least 5.5" length
Have an auto lock facility.

1.5.1.7 Camera Housing

The camera housing shall:
Be IP66 rated with integral cable management.
Be Weatherproof.
Be constructed from aluminium with epoxy coating.

1.5.2 VIDEO MONITORS –FULL HD

The monitor shall be capable of providing high levels of picture quality 10MHz bars visible at low brightness and reliability stable synchronization, black level clamping, low sensitivity and high stability.

The monitors shall be high performance color video monitors for monitoring scenes from the above cameras and viewing playback scenes from the video cassette recorders. The monitors shall be located at places shown on the drawings.
The monitor shall give stable and interference free pictures of scenes being viewed. It shall also conform to the following specifications:

- | | |
|----------------------|-------------------|
| • Color system | PAL |
| • Screen size | 25" |
| • Resolution | FHD |
| • Video input signal | 1.0 V pk-pk |
| • Power consumption | Not more than 75W |
| • Power input | 240V 50HZ |

The unit will be dual standard and be capable of using audio and SVHS in. Full loop through connectors to be provided and monitor to have a metal enclosure for reduced RF interference.

1.5.3 COLOUR DIGITAL VIDEO MULTIPLEXING RECORDER

The multiplexing recorder shall be used to record events from the Surveillance TV cameras. It shall have the following

- a) a high performance video multiplexer and digital video recorder.
- b) Operate, record, playback and multi-screen viewing with at least 50 PPS.
- c) With a wave reader software.
- d) Provide multi user remote access including remote control of fully functional cameras.

The multiplexing recorder shall have the following minimum requirements:-

- Ethernet: 10BaseT/ 100BaseT supplied complete with wave reader software.
- Should be rack mounted for security
- Shall feature time base correction, eliminating the need for external camera synchronization.

- Have an Internal CD-writer for archiving purposes
- Recording:- Automatic Priority Control, Interleaved or exclusive, or none; Programmable
- (Video Motion Detection)VMD Zones Per camera : 256,16x16 grid.
- Multi screen Display : Full, PIP, Quad, 6, 9, 16 way.
- Camera Inputs 16
- Fully multitasking - simultaneous recording whilst playing back
- To incorporate four removable hard disk drives, allowing upto 3 months storage at 24-hour record rates S-VHS quality without additional equipment.
- Alarm handling inputs 16 N/O or N/C
- Hard disk capacity of 1TB expandable to 2TB using 250 GB HDD'S
- 2 RS485 ports.
- Resolution: 700(h) x 550(v)
- Time and Date display
- False alarm rejection: 3 levels
- Power supply: 240 V AC, 50 HZ.

1.5.4 CABLES AND CONNECTORS

All the cabling shall be carried out in conduits or trunking. Basically cables carrying video signal between cameras and TV monitoring via video control multiplexer equipment shall be coaxial RG 59 cables. The positions for connectors and the equipments shall be directed and identified by the Engineer on site.

Bidders shall be required to visit the proposed site to ascertain cable routes and cable lengths before pricing the Bills of Quantities in this document.

It shall be the responsibility of the contractor to provide wiring and connection diagrams for approval by the Consulting Engineer.

1.5.5 UNINTERRUPTIBLE POWER SUPPLY (UPS)

This shall be an on-line Un-interruptible power supply with output rating of 7.5KVA, 240V, 50HZ single-phase supply. It shall provide power to the security surveillance system in case of power failure and/or maintained power failure for a minimum period of 8 hours.

It shall be microprocessor- based so that both output voltage and frequency are closely regulated and continuously monitored and also provide system diagnostic and shut down protection functions. It shall feature a maintenance by-pass to enable normal routine maintenance operations to be performed without interruptions to the system.

It shall be fitted with both visual and audible alarms to indicate any change in equipment status such as:-

- input power problems
- ups faults
- ups overload
- battery discharging

Other parameters are:

Input supply:	240VAC50HZ
Power factor:	0.7 lag at full load
Current limit:	125% of the normal
Output voltage:	240V AC 50 HZ
Output voltage tolerance:	2%
Output frequency tolerance	: 0.05%

SECTION VI:

DRAWINGS

- Note
1. List of drawings.
 2. The actual Contract drawings including site plans should be annexed in a separate booklet.

JOB No. 1801

PROJECT: PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

DRAWING No.	DRAWING TITLE	DATE	REVISIONS							
			A	B	C	D	E	F	G	H
	<u>ADMINISTRATION BLOCK</u>	8.03.18	✓							
	<u>SUB BASEMENT FLOOR PLAN</u>	2.05.18		✓						
		10.07.18			✓					
E1801-01	LIGHTING LAYOUT									
E1801-02	POWER LAYOUT									
E1801-03	FIRE ALARM LAYOUT									
E1801-04	SECURITY LAYOUT									
	<u>GROUND FLOOR PLAN</u>									
E1801-05	LIGHTING LAYOUT									
E1801-06	POWER LAYOUT									
E1801-07	FIRE ALARM LAYOUT									
E1801-08	SECURITY LAYOUT									
	<u>GATEHOUSE</u>									
E1801-08A	LIGHTING,POWER,FIRE ALARM AND SECURITY LAYOUT									
	<u>FIRST FLOOR PLAN</u>									
E1801-09	LIGHTING LAYOUT									
E1801-10	POWER LAYOUT									
E1801-11	FIRE ALARM LAYOUT									
E1801-12	SECURITY LAYOUT									
	<u>SECOND FLOOR PLAN</u>									
E1801-13	LIGHTING LAYOUT									
E1801-14	POWER LAYOUT									
E1801-15	FIRE ALARM LAYOUT									
E1801-16	SECURITY LAYOUT									
REVISIONS										
DATE										
ARCHITECT : BASELINE ARCHITECTS P.O. Box39928-00623 Nairobi, Kenya.										
SERVICES ENGINEERS:  FERADON ASSOCIATES LTD CONSULTING ENGINEERS P.O BOX 7375-00300 TEL. 0202392117 OR 0202392149. NAIROBI. E-MAIL : consult@feradon.com										
JOB No. 1801 PROJECT: PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY										
DRAWING TITLE: DRAWING LIST – ELECTRICAL INSTALLATIONS.										
DES/DRN. C.O/W.O	APPROVED. Eng.N.G	DATE. JULY, 2018	SCALE. N.T.S	JOB No. 1801	DRG No. E1801-00	REV. C				

JOB No. 1801

PROJECT: PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

DRAWING No.	DRAWING TITLE	DATE	REVISIONS							
			A	B	C	D	E	F	G	H
	<u>THIRD FLOOR PLAN</u>	8.03.18	✓							
		2.05.18		✓						
E1801-17	LIGHTING LAYOUT	10.07.18			✓					
E1801-18	POWER LAYOUT									
E1801-19	FIRE ALARM LAYOUT									
E1801-20	SECURITY LAYOUT									
	<u>FOURTH FLOOR PLAN</u>									
E1801-21	LIGHTING LAYOUT									
E1801-22	POWER LAYOUT									
E1801-23	FIRE ALARM LAYOUT									
E1801-24	SECURITY LAYOUT									
	<u>ROOF PLAN</u>									
E1801-25	LIGHTNING PROTECTION LAYOUT									
E1801-26	SITE PLAN									
E1801-27	SCHEDULE OF SYMBOLS									
	<u>RAW POWER</u>									
E1801-28	SCHEMATIC LAYOUT									
E1801-29	SCHEMATIC LAYOUT									
E1801-30	SCHEMATIC LAYOUT									
E1801-31	SCHEMATIC LAYOUT									
REVISIONS										
DATE										
ARCHITECT :										
BASELINE ARCHITECTS P.O. Box39928-00623 Nairobi, Kenya.										
SERVICES ENGINEERS:  FERADON ASSOCIATES LTD CONSULTING ENGINEERS P.O BOX 7375-00300 TEL. 0202392117 OR 0202392149. NAIROBI. E-MAIL : consult@feradon.com										
JOB No. 1801 PROJECT: PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY										
DRAWING TITLE: DRAWING LIST – ELECTRICAL INSTALLATIONS.										
DES/DRN. C.O/W.O	APPROVED. Eng.N.G	DATE. JULY, 2018	SCALE. N.T.S	JOB No. 1801	DRG No. E1801-00	REV. C				

JOB No. 1801

PROJECT: PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

DRAWING No.	DRAWING TITLE	DATE	REVISIONS							
			A	B	C	D	E	F	G	H
E1801-32	SCHEMATIC LAYOUT	8.03.18	✓							
		2.05.18		✓						
E1801-33	SCHEMATIC LAYOUT	10.07.18			✓					
	<u>CLEAN POWER</u>									
E1801-34	SCHEMATIC LAYOUT									
E1801-35	SCHEMATIC LAYOUT									
E1801-36	SCHEMATIC LAYOUT									
E1801-37	UPS BOARD									
E1801-38	MAIN SCHEMATIC LAYOUT									
REVISIONS										
DATE										
ARCHITECT : BASELINE ARCHITECTS P.O. Box39928-00623 Nairobi, Kenya.										
SERVICES ENGINEERS:  FERADON ASSOCIATES LTD CONSULTING ENGINEERS P.O BOX 7375-00300 TEL. 0202392117 OR 0202392149. NAIROBI. E-MAIL : consult@feradon.com										
JOB No. 1801 PROJECT: PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY										
DRAWING TITLE: DRAWING LIST – ELECTRICAL INSTALLATIONS.										
DES/DRN. C.O/W.O	APPROVED. Eng.N.G	DATE. JULY, 2018	SCALE. N.T.S	JOB No. 1801	DRG No. E1801-00	REV. C				

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 of 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 0.2m³ occurring 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.

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

- (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 item or class of Work with a high expectation of quantity overrun should be made by entering specific "Provisional Quantities" or "Provisional Items" in the 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.

**PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY COMMUNICATIONS /SECURITY AND CCTV SERVICES
ELECTRICAL INSTALLATIONS
BILLS OF QUANTITIES - COMMUNICATION SERVICES**

BILL NO. 1 – STRUCTURED CABLING INSTALLATIONS

ITEM No.	DESCRIPTION	QTY	UNIT	RATE (KShs Cts)	AMOUNT (KShs Cts)
	Supply, install, test, commission and set to work (To the full satisfaction of all parties to the contract) the following: -				
1.01a)	48-port Cisco switch as catalyst WS-C 3850-48PS-L superstack 10/100/1000 mbps stackable PoE LAN Base with cabinet Jumper Power Cord 250 VAC 13A C14-C15 connectors and CAT3850 Universal k9 Image S3850UK9-33SE. To also have SMARTNET 8X5XNBD Cisco Catalyst 3850 48port POE Lan Base CON-SNT-WSC388PL support for a period of one year.	10	No.		
b)	As above but 24-port	2	No.		
c)	GBIC transceiver modules (LC to LC) multimode CISCO make for the switches above	12	No		
d)	Cisco Catalyst 3850 4 X 1GE Network Module C3850-NM-4-1G	12	No.		
e)	50CM Type 1 Stacking Cable STACK-T1-50CM	12	No.	Included in Switch	
f)	715W AC Config 1 Power Supply PWR-C1-715WAC	12	No.	Included in Switch	
1.02	Dual Data cable outlets, type RJ45 as siemon, cat 6E complete with face plates.	400	No.		
1.03	Wireless access point as CISCO	16	No.		
1.04a)	48 Port patch panel as siemon, type RJ45 Cat. 6E.	20	No.		
b)	as above but 24-port	4	No.		
1.05	24 port Fiber optic patch panel, as Siemons or approved equivalent.	12	No.		
1.06a)	8 core armoured multi-mode fibre for Back bone cabling for the switches, in redundant wiring	120	m		
b)	LC-LC Multimode patch cords with connectors	12	No		
c)	Splicing, termination, testing and commissioning of the above Fibre connections	1	Item		
1.07a)	Purpose-made Free Standing Server cabinet 800x1000mm (Type 42U or equivalent) for the hub/patch-panel complete with 4No. extract fan and 4 No. 3 pin power points on UPS. To have a PDU with neon indicators. AS APC or TOTEN type or Siemon	7	No.		
b)	As above but 32U	2	No.		
1.08	UTP Cat 6E structured cables as siemon or approved equivalent in 305M box	60	Rolls		
1.09a)	UTP Cat. 6E patch cord, 3M as siemon or approved equivalent	400	No.		
b)	UTP Cat. 6E patch cord, 1M as siemon or approved equivalent	800	No.		
c)	Allow for structured cable termination at all computer terminals, attendance in power connection, testing and commissioning of the network to TSD-ISN Standards.	1	Item		
Total C/F to next page					

PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY COMMUNICATIONS /SECURITY AND CCTV SERVICES ELECTRICAL INSTALLATIONS
BILLS OF QUANTITIES - COMMUNICATION SERVICES

BILL NO. 1 – STRUCTURED CABLING INSTALLATIONS

ITEM	DESCRIPTION	QTY	UNIT	RATE (KShs Cts)	AMOUNT (KShs Cts)
	Total B/F from Previous page				-
1.1	Cable organizers.	100	No.		
1.11	Allow for integration to the PABX and all other network equipments for receiving, handling, testing and full configuration.	1	Item		
	NB: All to CISCO Solutions				
1.12	Any other items necessary to complete the data cabling satisfactorily. Please list the items. i) _____ ii) _____				
1.13	Allow for fixing permanent labels on all the equipment and cables.	1	Item		
1.14	Power outlet for the 10 No. switches, comprising 1 No. twin sockets, wiring in 2.5mm ² ring-main wiring, conduit, box and all accessories. (Outlets to be on UPS)	10	No.		
1.15	Supply and install communication wire mesh basket tray in server room for communication cables overhead 450x150mm dimensions complete with all accessories and mounting brackets	10	m		
Total for Bill No. 1 Structured Cabling Installations - C/F to Page 145					-

**PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY COMMUNICATIONS /SECURITY AND CCTV SERVICES
ELECTRICAL INSTALLATIONS
BILLS OF QUANTITIES - COMMUNICATION SERVICES**

BILL NO. 2 – STRUCTURED CABLING FOR CCTV INSTALLATIONS

ITEM No.	DESCRIPTION	QTY	UNIT	RATE (KShs Cts)	AMOUNT (KShs Cts)
	Supply, install, test, commission and set to work (To the full satisfaction of all parties to the contract) the following: -				
2.01a)	24-port Cisco switch as catalyst 3560-12PC-S superstack 10/100 mbps stackable PoE.	2	No.		
b)	As above but 12-port	5	No.		
2.02a)	Cisco Catalyst 3850 4 X 1GE Network Module C3850-NM-4-1G	7	No.		
b)	50CM Type 1 Stacking Cable STACK-T1-50CM	7	No.	Included in Switch	
c)	715W AC Config 1 Power Supply PWR-C1-715WAC	7	No.	Included in Switch	
2.03	Single Data cable outlets, type RJ45 as siemon, cat 6E complete with face plates.	90	No.		
2.04	12 Port patch panel as siemon, type RJ45 Cat. 6E.	8	No.		
2.05	UTP level 6E structured cables as siemon or approved equivalent in 305metre boxes	20	Rolls		
2.06	UTP Cat. 6E patch cord, 3M as siemon or approved equivalent	90	No.		
2.07	UTP Cat. 6E patch cord, 1M as siemon or approved equivalent	90	No.		
2.08	Data cable termination, both ends.	180	No.		
2.09	Cable organizer as Siemon 1 U.	50	No.		
2.10	Allow for testing and commissioning of the installations.	1	Item		
2.11	Allow for fixing permanent labels on all the equipment and cables.	1	Item		
2.12	Power outlet for the 12-port switches, comprising 1 No. twin sockets, wiring in 2.5mm ² ring-main wiring, conduit, box and all accessories.	7	No.		
2.13	Allow for structured cable termination at all CCTV terminals, attendance in power connection, testing and commissioning of the network to TSD-ISN Standards.	1	Item		
Total for Bill No. 2 Structured Cabling Installations For CCTV Installations - C/F to Page 145					-

**PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY COMMUNICATIONS /SECURITY AND CCTV SERVICES ELECTRICAL INSTALLATIONS
BILLS OF QUANTITIES - COMMUNICATION SERVICES**

BILL NO. 3 - TELEPHONE INSTALLATION

ITEM No.	DESCRIPTION	QTY	UNIT	RATE (KShs Cts)	AMOUNT (KShs Cts)
3	Fully programmable, High capacity Hybrid PBX complete with an integral control unit/MDF assembly (if necessary) and all accessories as described in the Technical Specifications. The set to be fully configured. The Hybrid PBX to have capacity for handling upto 50 direct lines and 300 extensions to be as Alcatel/Cisco Unified Communications or approved equivalent. Minimum warranty for equipment is 24months	1	NO		
3.1 (a)	Programmable IP telephone set with line cord as Alcatel/Lucent IP TOUCH 4028 (Middle level phones) or as approved	30	NO		
(b)	Executive telephone set with LCD screen auto-redial date-time indicator flasher/hold sp-phone, mute, auto-answer, pause, transfer caller etc as Alcatel-Lucent IP TOUCH 4068 (Executive handset) for as approved	30	NO		
c	Programmable digital enhanced cordless phones with extra range of 900 MHz and above with LCD screen auto redial, date-time, indicator/flasher, sp phone, mute, auto answer, pause, transfer caller and compatible and can also be well mounted etc	10	NO		
(d)	Secretarial set with DSS console operator Console state the following Make of equipment on offer..... Country of Origin..... No. of institution already using this type of equipment in Kenya(A Technical Brochure and product catalogue must be enclosed)	6	NO		
e)	Basic IP Phones for general staff	50	No.		
3.22	Solar-tek hi-volt guard	1	NO		
3.23	Line protector as Furze of equivalent	1	NO		
3.24	Amphinol Connector	1	Pcs		
3.25	Allow for termination of all the extention into the telephone sets	1	ITEM		
3.26	Allow for comprehensive programming (for customization of the telephone system to each of thr extensions) other tailor made program to user's needs, including conducting a general demonstration to all users and handling over of a completely operational installation and all manuals				
3.27	Allow for liaison with CA for certification of the installed equipment	1	Item		
3.28	Allow for acquiring of all the required licenses as per tailored client needs	1	No.		-
3.29	Any other items necessary to complete the data cabling satisfactorily. Please list the items. i) _____ ii) _____				
3.3	Allow for submission of all required samples for approval	1	Item	-	-
Total for Bill No. 3: Telephone Installation C/F to Page 145					-

**PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY COMMUNICATIONS /SECURITY AND CCTV SERVICES
ELECTRICAL INSTALLATIONS
BILLS OF QUANTITIES - COMMUNICATION SERVICES**

BILL NO. 4 - AV EQUIPMENT INSTALLATIONS

ITEM No.	DESCRIPTION	QTY	UNIT	RATE (KShs Cts)	AMOUNT (KShs Cts)
	Supply, install, test, commission and set to work (To the full satisfaction of all the parties to the contract) the following:-(State make and type of all the equipment supplied). ALL AV EQUIPMENT TO HAVE MANUFACTURERS AUTHORIZATION AND MINIMUM 24MONTHS WARRANTY PERIOD				
4.00a)	Interactive SMART whiteboard 87inch with dual pen functionality, smart display, wireless capability and Video Conference ready. To be complete with smart meeting pro software. And 24months warranty as Sony or equivalent and to be approved. With 4K UHD resolution (for 4No. boardrooms)	4	No.		
4.00b)	Shortthrow 3300lumens projector with 24months warranty as Sony or equivalent and to be approved	4	No.		
4.00c)	As above but 99inches screen (for conference hall)	2	No.		-
4.00d)	As above but 4500lumens projector	2	No.		
4.01	Universal mount kit for projector	6	No.		
4.02	Smart speakers	12	No.		
4.03	10M HDMI cables	6	no.		
4.04	10M power cables complete in 10m trunking, termination plates	6	No.		
4.05	Training for users	1	No.		
4.06a)	90inches LED Full HD screen as Sony or Samsung suitable for Video conference (for senate chamber)	1	No.		
b)	As above but 50inch TV FHD screen for Chancellor and Vice Chancellors offices.	2	No.		
4.07	Rack Mount Digital Modular Mixer; 8 Bus, 8 output configuration 912 x 8 matrix)	2	No.		-
4.08	Stereo Power Amplifier 2 x 600W	2	No.		
4.09	Ceiling/wall recessed 2-way Bass Reflex Loudspeakers 100w rated input complete with brackets	12	No.		
4.10	VHF Wireless Microphone System with receiver and Transmitter – Lapel	20	No.		
4.11	VHF Wireless Microphone System with receiver and Transmitter – Handheld	20	No.		
4.12a)	19” Rack DVD Player	2	No.		
Total C/F to next Page					-

PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY COMMUNICATIONS /SECURITY AND CCTV SERVICESELECTRICAL INSTALLATIONS
BILLS OF QUANTITIES - COMMUNICATION SERVICES

BILL NO. 4 -AV EQUIPMENT INSTALLATIONS

ITEM No.	DESCRIPTION	QTY	UNIT	RATE (KShs Cts)	AMOUNT (KShs Cts)
	Total B/F from Previous page				-
4.12b)	19" Equipment Rack	2	No.		
	For all the above, State:- Make of equipment on offer _____ Country of origin _____ Number of institutions already using this type of equipment in Kenya _____ (A technical brochure and product catalogues must be enclosed)				-
4.13	End user Training for up to 20 staff members	1	Item		-
4.14	Sollatek hi-volt guard.	10	No.		-
4.15	Allow for all the wiring for the above equipment.	1	Item		-
4.16	Allow for comprehensive testing and commissioning, then tailor made programming to user's needs, including conducting a detailed training and demonstration to all users and handing over of a completely operational installation and all manuals.	1	Item		-
4.17	Warranty: The warranty period for the workmanship, all materials and the equipment installed will be _____ months after commissioning. (Note: A minimum of 24 calendar months will be accepted. During warranty, all defective workmanship/materials will be replaced free of cost.	1	Item		-
4.18	Any other items to complete the installation satisfactorily. Please state. _____ _____ _____	1	Item		-
Total for Bill No. 4: AV Equipment Installation C/F to Page 145					-

**PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY COMMUNICATIONS /SECURITY AND CCTV SERVICES
ELECTRICAL INSTALLATIONS
BILLS OF QUANTITIES - COMMUNICATION SERVICES**

BILL NO. 5 - GENERAL ITEMS

ITEM No.	DESCRIPTION	QTY	UNIT	RATE (KShs Cts)	AMOUNT (KShs Cts)
5.00a)	Carry out comprehensive communications services tests and analysis, after installations. i) Record and print all the communications services system parameters.		Item		
b)	Carry out comprehensive Audio Visual Equipment Installations tests and analysis, after installations. i) Record and print all the Communication services system parameters. ii) Submit 3 copies of the printouts. (Note: Parameters must be satisfactory before power is switched on).		Item		-
5.01	Allow for presentation of all the required samples as per specifications, Bills of Quantities and Drawings.		Item		
5.02	Prepare and submit Working Drawings as follows:- i) Draft soft copy in Archicad® and Autocad® in CD-RW. ii) Amended soft copy in Archicad® and Autocad® in CD-RW. iii) 5 Final soft copies in Archicad® and Autocad® in CD-RW to Architect, Client, Quantity Surveyor, and Engineer (2 copies) iv) 3 Draft hard-copies of Working Drawings in Ao (Scales 1:50, 1:25) to Engineer, Architect and Main Contractor. v) 2 Amended hard copies of Working Drawings in Ao (Scales 1:50 and 1:25) to Engineer, Architect and Main Contractor. vi) 11 No. Final hard copies of working drawings in Ao (Scales 1:50, 1:25) to Engineer (3 copies), Architect (1 copy), Quantity Surveyor (1 copy), Client (3 copies), Contractor (3 copies). (Note: Full set of drawings to be presented as per drawing list).		Item		
5.03	As item no. 5.02, but for Record (As-Installed) Drawings comprising: i) Fully dimensioned drawings of all plants and apparatus. ii) General arrangement drawings of equipment, plant etc. iii) Routes – types and sizes and arrangement of all pipework. iv) System schematics and trunking diagrams showing all salient information relating to control and instrumentation. v) Grading charts vi) Wiring and piping diagrams of plant and apparatus. vii) Schematic diagram of individual plants and switch and control boards. viii) All the required operating instructions for all panels, boards, control panels etc.		Item		
Total C/F to Next Page					

**PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY COMMUNICATIONS /SECURITY AND CCTV SERVICES
ELECTRICAL INSTALLATIONS
BILLS OF QUANTITIES - COMMUNICATION SERVICES**

BILL NO. 5 - GENERAL ITEMS

ITEM	DESCRIPTION	QTY	UNIT	RATE (KShs Cts)	AMOUNT (KShs Cts)
	Total B/F from Previous Page				
5.04	Prepare and submit Maintenance Manuals for all items installed.		Item		
5.05	Provide a year's (12 months') initial maintenance upon expiry of the Defects Liability Period. The maintenance to be carried out every quarter (3 months) for a period of 12 months.		Item		
5.06	Allow for careful removal of any existing communications installations on site and handing over to the client. This includes any incidental charges by service providers/vendors and liason involved, filling of forms etc.		Item		
5.07	To ensure that equipment are provided to specifications allow for workshop visit for 4 No. persons (Engineer, Architect and 2No. Client representative to) visit the suppliers workshop to verify the equipment specifications and witness all the relevant functionality tests before approval of shipping is given. The cost of the visit to include:- i) Visa processing fees ii) Return business class air-tickets to and from the factory. iii) Any transfer fees iv) Local transport both in Nairobi and the city of destination. v) Accommodation for the three at a hotel/resort not less than 4 star in rating. vi) All upkeep costs and daily per diem of not less than USD 500 per person vii) All the necessary tools/Instruments required for undertaking a complete faulty test. viii) (Note: The tenderer/ supplier to ensure the three team members above are accompanied by a technically qualified/experienced skilled representative from their offices to guide the tour and answer all questions that may arise).				2,500,000.00
Total for Bill No. 5: General Items C/F to Page 145					

**PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY COMMUNICATIONS /SECURITY AND CCTV SERVICESELECTRICAL INSTALLATIONS
BILLS OF QUANTITIES - COMMUNICATION SERVICES**

SUMMARY PAGE

	DESCRIPTION	AMOUNT (KShs Cts)
S1.	Total for Bill No. 1: Structured Cabling Installations - B/F	
S2.	Total for Bill No. 2: Structured Cabling Installations for CCTV B/F	
S3.	Total for Bill No. 3: Telephone Equipment B/F	
S4.	Total for Bill No. 4: Audio Visual Equipment B/F	
S5.	Total for Bill No. 5: General Items, B/F	
S6	Sub-contract Preliminaries B/F from Section 4	-
S7	Sub-Total	
S8	PC Sum for 2No. Complete Video Conferencing/Telepresence equipment from Cisco, Huawei or approved equivalent complete with all accessories, hardware and software plus licenses: Type approved Antennas/VSATs, Video Display Screens, Modems, Conference Server system, Operating system software: Windows, Solaris, Linux or any other compatible and approved and standard soft ware, Multipoint Conference Unit (MCU), Multi-media Conference Manager, and Video Gate ways.	3,000,000.00
S9	Contingency sum	1,500,000.00
S10	Total for Communication Installations Works Carried Forward Summary Page 154	

PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
ACCESS CONTROL, SECURITY ALARM AND CCTV INSTALLATIONS
BILLS OF QUANTITIES

BILL NO. 1: ACCESS CONTROL SYSTEM INSTALLATION

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE	AMOUNT KShs. Cts.
	Supply, install, test, commission and set to work (To the full satisfaction of all parties to the contract) the following: - 1.00 PREAMBLE a) Total No. of double leaf doors. 10.00 b) Total No. of single leaf doors. 7.00 c) Details of doors, door handles, frames etc. to be confirmed with the Project Architects, Baseline Architects, <u>NAIROBI</u>. d) Strike : Electric <u>BILLS OF QUANTITIES</u> Supply, install, test, commission and set to work the following: - 1.01a) Supply and install combination Biometric finger print and proximity card readers for Access control (in and out operation). The readers should support fake/live finger detection, user capacity of 1,000, log capacity of 5,000, TCP/IP support, support for slave biometric fingerprint reader. inbuilt reader for Mifare,RFID, 125KHz-EM4100 cards. 500 dpi optical finger print reader with less than 0.0000001% false acceptance rate. Ethernet 10BaseT, RS-232/485 and Wiegand interfaces. Door open switch and door strike inputs. NO/NC 5A relay for door control. 12V DC power supply complete with power supply cables. As Genie AC2500 or as approved by engineer. 17 b) Supply and install slave Biometric finger print readers for access control (in and out operation). Support for fake/live finger detection. Inbuilt reader fo,RFID, 125KHz-EM4100 cards. 500 dpi optical finger print reader. RS-232/485 interface. 12V DC power supply complete with power supply cables. As Genie SR-100FP or as approved by engineer. 17 1.02 Client Base Station -A dedicated slave computer 8 GB RAM/1TB HDD/17' SVGA non-radiation emitting screen/key board/mouse/ DVD RW. The computer to be supplied with all the associated software to run the entire Security network. Computer to be as Dell Vostro or HP or Toshiba and to be approved. -Provisional 1 1.03 Mortice door lock cylinder, complete with non-duplicatable key for each terminal, capable of operating the lock whether power is available or not. 17				
Total C/F to Next Page					

PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
ACCESS CONTROL, SECURITY ALARM AND CCTV INSTALLATIONS
BILLS OF QUANTITIES

BILL NO. 1: ACCESS CONTROL SYSTEM INSTALLATION

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE	AMOUNT KShs. Cts.
	Total B/F from Previous page				
1.04a)	Door handle. Please check with Architects first.	17	No.		
1.04b)	Electric door opener	17	No.		
1.04c)	Door MAGNET (500 kg) Res. Force.	17	No.		
1.04d)	Automatic door-closures as Union or approved equivalent	17	No.		
1.05	Supply proximity cards, each bearing photograph of individual staff member. Conduct tailor-made programming of each card as per Client's requirements. The cards to be complete with printing.(provisional to be confirmed by client)	200	No.		
1.06	Allow for associated cabling, installation, testing, commissioning, all accessories, customized programming, training and handing over.	1	Item		
1.07	Any other items necessary to complete the access control system satisfactorily. Please list the items 1. _____ 2. _____ 3. _____	1	Item		
1.08	Allow for 1-week dedicated training of the client nominees (Assume 50 No.) on the operations of the door access control system	1	Item		
1.09	Turnstile and its emergency door at designated pedestrian exit points at the main entrance with the following specifications • Weight: 350kg Nett, • Arms: Hot dipped galvanised steel tubing • Mechanism: All steel • Nuts and Bolts: Cadmium plated steel • Heavy Bearing • Smooth surfaces • Round Arm ends • Adequate space for comfortable movement • Arms from top to bottom • Designated from heavy duty trafficking.	2	No.		
1.10a)	Walk-through body scanners as Rapiscan Metor 6S NIJ Standard 0601.02, high sensitivity walk-through metal detector complete with all its accessories or any other approved equivalent. Please submit catalogues and brochures for approval.	2	No.		
b)	X-ray screening equipment as Rapiscan 515 or any other approved equivalent. Please submit catalogues and brochures for approval.	2	No.		
Total for Bill No. 1: Access Control System Installations - C/F to Summary Page					

PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
ACCESS CONTROL, SECURITY ALARM AND CCTV INSTALLATIONS
BILLS OF QUANTITIES

BILL. NO 2. SECURITY ALARM INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE	AMOUNT KShs. Cts.
	Supply, install, test, commission and set to work (To the full satisfaction of all parties to the contract) the following: -				
2.00	Power supply to security alarm panel comprising 2A fused un-switched spur unit, wiring in 3 x 2.5 m ² SC-PVC-CU cables and all accessories.	1	No.		
2.01	24-zone security alarm panel, capable of being used with fixed panic buttons, motion sensors, smoke detectors, and remote panic buttons. (State make and type of the panel). Please note: 1No. Security panel to act as a master and the other 1No. To be slave.	2	No.		
2.02	Security Alarm signal transceiver wired to the main security alarm panel	2	No.		
2.03	Long-life sealed battery array to give minimum 72-Hour back-up on sustained power failure. The battery unit to be complete with its own enclosure/ cubicle, and an automatic battery charger.	2	No.		
2.04	Spring loaded 10A double-knock panic buttons wired to the main security alarm panel,	105	No.		
2.05	Peak-infra-red motion sensors, wired to the Control Panel.	76	No.		
2.06	Allow for wiring of all the points above to the main Security Alarm panel in fire-resistant/tamper-proof cables.	181	Points		
2.07	Installation charges	1	Item		
2.08	Communications Authority of Kenya Annual License.	1	Item		
2.09	Allow for providing 3-months, initial back up, prior to signing of back-up agreement.	1	Item		
2.10	Any other items (please specify) 1. _____ 2. _____ 3. _____				
Total C/F to Next Page					

PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
ACCESS CONTROL, SECURITY ALARM AND CCTV INSTALLATIONS
BILLS OF QUANTITIES

BILL. NO 2. SECURITY ALARM INSTALLATIONS

ITEM NO.	DESCRIPTION	QTY	UNIT	RATE	AMOUNT KShs. Cts.
	Total B/F from Previous Page				
2.11	Allow for connection to the main fire alarm panel.	1	Item		
2.12	Testing, commissioning, handing over of the installation, including conducting a demonstration to the client, including handing over maintenance/ operations manuals.	1	Item		
2.13	Remote Hand-held double-knock panic buttons wired to the security alarm panel.	20	No.		
2.14	Security Alarm break glasses at the main entrance	10	No.		
2.15	Vandal proof steel cabinet big enough to ensure suitable space to house all items of electronic security. To be made in 1.6mm powder coated steel with sufficient ventilation for control of equipment working temperature. Should have 2 No security locks on the doors with different keys for dual control. Cabinet to be secured to floor and/or wall	1	No.		
Total for Bill No. 2 : Security Alarm Installations - C/F to Summary Page					

PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
ACCESS CONTROL, SECURITY ALARM AND CCTV INSTALLATIONS
BILLS OF QUANTITIES

BILL. NO 3. CCTV INSTALLATIONS

Item No.	Description	Qty	Unit	Rate	Amount	
					KSh.	Cts.
	Supply, install, test, commission and set to work (To the full satisfaction of all parties to the contract) the following: -					
3.01	NVR, Network Video Recorder with the following specs; 1. RAID 5/6, 2. Integrated video management, 3. H.265, MPEG-4 video compression, 4. Rack mount, 5. 4X12 TB storage, 6. remote Access, 7. external DVD/CD writer, USB 2.0, 8. PTZ control, 9. CCTV keyboard support, 10. 2 x Gigabit ethernet, 11. Webclient. 12. PoE Capabilities. This from a reputable make and to be approved.	1	No.			
3.02	IP Video Management System/Software client server for over 100 channels per station. To be full VMS. To have Multisite support, over 5web connections, HD and SD resolution, Support for Windows 7/8/10, alarm management, Integration. To integrate with existing system.	1	Item			
3.03	Client Base Station -19inch rack mount RAID 5, H.265, MPEG 4 compression, minimum 1080p support, 2x USB 2.0 port, 2xGigabit LAN, 1TB memory, Remote access, PTZ control, CCTV keyboard support, Manual or automatic back-up, Minimum 8GB RAM	1	No.			
3.04	Cisco Router with support for variety of WAN connections, including xDSL, Ethernet, 3G/4G LTE, and fiber with inbuilt Encryption, VPN, firewall, and URL filtering and to be approved.	1	No.			
3.04a)	Vandal proof polycarbonate indoor/outdoor dome cover IP PoE digital camera as approved with the following specifications:- 3 axis Mini Dome (360 ⁰ horizontal x 90 ⁰ vertical) Powerful MPEG-4 Video compression. Supports up to 30 frames per second at full HD1080p resolution ▪ Bidirectional G.711 and G.726 audio communication ▪ Synchronized full-duplex one channel audio and video ▪ Intelligent bit rate control (flexible for difficult network environments) ▪ Embedded streaming server and embedded Web Server ▪ Motion-detected and event-triggered alarm processing ▪ Sensor-triggered recording and TFP;	69	No.			
	Total C/F to Next Page					-

PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
ACCESS CONTROL, SECURITY ALARM AND CCTV INSTALLATIONS
BILLS OF QUANTITIES

BILL NO. 3 – BILLS OF QUANTITIES - CCTV INSTALLATIONS

	DESCRIPTION				AMOUNT (KShs Cts)
	Total B/f from Previous Page One (1) alarm input One (1) relay output ▪ 1/3 in. (8 mm) Sony Super HAD CCD 410K CCD Day-Night with IR cut filter varifocal lens 410K CCD standard varifocal lens 270K CCD fixed lens ▪ True Day-Night capability, without loss of resolution and/or clarity. User authentication 128-bit encrypted data stream (selectable, for added security) (State make and type, and enclose catalogues) b) As above but PTZ IP camera with IP66 housing (State make and type, and enclose catalogues)				
3.05	Anodized aluminium brackets, minimum 4mm thickness.	19	No.		
3.06	5kW true-online rack mount UPS for the system	10	No.		
3.07	60inch LED HD screens as Sony, Samsung, LG and to be approved.	1	No.		
3.08	Training: Allow for conducting a 2-week Training on selected staff on the use of the CCTV system, including operational proficiency.	2	No.		
	Note: The training will only be considered complete <u>after</u> presenting a signed/stamped form from the client's authorized representative				
3.09	Installation, Testing, commissioning and handing over Maintenance/Operations Manual for all equipment.	1	Item		
3.10	Any other items to complete the CCTV Installation (please specify)				

	Total for CCTV Installations C/F to collection page				-

PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
ACCESS CONTROL, SECURITY ALARM AND CCTV INSTALLATIONS
BILLS OF QUANTITIES

BILL NO. 4 – GENERAL ITEMS

Item No.	Description	Qty	Unit	Rate	Amount KSh. Cts.
4.01	Carry out comprehensive Access Control, security alarm, CCTV and electric fence Installation, tests and analysis after installation and present documentation:		item		-
4.02	Allow for presentation of all the required samples as per specifications, Bills of Quantities and Drawings.		Item		-
4.03	Prepare and submit Working Drawings as follows:- i) Draft soft copy in Archicad® and Autocad® in CD-RW. ii) Amended soft copy in Archicad® and Autocad® in CD-RW. iii) 5 Final soft copies in Archicad® and Autocad® in CD-RW to Architect, Client, Quantity v) 2 Amended hard copies of Working Drawings in Ao (Scales 1:50 and 1:25) to Engineer, Architect and Main Contractor. vi) 11 No. Final hard copies of working drawings in Ao (Scales 1:50, 1:25) to Engineer (3 copies), Architect (1 copy), Quantity Surveyor (1 copy), Client (3 copies), Contractor (3 copies). iv) 3 Draft hard-copies of Working Drawings in Ao (Scales 1:50, 1:25) to Engineer, Architect and Main Contractor. (Note: Full set of drawings to be presented as per drawing list).		Item		-
4.04	As item no. 4.03, but for Record (As-Installed) Drawings comprising: i) Fully dimensioned drawings of all plants and apparatus. ii) General arrangement drawings of equipment, plant etc. iii) Routes – types and sizes and arrangement of all pipework. iv) System schematics and trunking diagrams showing all salient information relating to control and instrumentation. v) Grading charts vi) Wiring and piping diagrams of plant and apparatus. vii) Schematic diagram of individual plants and switch and control boards. viii) All the required operating instructions for all panels, boards, control panels etc.		Item		-
Total C/F to Next Page					-

PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
ACCESS CONTROL, SECURITY ALARM AND CCTV INSTALLATIONS
BILLS OF QUANTITIES

BILL NO.4 GENERAL ITEMS

Item No.	Description	Qty	Unit	Rate (KSh)	Amount KShs. Cts.
	Total B/F from Previous Page				-
4.05	Prepare and submit Maintenance Manuals for all items installed.		Item		-
4.06	Provide a year's (12 months') initial maintenance upon expiry of the Defects Liability Period. The maintenance to be carried out every quarter (3 months) for a period of 12 months.		Item		-
4.07	<u>All other items</u> of general preliminary to cover, but not limited to:- i) Attendance on all other sub-contractors, such as for Communication Services, Mechanical Installations, Security Installations, Sound Equipment/Wiring Installations, services etc. ii) Hiring and keeping a Supervisor/Foreman on site iii) Constant supervision of the works. iv) Provision of all the required spares. v) Testing and Inspection of materials/works. vi) Provision of labour camps. vii) Storage of materials. viii) Initial maintenance (During Defects Liability) ix) Providing water/electricity for the works. x) Protection of the works/materials xi) Clearing away on completion. xii) Preparing Final Account. xiii) Providing all Test Certificates, etc.		Item		-
Total for Bill No. 4: General Items C/F to Summary page					

PROPOSED ADMINISTRATION BLOCK FOR JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
ACCESS CONTROL, SECURITY ALARM AND CCTV INSTALLATIONS
BILLS OF QUANTITIES

SUMMARY PAGE:

ITEM	DESCRIPTION	AMOUNT KSHS. CTS.
S.01	Bill No. 1: Access Control systems Installations - B/F	-
S.02	Bill No. 2: Security alarm Installations - B/F	-
S.03	Bill No. 3: CCTV Installations - B/F	-
S.04	Bill No. 4: General Items B/F	-
S.05	Bill No. 5: Sub-contract Preliminaries B/F from Part D	-
S6	Sub-Total	-
S7	Allow for 5% contingency and variation of price (VOP)	-
S8	Total for Access Control, Security Alarms and CCTV Installations	
S9	Total for Communication Installations Works B/F from Page 145	
S10	Total for Communications/Security and CCTV Installations C/F to FORM OF TENDER	

Total Amount in words

.....

Tenderer's Name and Stamp

Signature.....

Date

PIN No.

VAT No.

Witness Address

Signature.....

Date

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: Permanent Secretary, Ministry of....., P.O.Box <u>NAIROBI</u> The Engineer's address is: Chief Engineer(.....), Ministry of....., P.O.Box..... <u>NAIROBI</u>

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 figures*] Kenya Shillings _____ [*amount of Guarantee in words*].

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

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

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

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

Yours faithfully,

Signature and Seal _____

Name of the Bank or financial institution _____

Address _____

Date _____

Witness: Name: _____
 Address: _____
 Signature: _____
 Date: _____

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:

	<i>Name in full</i>	<i>Nationality</i>	<i>Citizenship Details</i>	<i>Shares</i>
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			TRANSPORT ATION 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 thisday 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 of20.....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 of20.....

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 3 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	Communications Installations Sub-Contractors must have Communications Authority of Kenya (CA) license as a Telecommunication Contractor (provide Copy of current annual 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 venture

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 • Holder of Degree ----- 5 marks • Holder of Diploma ----- 3marks • Holder of Certificate ----- 0 marks		5	
	b) Project Engineer's experience • Over ten (10) year relevant experience -- 5 marks • Five (5) to ten (10) years relevant experience --- ----- 4 marks • Under five (5) years relevant experience-----2 marks • No experience -----0 marks		5	
	c) Works Inspector Qualification • Holder of Degree in electrical engineering ----- -- 5 marks • Holder of Diploma in electrical engineering ----- --- 3 marks • Holder of Certificate in relevant engineering ----- ---- 1 mark • No Qualification ----- 0 marks		5	
	d) Works Inspector's Experience • Over 10 years' relevant experience ----- 5 marks • Five (5) to ten (10) years' relevant experience -- ----- 3 marks • Under 5 years' relevant experience -----1 marks • No experience-----0 marks		5	
	e) Experience of Site Technicians with minimum of certificate qualification in relevant Engineering field • Over 10 years' relevant experience -----5 marks • Five (5) to ten (10) relevant experience ----- 3 marks • Under 5 years' relevant experience ----- 1mark • 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.) • Project of similar nature, complexity and magnitude of equal or higher value. ----- 5 marks each • Project of similar nature and complexity but of lower magnitude than the one in consideration ----- 3 marks each • 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) • Project of similar nature, complexity and magnitude ----- 5 marks each • Project of similar nature, but of lower value than the one in consideration ----- 2.5 marks each • 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 Audited financial report (last three [3] years) - 2017-2019 • Average Annual Turnover equal or higher than to Kshs. 40.0 Million----- 15 Marks • Average Annual Turnover between Kshs. 20 Million and Kshs 39.9 Million----- 10 Marks • Average Annual Turnover between Kshs. 10 Million and Kshs 19.9 Million----- 5 Marks • 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.) • Amount equivalent to or above 25% of submitted tender sum----- 20 Marks • Amount equivalent to 20% but below 25% of submitted tender sum----- 15 Marks		20	20

Item	Description	Points Scored	Max Points	Total Points
	• Amount equivalent to 15% but below 20% of submitted tender sum----- 10 Marks • Amount equivalent to 10% but below 15% of submitted tender sum----- 5 Marks • 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.