COUNTY GOVERNMENT OF MERU

DEPARTMENT OF HEALTH

INVITATION TO TENDER FOR

TENDER NO: CGM/ONT/003/2018-2019

SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF A COMMUNICATING ELECTRICAL LOW VOLTAGE SWITCHBOARD PANEL

AT

MERU TEACHING AND REFERRAL HOSPITAL

JULY 2018
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Date: ________________

Reference: SUPPLY, INSTALLATION AND COMMISSIONING OF A COMMUNICATING ELECTRICAL LOW VOLTAGE SWITCHBOARD AT MERU TEACHING AND REFERRAL HOSPITAL (MeTRH)

1. The MERU TEACHING AND REFERRAL HOSPITAL invites sealed tenders from eligible candidates for: SUPPLY, INSTALLATION AND COMMISSIONING OF A COMMUNICATING LOW VOLTAGE SWITCHBOARD AT MERU TEACHING AND REFERRAL HOSPITAL (MeTRH)

2. Interested eligible candidates can view and download the documents from the website www.meru.go.ke. Bidders will be required to email their detailed contact information to procurement.finance@meru.go.ke for recording, further clarifications and addenda. No other email addresses shall be used. No other email addresses should be used. Addenda will also be posted on the website as they become available.

3. In addition, all Mandatory requirements will be listed and must be placed in a separate envelope marked “Mandatory Requirements”.

4. Bidders must paginate all their documents and initial each page.
CGM reserves the right to confirm the authenticity of all documents submitted by Tenderers. Any attempt by bidders to misrepresent themselves by submitting documents that are not genuine will amount to disqualification.

4. Prices quoted should be net inclusive of all taxes and shall remain valid for a minimum of **One Hundred and Twenty days (120) days** from the closing date of the tender.

5. Tenders must be addressed to:

   The County Secretary  
   County Government of Meru  
   P. O. Box 120 – 60200  
   Meru - Kenya

   And deposited in the tender box on ground floor of County Headquarters on or before **10:00 AM 16th August 2018**. Tenders shall be opened immediately thereafter and tenderers or their representatives who wish to attend are welcome. Tender documents are not transferable.

   CGM reserves the right to accept or reject any tender either in whole or in part and is not bound to give reasons thereof.

Medical Engineering Services  
Department of Health  
**County Government of Meru**
Section C: Instructions to Tenderers

Introduction

1. Definitions

1.1. “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.

1.2. “Approved Tenderer” means the Tenderer who is approved by CGM.

1.3. 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”.

1.4. “Employer” means the County Government of Meru (CGM).

1.5. “The Contract” means the agreement entered into between MeTRH and the Tenderer, as recorded in the Contract Form signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein.

1.6. “The Contract Price” means the price payable to the Tenderer under the Contract for the full and proper performance of its contractual obligations

2. Eligibility and Qualification

2.1. This invitation to tender is open to all Tenderers who are eligible as stated in the appendix of the instruction to Tenderers. MeTRH employees, committee members, board members and their relatives (spouses and children) are not eligible to participate in the tender.

2.2. To be qualified for award of contract, the Tenderer shall provide evidence satisfactory to MeTRH 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 if this is carried out:
   (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 contractual documents;

   (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, tools and equipment proposed for use in carrying out the contract. Only reliable plant and equipment in good working order and suitable for requisite work shall be shown on this schedule. The Tenderer will also indicate on this schedule when each item will be available on the works.
(d) All equipment to be supplied and installed under the contract shall have their origin in eligible source countries. For purposes of this clause, “origin” means the place where the equipment(s) are produced. Goods are produced when, through manufacturing, processing, or substantial and major assembly of components, a commercially-recognized product results that is substantially different in basic characteristics or in purpose or utility from its components. The origin of equipment is distinct from the nationality of the Tenderer and shall be treated thus in the evaluation of the tender.

(e) Also to be included 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;

(f) 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;

(g) A draft of Program of Works in the form of a Gantt Chart and schedule of payment which shall form part of the contract if the tender is accepted. Any change in the Program or Schedule will be subjected to the approval of the Engineer;

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

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

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

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

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

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

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

2.4 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.

(e) Be incorporated in Kenya where Kenyan citizens hold a 100% capital share.

3 Cost of Tendering

3.3 The Tenderer shall bear all costs associated with the preparation and submission of its tender, and MeTRH, will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the tendering process.

3.4 The price to be charged for the tender document is (tender documents can be downloaded at no cost from www.meru.go.ke)

3.5 MeTRH shall allow the Tenderer to view the tender document free of charge before purchase.

4 Site Visit (Shall be held at 10:00 am on 6th August 2018 at MeTRH)

4.3 A pre-tender site visit is mandatory and a Certificate of Tenderer’s Visit will be available at th sites for signature. The Tenderer is advised examine the Site and its surroundings and obtain for himself on his own responsibility, all information that may be necessary for preparing the tender and entering into a contract. The costs of visiting the Site shall be the Tenderer’s own responsibility.

4.4 The Tenderer and any of his personnel or agents will be granted permission by MeTRH 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 MeTRH from and against all liability in respect of, and will be responsible for personal injury (whether serious or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused, which but for the exercise of such permission, would not have arisen.

4.5 MeTRH shall organize a site visit at a date to be notified. A representative of MeTRH will be available to meet the intending Tenderers at the site.

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

4.7 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.
The Tender Document

5 Contents

5.1 The tender document comprises the documents listed below and addenda issued in accordance with clause 6 of these instructions to tenders:
   Invitation for Tenders
   i. General information
   ii. General Conditions of Contract
   iii. Special Conditions of Contract
   iv. Technical Specifications
   v. Tender Form, Schedule of Requirements and Price Schedules
   vi. Confidential Business Questionnaire
   vii. Tender Security Form
   viii. Contract Form
   ix. Performance Security Form
   x. Manufacturer’s Authorization Form
   xi. Certificate of Site Visit

5.2 The Tenderer is expected to examine all instructions, forms, terms, and specifications in the tender documents. Failure to furnish all information required by the tender documents or to submit a tender not substantially responsive to the tender documents in every respect will be at the Tenderer’s risk and may result in the rejection of its tender.

6 Clarification of Documents

6.1 A prospective Tenderer requiring any clarification of the tender document may notify MeTRH in writing or by cable (hereinafter, the term cable is deemed to include telex and facsimile) at the entity’s address indicated in the Invitation for tenders. MeTRH will respond in writing to any request for clarification of the tender documents, which it receives no later than seven (7) days prior to the deadline for the submission of tenders, prescribed by MeTRH. Written copies of the entity’s response (including an explanation of the query but without identifying the source of inquiry) will be sent to all prospective Tenderers who have received the tender document. MeTRH may arrange for vendors clarification meeting before the tenders are opened.

6.2 Clarification of tenders shall be requested by the Tenderer to be received by MeTRH not later than 7 days prior to the deadline for submission of tenders.

6.3 MeTRH 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 Documents

7.1 At any time prior to the deadline for submission of tenders, MeTRH, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Tenderer, may modify the tender documents by amendment.
7.2 All prospective candidates who have received the tender documents will be notified of the amendment in writing or by cable, and such amendment will be binding on them.

7.3 In order to allow prospective Tenderer reasonable time in which to take the amendment into account in preparing their tenders, MeTRH, at its discretion, may extend the deadline for the submission of tenders.

**Preparation of Tenders**

8 **Language of Tender**

The tender prepared by the Tenderer, as well as all correspondence and documents relating to the tender exchanged by the Tenderer and MeTRH, shall be written in English language. Any printed literature furnished by the Tenderer may be written in another language provided they are accompanied by an accurate English translation of the relevant passages in which case, for purposes of interpretation of the tender, the English translation shall govern.

9 **Documents Comprising the Tender**

9.1 The tender prepared by the Tenderer shall comprise the following components:

   (a) A Tender Form and a Price Schedule completed in accordance with paragraph 10, 11 and 12 below.

   (b) Documentary evidence established in accordance with paragraph 13 that the Tenderer is eligible to tender and is qualified to perform the contract if its tender is accepted.

   (c) Tender security furnished is in accordance with paragraph 15.

10 **Tender Form**

10.1 The Tenderer shall complete the Tender Form and the appropriate Price Schedule furnished in the tender documents, indicating the services to be performed, a brief description of the activities, estimated total staff effort for each activity (both professional and support staff). This should be supported by bar chart diagrams.

11 **Tender Prices**

11.1 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 initialled by the person or persons signing the tender.

11.2 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 MeTRH when executed and shall be deemed covered by the rates for other items and prices in the Bills of Quantities.
11.3 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.

11.4 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.

11.5 Every rate entered in the Bills of Quantities, whether or not such rate is associated with a quantity, shall form part of the Contract. MeTRH 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 MeTRH to take full advantage of unbalanced low rates.

11.6 Unless otherwise specified the Tenderer must enter the amounts representing 25% 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.

11.7 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 where appropriate.

11.8 The rates and prices quoted by the Tenderer are not subject to adjustment during the performance of the 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.

12 Tender Currencies

12.1 Prices shall be quoted in either of the following currencies:
   (a) Kenya shillings; and
   (b) US dollars.

12.2 The Tenderer shall indicate on the appropriate Price Schedule the unit prices where applicable and total tender price of the equipment and installation it proposes to supply under the contract.

12.3 Prices indicated on the Price Schedule shall be entered separately in the following manner:
   (a) The price of the equipment quoted EXW (ex works, ex factory, ex warehouse, ex showroom, or off-the-shelf, as applicable), including all customs duties and sales and other taxes already paid or payable;
(b) Charges for inland transportation, insurance, and other local costs incidental to delivery of the goods to their final destination; and

(c) Installation charges shall also be indicated separately for each equipment

12.4 Prices quoted by the Tenderer shall remain fixed during the Tender’s performance of the contract. A tender submitted with an adjustable price quotation will be treated as non-responsive and will be rejected, pursuant to paragraph 25 unless otherwise agreed by the parties.

13 Tenderers Eligibility and Qualifications

13.1 Pursuant to paragraph 2 of section C, the Tenderer shall furnish, as part of its tender, documents establishing the Tenderers eligibility to tender and its qualifications to perform the contract if its tender is accepted.

13.2 The documentary evidence of the Tenderers qualifications to perform the contract if its tender is accepted shall establish to MeTRH’s satisfaction that the Tenderer has the financial and technical capability necessary to perform the contract.

13.3 The documentary evidence of the Tenderers qualifications to perform the contract if its tender is accepted shall establish to MeTRH’s satisfaction;

(a) that, in the case of a Tenderer offering to supply equipment under the contract which the Tenderer did not manufacture or otherwise produce, the Tenderer has been duly authorized by the equipment, Manufacturer or producer to supply the equipment

(b) that the Tenderer has the financial, technical, and production capability necessary to perform the contract;

(c) that, in the case of a Tenderer not doing business within Kenya, the Tenderer is or will be (if awarded the contract) represented by an Agent in Kenya equipped, and able to carry out the Tenderer’s maintenance, repair, and spare parts-stocking obligations prescribed in the Conditions of Contract and/or Technical Specifications.

14 Standards and Technical Tools

14.1 The Tenderer shall furnish MeTRH as part of its tender, documents supporting the suitability of its design/equipment and accessories against the expected output in the tender document.

14.2 The documentary evidence of the eligibility of the goods shall consist of statement in the Price Schedule of the country of origin of the goods and services offered which shall be confirmed by a certificate of origin issued at the time of shipment.

14.3 The documentary evidence of conformity of the equipment to the tender documents may be in the form of literature, drawings, and data, and shall consist of:

(a) A detailed description of the essential technical and performance characteristic of the equipment
(b) A list giving full particulars, including available source and current prices of spare parts, special tools, etc., necessary for the proper and continuing functioning of the equipment for a period of two (2) years, following commencement of the use of the equipment by MeTRH; and

(c) A clause-by-clause commentary on MeTRH Technical Specifications demonstrating substantial responsiveness of the goods and service to those specifications, or a statement of deviations and exceptions to the provisions of the Technical Specifications.

14.4 For purposes of the commentary to be furnished pursuant to paragraph 14.3 (c) above, the Tenderer shall note that standards for workmanship, material, and equipment, as well as references to brand names or catalogue numbers designated by the Procurement entity in its Technical Specifications, are intended to be descriptive only and not restrictive. The Tenderer may substitute alternative standards, brand names, and/or catalogue numbers in its tender, provided that it demonstrates to the Procurement entity’s satisfaction that the substitutions ensure substantial equivalence to those designated in the Technical Specifications.

15  Tender Security (Must be valid for 150 days from the date of tender opening)

15.1 The Tenderer shall furnish, as part of its tender, a tender security for the amount specified in the Invitation to Tenders.

15.2 The tender security is required to protect MeTRH against the risk of Tenderer’s conduct which would warrant the security’s forfeiture, pursuant to paragraph 15.8.

15.3 The tender security shall be denominated in Kenya Shillings or in another freely convertible currency, and shall be in the form of a bank guarantee or a bank draft issued by a reputable bank located in Kenya licensed by the Central Bank of Kenya, in the form provided in the tender documents or another form acceptable to MeTRH and valid for thirty (30) days beyond the validity of the tender.

15.4 Any tender not secured in accordance with paragraph 15.1 and 15.3 will be rejected by the MeTRH as a non-responsive, pursuant to paragraph 23.

15.5 Unsuccessful Tenderer’s tender security will be discharged or returned as promptly as possible as but not later than thirty (30) days after the expiration of the period of tender validity prescribed by MeTRH.

15.6 The successful Tenderer’s tender security will be discharged upon the Tenderer signing the contract, pursuant to paragraph 35, and furnishing the performance security, pursuant to paragraph 36.

15.7 The Tender Security shall be at least 0.5-2% of the value of contract.

15.8 The tender security may be forfeited:

(a) If a Tenderer withdraws its tender during the period of tender validity specified by MeTRH on the Tender Form; or

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MeTRH Low Voltage Switchboard Upgrade

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(b) In the case of a successful Tenderer, if the Tenderer fails:

(i) To sign the contract in accordance with paragraph 35

Or

(ii) To furnish performance security in accordance with paragraph 36

(c) If the Tenderer rejects correction of an arithmetic error in the tender.

16 Validity of Tenders

16.1 Tenders shall remain valid for 120 days or as specified in the tender documents after date of tender opening prescribed by MeTRH, pursuant to paragraph 23. A tender valid for a shorter period shall be rejected by MeTRH as non responsive.

16.2 In exceptional circumstances, MeTRH may solicit the Tenderer’s consent to an extension of the period of validity. The request and the responses thereto shall be made in writing. The tender security provided under paragraph 15 shall also be suitably extended. A Tenderer may refuse the request without forfeiting its tender security. A Tenderer granting the request will not be required nor permitted to modify its tender.

17 No Alternative Offers

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

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

17.3 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.

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

18 Pre-tender Meeting

18.1 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.

18.2 The Tenderer is requested as far as possible to submit any questions in writing or by cable, to reach MeTRH 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: 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 MeTRH exclusively through the issue of a tender notice pursuant to Clause 7 and not through the minutes of the pre-tender meeting.

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

19 Format and Signing of Tender

19.1 The Tenderer shall prepare two copies of the tender, clearly marking each “ORIGINAL TENDER” and “COPY OF TENDER,” as appropriate. In the event of any discrepancy between them, the original shall govern.

19.2 The original and all copies of the tender shall be typed or written in indelible ink and shall be signed by the Tenderer or a person or persons duly authorized to bind the Tenderer to the contract. The latter authorization shall be indicated by written power-of-attorney accompanying the tender. All pages of the tender, except for unamended printed literature, shall be initiated by the person or persons signing the tender.

19.3 The tender shall have no inter lineation, erasures, or overwriting except as necessary to correct errors made by the Tenderer, in which case such corrections shall be initiated by the person or persons signing the tender.

Submission of Tenders

20 Sealing and Marking of Tenders (this is a two envelope tender)

20.1 The technical and the financial tender bid shall be in two separate envelopes.

20.2 Pursuant to paragraph 15.1 and 15.2, the Tenderer shall seal the original and each copy of the tender in separate envelopes, duly marking the envelopes as “ORIGINAL” and “COPY.” The envelopes shall then be sealed in an outer envelope.

20.3 The original and all copies of the Technical Bid shall be placed in a sealed envelope clearly marked “TECHNICAL BID,” and the original and all copies of the Financial Bid in a sealed envelope clearly marked “FINANCIAL BID” and warning: “DO NOT OPEN WITH THE TECHNICAL BID.” Both envelopes shall be placed into an outer envelope and sealed. This outer envelope shall bear the submission address and other information indicated in the Invitation to Tender and be clearly marked, “DO NOT OPEN, EXCEPT IN PRESENCE OF THE OPENING COMMITTEE.”

20.4 The inner and outer envelopes shall:

(a) Be addressed to MeTRH at the following address:

   The County Secretary
   County Government of Meru
   P. O. Box 120 – 60200
   Meru - Kenya
b) Bear Supply, Installation, Testing and Commissioning of a Communicating Electrical Low Voltage Switchboard at Meru Teaching and Referral Hospital (MeTRH), the Invitation for Tenders (IFT), and the words: “DO NOT OPEN BEFORE 10:00 A.M.”

20.5 The inner envelopes shall also indicate the name and address of the Tenderer to enable the tender to be returned unopened in case it is declared “late”.

20.6 If the outer envelope is not sealed and marked as required by paragraph 20.3, CGM will assume no responsibility for the tender’s misplacement or premature opening.

21 Deadline for Submission of Tenders

21.1 Tenders must be received by CGM at the address specified in the Invitation to Tender no later than 16th August 2018 10:00 A.M.

21.2 Tenders delivered by hand must be placed in the “tender box” provided in the office of MeTRH.

21.3 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.

21.4 MeTRH may, at its discretion, extend this deadline for the submission of tenders by amending the tender documents in accordance with paragraph 6, in which case all rights and obligations of MeTRH and candidates previously subject to the deadline will thereafter be subject to the deadline as extended.

21.5 Any tender received after the prescribed deadline for submission of tender will be returned unopened to the Tenderer.

22 Modification and Withdrawal of Tenders

22.1 The Tenderer may modify or withdraw its tender after the tender’s submission, provided that written notice of the modification, including substitution or withdrawal of the tenders, is received by MeTRH prior to the deadline prescribed for submission of tenders.

22.2 The Tenderer’s modification or withdrawal notice shall be prepared, sealed, marked, and dispatched in accordance with the provisions of paragraph 23. A withdrawal notice may also be sent by cable, but followed by a signed confirmation copy, postmarked not later than the deadline for submission of tenders.

22.3 No tender may be modified after the deadline for submission of tenders.

22.4 No tender may be withdrawn in the interval between the deadline for submission of tenders and the expiration of the period of tender validity specified by the Tenderer on the Tender Form. Withdrawal of a tender during this interval may result in the Tenderer’s forfeiture of its tender security, pursuant to paragraph 15.7.
Opening and Evaluation of Tenders

23 Opening of Tenders

23.1 All tenders will be opened in the presence of Tenderers’ representatives who choose to attend, at 16th August 2018 10:00 A.M. and in the following location.

Meru County Headquarters

The Tenderers’ representatives who are present shall sign a register evidencing their attendance.

23.2 The Tenderers’ names, tender modifications or withdrawals, tender prices, discounts, and the presence or absence of requisite tender security and such other details as MeTRH, at its discretion, may consider appropriate, will be announced at the opening.

23.3 Tenders for which an acceptable notice of withdrawal has been submitted, pursuant to Clause 22, will not be opened. MeTRH will examine the tenders to determine whether they are complete, whether the requisite Tender Securities have been furnished, whether the documents have been properly signed and whether the tenders are generally in order.

23.4 MeTRH shall prepare a tender opening register and minutes of the tender opening including the information disclosed to those present.

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

23.6 Upon technical evaluation the successful bidders shall proceed for the financial bid opening and that shall proceed as prescribed under Clause 28

24 Process to be Confidential

24.1 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.

24.2 Any effort by a Tenderer to influence MeTRH 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.

25 Determination of Responsiveness
25.1 Prior to the detailed evaluation of tenders, MeTRH will determine whether each tender is substantially responsive to the requirements of the tender documents.

25.2 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, MeTRH’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.

25.3 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 MeTRH’s estimate of the works to be performed under any item or groups of items, the tender shall be deemed not responsive.

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

26 Clarification of Tenders

26.1 To assist in the examination, evaluation and comparison of tenders MeTRH may, at its discretion, ask the Tenderer for a clarification of its tender. The request for clarification and the response shall be in writing, and no change in the prices or substance of the tender shall be sought, offered, or permitted.

27 Preliminary Examination

27.1 MeTRH will examine the tenders to determine whether they are complete, whether any computational errors have been made, whether required securities have been furnished, whether the documents have been properly signed, and whether the tenders are generally in order.

27.2 MeTRH may waive any minor informality or non-conformity or irregularity in a tender which does not constitute a material deviation, provided such waiver does not prejudice or affect the relative ranking of any Tenderer.

27.3 Prior to the detailed evaluation, pursuant to paragraph 25, MeTRH will determine the substantial responsiveness of each tender to the tender documents. For purposes of these paragraphs, a substantially responsive tender is one which conforms to all the terms and conditions of the tender documents without material deviations. MeTRH’s determination of a tender’s responsiveness is to be based on the contents of the tender itself without recourse to extrinsic evidence.
27.4 If a tender is not substantially responsive, it will be rejected by MeTRH and may not subsequently be made responsive by the Tenderer by correction of the nonconformity.

28 Evaluation and Comparison of Tenders

28.1 MeTRH will evaluate and compare the tenders which have been determined to be substantially responsive, pursuant to paragraph 25.

28.2 The comparison shall be of the price to including all costs, as well as duties and taxes payable on all the services.

28.3 MeTRH’s evaluation of a tender will take into account, in addition to the tender price, the following factors, in the manner and to the extent indicated in paragraph 28.4 and in the technical specifications:

28.4 In evaluating tenders, MeTRH will determine for each tender the evaluated tender price by noting the price quoted. In addition:

(a) Making any correction for errors. There shall be no correction of errors during evaluation. The evaluation committee shall be guided by the Public Procurement and Disposal Act in addressing errors observed.

(b) Excluding Provisional Sums and provision, if any, for Contingencies in the Bills of Quantities, but including Day works where priced competitively.

28.5 MeTRH 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 MeTRH, shall not be taken into account in tender evaluation.

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

28.7 If the lowest evaluated tender is seriously unbalanced or front loaded in relation to MeTRH’s estimate of the items of work to be performed under the Contract, MeTRH 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, MeTRH may require that the amount of the Performance Security set forth in Clause 33 be increased at the expense of the successful Tenderer to a level sufficient to protect MeTRH against financial loss in the event of subsequent default of the successful Tenderer under the Contract.

28.7.1 If the tender documents are amended when the time remaining before the deadline for submitting of tenders is less than one third of the time allowed for the preparation of tenders, or the time remaining is less than the period in instructions to tenderers, MeTRH shall extend the deadline as necessary to allow the amendment of the tender documents to be taken into account in the preparation and amendment of tenders.

MeTRH Low Voltage Switchboard Upgrade
28.8 Only firms incorporated in Kenya where indigenous Kenyans own 100% share capital shall be allowed to participate in this Tender.

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

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

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

29 Contacting Meru Teaching and Referral Hospital

29.1 Subject to paragraph 26, no Tenderer shall contact MeTRH on any matter relating to its tender, from the time of the tender opening to the time the contract is awarded.

29.2 Any effort by a Tenderer to influence MeTRH in its decisions on tender evaluation, tender comparison, or contract award may result in the rejection of the Tenderer’s tender.

Award of Contract

30 Post-qualification

30.1 In the absence of pre-qualification, MeTRH will determine to its satisfaction whether the Tenderer that is selected as having submitted the lowest evaluated responsive tender is qualified to perform the contract satisfactorily.

30.2 The determination will take into account the Tenderer financial and technical capabilities. It will be based upon an examination of the documentary evidence of the Tenderers qualifications submitted by the Tenderer, pursuant to paragraph 12.3, as well as such other information as MeTRH deems necessary and appropriate.

30.3 An affirmative determination will be a prerequisite for award of the contract to the Tenderer. A negative determination will result in rejection of the Tenderer’s tender, in which event MeTRH will proceed to the next lowest evaluated tender to make a similar determination of that Tenderer’s capabilities to perform satisfactorily.

31 Award Criteria

31.1 Subject to paragraph 10, 25 and 28 MeTRH will award the contract to the successful Tenderer whose tender has been determined to be substantially responsive and has been determined to be both technically competent and financially capable, provided further that the Tenderer is determined to be qualified to perform the contract satisfactorily.

31.2 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.

32 Meru Teaching and Referral Hospital’s Right to Vary quantities

32.1 MeTRH reserves the right at the time of contract award to increase or decrease the quantity of services originally specified in the Schedule of requirements without any change in unit price or other terms and conditions.

33 Meru Teaching and Referral Hospital’s Right to accept or Reject any or All Tenders

33.1 MeTRH reserves the right to accept or reject any tender, and to annul the tendering process and reject all tenders at any time prior to contract award, without thereby incurring any liability to the affected Tenderer any obligation to inform the affected Tenderer of the grounds for MeTRH’s action.

33.2 MeTRH may at any time terminate procurement proceedings before contract award and shall not be liable to any person for the termination.

33.3 MeTRH shall give prompt notice of the termination to the Tenderers and on request give its reasons for termination within 14 days of receiving the request from any Tenderer.

33.4 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 reported to PPOA to be considered for debarment from participating in future public procurement.

34 Notification of Award

34.1 Prior to the expiration of the period of tender validity, MeTRH will notify the successful Tenderer in writing that its tender has been accepted and at the same notify all other tenderers that their tenders were not successful.

34.2 Upon the successful tenderer furnishing of the performance security pursuant to paragraph 36, MeTRH will promptly discharge its tender security.

35 Signing of Contract

35.1 At the same time as MeTRH notifies the successful Tenderer that its tender has been accepted, MeTRH will send the Tenderer the Contract Form provided in the tender documents, incorporating all agreements between the parties.

35.2 Within thirty (30) days of receipt of the Contract Form, but not fourteen (14) days have elapsed following the giving of that notice the successful tenderer shall sign the contract and return it to MeTRH.

36 Performance Security

36.1 Within thirty (30) days of the receipt of notification of award from MeTRH, the successful Tenderer shall furnish the performance security in accordance with the Conditions of
Contract, in the Performance Security Form provided in the tender documents, or in another form acceptable to MeTRH.

36.2 Failure of the successful Tenderer to comply with the requirement of paragraph 35 or paragraph 36 shall constitute sufficient grounds for the annulment of the award and forfeiture of the tender security, in which event MeTRH may make the award to the next lowest evaluated Candidate or call for new tenders.

37 Corrupt and Fraudulent Practices

37.1 MeTRH requires that Tenderers observe the highest standard of ethics during the procurement process and execution of contracts. In pursuance of this policy, MeTRH:-

(a) Defines, for the purposes of this provision, the terms set forth below as follows:

(i) “corrupt practice” means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution; and

(ii) “fraudulent practice” means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of MeTRH, and includes collusive practice among Tenderer (prior to or after tender submission) designed to establish tender prices at artificial non-competitive levels and to deprive MeTRH of the benefits of free and open competition.

(b) will reject a proposal for award if it determines that the Tenderer recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;

(c) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded any contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a contract in line with the provisions of Section 62 of the PPADA, 2015.

(d) MeTRH requires the tenderers to observe the highest standard of ethics during the procurement process and execution of the contract. A tenderer shall sign a declaration that he is not debarred from participating in procurement process under part XIV of the PPADA 2015 and the person will not engage in corrupt and/or fraudulent practices in competing for and executing the contract.

The Tenderer must also provide the following:

(i) Firm’s references indicating:
   a. Firm’s comments and suggestions on the Terms of Reference and facilities to be provided by the Client.
   b. Detailed capabilities of the items/products to be supplied and the benefits the company stands to benefit. Organizations where the stated items/products to be supplied have worked should be listed.
   c. The composition of the proposed staff team to commission the project on completion.
d. CVs recently signed by the proposed professional staff and the authorized representative submitting the proposal. Key information should include number of years working for the firm/entity, and degree of responsibility held in various assignments during the last five (5) years.

(ii) A brief description of the firm’s organization, certifications, partnerships with manufacturers/patent owners and an outline of recent experience on orders of a similar nature. For each order, the outline should indicate contract amount, and firm’s involvement

These details where possible should be provided using forms in section K.
SECTION III: APPENDIX TO INSTRUCTION TO TENDERERS

1. Performance Guarantee

The amount of Performance Security is 2 % of the Contract Price

2. Bidders must pagenate all their documents and initial each page

3. Award Criteria

The tender for the **Supply, Installation and Commissioning of Electrical Low Voltage Switchboard at Meru Teaching and Referral Hospital (MeTRH)**
shall be advertised accordingly. The Tenderers shall
then tender and return the completed tender documents to the company as in the instruction to Tenderers in the tender document. These shall be opened and the tender evaluation exercise shall follow.

The tender evaluation criteria shall be based on the information communicated to the Tenderers on the tender document and shall comprise competence evaluation, technical evaluation, and financial evaluation. These shall be as in the table below (**Technical Evaluation**). Ranking shall be in the order the marks scored.

**Note.** If any information requested for is not furnished, or the bidder fails to visit the site, or the bidder fails to bid for a substantial portion of the project, his tender shall be deemed non responsive. Non responsive tenders shall not be evaluated.

4. Work Plan and Methodology

Attach work plan and schedule of work together with the proposed no of staff. This shall be assessed and marks provided

5. Manuals, Catalogues, Drawings, Datasheets

All catalogues, manuals, drawings, datasheets and any other documentation should be attached here. Preliminary design drawings of the switchboards must also be attached.
6. **Schedule of Mandatory Spare Parts and Prices**

Attach a list of mandatory spare parts and prices. This is an evaluation criteria and in case the spares list is not attached, no marks shall be awarded.

7. **Curriculum Vitae of Key Staff**

Attach CVs of the following staff:

- ✓ Company Directors – At least 1 lead person must be a EBK/ERC and CAK Registered Professional on Electrical and Telecommunication works respectively.
- ✓ Project Manager – EBK registered Professional Engineer.
- ✓ Electrical Engineer – At least Class B Energy Regulatory Commission (ERC) Registered.
- ✓ Telecommunication Engineer - Communication Authority of Kenya (CAK) Registered.
- ✓ Software Engineering/Computer Engineering Personnel.
- ✓ Certified Energy Manager or Equivalent who understands Energy Audit.

8. **References for Similar Works Carried Out in The Last 3 Years**

Attach references for similar works carried out in the last 3 years

9. **Training Program and Content**

Attach training program and content here
Section D: General Conditions of Contract

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

1. Commencement Date (Sub-clause 1.1.1 (i))

The date for commencement of the Works is 14 days after Engineer’s instruction to commence.

2. The Employer (Sub-clause 1.1.12)

The Employer is Meru Teaching and Referral Hospital Ltd.

3. The Engineer (Sub-clause 1.1.15)

The Engineer is MeTRH’s Engineering Manager or his appointed representative.

4. Time for Completion (Sub-clause 1.1.35)

The Time for Completion is ________ weeks.

5. Ruling Language (Sub-clause 5.1)
The version in English language (ruling language) shall prevail.

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

The language for day to day communications is English.

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

The programme must be submitted in the form of MS Project with individual activities.

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

Services on the Site are:

(a) Electricity: Yes
(b) Water: Yes
(c) Medical Gas: Yes
(d) Other Services: None

9. Employer’s Equipment (Sub-clause 14.4)

The following Employer’s equipment is available for use by the Contractor under the Employer’s operation:

None

10. Working Hours (Sub-clause 18.3)

The normal working hours are 0800 to 1700hrs, Monday to Friday.

11. 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 KES 50,000.00

Maximum KES 1,000,000.00

12. Prolonged delay (Sub-clause 27.2)

Maximum amount recoverable from the Contractor by the Employer: 10% of the contract sum

13. Terms of Payment (Sub-clause 33.1)

Payment to be made after Completion of Work
14. Payment in Foreign Currencies (Sub-clause 35.1)

None.
Conversion shall be done using the rates of exchange as outline in clause 15 below.

15. Rates of Exchange (Sub-clause 53.3)

The rates of exchange for the purpose of the Contract are:

The prevailing mean exchange rates at the Central Bank of Kenya 5 days before the final date for the submission of tenders.

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

The percentage to be applied to Provisional Sums shall be 2½%.

17. Maximum Liability (Sub-clause 42.2)

The maximum liability of the Contractor to the Employer shall be 10% of the contract sum.

18. Insurance of Works (Sub-clause 43.1)

The deductible limits in the insurance cover of the Works shall not exceed 15% of the contract sum.

19. Insurance of Works (Sub-clause 43.1 (a))

The additional risks to be insured are:

Equipment and personnel on site, work in progress and all third party liabilities as defined by the Engineer.

20. 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 KES 700,000 per occurrence, with unlimited number of occurrences.

21. Payment on Termination for Employer’s Default (Sub-clause 46.3)

The additional amount payable by the Employer on termination shall not exceed the value of work done.

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

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

Not applicable because there shall be no variation.
23. Notices to Employer and Engineer (Sub-clause 49.2)

The address of the Employer for notices is:

The County Engineer for Health  
County Government of Meru  
P. O. Box 120 -60200  
MERU - KENYA

24. Applicable Law (Sub-clause 51.1)

The applicable law is Kenyan law.

25. Procedural Law for Arbitration (Sub-clause 51.2)

N/A

26. Language and Place of Arbitration (Sub-clause 51.3)

N/A

27. Use of Contract Documents and Information

The Tenderer shall not, without MeTRH’s prior written consent, disclose the Contract, or any provision thereof, or any specification, plan, drawing, pattern, sample, or information furnished by or on behalf of MeTRH in connection therewith, to any person other than a person employed by the Tenderer in the performance of the Contract.

Any document, other than the Contract itself shall remain the property of MeTRH and shall be returned (all copies) to MeTRH on completion of the Tenderer’s performance under the Contract if so required by MeTRH

28. Termination for default

MeTRH may, without prejudice to any other remedy for breach of Contract, by written notice of default sent to the Tenderer, terminate this Contract in whole or in part:

If the Tenderer fails to deliver any or all of the goods within the period(s) specified in the Contract, or within any extension thereof granted by MeTRH;

If the Tenderer fails to perform any other obligation(s) under the Contract;

If the Tenderer, in the judgment of MeTRH has engaged in corrupt or fraudulent practices in competing for or in executing the Contract;

In the event MeTRH terminates the Contract in whole or in part, it may procure, upon such terms and in such manner as it deems appropriate, equipment similar to those undelivered, and the Tenderer shall be liable to MeTRH for any excess costs for such similar goods.
29. Resolution of Disputes

MeTRH and the Tenderer shall make every effort to resolve amicably by direct informal negotiation and disagreement or dispute arising between them under or in connection with the contract:

If, after thirty (30) days from the commencement of such informal negotiations both parties have been unable to resolve amicably a contract dispute either party may seek adjudication in the High Court of Kenya.

30. Force Majeure

Neither MeTRH nor the Tenderer shall be liable for non-performance of its obligations under the contract if delay of such performance is as a result of and event of force majeure.
Section E: Terms of Reference (TOR)

The following are the terms of reference for the Supply, Installation, Testing and Commissioning of a Communicating Electrical Low Voltage Switchboard at Meru Teaching and Referral Hospital (MeTRH):

1. Determine MeTRH operational system, key priorities, product handling and Hospital requirements

2. Develop a supply, installation and commissioning implementation plan in consideration of (1) above, for the successful realisation of the Project.

Specifically, the Contractor will be required to perform the following tasks:

a) Supply, Installation, Testing and Commissioning of a Communicating Electrical Low Voltage Switchgear at Meru Teaching and Referral Hospital (MeTRH).

b) Provide a comprehensive accurate quotation for Supply, Installation and Commissioning of a Communicating Electrical Low Voltage Switchgear at Meru Teaching and Referral Hospital (MeTRH) together with the required accessories in particular site testing, spares and any other necessary engineering modification which shall be deemed necessary to meet expected internationally acceptable engineering practice as no additional costs shall be catered for by MeTRH to meet these standards outside the contract price.

c) Carry out installation and commissioning of the project with minimum interruption of MeTRH operations.

d) Incorporate MeTRH staff in the planning, design, implementation and commissioning of the project.
Section F: Special Conditions of Contract

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.

Special Conditions of Contract (SCC) shall supplement the General Conditions of Contract (GCC). Whenever there is a conflict, between the GCC and the SCC, the provisions of the SCC herein shall prevail over these in the GCC.

Conditions Precedent to Commencement (Sub-clause 1.1.1)

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

Defects Liability Period (Sub-clause 1.1.11)

The Defects Liability Period is 12 months after project commissioning.

Operation and Maintenance Manuals (Sub-clause 6.6)

Catalogues, Operation and Maintenance Manuals shall be in English language.

Manufacturing Drawings (Sub-clause 6.9)

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

Upon request

General Obligations (Sub-clause 8.1)

Not applicable

Performance Security (Sub-clause 10.1)

The Contractor shall obtain a Performance Security of an amount KES 10% of lump sum price of the contract sum.

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:

Nil

Price Variation

Contract price variations shall only be allowed subject to provisions of the Public Procurement and Disposal Act (2015).
Extension of Defects Liability Period (Sub-clause 30.4)

In the event of suspension the Defects Liability Period shall not last more than 90 days after the date the Plant would have been delivered but for the suspension.

Method of Application (Sub-clause 33.2)

Application for payment shall be made through an invoice from the contractor.

Payment (Sub-clause 33.5)

The period for payment shall be 30 days upon receipt of invoice.

The payment schedule under the contract will be as follows:
20% of contract value on getting approval from MeTRH for switchboard detailed designs and drawings and, and on receipt of order confirmation from switchboard manufacturer
20% of contract value on completion of FAT.
25% of contract value on delivery of the switchgear to Meru Teaching and Referral Hospital (MeTRH).
35% of contract value on successful installation and commissioning.

Notes:

a. The place for payment shall be County Headquaters.

b. 10% of each milestone value shall be retained whenever each milestone payment is due. This shall cumulatively amount to 10% of the total contract sum, to be paid upon expiry of the defects liability period of 1 year.

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.

Payment by measurement (Sub-clause 33.8)

The provisions for measurement are:

As defined in the Bill of Quantities and Scope of Works and jointly measured by the Contractor and the Employer.

Arbitration (Sub-clause 50.2)

N/A
**Section G: Scope of Works**

The scope of works shall include the following.

1. Decommissioning existing 415 V Switchboard at Meru Teaching and Referral Hospital (MeTRH). This includes disconnecting both power and control cables to all the loads and equipment.

2. Supply, installation, and commissioning of 415 V Switchboard at Meru Teaching and Referral Hospital (MeTRH).
   The installation includes termination onto existing cables for various loads and controls.

3. The Tenderer shall be required to supply and carry out installation for all the works with minimal interruption to MeTRH’s normal operations.

4. The Tenderer, together with a team of MeTRH engineers, shall be required to carry out a structured and comprehensive factory acceptance test (FAT) and site acceptance test (SAT) and sign the relevant forms.

5. The Tenderer shall ensure that before the completion of the project, at least four copies of the relevant manuals and documentation, including as built drawings are availed to MeTRH in hard and/or software forms.

6. The Tenderer shall offer a comprehensive and complete factory training for five MeTRH engineers and technicians. The content and depth of the training shall be agreed with MeTRH.

7. On award of the contract, the Tenderer shall develop and present to MeTRH, within two weeks, a comprehensive functional design specification (FDS) document which shall address all functions as stated in this tender document. Any omissions of the functions shall be re-instated, when noted by MeTRH at any time in the contract, by the Contractor at no additional cost to MeTRH.

8. The Tenderer shall propose the estimate implementation period from the date of contract signing to project commissioning. The project implementation schedule shall be provided.

9. The Tenderer shall be required to carry out own surveys of the site in order to come out with a complete quotation before tendering.

10. The Tenderer shall conduct insulation tests on both new and existing power and control cables before terminating them.

11. The Tenderer shall provide in their tender two years’ worth of maintenance spares as recommended by equipment manufacturer.

12. The Tenderer shall provide in their tender any special maintenance tools required.

13. The Tenderer shall provide in their tender a 1 Year warranty.
Section H: Technical Specifications

Part I: General Specifications

1 General

1.1 These specifications describe the **basic requirements for the equipment**. Tenderers are requested to submit with their offers the detailed specifications, drawings, catalogues, etc for the products they intend to supply.

1.2 Tenderers must indicate on the specifications sheets whether the equipment offered comply with each specific requirement.

1.3 All the dimensions and capacities of the equipment to be supplied shall not be less than those required in these specifications. Deviations from the basic requirements, if any, shall be explained in detail in writing with the offer, with supporting data such as calculation sheets, etc. MeTRH reserves the right to reject the products, if such deviations shall be found critical to the use and operation of the products.

1.4 The Tenderers are requested to present information along with their offers as follows:
   (a) Shortest possible delivery period of each product
   (b) Information on proper representative and/or workshop for back-up service/repair and maintenance including their names and addresses
   (c) Manufacturer’s Letter Of Authorization
Part II: Detailed Specifications

1 Definitions
1.1 The purpose of this specification is to define the minimum requirements for the supply and installation of Electrical equipment for Supply, Installation, Testing and Commissioning of a Communicating Electrical Low Voltage Switchboard at Meru Teaching and Referral Hospital (MeTRH).
1.2 “The Purchaser” is the Meru Teaching and Referral Hospital Limited or its nominated Representative.
1.3 “Must” signifies a legal or statutory requirement
1.4 “Shall” signifies a requirement made mandatory by this specification.
1.5 “May” signifies a feature, which is discretionary in the context in which it is applied.
1.6 “Will” signifies a feature which the Suppliers may assume to be already present

2 Precedence
Any case of apparent conflict between the requirements of this specification and any other relevant documents shall be notified to the engineer. Unless otherwise agreed the following descending order of precedence shall apply.

1st This specification
2nd The codes and standards listed in this specification
3rd Other Internationally recognized codes or standards as appropriate.

3 Applicable Codes and Standards
3.1 The installation, testing, equipment, and materials shall comply with the latest revisions of all relevant British and IEC Codes, regulations and standards unless specifically agreed otherwise, including, but not limited to those listed below:

IEC 60038 Standard voltages
IEC 60255 Electrical relays
IEC 60265-1 High-voltage switches - High-voltage switches for rated voltages above 1 kV and less than 52 kV
IEC 60269 Low-voltage fuses
IEC 60282 High-voltage fuses
IEC 60287-1-1 Electric cables - Calculation of the current rating - Current rating equations (100% load factor) and calculation of losses - General
IEC 60364 Electrical installations of buildings
IEC 60427 High-voltage alternating current circuit-breakers
IEC 60439 Low-voltage switchgear and controlgear assemblies
IEC 60446 Basic and safety principles for man-machine interface, marking and identification - Identification of conductors by colours or numerals
IEC 60529 Degrees of protection provided by enclosures (IP code)
IEC 60644 Spécification for high-voltage fuse-links for motor circuit applications
IEC 60664 Insulation coordination for equipment within low-voltage systems
IEC 60715 Dimensions of low-voltage switchgear and controlgear. Standardized mounting on rails for mechanical support of electrical devices in switchgear and controlgear installations.
IEC 60724 Short-circuit temperature limits of electric cables with rated voltages of 1 kV (Um = 1.2 kV) and 3 kV (Um = 3.6 kV)
IEC 60787 Application guide for the selection of fuse-links of high-voltage fuses for transformer circuit application
IEC 60947-1 Low-voltage switchgear and control gear - General rules
IEC 60947-2 Low-voltage switchgear and control gear - Circuit-breakers
IEC 60947-3 Low-voltage switchgear and control gear - Switches, disconnectors, switch-disconnectors and fuse-combination units
IEC 60947-4-1 Low-voltage switchgear and control gear - Contactors and motor-starters - Electromechanical contactors and motor-starters
IEC 60947-6-1 Low-voltage switchgear and control gear - Multiple function equipment
- Automatic transfer switching equipment
IEC 61000 Electromagnetic compatibility (EMC)
IEC 61140 Protection against electric shocks - common aspects for installation and equipment
IEC 61557 Electrical safety in low-voltage distribution systems up to 1000 V AC and 1500 V DC
IEC 62271-1 Common specifications for high-voltage switchgear and control gear standards
IEC 62271-100 High-voltage switchgear and control gear - High-voltage alternating-current circuit-breakers
IEC 62271-102 High-voltage switchgear and control gear - Alternating current disconnectors and earthing switches
IEC 62271-105 High-voltage switchgear and control gear - Alternating current switch-fuse combinations
IEC 62271-106 High-voltage switchgear and control gear - Alternating current contactors and contactor-based motor-starters
IEC 62271-200 High-voltage switchgear and control gear - Alternating current metal-enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV
BS 381C Colours for identification, coding, and special purposes
BS1433 Specification for copper for electrical purposes
BS3643 Isometric screw threads
BS5958 Control of undesirable static electricity
BS5467 Specification for 600/1000 V and 1900/3300V armoured cables having thermosetting insulation
BS6004 Specification for PVC insulated cables
BS6121 Mechanical cable glands
BS7430 Code of practice for earthing
BS7671 Requirements for Electrical installations
IEC 60885 Electrical Test Methods for Electrical cables
IEEE Std. C37.20.2 Standard for Metal-Clad Switchgear

4 Environmental Conditions

Ambient Temperature: 5° to 40°C

MeTRH

CE Low Voltage Switchboard Upgrade
Humidity : 100% max
Altitude : 0-100 above sea level (PS 12)

5 Equipment and Material Requirements

5.1 All equipment installed outdoors shall have a minimum IP55 degree of protection, and indoor equipment shall have a minimum IP 40 degree of protection to IEC 60529.

5.2 Cable trays and ladders, where provided, shall be heavy duty, galvanized steel with perforated base and return edge flanges of 50mm depth and 100 mm width as minimum. All accessories fitting and supporting brackets shall be galvanized steel. Where cables are subjected to direct sunlight, a galvanized steel cover shall be provided for the tray or ladder.

5.3 Cable protective tiles, where used, shall be reinforced concrete of approximate dimensions 500mm × 150mm × 40mm, with indented lettering ‘HATARI-CABLES’.

5.4 Cable warning tape shall be PVC, having approximate dimensions 1mm thick and 100 mm wide, coloured black and yellow stripes, inscribed ‘ELECTRIC CABLES’.

5.5 Cable Tags shall be either plastic or stainless steel. Plastic tags shall be channel type with slide in numbers and letters and stainless steel type shall be embossed or etched with cable tag number. Tags shall have slots in each end for attachment to the cable by plastic coated steel ties.

5.6 Cable termination lugs shall be compression type high conductivity electrolytic copper tube, heat resistant to 120°C.

5.7 Earth continuity conductors shall be single core, stranded copper with a yellow and green PVC sheath.

5.8 Earth connectors shall be hot dip galvanized high tensile steel for tape to tape, tape to cable, and branch to main earth connections, suitable for earth cable and tape sizes.

6 Installation Requirements

6.1 The installation shall be in accordance with BS7671, MeTRH regulations and any applicable Kenyan legislation. At all times during site construction, the contractor shall comply with MeTRH site safety procedures. Where such work is within a hazardous area or requires connection to existing equipment, it shall be done under a ‘permit to work’ which will be issued to the contractor by MeTRH.

6.2 The contractor shall take particular care that equipment is not damaged during unloading and installation. The contractor shall be responsible for providing all the lifting equipment for loading, unloading, and installing the equipment. This includes removing of old decommissioned switchboards. Cranes shall be of sufficient lifting capacity and control. The lifting operation shall be the responsibility of the contractor. The contractor shall note that it is mandatory that the lifting equipment eyes are used in
accordance with the supplier’s instructions and recommendations.

6.3 The contractor shall prepare the base to suit the equipment, which shall be rigidly bolted down with packing shims, as necessary to ensure the equipment is installed true and level. The contractor shall supply all fixing bolts, nuts, and shims. All panels shall be mounted in accordance with the respective manufacturer’s drawings. All spare cable entries shall be correctly sealed. After installation and with the agreement of MeTRH, the contractor shall energize the anti condensation heaters in accordance with site safety rules. Warning notices shall be attached to indicate live circuits.

6.4 The installation shall be done progressively, and to accommodate MeTRH’s pumping requirements, and at no time shall there be no pumping. For this, it is required that the contractor visits the site and makes a proposal to provide temporary power to enable some pumps to run per station during long installation periods.

6.5 System Voltages in scope of supply

MeTRH LV- 415V, 3 phase 4 Wire, 50 Hz

6.6 After the 415V Switchgear has been bolted down, the contractor shall check that all the drawable units can be freely inserted and withdrawn.

6.7 The contractor shall connect all LV and control cables as per the relevant drawings.

6.8 The contractor shall carry out all pre commissioning tests as detailed in the LV Switchboard test checklists in the appendices.

6.9 Cable trays and racks shall be bolted or clamped to supports using galvanized fixing materials. Welding of trays to structural steel is not permitted. Inside and outside couplings shall be used on all rack joints as appropriate. Electrical continuity shall be maintained at joints between sections of cable tray or racking and between cable trays or racks.

6.10 Site fabrication of accessories shall be kept to a minimum and manufacturer’s standard items shall be used as far as possible. After field cuts have been made to cable tray or rack, all sharp edges shall be dressed so that no projection remains to damage the cables or personnel and the cut edges shall be adequately treated to inhibit corrosion.

6.11 Where crossing of instrument and power cables is unavoidable, this shall be made at right angles.

6.12 Each cable shall be installed to its full length at one time. Cables shall not be pulled and coiled back without prior agreement of MeTRH. All cables shall run in continuous lengths. Joints will not be permitted.

6.13 The contractor shall so position the cable entry positions into his panel to match the existing panels so as to minimize on cable replacements.

6.14 The contractor must visit the sites before bidding and make provision for any cables that may need to be replaced due to the requirement for no joints. No variations to
contract price shall be made due to omissions by the contractor in this regard.

6.15 Every cable gland shall be earthed using a correctly sized, purpose-made lug and earth cable.

6.16 Cable entries shall, wherever possible, be at the bottom of equipment and the integrity of the equipment IP rating shall be maintained.

6.17 Where three phase power cables terminate, the phase colours shall be painted on the outside of all boxes indicating the physical arrangement of the internal connections. The cable boxes shall be marked to prevent cover plate reversal when replacing after removal for inspection or maintenance.

6.18 Cable cores shall be tagged with the associated terminal number. Spare cores shall be left long enough to reach any terminal, and shall be neatly disposed in trunking or terminal box.

6.19 Cables shall be secured by use of ties or cleats at 900 mm centres for vertical runs and 300mm for horizontal runs.

6.20 On completion of installation and before termination, each cable shall be checked for conductor continuity and insulation resistance. When termination is complete a full insulation test shall be undertaken.

6.21 Full daily record of all cables disconnected or installed and terminated shall be available at any time for inspection by MeTRH Engineer.

6.22 The contractor shall pre-commission the cables (both new and old cables) in accordance with the LV cable checklist in the appendices.

6.23 All earth bars shall be interconnected by 95 mm² copper/PVC Cable.

6.24 Each earthing cable shall terminate in a cable lug.

6.25 The contractor shall ‘red-line’ the contract drawings to show the exact details of the installation and provide the red-line mark-ups to MeTRH at the conclusion of the work. Based on the mark-ups, the contractor shall provide as built drawings of the installation to MeTRH.

6.26 The following tests and inspection shall be regarded as the minimum that shall be provided by the contractor in accordance with the BS 7671. Test sheet formats are attached for further guidance in the Appendices. All cable terminations and bus bar connections shall be checked and tightened before any other tests are carried out on any equipment. The following visual inspection shall be carried out on the electrical installation.

i. Equipment and workmanship

ii. Cables for visual damage, correct fittings and glands, armour and PVC sheath correctly terminated, type of cables installed, good engineering practice.

iii. Equipment tags for correct identification labels fixed without impairing Eex’d’/IP values during installation.
iv. Check that appropriate warning notices are installed as per installation specification and regulations.

v. Check appropriate safety signs and instructions installed in accordance with BS7671 and installation specifications.

vi. Metal structures, above ground equipment adequately bonded and earthed as per installation specification, IP Model code of practice and BS7671.

vii. Check wiring diagram for correct termination.

6.27 Equipment that could be damaged by the high voltages used during insulation tests and measurement shall be disconnected. On the LV Switchgear and distribution boards, the following tests shall be carried out:

i. Bus bars insulation resistance measurement and pressure test at 1000V for LV boards for 1 minute, all phases to earth.

ii. General wiring insulation resistance test measurement at 500V.

iii. Continuity ‘Ducter’ tests of main bus bars and connections.

iv. Tests to prove correct operation of interlocks, tripping and closing circuits, indication and fault circuits.

v. Operation of all protection and indication equipment by primary and/or secondary injection, system fault tests to check sensitivity and stability.

Three points shall be the minimum to establish an operating curve.

vi. Protection gear timing tests as necessary.

vii. Test operation of alarm devices.

6.28 On LV and control cables, the following tests shall be carried out:

i. Test LV Cables for insulation resistance at 1000 V (all phases to earth).

ii. Continuity test.

iii. Phase checks.

6.29 When all equipment and cabling has been completed and tested in accordance with the foregoing clauses, tests shall be carried out to check that all manual and automatic operating and protective devices function correctly. All meters, switches, lamps, alarms, initiating devices and other such items shall be checked for correct operation.

6.30 Test records, test certificates and performance curves shall be completed for all tests and submitted to MeTRH. The contractor shall be responsible for issuing the Electrical installation completion certificate as per BS 7671, completed and signed for presentation to KPLC.

7 Specification for LV Switchgear

A. Codes, Standards, Regulations, or Specifications

1. Interpret the following codes as the minimum requirements applicable to the subject work, and no statement that is contained in this specification can be construed as limiting the work to such minimum requirements. The latest editions of codes that are listed below, and in other parts of this document, must govern the work.

a) IEC 61439-1: 2011, Low-voltage switchgear and control gear assemblies – Part 1: General rules
b) IEC 61439-2: 2011, Low-voltage switchgear and control gear assemblies –
   Part 2: Power Switchgear and control gear assemblies

c) IEC 60204-1:1997, Safety of machinery - Electrical equipment of machines –
   Part 1: General requirements

d) More Electrical Safety

2. Arc fault tests per IEC/TR 61641:2008 Criteria 1-7 must be conducted and
   evaluated to be in compliance to help protect against internal arcing faults for
   durations up to 300 ms.
   a) MCC must provide arc-containment latches on all doors (vertical wireway and
      unit).
   b) MCC must provide a top exhaust-vent system to direct heat and energy in the
      event of an internal arc without the need of more plenums or ducts.

7.02 PRE-MANUFACTURE SUBMITTALS

A. MANUFACTURER Drawings
   1. MCC elevations that show dimensional information including details such as, but
      not limited to, the following:
      a) MCC height (less any removable lifting angles or eyes)
      b) MCC width
      c) MCC depth
      d) Location of shipping splits
   2. Structure descriptions that show the following:
      a) Bus ratings
      b) Enclosure ratings
      c) Short circuit withstand ratings
      Other information as required for approval
   3. Conduit and cable locations
   4. Required bus splices
   5. Unit descriptions including, but not limited to, starter sizes, circuit breaker frame
      sizes, circuit breaker continuous ampere ratings, and pilot devices
   6. Nameplate information
   7. Schematic wiring diagrams
   8. MANUFACTURER drawings must be provided in DWG format
   9. MANUFACTURER drawings do not need to be stamped if a drawing schedule is
      provided that lists the drawing numbers, revision levels, and status of drawings
      (such as Preliminary, Approval, and Final)

B. Product Data
   1. Data sheets and publications on all major components, including, but not limited
      to, the following:
      a) Motor starters
      b) Overload relays
      c) Circuit breaker and fuse information, including time current characteristics
      d) Control power transformers
      e) Pilot devices
      f) Relays

C. Specification Response
   1. All clarifications and exceptions must be clearly identified.
D. Installation Instructions

1. Provide a copy of the installation instructions from the MANUFACTURER, which includes the following:
   a) Receiving, handling, and storage instructions
   b) General description for reading nameplate data, serial numbers, and short circuit ratings
   c) Installation procedures including splicing procedures
   d) Conduit and cable installation
   e) Installing and removing plug-in units
   f) Operation of operator handles and unit interlocks
   g) Checklist before energizing
   h) Procedure for energizing equipment
   i) Maintenance procedures

7.03 FINAL SUBMITTALS

A. The CONTRACTOR must provide certification that:
   1. The MCC has been installed in accordance with the installation instructions from the MANUFACTURER, and with local codes and standards that govern MCC installations.
B. Final Drawings
   1. The MANUFACTURER must provide final drawings that reflect the “As-Shipped” state of the MCC documents previously sent.
   2. MANUFACTURER drawings must be provided in DWG format.
   3. MANUFACTURER drawings do not need to be stamped if a drawing schedule is provided that lists the drawing numbers, revision levels, and status of drawings (such as Preliminary, Approval, and Final).
   4. The CONTRACTOR is responsible for any changes to the “As-Shipped” drawings from the MANUFACTURER to reflect any field modifications.
C. Test reports that indicate standard testing are performed by the MANUFACTURER.
D. Maintenance Data
   1. MCC installation instructions.
   2. Installation/operation instructions for major components such as the automatic transfer switch and circuit breakers.
   3. MCC spare parts list and prices.
   4. Name and phone number for a local distributor who can provide spare parts.

7.04 QUALITY ASSURANCE

A. The MCC must be designed, manufactured, and tested in facilities that are registered to ISO 9001 quality standards.
B. Type testing must be verified by a recognized testing authority and must be available upon request.
C. The bidders must be fully aware of this specification, plus any referenced document.

7.05 CLEANING

A. At time of shipment, the equipment must be clean inside and outside.
B. All waste (such as metal chips or filings, weld stubs, dirt, rags, debris, and any other foreign material) must be removed from the interior of each component. All mill scale, rust, oil, grease, chalk, crayon, or paint marks and other deleterious material must be removed from all interior and exterior surfaces.
7.06 DELIVERY, STORAGE, AND HANDLING

A. All openings must be provided with protection to prevent damage, corrosion, and entrance of foreign matter during storage and shipment.

B. Each MCC assembly must be divided into a shipping section, if necessary, as designated on the single-line drawings. Each shipping section must be assembled on continuous mounting sills, and must be protected during shipment by a plastic wrapping for moisture protection and rigidly braced framework that is constructed of not less than 2 x 4 in. (45 x 90 mm) lumber around the structure for mechanical protection. All loose parts must be crated or boxed for shipment and appropriately identified.

C. Equipment-standard 600 mm wide stacks must be shipped in sections from the factory that are fully assembled, prewired, and with all components in place, as far as practicable. The 800 mm wide sections and larger must be shipped as individual sections that are equipped with suitable bus connectors.

7.07 DOCUMENTATION

A. The manufacturer must provide handling and installation instructions to the contractor. One set of these instructions must be fastened securely to the outside of the shipping unit.

7.08 WARRANTY

A. Defective components must be replaced by contractor under terms of the warranty for one year.

7.09 IEC MCC STRUCTURE

A. The IEC MCC must consist of one or more columns that are bolted together to form a rigid, free-standing assembly that is designed so future columns can be added without significant fabrication or interruption of service.

B. The MCC must be designed with full isolation of electrical components from the front side of the enclosure.

C. Columns must be fabricated of formed sheet steel to provide an enclosed, dead-front construction, joined to form one, rigid, free-standing assembly. Separation must be only as required for shipping. Continuous floor sills and removable continuous steel lifting angles must be furnished on all shipping blocks. Two lifting angles must be furnished for dual-front columns.

D. Units within each vertical column must be based on module spacing approximately 80 mm high to allow the installation of 24 modules of varying unit combination.

1. Any given column can house a combination of fixed and withdrawable units.

E. Each vertical column of the motor control center must be provided with a top- and bottom-mounted horizontal wiring trough that extends the full depth of the column, with front, removable-access cover. In addition, each structure must be provided with an adequately sized (350 mm deep) vertical wiring trough. All wiring troughs must be isolated from all buses and units. Vertical troughs must have a separate access door for the full height of the vertical section.

F. Painting must be according to standards by the MANUFACTURER.
1. Before painting, all rough edges must be ground smooth.
2. The external structure is given a rust resistant primer and two finish coats.
The paint must be applied with an electro-deposition process to help ensure a uniform paint coat with high adhesion.

G. Cable entrances into the motor control center must be from either the top or bottom. All cabling knockouts are provided in the field.

H. When doors are open, a person on the operating side of the equipment must not be exposed to live parts. There must be an IP2X minimum protection maintained.

I. Side sheets must be 2.0 mm thickness minimum.

J. Back plates must be of 2.5 mm thickness minimum.

K. For flexibility of layout, standard columns must be available in widths of 600 mm to 1000 mm.

L. MCC columns must be 600 mm or 800 mm deep, depending on bus size.
   1. 800 mm deep columns do not increase the volume of the units that are contained in the column. An extra 200 mm is added to the back of the structure. Horizontal bus and front of columns remain flush.

7.10 FORM OF SEPARATION

A. Internal isolation and separation must exist between the following:
   1. Individual units
   2. Units and wireways
   3. Units and the bus system
   4. Wireways and the bus system
   5. Vertical wireway for unit load connections and the vertical wireway for control/network connections (Form 3b)
   6. Each terminal’s group for external conductors must be shrouded by insulating barriers within the vertical wireway with separate segregated-cable areas for top or bottom direct-cable connections (Form 4b option)
   7. Each terminal’s group for external conductors that is housed in a dedicated metal box within the vertical wireway must be separated from the terminal box in another unit with separate segregated-cable areas for top or bottom direct-cable connections (Form 4b Type 7 option)

7.11 MOUNTING CONFIGURATIONS

A. The MCC must be available in front-only or dual-front configurations.

B. Front-only columns must be joined and installed side-by-side.

C. Dual-front columns must be comprised of two separate columns joined at the rear. The two columns must have separate, power bus systems that provide the same phasing on units, both front and rear. Full usage of unit space must be available for front and rear columns. The horizontal power bus must be linked, front to rear, with a factory installed U-shaped bus splice assembly.

7.12 WIREWAYS

A. Horizontal wireways must be at the top and bottom of each MCC column.
   1. The top horizontal wireway must be no less than 170 mm high.
   2. The bottom horizontal wireway must no less than 115 mm high.
   3. Horizontal wireways must extend the full width and depth of the MCC.
   4. Horizontal wireways must have removable front covers that are held in place by captive screws.

B. Openings must be provided in each side plate of the column in the top and bottom horizontal wireways to allow access between joined columns.

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1. Closing plates must be provided for these openings for columns that are at the end of an MCC lineup.
C. Horizontal wireways must be isolated from the power bus. Horizontal wireways for incoming line sections must maintain isolation from the incoming line area.
D. The vertical wireway must be on the right side of each column and must extend from the top horizontal wireway to the bottom horizontal wireway.
   1. Hinge location of the door permits unobstructed access to units and wireway alike.
E. The vertical wireway must be isolated from the power bus and must be independent of unit space.
F. Vertical wireways must not be present in fixed, frame-mounted, full-column units.
G. Vertical wireways must be covered with steel doors and must be held in place by five door latches.
H. Optional cable supports for use in vertical wireways must be available.
I. Vertical wireways must be 200...500 mm wide, and 350 mm deep.

7.13 POWER BUS

A. Incoming Power
   1. MCC incoming line voltage must be between 415V, 3-phase, and 50Hz.
   2. It shall be a 4-wire system. TN-S grounding is required; TN-C is not sufficient.
B. Short Circuit Withstand
   1. The power bus system must be supported, braced, and isolated by a continuous bus support. This bus support must be fabricated of a non-tracking glass-polyester blend.
   2. Bus bracing must be 50 kA minimum.
C. Horizontal Power Bus
   3. Standard, horizontal power-bus material must be tin-plated copper per the MANUFACTURER with a capacity up to 2000 A.
   4. The power bus must be continuous in each column or shipping block.
   5. Horizontal power-bus splicing must be accomplished with a splice kit of the same ampere rating as the horizontal power bus.
   6. To help ensure the reliability of the splice connections, both ends of the horizontal bus splices must have at least two bolts. Bolts must be machined torqued and require no periodic maintenance.
   7. The splice connections must be front accessible through the vertical wireway for installation and service.
   8. The vertical spacing of the horizontal busbars must be 165 mm or larger.
D. Vertical Power Bus
   1. The vertical power-bus material must be tin-plated copper.
   2. Vertical power busbars must be cylindrical, providing optimum contact with the unit plug-in stabs.
   3. The vertical bus rating must be a minimum 300 A above and below the main horizontal bus for a total rating of 600 A.
   4. Horizontal spacing between the vertical power busbars must be 100 mm.
   5. The vertical bus must be contained in a continuous, recessed bus support. No point-bracing is allowed.
E. Neutral Bus
   1. The horizontal neutral bus, when specified for 4-wire systems, must be provided across the full width of the MCC and must be located above or below the horizontal power bus.
2. The neutral bus must match the material and specifications of the vertical power bus.
3. The vertical neutral bus must be mechanically joined to the horizontal neutral bus and must provide a neutral contact for plug-in unit stabs throughout the length of the column.
4. The space between the horizontal power busbars and horizontal neutral bus bar must be 165 mm.
5. The space between the vertical power bus bar and vertical neutral bus bar must be 75 mm.
6. The neutral bus must be braced the same way as the horizontal and vertical power bus.

F. Automatic Shutters
1. Automatic shutters that must open as withdrawable units are inserted and must close by using non-gravitational mechanisms when the unit is removed.

7.14 PROTECTIVE EARTH CONDUCTOR

A. Horizontal Protective Earth (PE) Conductor
1. The horizontal PE conductor must be:
   a) Made from standard copper (minimum 6 x 50 mm²) or optional tin-plated copper.
   b) Continuous for the width of the column and must be located in the bottom horizontal wireway.
   c) Comprised of one, two, or three (minimum 6 x 50 mm²) conductors.
2. Each column is pre-punched and predrilled with 12 evenly spaced, 8 mm holes along the length of the conductor to receive ground connections.
3. A pressure-type mechanical lug must be mounted on the horizontal PE conductor in the incoming line section.

B. Vertical Plug-in Protective Earth (PE) Conductor
1. A 6 mm x 32 mm² copper (or optional tin-plated copper) vertical plug-in PE conductor must be provided in each standard column.
2. The vertical plug-in PE conductor must be mechanically connected to the horizontal PE conductor, which forms a complete internal-protective earth circuit.
3. For power connections, the vertical plug-in PE conductor, in combination with the unit PE contact, must establish a first make, last break operation of the PE connection.

7.15 MAIN INCOMING SECTION

A. Air Circuit Breaker or Molded Case Circuit Breaker
1. All main incoming units must be front accessible.
2. Main ACB incoming units must be withdrawable.
3. All main incoming units must be 4-pole.
4. All main incoming units must be easily integrated into Auto Transfer Schemes.
5. The main incoming section must contain removable protective barriers on the line side to help reduce the possibility of accidental contact with line terminals.
6. The main incoming section must contain power metering with communication capabilities.
7.16 UNITS

A. Unit Design
1. For flexibility of design and use, a column must accept units of different types, such as VFD, DOL, FD, MCB, and SMC, and fixed and withdrawable units in the same column.
2. In fixed units, line, load, PE, network, and control connections must be made directly within the unit to dedicated terminals.
3. Withdrawable units must have withdrawable line, load, control, network, and protective earth (PE) connections. Outgoing load and control connections from these units must be made in the vertical wireway.
4. Units must be of modular dimensions so units of the same size can be interchanged without modification in the structure. After insertion, each plug-in unit must be held in place by a latch at the front of the unit.

B. Unit Design Features
1. Withdrawable units must consist of the unit, unit support pan, and unit door.
2. Withdrawable units must be held securely in the column when inserted.
3. Withdrawable units must be designed with an interlock to help ensure that units cannot be inserted or withdrawn when the disconnect means is in the ON/I position.
4. Tools are not required to fully remove or insert withdrawable units.
5. The withdraw lever must feature a locking mechanism that can be disengaged to change positions.
6. Detents must be present to help confirm that the unit is secured in one of the operating positions.
7. Withdrawable units must have four operating positions: connected, test, disconnected, and withdrawn.
   a) Connected - In the connected position, the line, load, control, network, and PE connections must be engaged. The unit door must be closed to help ensure that the withdraw lever is in the connected position. To engage the interlock or to turn the disconnect means to the ON/I position, the unit door must be fully closed.
   b) Test - In the test position, the control, network, and PE connections must be engaged. Line and load connections must be isolated for the control and network wiring of the units to be verified. Units can be locked in this position.
   c) Disconnected - In the disconnected position, the unit remains housed in the column, but power/control connections are not present. It must be an isolated position with PE maintained. Units can be locked in the disconnected position.
   d) Withdrawn - Withdrawable units must be fully removed from the columns. When units are withdrawn from the MCC, they must be isolated from connections. Withdrawn units must be locked to prevent insertion.

C. Operating Handle Mechanism
1. An industrial, heavy duty, rotary operating-handle mechanism must be supplied for control of the disconnecting means in each unit.
2. When the unit door is closed, the handle can be engaged with the disconnect means.
3. The operating handle can be locked in the OFF/O position with up to three 8 mm diameter shackle padlocks.
4. The operating handle can be modified to enable locking in the ON/I position.
5. The unit operating handle must be interlocked with the unit door to help prevent opening the unit door unless the disconnect means is in the OFF/O position.
6. An externally operated defeater must be provided for access to the unit without interrupting service.
7. The operating handle must be interlocked with the unit so the unit cannot be inserted or withdrawn with the operating handle in the ON/I position.

D. Unit Disconnect Means
   1. The unit main switch must be available as a circuit breaker or disconnect. Withstand ratings for combination starter units must be based on what short-circuit protective devices and components are selected.

E. Circuit Breakers
   1. Circuit breakers must be provided as the disconnecting means for units that are specified with a main switch for the circuit breaker unit.
   2. Motor circuit protectors must be used for combination motor-control units.
   3. Motor protection circuit breakers or molded case circuit breakers must be used for feeder units.

F. Power Stab Assembly
   1. The power cable connection at the plug-in stab must be made with lower maintenance cost, crimp-style connection. There must be no exposed wiring at the back of the unit between the disconnecting means and the plug-in stabs. Unit plug-in power stabs must be free-floating and self-aligning. The stabs must be made of tin-plated copper for a low-resistance connection and must be designed to tighten during heavy current surges. Use stainless-steel spring clips to back unit plug-in power stabs for a high pressure, 4-point connection to the vertical power bus.

G. Neutral Stab Assembly
   1. The neutral stab assembly must have the ability be supplied on withdrawable units when a 4-wire TNS system is required. The neutral stab assembly must have the same design and features as the power stab assembly.

H. Protective Earth Contact
   1. An unplated copper PE contact must be provided on withdrawable units. This contact must establish a connection with the PE circuit before other connections are made and must be the last withdrawable connection to be disconnected.

I. Pilot Devices
   1. Pilot devices must be housed in door-mounted control stations. Each control station must accommodate up to four devices. Multiple control stations must be mounted on a unit door if more than four pilot devices are required. Control stations must be equipped with a quick connect plug to easily connect and disconnect control wiring. The control station must be easily removed by using captive screws. If a control station is removed, closing plates must be available to cover the opening in the unit door and provide isolation.

J. Unit Doors and Door Latches
   1. Each unit must be provided with a removable unit door mounted on removable pin-type hinges.
   2. The unit door must be fastened to the stationary structure (not the unit itself), so it can be closed to maintain external IP rating and arc flash protection with the unit removed.
   3. The door must be hinged on the left side so that it opens away from the vertical wireway.
4. The unit door can be removed from any location on the MCC without other unit doors being disturbed.
5. Control stations for pilot devices and low-profile, external reset buttons for overload relays must often be mounted to the unit door.
6. Door latches must be provided on unit and vertical wireway doors to hold the door closed and isolate the column.
7. Door latches can be locked or released by rotating the latch ¼ turn. An arrow on the door latch head must indicate the position of the latch.
8. Optional arc-containment latches must be available for doors. Arc-containment latches can be locked or released by rotating the latch ¼ turn.

K. Control Power
1. Unit control power must be one or several of the following: 110V AC; 115V AC; 120V AC; 220V AC; 24V DC wired with a minimum size of 1.5 mm².
2. Each unit shall have its own control transformer to enable independent supply for control functions.

L. Power Wire
1. Power wire must be copper and rated for 90 °C (194 °F) with a minimum size of 6 mm².

M. Communication Networks
1. Each MCC unit must have network-communication capabilities to retrieve individual unit data and/or provide unit control functionality. Capabilities include DOLs, DOLRs, FCBs, SoftStarts, VFDs, and Mains.
2. Each unit within the MCC must maintain the tool-less withdrawable feature, including the communication network connections.
3. The configuration must allow removal of multiple units without disrupting communication to remaining units.
4. Each MCC must communicate on the preferred EtherNet/IP or DeviceNet network protocol of the BUYER.
5. Network cabling must be separated from the bus compartments and BUYER wireways.
6. When a TCP/IP configuration is selected, the managed switches are provided and installed in the MCC columns by the MANUFACTURER before shipment.
7. The network and node assignments of each MCC lineup are preconfigured and tested by the MANUFACTURER before shipment.
8. All network configuration data must be available to the customer before the MCC is shipped.
9. Network Cabling
   a) Network communication cables must be protected with a heavy outer jacket for dielectric strength. No special separation, barriers, or internal conduit must be required.
      i. The DeviceNet cable that is used for trunk lines must be Class 1 flat cable rated 8 A.
      ii. The DeviceNet cable that is used for drop lines to connect DeviceNet units must be Class 1 round cable rated 8 A.
      iii. EtherNet/IP communication must be embedded in each unit of the MCC by using Cable Tray rated 600V Ethernet cable and managed switches in each column.
10. Network Cable Layout
    a) The network cables must be routed through the control and network wireway and top horizontal wireway of the MCC.
b) For the EtherNet/IP network, each unit with a network connection must have a cable routed in the control and network wireway to a switch located in the top or bottom horizontal wireway.

c) Cables must be routed behind barriers that isolate the cable from the unit space and wireways to help prevent accidental damage during MCC installation.

d) Up to 24 DeviceNet ports must be provided in the control and network wireway. Each component in an MCC unit must be connected to a port located in the control and network wireway.

e) Up to 12 EtherNet/IP ports must be provided in the control and network wireway. Each component in an MCC unit must be connected to a port located in the control and network wireway.

f) The addition or removal of a unit from the system must not interrupt the operation of other units in the system.

11. Power Supply

a) The system within the MCC must require a power supply that provides 24V DC rated no less than 8 A.

b) This power supply must be supplied with a buffer for enhanced ride-through performance.

c) For the DeviceNet network, this power supply must be ODVA approved.

d) The DeviceNet system in the MCC must require a DeviceNet scanner.

e) The EtherNet/IP system in the MCC must require an EtherNet/IP scanner.

f) The scanner must be located in the MCC or mounted remotely.

12. DeviceNet System Performance

a) The DeviceNet system in the MCC must be designed to operate at 500 kBd to maximize performance, unless precluded by the cumulative length of the trunk and drop lines.

b) The DeviceNet system in the MCC must be qualified to communicate and perform under normal and adverse electrical environments, for example, contactor electrical operation, contactor jogging duty, and unit short-circuit fault.

c) Each unit must be provided with a DeviceNet component. Starter units must be provided with E3™ or E3 Plus™ electronic overload relays or solid-state overload relays with a DeviceNet starter auxiliary. Contactor units must be provided with a DeviceNet starter auxiliary. AC drives must be provided with a DeviceNet communication module. Solid-state controllers must be provided with DeviceNet communication modules and, in some instances, a DeviceNet starter auxiliary. Fusible disconnect and circuit-breaker feeder circuits must be provided with a DeviceNet starter auxiliary.

13. EtherNet/IP System Performance

a) The EtherNet/IP system in the MCC must be designed to operate at 100 megabaud to maximize performance.

b) The EtherNet/IP system in the MCC must be qualified to communicate and perform under normal and adverse electrical environments, for example, contactor electrical operation, contactor jogging duty, and unit short-circuit fault.

c) Each unit must be provided with an EtherNet/IP component. Starter units must be provided with E3 or E3 Plus electronic overload relays or E1 Plus™ overload relay with an EtherNet/IP side mount module or E300™. Contactor units must be provided with an EtherNet/IP POINT I/O™ system. AC drives must be provided with an EtherNet/IP communication module. Solid-state
controllers must be provided with EtherNet/IP communication modules and, in some instances, an EtherNet/IP POINT I/O system. Fusible disconnect and circuit-breaker feeder circuits must be provided with an EtherNet/IP POINT I/O system.

i. The Ethernet switches in the MCC architecture must support an optional, switch-level ring topology (such as Resilient Ethernet Protocol) to provide a level of redundancy to MCC lineup.

14. Programming of Parameters
   a) The DeviceNet MAC ID number (node address) must be programmed for each unit as specified by the BUYER. All other parameters are left at the factory default setting.
   b) The DeviceNet components must be configured to operate at the specified communication rate.
   c) The EtherNet/IP address (node address) and subnet address must be programmed for each unit as specified by the BUYER. All other parameters are left at the factory default setting.
   d) The Ethernet switch in the MCC architecture must support a mechanism to automatically set device Ethernet IP addresses when a new device is connected to a switch port.

B. Nameplates
   1. Nameplates must be secured by using two steel self-tapping screws.

7.17 SOFTWARE

A. Preconfigured Software
   1. The software must be preconfigured for the MCC lineups.
   2. The software communication driver must allow the software to be installed and operated on the Ethernet or DeviceNet network.
   3. The software must function as a standalone software package or as an ActiveX control in a Human Machine Interface (HMI).
   4. The software must display the following:
      a) Elevation View
         i. Dynamically displays status information that is based on data read from devices in the MCC lineup
         ii. Sizeable view to easily view multiple MCC lineups
         iii. Unit nameplate information
         iv. Unit status indicators (ready, running, warning, fault, and no communication)
      b) Unit Monitor View
         i. Preconfigured for a specific unit
         ii. Real-time monitoring via analog dials and trends
         iii. Data configurable for customized views
         iv. Modifying device parameters
      c) Spreadsheet View
         i. Configurable for customized monitoring
         ii. Sorting and cascading functions
         iii. Custom user fields
      d) Event Log
         i. Track history of MCC unit
         ii. Automatic logging of trips, warnings, and changes
iii. Manual entry of events
e) Documentation
   i. Front elevation drawings
   ii. Unit wiring diagrams
   iii. User manuals
   iv. Spare parts lists
f) Automatic PLC Integration for EtherNet/IP based MCC lineups
   i. Automatic export of intelligent MCC devices and their configuration (such as name and node settings) into PLC software
g) Integrated Energy Monitoring Functionality
   i. Device-level energy monitoring functionality for intelligent MCC devices via the Elevation View menu
   ii. Energy report options include historical calendar trends, parameter trends, and numerical data tables

7.18 INSTALLATION

A. The installer must install the MCC in accordance with instructions from the MANUFACTURER.
B. The installer must tighten accessible bus connections and mechanical fasteners to the torque requirements of the MANUFACTURER.
C. The installer must select and install fuses in fusible switches that are based on field requirements.
D. The installer must adjust circuit breaker settings that are based on field requirements.
E. The installer must adjust solid-state overloads to match the installed motor characteristics.

7.19 MANUFACTURER’S SERVICES

A. The MANUFACTURER of the MCC must provide the programming for the programmable logic controller and the operator interface if provided within the MCC.
B. The MANUFACTURER of the MCC must provide start-up services as part of the supply of the MCC.

7.20 TRAINING

A. A course outline must be submitted as part of the MCC submittals.
B. The MANUFACTURER must offer offsite training on the concepts, knowledge and tools necessary to design, specify, install, troubleshoot, and use a DeviceNet MCC.
8 Specification for Circuit Breakers

8.02 SUMMARY
A. This section includes globally rated Molded Case Circuit Breakers used for feeder circuits, disconnects, and branch protection.

8.03 QUALIFICATIONS
A. Manufacturer
   1. The manufacturer shall have a minimum of 25 years of experience in the manufacture of molded case circuit breakers.

B. Certification – To ensure all quality and corrective-action procedures are documented and implemented, all manufacturing locations shall be certified to the ISO-9001 Series of Quality Standards.

8.04 REFERENCES
A. The molded case circuit breakers shall be:
   1. UL Listed
   2. CSA Certified
   3. CE Marked
   4. CCC Certified
   5. RoHS Compliant

B. The following standards shall be met:
   1. UL 489
   2. CSA C22.2-5
   3. EN 60947-2
   4. CCC GB 14048.2

C. NFPA 79 compliance shall be available through the use of an internal rotary operating handle kit.

8.05 ENVIRONMENTAL REQUIREMENTS
A. The contractor shall confirm specified service conditions during and after installation of products.

B. The contractor shall maintain the area free of dirt and dust during and after installation of products.

8.06 PRE-MANUFACTURE SUBMITTALS
A. Product data shall include:
   1. Publications on each type of molded case circuit breaker.
   2. Data sheets on options and accessories, when applicable.
B. Installation instructions shall include a copy of the manufacturer’s installation instructions, including receiving, handling, and storage requirements.

8.07 FINAL SUBMITTALS

A. Supplier certification shall be provided that the molded case circuit breakers have been installed in accordance with the manufacturer’s instructions.
B. Testing shall be performed per manufacturer’s standard. A copy of the test reports, shall be provided as part of the final documentation.
C. Final drawings shall include:

1. Drawings for each circuit breaker of dimensioned plans, elevations, sections, and details, along with clearances and service-space requirements. The drawings shall show tabulations of installed devices, including –
   i. Enclosure details
   ii. Current and voltage ratings
   iii. Short-circuit ratings
   iv. Time-current curves with selectable ranges, as applicable

2. Diagrams to show power, signal, and control wiring.

D. Maintenance data shall include:

2. Name and phone number of a local distributor for the spare parts.

8.08 RATINGS

A. The molded case circuit breakers shall have current ranges as indicated on the drawings.

1. G-Frame: 15A to 125A (160A, IEC only)
2. H-Frame: 15A to 125A (160A, IEC only)
3. I-Frame: 60A to 225A
4. J-Frame: 25A to 250A
5. K-Frame: 120A to 400A
6. M-Frame: 240A to 800A
7. N/NS-Frame: 480A to 1200A
8. R-Frame: 800A to 3000A

B. The molded case circuit breakers shall have IEC-rated insulation voltage, Ui, of:

1. G-Frame and I-Frame: 800V
2. H-Frame and J-Frame through R-Frame: 1000V

C. All molded case circuit breakers shall be dual-rated EN/IEC 60947-2 and UL 489 in both 3- and 4-pole configurations.
D. Protection shall be as indicated on the drawings:

1. Thermal/Magnetic – 15A to 800A
2. Electronic – 10A to 3000A

E. Interrupting capacities shall be 25 kA to 150 kA, as indicated on the drawings.
F. All molded case circuit breakers shall have short-circuit current rating (SCCR) coordination with contactors, overload relays, and motor starters.

G. The molded case circuit breakers shall be:

1. Rated for an operating environment of 40°C (104°F) without derating.
2. Rated for storage at -40 to +80°C (-40 to +176°F).

H. Molded case circuit breakers shall have a mechanical life of:

1. G-Frame, H-Frame, I-Frame, J-Frame – 25,000 operations / 240 ops/hour
2. K-Frame and M-Frame – 20,000 operations / 120 ops/hour
3. N-Frame and NS-Frame – 10,000 operations / 60 ops/hour
4. R-Frame – 15,000 operations / 60 ops/hour

I. Molded case circuit breakers shall have an electrical life at 415 V AC of:

1. G-Frame, H-Frame, I-Frame, J-Frame – 8000 operations / 120 ops/hour
2. K-Frame – 7000 (400A) - 5000 (630A) operations / 60 ops/hour
3. M-Frame – 7000 (630A) - 5000 (800A) - 4000 (1000A) operations / 60 ops/hour
4. N-Frame and NS-Frame – 2000 operations / 60 ops/hour
5. R-Frame – 4500 (2000A) - 4000 (2500A) - 3000 (3200A) operations / 60 ops/hour

8.09 CONSTRUCTION

A. Each molded case circuit breaker shall be an assembled unit in a supporting case and shall consist of:

1. Circuit breaker
2. Operator
3. Internal accessories (optional)
4. External accessories (optional)

B. In addition to short-circuit protection, molded case circuit breakers shall provide thermal overcurrent protection through mechanical means with heater elements or by using electronics. Protection methods include:

1. Fixed Thermal/Magnetic
2. Adjustable Electronic
3. Adjustable Thermal/Adjustable Magnetic

Adjustment ranges shall be as indicated on drawings.

C. The molded case circuit breakers shall be panel-mounted, DIN rail-mounted, or bus bar-mounted as indicated on the drawings.

8.10 CIRCUIT BREAKERS

A. The molded case circuit breakers shall be in 3- and 4-pole configurations, as indicated on the drawings.

B. The molded case circuit breakers shall have clearly-marked ON (I), OFF (O), and tripped positions, and a test button for initiating an alarm trip.
C. The molded case circuit breakers shall have a removable front cover to accept installation of internal accessories.

8.11 OPERATORS

A. Operators shall be wired with 600V (UL/CSA) insulated wire. No voltage derating shall be required.
B. Variable depth rotary operators shall enable the external control of breakers that are installed inside industrial control panels, through the use of a handle with rotary motion.
C. Flex cable operators shall enable the external control of breakers that are installed inside flanged enclosures or industrial control panels, through the use of flex cables, rather than operating rods.
D. Motor operators shall enable remote opening, closing, and resetting of breakers with provisions for local control.
E. Direct rotary operators shall mount with direct handle operation of the breaker and shall be lockable.
F. NFPA internal operating handles shall enable turning an energized panel off with the door open and shall satisfy NFPA requirements.

8.12 INTERNAL ACCESSORIES

A. Internal accessories shall be installed by removing the front cover.
B. Shunt trips and undervoltage releases shall fit into left-side slots inside the circuit breakers and shall be wired with 600V (UL/CSA) insulated wire. No voltage derating shall be required.
   1. Shunt trips shall allow the breaker to be opened via electric command.
   2. Shunt closes shall allow remote closing when the spring motor is charged (NS- and R-Frame).
   3. Undervoltage releases shall allow the breaker to be opened via a change in the voltage of its power supply.
   4. Residual current release modules (IEC only) shall be available to protect against low levels of earth-fault currents.
C. Auxiliary and alarm contacts shall have snap-in mounting provisions to fit into right-side pockets inside the circuit breakers and shall be changeover contacts (Form C).
   1. Auxiliary contacts shall indicate ON/OFF status of the molded case circuit breakers.
   2. Alarm contact shall indicate trip status:
      i. due to pressing the test button
      ii. due to overcurrent or short-circuit
      iii. due to residual current, shunt, or undervoltage release signal, as equipped
   3. Thermal trip contacts shall indicate trip status due to overcurrent, short-circuit, or undervoltage release only (H-, J-, N-, NS-, and R-Frame).
8.13 EXTERNAL ACCESSORIES
   A. In addition to the standard end cap, termination options, including lugs, extended
      terminals, multitap lugs, rear terminals, and spreader terminals, shall be provided
      as indicated on the drawings.
   B. Phase barriers and terminal covers shall be provided as shown on the drawings.
   C. Padlock attachments shall be supplied as indicated on the drawings to enable
      locking the breakers in the off position.

8.14 DELIVERY, STORAGE, AND HANDLING
   A. The contractor shall coordinate the shipping of equipment.
   B. The contractor shall store the equipment in a clean and dry space.
   C. The contractor shall protect the units from dirt, water, construction debris, and
      traffic.

8.15 INSTALLATION
   A. The contractor shall verify all trip settings have been properly adjusted prior to
      energizing.
   B. The contractor shall ensure accessibility to operator. These components shall be
      free from obstruction at all times.

8.16 SPARE MATERIALS
   A. Provide one (1) spare molded case circuit breaker of each size utilized, including
      options.

8.17 WARRANTY
   A. The manufacturer shall provide their standard parts warranty for eighteen (18)
      months from the date of shipment or twelve (12) months from the date of being
      energized, whichever occurs first.
   B. The manufacturer shall confirm this warranty as part of the submittal.
9 Specification for VFDs

9.01 SUMMARY

A. The Variable Frequency Drive (VFD) system shall contain all components required to meet the performance, protection, safety and certification criteria of this specification.

9.02 REFERENCES

B. National Electrical Manufacturers Association - NEMA 250 - Enclosures for Electrical Equipment.
C. Underwriters Laboratory Inc. – UL 508.

9.03 SUBMITTALS

A. Submit under provisions of this tender document
B. Shop Drawings - Approval
   1. Elevation Drawings: Include dimensional information and conduit routing locations.
   2. Unit Descriptions: Include amperage ratings, enclosure ratings, fault ratings, nameplate information, etc. as required for approval.
   3. Wiring Diagrams:
      i. Power Diagram: Include amperage ratings, circuit breaker frame sizes, circuit breaker continuous amp ratings, etc. as required for approval.
      ii. Control Diagram: Include disconnect devices, pilot devices, etc.
   4. Major components list.
C. Product Data Sheets
   1. VFD and Operator Interface publications.
   2. Data sheets and publications on all major components including but not limited to the following:
      i. Contactors
      ii. Circuit breaker and fuse (power and control)
      iii. Control power transformers
      iv. Pilot devices
      v. Relays/Timers
D. Test procedures shall be per the manufacturer’s standards.
9.04 CLOSEOUT SUBMITTALS (OPERATION AND MAINTENANCE MANUALS)

A. Submit under provisions of this tender document
B. Shop Drawings – Final as shipped
   1. Elevation Drawings: Include dimensional information and conduit routing locations.
   2. Unit Descriptions: Include amperage ratings, enclosure ratings, fault ratings, nameplate information, etc. as required for approval.
   3. Wiring Diagrams:
      i. Power Diagram: Include amperage ratings, circuit breaker frame sizes, circuit breaker continuous amp ratings, etc. as required for approval.
      ii. Control Diagram: Include disconnect devices, pilot devices, etc.
   4. Major components list.

C. Product Data Sheets
   1. VFD and Operator Interface publications.
   2. Data sheets and publications on all major components including but not limited to the following:
      i. Contactors
      ii. Circuit breaker and fuse (power and control)
      iii. Control power transformers
      iv. Pilot devices
      v. Relays/Timers

D. Test procedures shall be per the manufacturer’s standards.
E. Operation and Maintenance Data
   1. Service and Contact information
   2. VFD and Operator Interface User Manuals
   3. Troubleshooting / Service Manuals

9.05 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturers:
      i. The VFD and all associated optional equipment shall be UL listed or recognized.
      ii. The VFD shall contain a UL label attached on the inside of the enclosure cabinet.
2. Suppliers:
   i. All inspection and testing procedures shall be developed and controlled under the guidelines of the Supplier’s quality system and must be registered to ISO 9001 and regularly reviewed and audited by a third party registrar.
   ii. The VFD shall be factory pre-wired, assembled and tested as a complete package.

9.06 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall coordinate the shipping of equipment with the manufacturer.
B. Contractor shall store the equipment in a clean and dry space at an ambient temperature range of -25 °C to 55 °C (-13 °F to 130 °F).
C. The contractor shall protect the units from dirt, water, construction debris and traffic.

9.07 WARRANTY

A. The manufacturer shall provide their standard parts warranty for eighteen (18) months from the date of shipment or twelve (12) months from the date of being energized, whichever occurs first.
B. This warranty applies to variable frequency drive systems.

9.08 VARIABLE FREQUENCY DRIVE UNIT

A. Features
   1. Certifications
      i. Listed to UL508C and CAN/CSA-C22.2 No. 14-05
      v. Electric Power Research Institute. Certified compliant with standards SEMI F47 and IEC 61000-4-34
      vi. Russian GOST-R Certificate No. POCC US.ME92.H00040
      vii. Compliant with the European “Restriction of Hazardous Substances” Directive
   2. Hardware
      i. Utilize diode bridge or SCR bridge on the input rectifier.
      ii. Utilize DC bus inductor on all six-pulse VFDs only.
      iii. Utilize switching logic power supply operating from the DC bus.
iv. Incorporate phase to phase and phase to ground MOV protection on the AC input line.

v. Microprocessor based inverter logic shall be isolated from power circuits.

vi. Utilize latest generation IGBT inverter section.

vii. Battery receptacle for Lithium battery power to the Real Time Clock.

viii. Additional DPI port for handheld and remote HIM options.

ix. Dedicated Digital Input for hardware enable.

x. Conformal coated printed circuit boards.


3. Control Logic

i. Ability to operate with motor disconnected.

ii. Provide a controlled shut down, when properly protected, with no component failure in the event of an output phase to phase or phase to ground short circuit. Provide annunciation of the fault condition.

iii. Provide multiple programmable stop modes including Ramp, Coast, DC-Brake, Ramp-to-Hold, Fast Braking, and Current Limit Stop.

iv. Provide multiple acceleration and deceleration rates.

v. Adjustable output frequency up to 650Hz.

4. DeviceLogix Control

i. Ability to control outputs and manage status information locally within the VFD.

ii. Ability to function stand-alone or complimentary to supervisory control.

iii. Ability to speed reaction time by processing in the VFD.

iv. Ability to provide scaling, selector switches, or other data manipulations not already built into the VFD.

v. Ability to read inputs/write outputs and exclusively control the VFD.

vi. Ability to provide an option for decision making if communication is lost with main controller.

vii. Ability to control other VFDs via a peer-to-peer EtherNet/IP network.

viii. Ability to write programs off-line.

5. Motor Control Modes

i. Selectable Sensorless Vector, Flux Vector, V/Hz, and Adjustable Voltage Control modes selectable through programming.

ii. The drive shall be supplied with a Start-up and Auto-tune mode.

iii. The V/Hz mode shall be programmable for fan curve or full custom patterns.

iv. Capable of Open Loop V/Hz.

6. Current Limit

i. Programmable current limit from 20 to 160% of rated output current.

ii. Current limit shall be active for all drive states: accelerating, constant speed and decelerating.

iii. The drive shall employ PI regulation with an adjustable gain for smooth transition in and out of current limit.
7. Acceleration / Deceleration
   i. Accel/Decel settings shall provide separate adjustments to allow either setting to be adjusted from 0 to 3600 seconds.
   ii. A second set of remotely selectable accel/decel settings shall be accessible through digital inputs.

8. Speed Profiles
   i. Programming capability shall allow the user to produce speed profiles with linear acceleration/deceleration or "S Curve" profiles that provide changing accel/decel rates.
   ii. S Curve profiles shall be adjustable.

9. Adjustments
   i. A digital interface can be used for all set-up, operation and adjustment settings.
   ii. All adjustments shall be stored in nonvolatile memory (EEPROM).
   iii. No potentiometer adjustments shall be required.
   iv. EEPROM memory for factory default values shall be provided.
   v. Software must be available for trending and diagnostics, as well as online and offline programming functionality.

10. Process PID Control
    i. The drive shall incorporate an internal process PI regulator with proportional and integral gain adjustments as well as error inversion and output clamping functions.
    ii. The feedback shall be configurable for normal or square root functions. If the feedback indicates that the process is moving away from the set-point, the regulator shall adjust the drive output until the feedback equals the reference.
    iii. Process control shall be capable of being enabled or disabled with a hardwire input. Transitioning in and out of process control shall be capable of being tuned for faster response by preloading the integrator.
    iv. Protection shall be provided for a loss of feedback or reference signal.

11. Skip Frequencies
    i. Three adjustable set points that lock out continuous operation at frequencies which may produce mechanical resonance shall be provided.
    ii. The set points shall have a bandwidth adjustable from Maximum Reverse Speed to Maximum Forward Speed.

12. Fault Reset / Run
    i. The drive shall provide up to nine automatic fault reset and restarts following a fault condition before locking out and requiring manual restart.
    ii. The automatic mode shall not be applicable to a ground fault, shorted output faults and other internal microprocessor faults.
iii. The time between restarts shall be adjustable from 0.5 seconds to 30 seconds.

13. Run on Power Up

i. A user programmable restart function shall be provided to allow restart of the equipment after restoration of power after long duration power outages. Restart time dependent on presence of incoming signal.

14. Fault Memory

i. The last 32 fault codes shall be stored and time stamped in a fault buffer.

ii. Information about the drive's condition at the time of the last fault such as operating frequency, output current, dc bus voltage and twenty-seven other status conditions shall be stored.

iii. A power-up marker shall be provided at each power-up time to aid in analyzing fault data.

iv. The last 32 alarm codes shall be stored and time stamped for additional troubleshooting reference.

15. Overload Protection

i. The drive shall provide internal class 10 adjustable overload protection.

ii. Overload protection shall be speed sensitive and adjustable.

iii. A viewable parameter shall store the overload usage.

16. Auto Economizer

i. An auto economizer feature shall be available to automatically reduce the output voltage when the drive is operating in an idle mode (drive output current less than programmed motor FLA). The voltage shall be reduced to minimize flux current in a lightly loaded motor thus reducing kW usage.

ii. When the load increases, the drive shall automatically return to normal operation.

17. Terminal Blocks

i. Separate terminal blocks shall be provided for control and power wiring.

ii. I/O terminal blocks shall be removable with wiring in place.

18. Flying Start

i. The drive shall be capable of determining the speed and direction of a spinning motor and adjust its output to "pick-up" the motor at the rotating speed. This feature is disabled by default.

19. Inputs and Outputs

i. The Input / Output option modules shall consist of both analog and digital I/O.

ii. No jumpers or switches shall be required to configure digital inputs and outputs.

iii. All digital input and output functions shall be fully programmable.
iv. The control terminal blocks shall be rated for 115V AC.

v. Inputs shall be optically isolated from the drive control logic.

vi. The control interface card shall provide input terminals for access to fixed drive functions that include start, stop, external fault, speed, and enable.

vii. The VFD shall be capable of supporting up to 7 analog inputs, 7 analog outputs, 21 digital inputs, 7 relay outputs, 7 transistor outputs, and 3 positive temperature coefficient (PTC) inputs.

viii. The Input / Output option modules shall have the following features:

i. Analog Inputs:
   a. Quantity two (2) differentially isolated, ±10V (bi-polar), 88k ohm input impedance, 11 bit plus sign.
   b. Analog inputs shall be user programmable for a variety of uses including frequency command and process loop input. Analog inputs shall be user programmable for function scaling (including invert), offset, signal loss detect and square root.

ii. Analog Outputs:
   a. Quantity two (2) ±10V (bi-polar) / 11 bit & sign, 2 kΩ minimum load, 4-20 mA, 11 bit plus sign, 400 kΩ maximum load.
   b. The analog output shall be user programmable to be proportional to one of fourteen process parameters including output frequency, output current, encoder feedback, output power.
   c. Programming shall be available to select either absolute or signed values of these parameters.

iii. Digital Inputs:
   a. Quantity of six (6) digital inputs rated 24V DC/115V AC.
   b. All inputs shall be individually programmable for multiple functions including: Start, Run, Stop, Auxiliary Fault, Speed Select, Jog and Process PI functions.

iv. Digital Outputs:
   a. At least one (1) relay output (N.O. or N.C.).
   b. For 240V AC or 24V DC, N.O. contact output ratings shall be 2 amp max., general purpose (inductive)/resistive. N.C. contact output ratings shall be 2 amp max., resistive only.
   c. Relays shall be programmable to multiple conditions including: Fault, Alarm, At Speed, Drive Ready and PI Excess Error.
   d. Timers shall be available for each output to control the amount of time, after the occurring event, that the output relay actually changes state.
   e. At least one (1) transistor output.
   f. For 24V DC, transistor output rating shall be 1 amp max, Resistive.

20. Reference Signals

i. The drive shall be capable of using the following input reference signals:
i. Analog inputs  
ii. Preset speeds  
iii. Remote potentiometer  
iv. Digital MOP  
v. Human Interface Module  
vi. Communication modules

21. Loss of Reference

i. The drive shall be capable of sensing reference loss conditions.

ii. In the event of loss of the reference signal, the drive shall be user programmable to the following:

   i. Fault the drive and coast to stop.
   ii. Issue a minor fault - allows the drive to continue running while some types of faults are present.
   iii. Alarm and maintain last reference.

iii. When using a communications network to control the drive, the communications adapter shall have these configurable responses to network disruptions and controller idle (fault or program) conditions:

   i. Fault  
   ii. Stop  
   iii. Zero Data  
   iv. Hold Last State  
   v. Send Fault Configuration

22. Metering

i. At a minimum, the following parameters shall be accessible through the Human Interface Module, if installed:

   i. Output Current in Amps  
   ii. Output Voltage in Volts  
   iii. Output Power in kW  
   iv. Elapsed MWh  
   v. DC Bus Voltage  
   vi. Frequency  
   vii. Heatsink Temperature  
   viii. Last eight (32) faults  
   ix. Elapsed Run Time  
   x. IGBT Temperature

23. Faults

i. At a minimum, the following faults shall be accessible through the Human Interface Module:

   i. Power Loss  
   ii. Undervoltage  
   iii. Overvoltage  
   iv. Motor Overload
v. Heat Sink Over-temperature
vi. Maximum Retries
vii. Phase to Phase and Phase to Ground Faults

24. Predictive Diagnostics

i. At a minimum, the following predictive diagnostic features shall be provided:
   i. Relay Output Life Cycles based on load type and amps.
   ii. Hours of Fan Life based on load and ambient temperature.
   iii. Motor Bearing life based on expected hours of use.
   iv. Motor Lubrication schedule based on hours of use.
   v. Machine Bearing life based on expected hours of use.

25. Real-Time Clock

i. Shall be capable of providing time stamped events.
ii. Shall have the ability to be set locally or via a remote controller.
iii. Shall provide the ability to be programmable for month, day, year and local time zones in HH:MM:SS.

9.09 VFD PACKAGED SYSTEM

A. Features

1. Ratings

i. Voltage
   i. Capable of accepting nominal plant power of 480V AC at 60Hz.
   ii. The supply input voltage tolerance shall be ± 10% of nominal line voltage.

ii. Displacement Power Factor
   i. Six-pulse VFD shall be capable of maintaining a minimum true power factor (Displacement P.F. X Distortion P.F.) of 0.95 or better at rated load and nominal line voltage, over the entire speed range.
   ii. Eighteen-pulse VFD shall be capable of maintaining a minimum true power factor (Displacement P.F. X Distortion P.F.) of 0.98 or better at rated load and nominal line voltage, over the entire speed range.

iii. Efficiency
   i. A minimum of 96.5% (+/- 1%) at 100% speed and 100% motor load at nominal line voltage.
   ii. Control power supplies, control circuits, and cooling fans shall be included in all loss calculations.
   iv. Operating ambient temperature range without derating: 0 °C to 40 °C (32 °F to 104 °F)
   v. Operating relative humidity range shall be 5% to 95% non-condensing.
vi. Operating elevation shall be up to 1000 Meters (3,300 ft) without derating.

2. Sizing
   i. Systems rated at Normal Duty loads shall provide 110% overload capability for up to one minute and 150% for up to 3 seconds.
   ii. Systems rated at Heavy Duty loads shall provide 150% overload capability for up to one minute and 180% for up to 3 seconds.

3. Auto Reset/Run
   i. For faults other than those caused by a loss of power or any other non-critical fault, the drive system shall provide a means to automatically clear the fault and resume operation.

4. Ride-Through
   i. The VFD system shall attempt to ride through power dips up to 20% of nominal. The duration of ride-through shall be inversely proportional to load. For outages greater than 20%, the drive shall stop the motor and issue a power loss alarm signal to a process controller, which may be forwarded to an external alarm signaling device.

5. Run on Power Up
   i. The VFD system shall provide circuitry to allow for remote restart of equipment after a power outage. Unless indicated in the contact drawings, faults due to power outages shall be remotely resettable. The VFD system shall indicate a loss of power to a process controller, which may be forwarded to an external alarm signaling device. Upon indication of power restoration the process controller will attempt to clear any faults and issue a run command, if desired.

6. Communications
   i. VFD shall be capable of communicating on multiple networks.
   ii. VFD shall be capable of supporting the following network options:
      i. DeviceNet
      ii. EtherNet/IP
      iii. ControlNet Coax
      iv. ControlNet Fiber
      v. Interbus
      vi. CANopen
      vii. Modbus/TCP
      viii. Modbus RTU
      ix. Profibus DP
      x. RS-485 DF1
      xi. RS-485 HVAC
      xii. Remote I/O
7. Enclosure Door Mounted Human Interface Module (HIM)
   i. VFD shall provide a HIM with integral LCD display, operating keys and
      programming keys.
   ii. An enclosure door-mounted HIM, rated NEMA/UL Type 1 or NEMA/UL
       Type 4/12, shall be selected provided.
   iii. An optional VFD-mounted HIM, rated NEMA/UL Type 1, may be
       provided and shall be capable of connecting via a separate cable for use as
       a handheld terminal.
   iv. The HIM shall have the following features:
       i. A seven (7) line by twenty-one (21) character backlit LCD display
          with graphics capability.
       ii. Shall indicate drive operating conditions, adjustments and fault
           indications.
       iii. Shall be configured to display in the following three distinct zones:
           a. The top zone shall display the status of direction, drive
              condition, fault / alarm conditions and Auto / Manual mode.
           b. The middle zone shall display drive output frequency.
           c. The bottom zone shall be configurable as a display for either
              programming menus / information or as a two-line user display
              for two additional values utilizing scaled units.
       iv. Shall provide digital speed control.
       v. The keypad shall include programming keys, drive operating keys
          (Start, Stop, Direction, Jog and Speed Control), and numeric keys for
          direct entry.

8. Enclosure
   i. Shall be rated NEMA/UL Type (1) or (12) – **Bidder shall recommend
      and justify selection**.
   ii. Shall be painted per the manufacturer’s standard.
   iii. Shall provide entry and exit locations for power cables.
   iv. Shall contain a label for UL508.
   v. The drive system nameplate shall be marked with system Short Circuit
      Current Rating (SCCR).

9. Drive Enclosure Input Disconnect
   i. Provide an enclosure door interlocked disconnect with fusing, or
      disconnect, or thermal magnet circuit breaker, or motor circuit – **Bidder
      shall recommend and justify selection**.

10. Operator Handles
    i. Provide externally operated main disconnect handle.
    ii. Handles shall be lockable with up to three lockout / tagout padlock
        positions.

B. Branch Circuit Protection
1. Input fusing, motor circuit protector (MCP), or inverse time circuit breaker shall be provided – Bidder shall recommend and justify selection.

C. Bypass – Bidder shall recommend and justify selection.

1. Manual Bypass Option:
   i. Shall provide a means to manually switch a single motor from drive control to bypass (across the line operation).
   ii. Shall provide separate drive output and bypass contactors. The contactors shall be electrically and mechanically interlocked.
   iii. Shall provide a Drive/Off/Bypass selector switch, mounted on the enclosure door, for selection of Drive and Bypass modes of operation.
   iv. Provide a Class 10 overload for motor protection while operating in the bypass mode.

2. Automatic Bypass Option:
   i. Shall provide a means to automatically (upon a drive fault) switch a single motor from drive control to bypass (across the line operation).
   ii. Shall provide separate drive output and bypass contactors. The contactors shall be electrically and mechanically interlocked.
   iii. Shall provide a Drive/Off/Bypass selector switch, mounted on the enclosure door, for selection of Drive and Bypass modes of operation.
   iv. Shall provide a Auto Bypass/Off/On selector switch, mounted on the enclosure door, for selection of Auto Bypass mode of operation.
   v. Provide a Class 10 overload for motor protection while operating in the bypass mode.

3. SMC Flex / Pump Option Bypass:
   i. Shall provide a means to switch a single motor from drive control to bypass via a soft start (across the line operation).
   ii. Shall provide separate drive output and bypass contactors. The contactors shall be electrically and mechanically interlocked.
   iii. Shall provide a Drive/Off/Bypass selector switch, mounted on the enclosure door, for selection of Drive and Bypass modes of operation.
   iv. Provide a Class 20/30 overload for motor protection while operating in the bypass mode.
   v. Shall provide smooth deceleration when stopping in bypass mode.
   vi. Shall provide a door-mounted HIM.
   vii. Shall provide bypass fusing on input of RVSS bypass unit.

D. Control Power Transformer

1. Provide a control power transformer mounted and wired inside of the drive system enclosure.
2. The transformer shall be rated for the VFD power requirements.

E. Harmonic Mitigation Techniques

1. Drive Input Line Reactor
i. Provide a drive input line reactor mounted within the drive system enclosure for drives that are less than 100 horsepower.

ii. The line reactor shall meet the following specifications:

   i. The construction shall be iron core with an impedance of (3 or 5) percent – Bidder shall recommend and justify selection.

   ii. The winding shall be copper or aluminum wound.

   iii. The insulation shall be Class H with a 115 °C rise over 50 °C ambient.

   iv. The unit shall be rated for system voltage, ampacity, and frequency.

2. 18-pulse VFD (greater than 100 horsepower) with Auto Transformer

   i. Provide VFD with a single 18-pulse converter.

   i. The converter bridge shall be a parallel 18-pulse diode bridge assembly with DC snubber (board or assembly). Diodes shall be rated (devices) with a blocking voltage minimum of 1600V.

   ii. The converter shall incorporate 1000V three phase block style MOV protection rated 85 °C.

   ii. The drive system shall incorporate an 18-pulse phase shifting auto transformer with line reactor as an assembly. The 18-pulse assembly shall be wired into the VFD System enclosure where possible. The auto transformer shall have the following minimum features:

      i. Rated for input rectifier duty and matched to VFD overload capability.

      ii. Copper or aluminum wound.

      iii. Class 180 or 220 insulation.

      iv. Power factor of 0.98 or better at rated load and nominal line voltage.

      v. Open core construction.

      vi. One normally closed thermoswitch contact in each coil wired into a VFD control circuit.

   iii. The drive system shall be compliant with IEEE519-1992 standards at the input VFD terminals based upon the input power phase imbalance within 0.5% of nominal line voltage and under full VFD output current ratings.

F. Auxiliary Relays

1. Provide relays for Drive Alarm, Drive Fault, Drive Run, and System Status Faults (as required).

2. The relays shall be combination (2 N.O. & 2 N.C.). The relay contacts shall be rated for 115V AC/30V DC, 5.0 amp resistive, 2.5 amp inductive.

G. Control Interface

1. The control terminals shall be rated for 115V AC.

2. The control interface shall provide input terminals for access to VFD functions that include start, stop, external fault, speed select, and enable, as required.
H. Motor Heater Control

1. The drive system shall provide the drive control circuitry to energize an existing motor heater whenever the motor is not running via remote power.
2. The heater control shall be interlocked with the drive and/or bypass and shall be energized whenever the motor is not running. The source shall be remotely provided.
3. A pilot light with LED NEMA Type 4/13 shall be mounted on the drive system enclosure door for indication of Motor Heater On.

I. Hand/Off/Auto Selector Switch

1. Provide a "Hand/Off/Auto" selector switch, mounted on the enclosure door.
2. The "Hand/Off/Auto" selector switch shall start the drive in the “Hand” mode and stop the drive in the “Off” mode.
3. In the “Auto” mode the drive shall be started and stopped from a remote “RUN” contact.
4. In all modes, Auxiliary and Enable inputs to the drive control interface board must be present before the drive will start.
5. When a HIM is present, the stop function shall always be available to stop the drive regardless of the selected mode (“Hand” or “Auto”). The HIM will be non-functional (except for the display and programming) when the switch is in “Off” mode. The HIM shall stop the drive if the switch is in the “Auto” mode with the remote start contact initiated.
6. The drive speed reference shall be controlled from the HIM, unless a separate door-mounted potentiometer is provided, when in “Hand” mode (factory default setting).
7. The drive speed reference shall be controlled by a remote 4…20 mA input when in “Auto” mode.
8. The device shall be a NEMA Type 4/13, mounted on the drive system enclosure door.

J. Drive Disable Mushroom Push Button

1. Provide a maintained mushroom style push button, mounted on the enclosure door that when pushed, will open the drive enable input.
2. The device shall be a NEMA Type 4/13, mounted on the drive system enclosure door.

K. Pilot Lights

1. Provide LED pilot lights, mounted on the enclosure door, for indication of the following status:
   i. Run
   ii. Drive Fault
   iii. Control Power On
   iv. Motor Fault
2. The device shall be a NEMA Type 4/13, mounted on the drive system enclosure door.

L. Motor Run Time Meter
   1. Provide a digital, non-resettable, door-mounted elapsed time meter.
   2. The meter shall be electrically interlocked with the Drive Run relay and Bypass contactor to indicate actual motor operating hours.

M. Output Filtering – *Bidder shall recommend and justify selection.*
   1. 3% output line reactor
   2. 5% output line reactor
   3. 1321 Reflected Wave Reduction (RWR) output filter
   4. DV/DT output filter (may affect the system SCCR rating)

9.10 EXAMINATION
   A. Verify that location is ready to receive equipment.
   B. Verify that the building environment can be maintained within the service conditions required by the manufacturer of the VFD.

9.11 INSTALLATION
   A. Installation shall be in compliance with all manufacturer requirements, instructions and drawings.

9.12 START-UP SERVICE
   A. At a minimum, the start-up service shall include:
      1. Perform pre-Power Check
      2. Megger Motor Resistances: Phase-to-Phase and Phase-to-Ground
      3. Verify system grounding per manufacturer’s specifications
      4. Verify power and signal grounds
      5. Check connections
      6. Check environment
   B. Drive Power-up and Commissioning:
      1. Measure Incoming Power Phase-to-Phase and Phase-to-Ground
      2. Measure DC Bus Voltage
      3. Measure AC Current Unloaded and Loaded
      4. Measure Output Voltage Phase-to-Phase and Phase-to-Ground
      5. Verify input reference signal
   C. All measurements shall be recorded.
   D. Drive shall be tuned for system operation.
   E. Drive parameter listing shall be provided.

9.13 TRAINING
A. Manufacturer to provide a quantity of five day 8-hour sessions of on-site instruction.

B. The instruction shall include the operational and maintenance requirements of the variable frequency drive.

C. The basis of the training shall be the variable frequency drive, the engineered drawings and the user manual. At a minimum, the training shall:

1. Review the engineered drawings identifying the components shown on the drawings.
2. Review starting / stopping and speed control options for the controller.
3. Review operation of the Human Interface Module for programming and monitoring of the variable frequency drive.
4. Review the maintenance requirements of the variable frequency drive.
5. Review safety concerns with operating the variable frequency drive.
10 Specification for Overload Relays

10.01 RATINGS

A. The electronic overload relay shall have a current operating range of:

1. 0.1 to 800 A (for IEC selectable motor protection models)
2. 0.1 to 45 A (for IEC fixed motor protection models)

B. All relay contacts shall be rated AC15/B600.

C. The electronic overload relay main circuits shall be rated:
   - Insulation Voltage (U_i) 690 V AC [or 1000 V AC, D contactor models]
   - Impulse Strength (U_imp) 6 kV AC
   - Operating Voltage (U_e) IEC/UL 690 V AC/600 V AC [or 1000 V AC/600 V AC, D contactor models]
   - Operating Frequency 50/60 Hz (sinusoidal)

D. The electronic overload relay control circuits shall be rated:
   - Insulation Voltage (U_i) 690 V AC
   - Impulse Strength (U_imp) 6 kV AC
   - Operating Voltage (U_e) IEC/UL 690 V AC/600 V AC
   - Operating Current (I_e) N.O./N.C.
     - 12 – 120V 3/2
     - 220 – 240V 1.5/1.5
     - 380 – 480V 0.75/0.75
     - 500 – 600V 0.6/0.6
   - Thermal Current (I_ther) 5 A
   - Contact Reliability 17V, 5 mA

E. Environmental Specifications – The electronic overload relay shall be:

   1. Capable of operating in an environment with a relative humidity range of 0 to 95%, non-condensing.
   2. Able to withstand a shock of 30 G (per IEC 68-2-27).
   3. Able to operate without disruption for vibration levels up to 3 G (per IEC 68-2-6).
   4. Able to operate without de-rating to an elevation of 2000 m.
   5. Rated for an operating environment of -20 to +60°C (-4 to +140°F).
   6. Rated for application in Pollution Degree 3 environments.

10.02 CONSTRUCTION

A. The electronic overload relay shall be a self-powered, low energy consumption (150 mW) device and shall consist of:

   1. Overload relay
   2. One side-mount expansion module (optional)
   3. Accessories (optional)
B. The electronic overload relay shall be direct mounting style or compact, pass-through style with integrated DIN rail and panel mount. The direct mounting style shall be capable of being separate-mounted through a DIN rail/panel mount adapter accessory.

10.03 OVERLOAD RELAY

A. The electronic overload relay shall be NEMA or IEC configuration, providing current measurement-based protection.

1. Motor current shall be monitored through 3 integral current transformers, secured separately in the housing, that power the overload protection circuitry.
2. Performance of the electronic overload relay shall not be impacted by ambient temperature over the specified temperature operating range.

B. The electronic overload relay shall perform thermal modeling electronically with precision solid-state components and shall have:

1. An application-specific integrated circuit (ASIC), which continually processes motor current data to accurately maintain the time-current status of the motor thermal capacity utilization value.
2. A thermal memory circuit, which allows the relay to model the heating and cooling effects of motor on and off periods, ensuring accurate protection of both hot and cold motors.
3. A separate phase loss detection circuit, which allows the relay to quickly respond to phase loss conditions, typically within 3 seconds.

C. The electronic overload relay’s trip class shall be:

1. Fixed Trip Class 10, or,
2. Selectable Trip Class 10, 15, 20 or 30, through means of a DIP switch setting.

D. The electronic overload relay’s reset mode shall be:

1. Manual, or,
2. Selectable Manual/Automatic, through means of a DIP switch setting.

E. The face of the electronic overload relay shall provide:

1. A potentiometer that can be set to a wide 5:1 adjustment range.
2. A trip indicator flag for visual trip status indication.
3. A reset button.
4. A test button that momentarily actuates the N.C. contact.
5. A mechanical trip cam for operating both sets of contacts.

F. Electrical connections:

1. The electronic overload relay shall work with three-phase or single-phase applications.
2. The electronic overload relay shall be capable of direct connection and mounting to contactors in low voltage applications.
3. The electronic overload relay shall provide 1 N.O. and 1 N.C. isolated auxiliary contacts. The isolated configuration allows them to be applied in circuits operating at different voltage levels and without polarity restrictions.
4. The electronic overload relay shall have line-side over-molded connections.
5. Wiring terminals shall provide IP20 finger protection.

10.04 OPTIONAL PROTECTIVE, REMOTE RESET AND COMMUNICATION MODUL ES (LIMIT 1)

A. Remote Reset Module

1. Ratings:
   - Insulation Voltage ($U_i$) 300V
   - Operating Voltage ($U_e$) 24 to 240 VAC/VDC, 50/60 Hz
   - Power at $U_e$
     - 24 VAC 0.8 W
     - 120 VAC 0.8 W
     - 240 VAC 1.0 W
   - Impulse Withstand Voltage 2.5 kV

2. The remote reset module shall provide remote reset of the electronic overload relay after a trip occurs.
   i. Directly mounts to the left side of the electronic overload relay, adding only 18 mm to the overall width.
   ii. Electronically interfaces with the electronic overload relay so that all control circuit connections are made at the relay terminals.

B. Jam Protection Module with Remote Reset

1. Ratings:
   - Insulation Voltage ($U_i$) 300V
   - Operating Voltage ($U_e$) 24 to 240 VAC/VDC, 50/60 Hz
   - Power at $U_e$
     - 24 VAC 0.3 W
     - 120 VAC 0.3 W
     - 240 VAC 0.5 W
   - Impulse Withstand Voltage 2.5 kV

2. The jam protection module with remote reset shall provide flexible jam protection.
   i. Directly mounts to the left side of the electronic overload relay, adding only 18 mm to the overall width.
   ii. Electronically interfaces with the electronic overload relay so that all control circuit connections are made at the relay terminals.

3. The jam protection module with remote reset shall provide front-accessible DIP switches that offer jam protection settings to match application requirements.
   i. Enabling/disabling of jam protection function and remote reset operation.
   ii. Jam trip level settings at 150%, 200%, 300% and 400% of full load current setting.
   iii. Trip delay settings of 1/2, 1, 2 and 4 seconds to minimize nuisance tripping.
C. Ground Fault Protection Module with Remote Reset

1. Ratings:
   - Insulation Voltage ($U_i$) 300V
   - Operating Voltage ($U_e$) 24 to 240 VAC/VDC, 50/60 Hz
   - Power at $U_e$
     - 24 VAC 0.8 W
     - 120 VAC 0.8 W
     - 240 VAC 1.0 W
   - Impulse Withstand Voltage 2.5 kV

2. The ground fault protection module with remote reset shall provide flexible ground fault protection.
   i. Directly mounts to the left side of the electronic overload relay, adding only 18 mm to the overall width.
   ii. Electronically interfaces with the electronic overload relay so that all control circuit connections are made at the relay terminals.

3. The ground fault protection module with remote reset shall provide front-accessible DIP switches that offer ground fault protection settings to match application requirements.
   i. Enabling/disabling of ground fault protection function and remote reset operation.
   ii. Ground fault trip level settings in 4 ranges: 20 to 100 mA (resistive loads); 100 to 500 mA; 0.2 to 1 A; 1 to 5 A. Within each range, specific percentages of maximum ground fault can be set.
   iii. Trip delay fixed at 50 ms ± 20 ms.

D. Ground Fault/Jam Protection Module with Remote Reset

1. Ratings:
   - Insulation Voltage ($U_i$) 300V
   - Operating Voltage ($U_e$) 24 to 240 VAC/VDC, 50/60 Hz
   - Power at $U_e$
     - 24 VAC 0.8 W
     - 120 VAC 0.8 W
     - 240 VAC 1.0 W
   - Impulse Withstand Voltage 2.5 kV

2. The ground fault/jam protection module with remote reset shall provide flexible ground fault and jam protection.
   i. Directly mounts to the left side of the electronic overload relay, adding only 18 mm to the overall width.
   ii. Electronically interfaces with the electronic overload relay so that all control circuit connections are made at the relay terminals.

3. The ground fault/jam protection module with remote reset shall provide front-accessible DIP switches that offer ground fault and jam protection settings to match application requirements.
i. Enabling/disabling of ground fault protection and jam protection functions and remote reset operation.

ii. Ground fault trip level settings in 4 ranges: 20 to 100 mA (resistive loads); 100 to 500 mA; 0.2 to 1 A; 1 to 5 A. Within each range, specific percentages of maximum ground fault can be set.

iii. Ground fault trip delay fixed at 50 ms ± 20 ms.

iv. Jam protection fixed at 400% of full load current setting with a 0.5 second trip delay.

E. PTC Module with Remote Reset

1. Ratings:
   - Insulation Voltage ($U_i$) 300V
   - Operating Voltage ($U_e$) 24 to 240 VAC/VDC, 50/60 Hz
   - Power at $U_e$
     - 24 VAC 0.8 W
     - 120 VAC 0.8 W
     - 240 VAC 1.0 W
   - Impulse Withstand Voltage 2.5 kV

2. The PTC module with remote reset shall provide enhanced motor protection based on actual temperature.
   - i. Directly mounts to the left side of the electronic overload relay, adding only 18 mm to the overall width.
   - ii. Electronically interfaces with the electronic overload relay so that all control circuit connections are made at the relay terminals.

3. The PTC module with remote reset shall provide 2 terminals for the connection of positive temperature coefficient (PTC) thermistor sensors.
   - i. PTC sensors shall be able to directly monitor the temperature of motor stator windings.
   - ii. Conditions such as obstructed cooling and high ambient temperature shall be addressed.

F. EtherNet/IP and Protection Module

1. Power Supply Ratings
   - Supply Voltage ($U_s$) 24 VDC
   - Operating Range ($U_e$) 20.4 to 26.4V
   - Supply Current ($I_{se}$) 0.11 A
   - Max Surge @ Power-Up 2.5 A
   - Max Power Consumption 2.7 W

2. Output Relay Ratings:
   - Thermal Current ($I_{thr}$) 5 A
   - Insulation Voltage ($U_i$) 300 VAC
   - Operating Voltage ($U_e$) 240 VAC
   - Operating Current ($I_{ce}$)
     - 120 VAC 3 A
     - 240V 1.5 A
     - 110 VDC 0.25 A
3. The EtherNet/IP and protection module shall provide seamless control and direct access to motor performance and diagnostic data on an Ethernet-based network.

i. Directly mounts to the left side of the electronic overload relay, adding only 22 mm to the overall width.

ii. Electronically interfaces with the electronic overload relay so that all control circuit connections are made at the relay terminals.

4. The EtherNet/IP and protection module shall enhance communication.

i. Supports I/O and explicit messaging for data access by a PAC and contains compatible tags for direct software access.

ii. Has integrated web and email server so information can be read and parameters can be configured via a web browser.

iii. Uses a simple mail transfer protocol (SMTP) to send email or text messages in the event of a warning or trip condition.

5. The EtherNet/IP and protection module shall include integrated I/O: 2 inputs, 1 output.

6. The EtherNet/IP and protection module shall provide operational and diagnostic data:

i. Average motor current

ii. Percentage of thermal capacity usage

iii. Device status

iv. Trip and warning identification

v. Trip history (5 previous trips)

7. The EtherNet/IP and protection module shall expand protective functions:

i. Overload warning

ii. Jam protection

iii. Underload warning

G. PROFIBUS and Protection Module

1. Power Supply Ratings

<table>
<thead>
<tr>
<th>Supply Voltage (U_s)</th>
<th>24 VDC</th>
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<tbody>
<tr>
<td>Operating Range (U_e)</td>
<td>20.4 to 26.4V</td>
</tr>
<tr>
<td>Supply Current (I_e)</td>
<td>0.11 A</td>
</tr>
<tr>
<td>Max Surge @ Power-Up</td>
<td>2.5 A</td>
</tr>
<tr>
<td>Max Power Consumption</td>
<td>2.7 W</td>
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2. Output Relay Ratings:

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<thead>
<tr>
<th>Thermal Current (I_{thc})</th>
<th>5 A</th>
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</thead>
<tbody>
<tr>
<td>Insulation Voltage (U_i)</td>
<td>300 VAC</td>
</tr>
<tr>
<td>Operating Voltage (U_o)</td>
<td>240 VAC</td>
</tr>
<tr>
<td>Operating Current (I_e)</td>
<td></td>
</tr>
</tbody>
</table>
### Ratings:

**Insulation Voltage (U_i)**
- Terminals 13 & 14: 300 VAC
- Terminals 1, 2, 3: 30 VDC
- DeviceNet Terminals: 30 VDC

**Operating Voltage (U_e)**
- Terminals 13 & 14: 250 VAC
- Terminals 1, 2, 3: 24 VDC
- DeviceNet Terminals: 24 VDC

**Power at U_e**
- 24 VDC: 2.0 W

**Impulse Withstand Voltage**
- 2.5 kV

**Designation**
- B300/AC15

3. The PROFIBUS and protection module shall provide seamless control and direct access to motor performance and diagnostic data on a field bus-based network.
   
i. Directly mounts to the left side of the electronic overload relay, adding only 22 mm to the overall width.
   
ii. Electronically interfaces with the electronic overload relay so that all control circuit connections are made at the relay terminals.

4. The PROFIBUS and protection module shall support both PROFIBUS DP-V0 and DP-V1.

5. The PROFIBUS and protection module shall include integrated I/O: 2 inputs, 1 output.

6. The PROFIBUS and protection module shall provide operational and diagnostic data:
   
i. Average motor current
   
ii. Percentage of thermal capacity usage
   
iii. Device status
   
iv. Trip and warning identification
   
v. Trip history (5 previous trips)

7. The PROFIBUS and protection module shall expand protective functions:
   
i. Overload warning
   
ii. Jam protection
   
iii. Underload warning

**H. DeviceNet and Protection Module**

1. Ratings:
   
   **Insulation Voltage (U_i)**
   - Terminals 13 & 14: 300 VAC
   - Terminals 1, 2, 3: 30 VDC
   - DeviceNet Terminals: 30 VDC

   **Operating Voltage (U_e)**
   - Terminals 13 & 14: 250 VAC
   - Terminals 1, 2, 3: 24 VDC
   - DeviceNet Terminals: 24 VDC

   **Power at U_e**
   - 24 VDC: 2.0 W

   **Impulse Withstand Voltage**
   - 2.5 kV

   **Designation**
   - B300
2. The DeviceNet and protection module shall provide seamless deployment of motor starters onto the Integrated Architecture.
   i. Directly mounts to the left side of the electronic overload relay, adding only 18 mm to the overall width.
   ii. Electronically interfaces with the electronic overload relay so that all control circuit connections are made at the relay terminals.

3. The DeviceNet and protection module shall enhance communication.
   i. ODVA tested
   ii. Unconnected Message Manager (UCMM) support
   iii. Get/set single attribute explicit messaging
   iv. Autobaud network rate detection

4. The DeviceNet and protection module shall include integrated I/O: 2 inputs, 1 output.

5. The DeviceNet and protection module shall provide operational and diagnostic data:
   i. Average motor current
   ii. Percentage of thermal capacity usage
   iii. Device status
   iv. Trip and warning identification
   v. Trip history (5 previous trips)

6. The DeviceNet and protection module shall expand protective functions:
   i. Overload warning
   ii. Jam protection
   iii. Underload warning

I. Remote Indication Display

1. Ratings:
   Insulation Voltage (Uᵢ) 300V
   Operating Voltage (Uₑ) 24 VDC
   Degree of Protection IP 65/66 (Type 4/4X/12/13)

2. The remote indication display shall display the status of the electronic overload relay from the front of a panel.
   i. Features status indicators and a reset button.
   ii. Mounts in a standard 22 mm push button cutout.

10.05 ACCESSORIES

A. A DIN rail/panel adapter shall be available from the manufacturer for separate mounting of direct mounting style models.
B. A current adjustment shield shall be available from the manufacturer to provide protection from inadvertent adjustment of the FLA setting.
C. External reset buttons and adapters shall be available from the manufacturer for enclosed applications.
D. A core balanced ground fault sensor shall be available from the manufacturer for use with the ground fault modules.

10.06 DELIVERY, STORAGE, AND HANDLING

A. The contractor shall coordinate the shipping of equipment.
B. The contractor shall store the equipment in a clean and dry space.
C. The contractor shall protect the units from dirt, water, construction debris and traffic.

10.07 INSTALLATION

A. The contractor shall verify all electronic overload relay settings have been properly adjusted prior to energizing.
B. The contractor shall ensure accessibility to diagnostic lights, communication ports and optional modules. These components shall be free from obstruction at all times.

10.08 SPARE MATERIALS

A. Provide one (1) spare overload relay of each size utilized, including options.

10.09 WARRANTY

A. The manufacturer shall provide their standard parts warranty for eighteen (18) months from the date of shipment or twelve (12) months from the date of being energized, whichever occurs first.
B. The manufacturer shall confirm this warranty as part of the submittal.
11 Specifications for Electrical Control Devices

11.01 ELECTRICAL CONTROL DEVICES

A. The electrical control devices shall include:

1. Pilot Devices
2. Relays and Timers
3. Miniature Circuit Breakers
4. Terminal Blocks and Fuse Blocks
5. Alarms and Signals
6. Power Supplies

B. The electrical control devices shall be interoperable with standard electrical equipment.

11.02 PILOT DEVICES

A. 30.5 MM PUSH BUTTONS, SELECTOR SWITCHES AND PILOT LIGHTS

1. 30.5 mm push buttons, selector switches and pilot lights shall be heavy industrial as:

   i. Type 4/13 watertight/oil tight metal, or
   ii. Type 4/4X/13 corrosion-resistant/watertight/oil tight plastic

2. 30.5 mm push buttons, selector switches and pilot lights shall provide EN/IEC 60529 IP66/65 degree of protection.
3. 30.5 mm push buttons, selector switches and pilot lights shall have electrical ratings of:

   i. Dielectric strength – 2200V for 1 minute [or 300V for 1 minute ]
   ii. Electrical design life cycles – 10,000,000 at max. rated load [200,000 at max rated load]

4. 30.5 mm push buttons, selector switches and pilot lights shall have an operating range of -40 to 131°F (-40 to 55°C).
5. Illuminated devices shall offer universal LED that accepts 12 to 130 VAC/VDC voltage input.
6. 30.5 mm push buttons shall have a diaphragm seal for protection from liquids, particles and corrosive agents.
7. 30.5 mm selector switches shall incorporate a positive detent to prevent the switch from hanging up between positions.

B. 22.5 MM PUSH BUTTONS, SELECTOR SWITCHES AND PILOT LIGHTS

1. 22.5 push buttons, selector switches and pilot lights shall be internationally rated as:

   i. Type 4/4X/13 chemical-resistant engineering grade thermoplastic, or
   ii. Type 4/13 chrome-plated die-cast metal
2. 22.5 mm push buttons, selector switches and pilot lights shall provide EN/IEC 60529 IP66/65 degree of protection.
3. 22.5 mm push buttons, selector switches and pilot lights shall have ratings of:
   i. Dielectric strength – 2500V for 1 minute
   ii. Mechanical durability per EN 60947-5-1 (Annex C) – up to 10,000,000 cycles, depending on device
4. 22.5 mm push buttons, selector switches and pilot lights shall have an operating range of -13 to 158°F (-25 to 70°C).
5. 22.5 mm push buttons, selector switches and pilot lights shall have a latch with snap-fit design, stackable contact blocks and a rotating collar for easy latch removal.
6. 22.5 mm push buttons shall have a diaphragm seal for protection from liquids, particles and corrosive agents.
7. 22.5 mm selector switches shall incorporate a positive detent to prevent the switch from hanging up between positions.

C. POTENTIOMETER DEVICES
1. 30.5 mm potentiometer devices shall be heavy industrial:
   i. Type 4/13 watertight/oiltight metal, or
   ii. Type 4/4X/13 corrosion-resistant/watertight/oiltight plastic
2. Potentiometer devices shall be rated for 300 VAC/VDC, 2 W maximum (6 VDC minimum):
   i. Mechanical design life – Min. 25,000 cycles
   ii. Rotational torque – 3 to 12 in-oz
   iii. Stopping torque – Min. 12 in-lb
3. Potentiometer devices shall have single-turn operation, 312 degree rotation.
4. Potentiometer devices shall be finger-safe.

D. CONTROL STATIONS
1. Control stations shall provide heavy industrial 30.5 mm push button(s) or selector switch with appropriate contact action, button/lever type and color/legend marking. Devices shall be:
   i. Type 4/13 watertight/oiltight metal, or
   ii. Type 4/4X/13 corrosion-resistant/watertight/oiltight plastic
2. Control stations shall be constructed of either:
   i. Die-cast aluminum
   ii. Chlorosulfonated-polyethylene-booted operator – stainless steel
   iii. Chlorosulfonated-polyethylene-booted operator – glass polyester
   iv. Bootless operator – stainless steel
   v. Bootless operator – glass polyester
11.03 RELAYS AND TIMERS

A. RELAYS – TIME DELAY

1. Time delay relays shall mount on tube-type bases with pin-style socket mounting.
2. Time delay relays shall have 10A, B300, DPDT contact ratings and coil voltages as shown on drawings.
3. Time delay relays shall have adjustable timing ranges [or fixed timing ranges to avoid tampering]. Timing ranges shall be as shown on drawings.

B. RELAYS – GENERAL PURPOSE

1. General purpose relays shall have tube-base/Octal 8-pin [or 11-pin] terminals and ON/OFF flag indicators.
2. General purpose relay contacts shall be silver nickel [or silver nickel bifurcated or gold-plated bifurcated] and have 10A, B300, DPDT [or 3PDT] ratings. Coil voltages shall be as shown on drawings.
3. General purpose relays shall have an electrical schematic on the faceplate, a clear cover for visual inspection and snap-in marker ability.
4. General purpose relays shall have LED status indicators, push-to-test and manual override.

C. RELAYS – MINIATURE

1. The miniature relays shall be square-base, 4-pole, plug-in type with blade-style terminals and ON/OFF flag indicators.
2. Miniature relay contacts shall be silver nickel [or gold-plated silver nickel] and have 7A [or 10A], DPDT [or 4PDT] ratings. Coil voltages shall be as shown on drawings.
3. Miniature relays shall have an electrical schematic on the faceplate and a clear cover for visual inspection.

D. Miniature relays shall have LED status indicators and push-to-test button with incorporated manual override lever.

E. RELAYS – INDUSTRIAL-TYPE

1. Industrial-type relays shall be ruggedly constructed (10 million operation mechanical life), 2-pole [or 4-pole, 8-pole, 12-pole], configured N.O./N.C. as shown on drawings, and panel- [or strip-, DIN rail-] mounted.
2. Industrial-type relays shall be finger-safe.
3. Industrial-type relay contacts shall be silver nickel with a double-break and bifurcated design and 10A, A600 rating for AC [5A, P600 rating for DC].
4. Accessories shall include adder decks, time delay, latching, surge suppressors and/or mounting strip.

F. TIMERS – PNEUMATIC

1. Pneumatic timers shall be open-type and mounted on industrial-type relays.
2. Pneumatic timer contacts shall be 1 N.O. and 1 N.C., rated 10A.
3. Timing modes shall be On-Delay and Off-Delay with ranges of 0.1 to 60 seconds as shown on drawings.
G. TIMERS – SOLID-STATE

1. Solid-state timers shall be DIN rail-mounted.
2. The solid-state timer contacts shall be available as SPDT or DPDT, 8A.
3. Solid-state timers shall be available with On-Delay, Off-Delay, On- and Off-Delay, One-Shot and Flasher operating modes as required on the drawings.
4. Solid-state timers shall have coil surge protection and adjustable timing ranges of 0.05 seconds to 60 hours as shown on drawings.

H. TIMERS – PROGRAMMABLE

1. Programmable timers shall be digital timing relays with LCD display and shall be socket- [or panel-] mounted.
2. Programmable timer contacts shall be SPDT, rated 5A, B300.
3. Programmable timer panel surface shall offer Type 4X/IP66 protection.
4. Programmable timers shall be configurable for Signal On-Delay, Power On-Delay, Off-Delay, Repeat Cycle, One-Shot and Cumulative operating modes as required on the drawings.
5. Programmable timers shall have timing ranges of 0.000 seconds to 9999 hours, depending on selected mode and as shown on drawings.

11.04 MINIATURE CIRCUIT BREAKERS

A. Miniature circuit breakers shall be thermal-magnetic, current-limiting type, sized as specified on the drawings:

1. 0.5A to 63A current rating
2. 1-, 2- or 3-pole
3. Type C or Type D tripping characteristic

B. Miniature circuit breakers shall be UL Listed (E197878), CSA Certified (259391), CE Marked, VDE and CCC Certified and RoHS Compliant. Standards compliances shall include:

1. UL 489
2. CSA C22.2, No. 5.1
3. EN 60947-2
4. GB 14048.2

C. Miniature circuit breakers shall be rated for:

1. Voltage – Max. 480Y/277 VAC (UL/CSA); Ue 230/400 VAC (IEC)
2. Interrupting capacity – 10 kA (UL/CSA); 15 kA (IEC)

D. Housing shall satisfy Insulation Group II/RAL 7035, shall have IP20 finger-safe design, shall be suitable for DIN rail mounting and shall include status indicator window and scratch- and solvent-resistant printing.

E. Miniature circuit breakers shall support reversible line and load connections and shall have dual terminals that:

1. Connect up to 4 wires, or 2 wires and a bus bar.
2. Clamp from both sides.
3. Have a unique design that directs wires into openings to prevent wiring misses.

F. Miniature circuit breakers shall be compatible with UL 508 Listed bus bars, auxiliary contacts, signal contacts, shunt trips and toggle-mount lockout attachments.

11.05 TERMINAL BLOCKS AND FUSE BLOCKS

A. TERMINAL BLOCKS – CONTROL, #22 to #8 AWG

1. Control terminal blocks shall be screw-type, feed-through.
2. Control terminal blocks shall be certified:
   i. UR/CSA – #22 to #8 AWG wire range, 50A maximum current, 600 VAC/VDC voltage rating
   ii. IEC – 6 mm² wire range, 41A maximum current, 800 VAC/VDC voltage rating
   iii. ATEX – 6 mm² (#20 to #10 AWG) wire range, 36A maximum current, 550 VAC/VDC voltage rating
3. Control terminal blocks shall have a snap-in card marking system.

B. TERMINAL BLOCKS – POWER

1. Power terminal blocks shall be, as applicable, either:
   i. Mini-block – 3-pole, rated at 600 VAC/VDC, 115A
   ii. Open-style power distribution block with aluminum or copper connectors – 3-pole [or 1-pole], rated at 600 VAC/VDC, 175 to 760A
   iii. Open-style feed-through/splicer terminal block with aluminum or copper connectors – 3-pole [or 1-pole], rated at 600 VAC/VDC, 175 to 760A
2. Power terminal blocks shall be certified by UR, CSA and CE.
3. Wire ranges and tightening torques shall be labeled on the block.
4. Power terminal blocks shall have a write-on marking surface or marker retention feature.

C. FUSE BLOCKS

1. Fuse block kits shall be used for protection of transformers and control circuits capable of delivering no more than 200,000 RMS symmetrical amps, 600V maximum.
2. Fuse block kits shall be 1-pole, 2-pole or 3-pole.
3. Each pole shall have a fuse cover.

11.06 ALARMS AND SIGNALS

A. ALARM HORN

1. The alarm horn shall be an High Performance Electronic Horn and shall have up to 4 stages and low current consumption.
2. The alarm horn shall have a UV-stable plastic housing and non-moving parts.
3. The alarm horn shall have an on-board microphone, 45 alarm tones selectable by DIP switch and fine volume control via potentiometer.
4. The alarm horn shall allow synchronized output in multi-horn installations and shall have the ability to replicate content to other devices (master/slave).

B. ALARM BEACON
1. The alarm beacon shall be a high-intensity, minimum 5-Joule Xenon, minimum 20-Watt Halogen or LED illumination as required on the drawings.
2. The alarm beacon shall have polycarbonate housing and lens, available in square or round configuration, and Type 4/4X/13, IP65/IP66 ingress rating as required on the drawings.
3. Flashing frequency shall be 1 Hz.
4. Alarm beacon lens colors shall be red, green, amber, blue, yellow or clear as required on the drawings.

C. ALARM LIGHT TOWER (where required)
1. The alarm light tower shall consist of Stack Lights, stacked 1 [or 2, 3, 4, 5] module(s) high and shall be surface- [or vertical-, quick-release-, pole-] mounted.
2. The alarm light tower shall be 40 mm [or 60 mm] size and the terminal block shall be top-mounted on the base.
3. The light modules shall be Type 4/4X/13, IP65 and are:
   i. Steady incandescent
   ii. LED (steady, flashing or strobe)
   iii. Piezo Electric Sound Module
4. The alarm light tower shall include a continuous (or pulsing) piezo [or transducer] sound module.
5. The alarm light tower shall have a DeviceNet base.

D. SIGNAL ALARM (PANEL MOUNT)
1. The signal alarm shall be a Panel Mount Signaling Alarm in a 30 mm [or 45 mm, 65 mm] size that mounts in a standard 22.5 mm hole.
2. The signal alarm shall have polycarbonate base and lens.
3. The signal alarm shall be, as applicable, either:
   i. Sounder
   ii. Selectable steady or flashing LED
   iii. Combination sounder and LED
   iv. Strobe
   v. Dual circuit
4. The signal alarm shall be rear-securing and finger-safe.

11.07 POWER SUPPLIES

A. CONTROL POWER TRANSFORMERS
1. The control power transformers shall be located on each unit of the Motor Control Centre (MCC), single-phase and sized as shown on drawings submitted.
2. The control power transformer shall be epoxy encapsulated and shall offer EN 60-529 finger-safe protection.
3. The control transformer shall have a:
   i. Dual primary and secondary fuse block, pre-wired and top-mounted.
   ii. Primary and secondary fuse block, factory-installed or panel-mounted.

B. 24 VDC POWER SUPPLIES
1. 24 VDC power supplies shall be with active or passive PFC choke and input as shown in drawings [or auto-select input].
2. 24 VDC power supplies shall have low inrush current, and power supplies with greater than 100-Watt output shall incorporate a minimum 120% Power Burst design.
3. 24 VDC power supplies shall have NEC Class 2 “Limited Power” output.

11.08 DELIVERY, STORAGE AND HANDLING
   A. The contractor shall coordinate the shipping of equipment.
   B. The contractor shall store the equipment in a clean and dry space.
   C. The contractor shall protect the devices from dirt, water, construction debris and traffic.

11.09 INSTALLATION
   A. The contractor shall verify all settings have been properly adjusted prior to energizing.
   B. The contractor shall ensure accessibility to electrical control devices.

11.10 SPARE MATERIALS
   A. The contractor shall provide one (1) spare electrical control device of each type utilized.

11.11 WARRANTY
   A. The manufacturer shall provide their standard parts warranty for eighteen (18) months from the date of shipment or twelve (12) months from the date of being energized, whichever occurs first.
   B. The manufacturer shall confirm this warranty as part of the submittal.
12  Power Factor Correction (PFC) System

12.01 GENERAL

This section specifies the requirements for the design, manufacture, testing of low voltage power factor correction sets with all necessary ancillary equipment. Three phase automatic power factor correction sets shall be installed indoor. Installation will be carried out by the contractor and all relative information to enable the installation to be carried out efficiently shall be provided.

12.02 APPLICABLE STANDARDS

The design of the low voltage capacitor bank and accessories shall comply with the requirements of the latest current edition of following standards and with the specific requirements of this specification.

IEC 60831 : Part 1&2- Shunt power capacitors of the self healing type for a.c systems having rated voltage up to and including 1 kV
IEC 61921 : Power factor capacitors. Low voltage capacitor banks
IEC 60439-1 : Low Voltage Switchgear and Control gear Assemblies
IEC 60947 : Low Voltage Switchgear
   Part 2 : Circuit Breakers
   Part 4 : Controlgear for voltages up to and including 1000 V a.c
IEC 60269 : LV fuses
IEC 60289 : Reactors
IEC 60529 : Degree of protection provided by enclosures ( IP code )
UL 810 : Capacitors

12.03 HANDLING

A shock control shall be placed on the packaging of the capacitor bank. If the bank fall, this control will be broken.
The handling will be done with lifting rings (already installed on the bank), or with a forklift truck (design of the bank bottom will allow this).
A 10cm part shall be present at the back of the bank in order to have an optimal position of the bank for a good ventilation.

12.04 DESIGN CONDITIONS

4-1  Ambient temperature
The LV capacitor banks shall be designed for the following ambient temperature inside the electrical room :

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Maximum :</td>
<td>40°C</td>
</tr>
<tr>
<td>Average over 24 hours :</td>
<td>35°C</td>
</tr>
<tr>
<td>Annual average :</td>
<td>25°C</td>
</tr>
<tr>
<td>Minimum :</td>
<td>-5°C</td>
</tr>
</tbody>
</table>
In case of higher temperature, the components must be overrated. With overrated components (capacitors, reactors, fans), the LV capacitor banks must be able to withstand the following ambient temperature inside the electrical room:

- **Maximum:** 50°C
- Average over 24 hours: 45°C
- **Annual average:** 35°C
- **Minimum:** -5°C

4-2 Altitude
The LV capacitor bank shall be designed to be installed at a maximum of 2000m.

4-3 Humidity
The humidity withstand by the equipment shall be according to IEC 60439-1: 50% of humidity and a maximum temperature of 40°C.

4-4 Site pollution conditions
The site pollution conditions shall be maximum class 3 according to IEC 60815. “Class 3” definition: conductive pollution occurs or dry, non-conductive pollution occurs which becomes conductive due to condensation.

12.05 ELECTRICAL SYSTEM CHARACTERISTICS

5-1 Low voltage network system
Nominal system voltage: 415 V
Voltage tolerance (400 V): +/-10%
Rated frequency: 50 Hz

5-2 Harmonic pollution
The capacitor bank shall be designed to withstand harmonic pollution and avoid harmonic amplification.

The following rules shall be taken into account.

- Capacitors rated 415 V (for 380 & 400 V network) shall be used if the power of harmonic generating loads in kVA is lower or equal than 15% of the power of the transformer. (THD (I) ≤ 5%)
- Filtering solutions shall be used if the power of harmonic generating loads in kVA is higher than 50% of the power of transformer. (THD (I) > 20%)

12.06 POWER SUPPLIES

Power supplies for LV capacitor bank shall be: or 415V, 3 phases, 3 or 4 wires, 50 Hz, 400/230 V single phase 50 Hz for control circuits, fans and anti-condensation heaters.

Cable connection: Top entry or bottom entry depending on the assembly within the LV Switchboard

12.07 CAPACITORS

The capacitors shall be low-losses units, tested in accordance with IEC 60831 part 1&2. Each element is to be of a dry self-healing metallised polypropylene film and to be housed in an individual case or combined in a three-phase assembly in one case.

A protection system shall be fitted to each element which shall comprise an HRC cartridge or tear off fuses, an integral discharge resistor and an overpressure disconnect device.
Each element forming the three phase capacitor shall be fitted with an internal discharge resistor to ensure that the capacitor is discharged to a voltage not exceeding 50 V measured at the capacitors terminals, one minute after disconnection from the power supply. The use of polychlorinated biphenols (PCB) and oil as capacitor impregnation is not acceptable.

The capacitor losses in Watts shall not exceed 0.5 W/kvar, discharge resistor included.

7-1) Enclosure and connection
The group of elements forming a three phase capacitor unit shall be installed in a plastic enclosure or in a aluminium casing.
The plastic material shall be V0 type, self-extinguishing, according to the UL810 standard.
The capacitor shall be indoor type.
Each capacitor shall be provided with three terminal pads and shall not require earth connection.
For aluminium casing the earth connection shall be done with the mounting stud and a star washer.

7-2) Certification
The three phase capacitor shall be designed and manufactured in an ISO 9001 and ISO 14001 certified plant. Certificates shall be available on demand.

7-3) Technical data
Capacitance Rating: 240kVAR (Upgrade from existing rating)
Tolerance on capacitance value: -5, + 10 %.
Insulation level:
- 50 Hz, 1 minute withstand voltage : 4 kV
- 1.2 / 50 µs : 15 kV
Temperature class: - 25 / D
Surrounding temperature:
- Maximum : 55 °C
- Average over 24 hours : 45°C
- Annual average : 35°C
Admissible current overloads: 30 % permanently
Admissible voltage overloads:
- 8 h in any 24 h period : 10 %
- 30 min in any 24 h period : 15 %
- 5 min in any 24 h period : 20 %
- 1 min in any 24 h period : 30 %

12.08 POWER FACTOR CONTROLLER
The power factor controller shall be of the electronic type capable of switching capacitor contactors in 6 or 12 steps.
The controller can communicate on the Modbus network as an option.
The controller shall have capacity to work with the power meter
The technical specification should be as follows :

Controller
The controller will allow to control 6 or 12 steps.
Display: LCD screen
Alarm output contact
The controller shall absolutely have a temperature sensor
Separated output contact to control the fans in the capacitors banks.

MeTRH Low Voltage Switchboard Upgrade
Accuracy class: 1.5%
Temperature: Working state 0 to 60°C
Simple to use menu

Connection type: Line to line or Line to neutral.
Connection features: Insensitive to CT direction / Insensitive to phase rotation polarity
  Current input: CT ……/ 5 A class 1.
  Potential free output contacts:
    CA: 1A / 400V; 2A / 250V; 5A / 120V
Step configuration programming: automatic or disconnected
Power factor setting: Digital, 0.85 ind to 0.90 cap
C/K setting: Automatic search or manual setting
Four quadrant measuring and operation feature

It shall provide the following information:
- Cosine phi
- Connected steps
- Period before switching
- Step output status (capitance loss survey)
- Load and reactive current
- Total voltage harmonic distortion
- Voltage, temperature, Power (S, P, Q)
- Voltage harmonic spectrum (3, 5, 7, 11, 13)

It shall provide the following Alarms and warning:
- Low power cosine phi
- Hunting
- Abnormal cosine phi
- Overcompensation
- Frequency not detected
- Over current
- Under voltage
- Over voltage
- Over temperature
- Total voltage harmonic distortion
- Capacitor overload

7-3 ) Controller for specific functions
Possibility to install an external temperature sensor
Possibility to have the controller communicating with a Modbus RS485 or TCP/IP
Possibility to have fixed step configuration
Possibility to have 2 cosine phi

Following information will be available:
- Response delay
- Voltage and current harmonic spectrum (orders 3, 5, 7, 11, 13)
- Step output status (capitance loss monitoring)
- Total current harmonic distortion THD(I)

Following alarms will be available:
- Capacitor capacitance loss
- Capacitor current overload
12.09 CONTACTORS

Contactors shall be used to switch capacitors in or out of service. They shall comply with IEC 60947-4 and shall have a rating suitable for the service required. Especially suitable Capacitor Switching Contactors, which include a current limiting device, with a proven track record should be used. Contactors shall be able to hold 300 000 operations.

12.10 REACTORS

Detuned reactors shall be used in case of harmonic pollution
The detuned reactor shall be three phase iron core with copper winding or aluminium winding. All the parts of the reactor shall be covered by a varnish preventing from ant corrosion. The reactor shall comply with IEC 60289.

- Tolerance : +/- 5 %
- Tolerance between phase : Lmax/Lmin < 1.07
- Tuning order : 2,7 (relative impedance : 13,7%); 4,2 ( relative impedance : 5.67 % )
- Permissible overload fundamental current : 1.1 time the nominal current ( I1 ).
- Insulation level : 1.1 kV according to IEC 76
- Test voltage ( coil to core ) : 3,3 kV 1 minute
- Distance between terminals and earth : 20 mm

12.11 CABLES

11-1 ) Control cables
Small wiring shall be carried out in PVC insulated 1000 V conductor and with core ferruled. The cross section shall be minimum 1.5mm² except for the power supply of the power factor controller which shall be 2.5 mm². Labels shall be fitted at the end of the conductor to identify it.

11-2 ) Power cable
The power cable used shall be black PVC insulated 1000V.

12.12 DESIGN FEATURES

The equipment shall be housed in a metal enclosure with an IP 31 protection degree (IP21D if using forced ventilation). The doors of the capacitor bank enclosure shall be interlocked to prevent access to the bank, and the capacitor bank will have protection against direct contact when door is opened. The ventilation will be natural or forced. In case of forced ventilation, it will be controlled by a temperature sensor. In order to make the installation of the bank easy, a part of 10 cm will present on the back to have an optimal position. Each panel shall be fitted with an earth terminal in the form of a 10 mm diameter threaded bolt and fitted with two nuts and washers.

12-1 ) Design data

IEC standard : 60439-1 and 61921
Protection degree : IP 31 (IP21D if forced ventilation)
Indoor type

MeTRH Low Voltage Switchboard Upgrade
Insulation level : 0,69 kV
Withstand 50 Hz, 1 minute : 2,5 kV
Short circuit level for 1 second : 35 kA
Gland plates : Un-drilled

Load shedding (main-standby)

12-2) Enclosure thickness

The thickness of the metal sheet of the enclosure shall be 1 or 1.5 mm. However some metal parts and devices inside the enclosure may have a lower thickness.

12-3) Surface treatment / Painting

12-3-1) Surface treatment:
The metallic parts of the enclosure shall be washed at 40°C minimum to take off grease.
Rinsed in water.

12-3-2) Painting:
A powder Epoxy Polyester shall be applied with a thickness of 30 microns. Epoxy protects against chemical attack and polyester protects against mechanical attack. The painting shall be polymerised into an oven. The colour of the capacitor bank shall be RAL 9001.

12-4) Rating plate
Self-stick shall be fitted inside the cubicle with the following information:
Reactive power
Nominal voltage
Frequency
IEC 60439-1 and IEC 61921 standard compliance

12-5) Components identification.
Self-stick shall be used to identify each components fitted in the capacitor banks capacitors, contactors, power factor controller, reactors (if any).

12.13 CIRCUIT BREAKERS

In any case, use an incoming Circuit Breaker as the main isolator to the capacitor bank. The Circuit Breaker used as the main supply isolator to the capacitor bank should be properly sized to ensure an overload and short circuit protection: 1,5 times the nominal current of the complete bank.

12.14 INSPECTION AND TESTING

Tests shall be performed at the manufacturer’s works in accordance with the relevant IEC standards.

The tests shall include:

Routine tests for capacitor bank:
- Inspection for conformity with the specifications
- Dielectric test : 2,5 kV 1 minute
- Insulation resistance measurement at 500 V

During inspection, routine test shall be carried out only on some samples (2 or 3 capacitor banks).

Routine tests for capacitor:
- Voltage withstand test between terminals : 2,15 Un (2 s)
- Capacitance measurement
• Loss angle measurement on similar capacitor

**Type tests:**
Type testing shall be only supplied for loose capacitors on similar capacitor. Type test certificate shall be issued by an independent test station of international repute.

12.15 CURRENT TRANSFORMERS

The current transformer shall comply with IEC 44 and shall be of 5 A output, class 1, 5 VA minimum.

13 Automatic Transfer Switch

13.01 GENERAL

1.01 Scope

A. Provide and install Automatic Transfer Switch (ATS) with poles, ampere rating, voltage rating, and Withstand and Close Ratings (WCR) as in line with the Low Voltage Switchboard requirements. Transfer switches shall be mechanically interlocked, double throw construction and include a microprocessor-based controller for automatic operation. All Transfer switches and controllers shall be products of the same manufacturer.

B. The transfer switches shall have 600Volt insulation on all parts in accordance with UL, IEC, and NEMA standards. The current rating shall be a continuous rating when the switch is installed in an enclosure, and shall conform to UL, IEC, and NEMA temperature rise standards.

1.02 Codes and Standards

The automatic transfer switches and controls shall conform to the requirements of:

A. UL 1008/cUL: Underwriters Laboratories standard for ATS/Canada UL
B. IEC 60947-6-1: Low-voltage switchgear and controlgear Multiple function equipment
   " Transfer switching equipment
C. NFPA 70: National Electrical Code including Articles 517, 700, 701, 702
D. NFPA 99: Essential electrical systems for health care facilities
E. NFPA 110: Standard for emergency and standby power systems
G. NEMA ICS 10 P1: Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment (supersedes ICS2-447)
H. UL 50: Enclosures for Electrical Equipment, Non-Environmental Considerations
I. UL 508: Standard for Industrial Control Equipment
J. CSA 282: Emergency Electrical Power Supply for Buildings
buildings, structures, and equipment

M. NFPA 101: Life safety code
Q. IEEE 241: I.E.E.E. recommended practice for power systems in commercial buildings
R. ICS 6: Enclosures
S. ANSI C33.76: Enclosures
T. NEMA 250: Enclosures
U. IBC 2006: Seismic certified to Ip=1.5 for z/h less than or equal to 1
V. IEEE-693-2005: Seismic certified at HIGH level with 2.5 amplification factor

PRODUCTS

2.01 Mechanically Held Transfer Switch

A. Transfer switches shall be electrically operated and mechanically held with double throw construction, and operated by a momentarily energized solenoid-driven mechanism. Main operators that include overcurrent disconnect devices; linear motors or gears shall not be acceptable.

All Open and Delayed Transition-type ATS shall include mechanical interlocks to ensure only two possible positions: connected-to-normal or connected-to-emergency.

Closed transition-type ATS shall include mechanism to permit momentary closure of both sources to the load, but shall include backup trip/interlocks to inhibit closure of both sources to the load for a time period in excess of 100ms. System shall operate independently as a backup to the main control circuit. Should this time delay expire, a contact shall be provided to trip a remote source breaker to ensure extended parallel time does not exceed 300ms.

B. ATS shall include a manual handle and provisions for manual operation for maintenance purposes. Manual operation shall be with the switch de-energized.

C. Switch shall be mechanically latched and unaffected by momentary source power outages, swells, and surges such that contact pressure is maintained at a constant value and contact temperature rise is minimized. Switch shall derive power to transfer from the source into which it will transfer to.

D. The contact structure shall consist of main current carrying contacts and arcing contacts. All main contacts shall be of silver tungsten alloy composition. Separate arcing contacts shall be provided to protect the main contacts from excessive wear during transfers. The arcing contacts shall also be of silver tungsten composition on all sizes rated 600A and above. Contacts rated 600A and higher shall have segmented construction for high withstand and closing (WCR) ratings.

E. Main and arcing contacts on switches rated 600A and above shall be visible without major disassembly to facilitate inspection and maintenance.

F. Switches constructed of circuit breakers or electrical contactors not certified and tested as a complete Automatic Transfer Switch assembly under either UL1008 or IEC 60947-6-1 are not acceptable.

G. Where neutral conductors must be switched as shown on the plans, the ATS shall be supplied with a full ampere/voltage rated 4th/neutral pole. The neutral pole shall have the same withstand and closing and operational ratings as the phase poles, and shall be arranged for break-last and make-first to minimize neutral switching transients. To ensure that the neutral pole operates reliably with the phase poles, the neutral pole shall be operated directly from the same mechanism and shaft as the phase poles. This construction shall provide complete disconnect of the Emergency and Normal source
neutrals in the mid position, after the phase contacts are disconnected. Overlapping neutral and other neutral poles that do not have identical construction to the phase poles and/or do not operate directly from the main ATS transfer mechanism and shaft are not acceptable.

H. Where neutral conductors are to be solidly connected as shown on the plans, a 100% fully rated neutral conductor plate and 100% fully rated AL-CU connectors shall be provided.

I. The automatic transfer switch must be equipped with self-diagnostic programmable solenoid protection. This protection shall remove power from the solenoid after a maximum of two (2) unsuccessful transfer attempts to prevent the solenoid from over heating. This condition shall be latched and annunciated on the microprocessor controller screen, and capable of annunciation via a communication port, and configurable as an alarm status output signal. Reset shall require manual intervention by an operator.

2.02 Microprocessor Controller

A. For ease of maintenance and future upgrades, the controller shall be of a modular construction, with standard power supply, CPU, and I/O modules across all voltage and ampere ranges of product. Modules shall be constructed for quick removal and replacement into a rugged backplane assembly. Controller shall be capable of both serial and Ethernet communications.

B. For highest reliability, the ATS shall contain Source Sensing Modules capable of being calibrated for direct 3-phase sensing of each source from 120 VAC to 690 VAC without the need for additional step-down transformers. In addition, the ATS shall contain a Universal Transformer Assembly (UTA) Module to provide reliable power to the controller from either source. Additionally, UTA shall accept both a 120VAC and 24VDC external auxiliary control power source allowing controller communication, sensing, and I/O module activity in the event of a power outage, swell, or surge condition.

For ease of maintenance and spare parts, the Source Sensing Modules and UTA Modules shall be standard (single) part numbers for all ATS sizes, voltage ratings, and configurations. Voltage sensing shall be true RMS type and shall be accurate to ±1% of nominal voltage. Frequency sensing shall be accurate to ±0.05Hz. Current sensing shall be accurate to ±0.5% at full scale with 5 A secondary current transformer (CT). The controller shall be capable of operating over a temperature range of -20 to +50 degrees C and storage from -40 to +90 degrees C.

C. The controller shall connect to the transfer switch thru an interconnecting wiring harness. For safety, the ATS shall be supplied with a disconnect switch that allows the operator to disable the automatic operation during maintenance, inspection or maintenance without the need to disconnect the wiring harness. Interfacing relays shall be provided to isolate and protect the controller from abnormal voltages applied to any/all input or output customer wiring terminals. Controller shall include protective covers and guards for safety and ease of maintenance.

D. All customer connections shall be wired to a common terminal block to simplify field-wiring connections. For ease of upgrade, additional customer connections to controller shall be possible through the use of quick-connect, modular terminal block and harness assemblies. DIN rail provisions for customer connections shall be in sufficient length to allow future modifications and upgraded without need for door punching, drilling, tapping or major field modification.

E. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

*MeTRH Low Voltage Switchboard Upgrade*
1. EN55022: (CISPR11): Conducted and radiated emissions, Class B: (Exceeds EN55011:1991 & MILSTD 461 Class 3)
2. EN61000-4-2: (Level 4): ESD immunity test
   EN61000-4-3: (ENV50140): Radiated RF, electromagnetic field immunity test
   EN61000-4-4: Electrical fast transient/burst immunity test
   EN61000-4-5: IEEE C62.41: Surge immunity test (1.2 x 50μs, 5 & 8 kV)
   EN61000-4-6: (ENV50141): Conducted immunity test
   EN61000-4-11: Voltage dips and interruption immunity
3. IEEE 472: (ANSI C37.90A): Ringing wave immunity

F. Controller shall have the capability of direct power quality metering of each source and the connected load through the addition of a modular, current transformer (CT) sensing card and accept CT’s with both 1A or 5A secondary ratings. ATS shall be constructed to permit the upgrade/addition of metering in the field without the need for door punching, drilling, tapping or major field modification.

G. Controller and all customer terminal block connections shall be DIN rail mountable for ease of upgrade and installation.

2.03 Enclosure

A. The switch shall be mounted in a NEMA 1 enclosure unless otherwise indicated on the plans.
B. All door-mounted LED’s shall be high-intensity type for ease of visibility at a distance. All door hardware shall be constructed for ease of replacement. Enclosure shall be pre-engineered and constructed for simple addition of the following standard control switches in the field, without the need for field punching and drilling: Alarm Reset, Prime Source Select, Commit/No-Commit, and Transition Mode Select.
C. All enclosures shall be certified for seismic installations. All ATS supplied shall meet the following minimum requirements: [IEEE Std 693-2000 for High Seismic locations and IBC-2006 @ 3.2g, with Ip = 1.5]. Seismic certification shall be via shake table testing, with switches tested and certified to transfer during the Seismic event. All ATS(s) provided must have had a representative sample tested and certified to these levels. Provide copy of independent analysis and certification with submittals.
D. Installation drawings must clearly state mounting provisions and requirements for installation by installing contractor to maintain this certification.

2.04 Controller Display and Keypad

C. A color, ¼ VGA minimum, graphical display shall be provided for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through a standard front accessible communications port. To permit remote adjustability, all parameters shall be accessible via configuration software without the need to manually adjust DIP switches on the controller. The graphical display shall be capable of operating over a temperature range of -20 to +50 degrees C and storage from -40 to +90 degrees C.

D. Controller shall be provided with easy-to-see, high intensity LED’s for the following:
   1. **Source Availability** – Indicates that source voltage and frequency are within acceptable ranges.
   2. **Source Connected** - Indicates that the source contacts are closed and load is being fed from the source.
   3. **XFER** (Transfer) **Inhibit** – Indicates that ATS is being inhibited from Automatically transferring to the unconnected source.
4. **Alarm** – Indicates that an alarm condition is active.
5. **TD (Time Delay) Active** – Indicates that the transfer switch time delay is actively timing as part of an automatic sequence.

E. For ease of navigation and intuitive operation, the display shall include the following:

1. **Soft keys**: That change function based on user location in the menu structure
2. **Dedicated navigational keys**: For HOME, SCROLL UP, SCROLL DOWN, END, ESC (Escape), and ENTER.
3. **Dedicated control pushbuttons**: For ALARM RESET, TEST, CONTROL, and INFO
   a) **ALARM RESET** – Resets all alarm conditions.
   b) **TEST** – Permits selection of Test With Load, Test Without Load, or Fast Transfer Test modes of operation.
   c) **CONTROL** – Immediately initiates a Control Menu, where operator-initiated controls functions may be activated.
   d) **INFO** – Initiates a Report Screen that provides the following information:
      i. **Sequence of Events Recorder**, including: Time Genset start signal sent, Date Genset start signal sent Genset startup time, time transferred to Genset, time utility supply returned or test reset, time re-transferred to utility supply, time start signal removed.
      ii. **Genset Loading Performance Recorder**, including: Maximum Genset voltage & frequency transients on connection of load.
      iii. **Genset on Load Performance Recorder**, including: Maximum current, kW, Avg PF, and Avg THD% during the test or outage event.

Values shall be stored in non-volatile memory and automatically updated after each Test with Load or Outage Event.

D. For ease of programming and safety, the ATS shall include a front door mounted USB programming port.
   1. The port shall provide a connection point for free configuration software.
   2. The port shall provide the capability for closed-door configuration and programming changes, without risk of contact with electrical conductors and switching mechanisms inside the ATS enclosure.
   3. For simplicity and ability to adjust parameters from a remote PC, all switch parameters shall be fully accessible via free configuration software, without the need to manually adjust DIP-switches or potentiometers on the controller.

**PART 3 OPERATION**

3.01 Voltage, Frequency and Phase Rotation Sensing

A. Controller shall monitor the voltage and frequency of each source and detect single or 3-phase losses of either source. The controller shall have adjustable pickup and dropout setting for each source as indicated below. Values shows are % of nominal:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sources</th>
<th>Dropout / Trip</th>
<th>Pickup / Reset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undervoltage</td>
<td>N&amp;E, 3-phase</td>
<td>75 to 98%</td>
<td>85 to 100%</td>
</tr>
<tr>
<td>Overvoltage</td>
<td>N&amp;E, 3-phase</td>
<td>105 to 110%</td>
<td>103 to 108%</td>
</tr>
<tr>
<td>Underfrequency</td>
<td>N&amp;E</td>
<td>45.0 to 59.9Hz</td>
<td>45.1 to 60Hz</td>
</tr>
<tr>
<td>Overfrequency</td>
<td>N&amp;E</td>
<td>50.1 to 63Hz</td>
<td>50.0 to 62.0Hz</td>
</tr>
<tr>
<td>Voltage unbalance</td>
<td>N&amp;E</td>
<td>5 to 20%</td>
<td>4 to 19%</td>
</tr>
</tbody>
</table>
3. Setting shall be field adjustable in 1% increments either locally via the front panel keypad, locally via the front door USB port, or remotely via serial and Ethernet communications without unlatching of enclosure door.

C. The controller shall continuously monitor the phase rotation of both sources and inhibit transfers if both sources are not of the same phase rotation (ABC or CBA).

D. A single source status screen shall be provided for quick viewing of the status of both sources, including 3 phase voltages, power and frequencies.

3.02 Time Delays

A. Controller shall include an adjustable time delay of 0 to 10 seconds to momentarily override a normal source failure and delay the operation of the transfer switch for a user-specified time period. Controller shall be capable of being programmed for an extended time delay up to 259 minutes if an external power supply is provided to the ATS control. All ATS supplied shall have wiring and provisions for the connection of a customer supplied external 120VAC power supply source for extended time delay.

B. Controller shall include an adjustable time delay on transfer to emergency, adjustable from 0 to 259 minutes, for controlled timing of transfer of loads to emergency allowing emergency source to stabilize prior to transfer.

C. Controller shall include two independent time delays on retransfer to normal – one adjustable 0 to 259 minutes for re-transfer from an outage of the normal source and one for re-transfer after a Fast Test operation. Time delays after a Fast Test operation shall correspond to minimum values to reduce testing time. The time delay on transfer to normal shall be automatically bypassed if the normal source is available and the emergency source fails during the time delay period.

D. Controller shall include a time delay to override momentary emergency source outages or swells and delay all retransfer signals allowing initial loading of engine generator set. Time shall be adjustable from 0 to 30 seconds.

E. Controller shall include a time delay for cool down of the engine ahead of engine shutdown. Time shall be adjustable from 0 to 60 minutes.

F. Controller shall include fully user-configurable load control relays and contacts for control and signaling of loads before and after switch transfers. These Capabilities shall include:

1. The configuration of up to (6), programmable load control relays - each with a Form-C contact output pair wired to a terminal block for customer use, rated at 10A, 24VDC/120VAC.

2. Each load control relay shall be independently programmable as either an elevator pre-signal, or load control (connect/disconnect) signal.

3. Each relay shall have a customer-programmable time delay period, from 0 to 60 minutes.

4. Controller shall permit field adjustability of the type and time delay settings, without the need for field wiring or hardware changes.

F. All Closed Transition and Delayed (programmed) transition-type ATS shall also include the following time delays and capabilities:
1. Delayed (programmed) transition-type ATS shall include a time delay for the center-off/neutral position when transferring from source-to-source. Time shall be adjustable from 0 to 10 minutes.

2. Closed transition-type ATS shall include a Failure to Synchronize time delay, fixed at 1 minute, for failure to synchronize normal and emergency sources prior to closed transition transfer.

3. Closed transition-type ATS shall include a two-stage, backup time delay system for protection against unintended extended paralleling of both sources beyond 100ms. System shall operate independently as a redundant backup to the main controller. Should this time delay expire, a contact shall be provided to trip a remote source breaker to ensure extended parallel time does not exceed the local utility maximum parallel time, typically 100ms.

4. Closed transition-type ATS shall include a digital synchroscope for display of the phase difference, in electrical degrees, between the two sources. Display shall indicate fast/slow phase relationship of Genset source in relation to Utility source. Digital synchroscope shall indicate numbers of degrees sources are out of sync as real time values. Synchroscope data must be displayed and accessible from transfer switch main microprocessor controller.

G. All time delays shall be adjustable in 1 second increments. All time delays shall be adjustable by using the graphical display, the front USB port, or manufacturer supplied free configuration software connected to the local USB, Serial, or Ethernet communication ports.

3.03 Power Quality Metering

A. The ATS shall be able to provide metering for current, voltage, real power, reactive power, energy use, power factor, and frequency. Metering shall be true RMS type, 1% accuracy for voltage and 0.5% for currents with 5 A secondary current transformer (CT).

B. The following parameters shall be provided:
   1. Phase and Neutral Current: Ia, Ib, Ic, In, and average Current (Iavg)
   2. Voltage: Va, Vb, Vc, Vab, Vbc, Vca
   3. Voltage and Current unbalance
   4. Hz, PF, W, Var, VA
   5. Wh, VARh
   6. Voltage and Current Harmonics (%THD up to 8th order)

3.04 Data Logger

A. In addition to logging system events, the ATS shall be capable of logging digital and analog measured parameters and storing the data in non-volatile memory.

   1. Controller shall contain a 20-channel Data Logger. Each channel shall be capable of being configured to monitor a digital (on/off) or analog measured parameter.
   2. The sampling rate of each channel shall be configurable from 1 cycle to 60 minutes per sample.
   3. Data shall be stored in nonvolatile memory, in a FIFO (First In, First Out) sequence.

3.05 Waveform Capture/Oscillography

MeTRH Low Voltage Switchboard Upgrade
A. The ATS shall be capable of monitoring and capturing waveform data in the event of utility power outages or other user-specified events.
   1. Up to 10 active channels of waveform capture may be user-configured.
   2. Each channel shall be capable of capturing up to 256 cycles of waveform information.
   3. Analog channels may be configured for 4, 8, 16, or 32 samples/cycle.
   4. Digital channels shall be configured for 1 sample/cycle.
   5. Waveform triggers shall be user configurable.
   6. Waveform data shall be stored in industry-standard COMTRADE format (IEEE C37.111) for broadest compatibility and ease of downloading to a PC.

3.06 Customer-Configurable Alarms

The ATS shall be capable of being configured to display customer-configured alarm events.

1. Controller shall be capable of being user-configured for up to ten (10) Digital and eleven (11) Analog alarms.
2. Each Digital Alarm shall be user-assignable to an available digital input (dry contact input), and shall include a user-configurable alarm name and time delay.
3. The following measured parameters shall be available for configuration as Analog Alarms, with user-specified pickup values and time delays:
   i. Low (load) PF Alarm
   ii. Source 1 (or 2) Voltage Harmonics Alarm (%THD)
   iii. Load Current Harmonics Alarm (%THD)
   iv. KW Overload Alarm
   v. Overcurrent Alarms (A, B, C, or N)
   vi. Source 1 (or 2) Voltage Unbalance Alarm
   vii. Load Current Unbalance Alarm
4. All alarms shall also be capable of being reset via a remote dry contact input to the controller or a network-activated reset signal.

3.07 Flexible Feature Re-Assignment

A. The ATS shall be factory pre-configured in accordance with the project specifications.
B. The ATS shall utilize flexible controller inputs and outputs to permit re-configuration after installation, without the need for re-wiring, software upgrades, or factory service support.
C. Each ATS shall be configured with 8 field-reconfigurable Digital Inputs and 8 field-reconfigurable Digital Outputs.
D. Configurable Digital Outputs: Each Digital Output may be assigned to one of the following features:
   a) Common/Any Alarm Active
   b) Self Diagnostics Alarm
   c) Switch Exercising
   d) Control Disconnect Switch in Inhibit position
   e) ATS Not in Auto Mode
   f) Fail to Transfer to Source 1
   g) Fail to Transfer to Source 2
   h) Engine Start Active
   i) Source 1 Failure
   j) Source 2 Failure
   k) Load Connected to Source 1
   l) Load Connected to Source 2
m) ATS in Center/Neutral Position (delay type ATS only)

n) Bypass Switch connected to Source 1 (bypass type ATS only)

o) Bypass Switch connected to Source 2 (bypass type ATS only)

p) Auto Transfer Occurred – Source 1 to Source 2

q) Auto Transfer Occurred – Source 2 to Source 1

r) Programmable Load Control (up to 6 stages) – Each individually configurable for either Elevator Pre-signal or Load Disconnect/Connect signal. Each with independent timer adjustment.

E. Configurable Digital Inputs: Each Digital Input may be assigned to one of the following features:

  a) Bypass Time Delay on Transfer to Source 2
  b) Bypass Time Delay on Re-Transfer to Source 1
  c) Engine Start
  d) Test with or without Load
  e) Inhibit Transfer to Source 1
  f) Inhibit Transfer to Source 2
  g) Selection of Preferred Source
  h) Auto/Manual Re-Transfer to Source 1
  i) Auto/Manual Re-Transfer to Source 1 and Source 2
  j) Commit/No-Commit to Transfer to Source 2

3.08 Flexible Logic Editor

A. The ATS shall be capable of being configured to execute customized protection and control schemes.

B. The following logical operations shall be supported:
   a. Gates: AND, NAND, OR, NOR, NOT, XOR, LATCH
   b. Positive/Negative edge triggered One-Shot
   c. Dual edge triggered One-Shot

C. Control logic shall be constructed using any of the measured parameters (analog) in the controller, the customer-configured Alarms, plus any of the controller’s hardwired inputs or outputs (digital).

3.09 Additional Features

A. Test Switch – Controller shall be provided with a 2 position, password-protected, Test Switch. The test switch will simulate a normal source failure. The test mode may be user-configurable for Test With Load, or Test Without Load functionality. A Reset function shall be provided to cancel the Test and bypass any time delays on either transfer to emergency or retransfer to normal. The Controller shall support local activation of the Test function via pushbuttons on the operator display, or remote activation via dry contact closure or network signal.

B. Engine Start Signal - A SPDT contact, rated 10 amps at 28 VDC, shall be provided to start an engine generator in the event of an outage of the normal supply.

C. Source Connected Aux. Contacts - Auxiliary contacts, rated 15 amps, 250 VAC shall be provided to signal when the ATS is connected to each source.

D. Source Connected Status LED’s – Controller display shall include dedicated LED’s to indicate when the ATS is connected to each source. LED’s shall be of high-intensity type for viewing at a distance.
E. **Source Availability Status LED’s** – Controller display shall include dedicated LED’s to indicate the availability of each source. LED’s shall be of high-intensity type for viewing at a distance.

F. **Commit/No-Commit to Transfer Control Selector** – Controller shall include a “Commit/No Commit to transfer” Control Switch. The programmable selector shall be used to configure the controller to commit to transferring the load to the emergency supply (or not) in the event that the normal source is restored prior to the generator being ready to accept the load. The Controller shall support local activation of this control function via pushbuttons on the microprocessor display, or remote activation via customer dry contact closure or network signal.

G. **Inhibit Transfer Signals** – Controller shall accept inhibit transfer control inputs that inhibit transfer of the ATS to either source. If activated, a red LED “Transfer Inhibit” LED shall be illuminated on the front of the operator display. The Controller shall support local activation of this control function via pushbuttons on the operator display, remote activation via customer dry contact closure or network communication signal.

H. **In-phase Monitor** – Controller shall include an in-phase monitor function. The in-phase monitor shall inhibit automatic transfers from source-to-source until the phase difference between the sources is below a pre-set value. The in-phase monitor shall operate to reduce inrush currents during the transfer of loads with re-generative capabilities (transformers, motors). Controller shall indicate the number of degrees lag/lead between both sources in real time.

I. **Auto/Manual Selector** - The controller shall include an Auto/Manual selector to permit operator intervention in the transfer operation. Controller shall be programmable to wait for an operator permissive signal to transfer to one, or both sources. Controller shall support On/Off setting and type configuration of the Auto/Manual switch via the front display.

J. **Engine Exerciser** - The controller shall include a fully user-configurable engine exerciser.

1. Exerciser shall be configurable for Daily, 7-day, 14-day, 21-day, or 28-day exerciser type, each with (7) independently-programmable events.
2. Exerciser shall be configurable for as a full, 365-day exerciser.
   i. Up to 24 independent exerciser events shall be user-programmable.
   ii. Each event shall be configurable for Test with Load (includes transfer of load to non-priority source) or Test with Without Load (starting of genset only).
   iii. Each event shall include user-adjustable start time, date, and test duration.

At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. All time and date settings shall be stored in non-volatile EEPROM memory, without the requirement of a battery. Controller shall include full programmability for daylight savings time, and permit future adjustment of the DST starting and ending dates without the need for software or firmware updates.

K. **Diagnostics** - The controller shall contain self and system diagnostic screens for the purpose of detecting and troubleshooting abnormal system events. Diagnostics shall include the following:

   a. Self Diagnostics: Controller health and condition of communications ports
   b. Switch Diagnostics: Limit switch failures, phase rotation mismatch, Fail to Transfers

L. Communications Interface – The controller shall be capable of interfacing via optional serial/RS485 or Ethernet TCP/IP communications ports integral to the controller. All communication parameters (baud rate, parity, IP Address, etc) shall be fully accessible and programmable via the front keypad without the need for additional programming tools. Switch shall be capable of connecting to Plug-&-Play monitoring software available by the transfer switch manufacturer. This software shall allow for the monitoring, control and setup of ATS parameters. Externally mounted Communication interface modules shall not be acceptable.

M. Event Logger – The controller shall have the ability to log data and to maintain the last 256 events, even in the event of total power loss. Time and data stamping of events shall be accurate to within 1ms. Controller shall be capable of synchronizing it’s date/time setting with a main PC via Network Time Protocol (NTP) over an Ethernet TCP/IP network connection.

The following events shall be time and date stamped and maintained in a non-volatile memory:

**Statistical Data**

1. Last Primary Source Failure – Date & time
2. Last reason for transfer (source fail, test)
3. Last transfer to alternate source - Date & time
4. Last re-transfer to primary source - Date & time
5. Time load without power (last event) – Seconds
6. Time ATS powered up - days
7. Total (accumulated) time on Source 1 – Hours
8. Total (accumulated) time on Source 2 – Hours
9. Total # of Primary Source failures
10. Total # transfers [Primary->Alternate->Primary]

O. Communications Modules

a. **Serial Communications:** Controller shall support RS485 communications port to enable serial communications. Controller shall support communication baud rates up to an including 115.2Kbps. The baud rate shall be user configurable. The serial communications shall be capable of a direct connect or multi-drop configured network. All serial communications parameters shall be accessible from the front display without the use of additional programming tools. Controller shall support the addition of communications in the field without field wiring modifications.

b. **Ethernet Communications:** Controller shall support Ethernet TCP/IP communications via an internally mounted and self-powered communications card. Ethernet shall be 10/100 Mbit, auto-sensing and shall include an RJ45 network connector. All Ethernet communications parameters shall be accessible from the front display without the use of additional programming tools. Controller shall support the addition of communications in the field without field wiring modifications. Ethernet communication modules/cards requiring an external power supply source are not acceptable.

c. **Open Protocol:** Both Serial and Ethernet communications shall be Modbus protocol. Non-Open/Proprietary communication protocols shall not be acceptable.

P. External Power Supplies

a) **Controller Power Supply** - The controller shall be capable of being connected to an external 120VAC power supply to permit full operation of the controller when both
sources (S1 and S2) are deenergized. Transfers shall be inhibited until the source(s) return, but full operation of the controller and display shall be available. In addition, controller shall support an external customer supplied 120VAC supply input from a UPS system supply (or other AC source) to permit continued microprocessor controls and communication (Ethernet and/or Serial) in event of a failure of both normal and emergency sources.

b) **Power Supply for Customer Control Inputs** – Control system shall provide 24VDC control power for all interconnect control signal inputs (test, inhibit transfers, etc) to permit use of dry-type contact signals when either source is available. In addition, controller shall support an external customer supplied 24VDC supply input from GenSet starting batteries (or other DC source) to permit continued monitoring of control inputs in event of a failure of both sources.

**Q. Auto Load Shed**

a. The controller shall be capable of being programmed to automatically shed the connected load in the event of an overload of the generator supply.

b. Controller shall have separate triggers for undervoltage and overload (kW). Each trigger shall have individually configurable time delays.

c. Switch shall be configurable to either command the switch to a center/off position, a dead normal position, or stay in the connected position upon activation of the Auto Load Shed.

d. Switch shall be configurable to pickup an output status relay upon activation of the Auto Load Shed feature. Output shall be usable to trip/isolate downstream loads in the event of an overload.

e. Reset of the Auto Load Shed function shall be via operator reset on display, remote reset contact input, or via network signal.

**ADDITIONAL REQUIREMENTS**

4.01 Withstand and Closing Ratings (WCR)

**A.** The ATS shall be UL (or cUL) listed in accordance with UL 1008 and IEC Certified to 60947-6-1 in accordance with each standard’s 1½ and 3 cycle. ATSs that are not tested and labeled with 1½ and 3 cycle (any breaker) ratings are not acceptable.

**B.** Minimum UL & IEC listed withstand and close into fault ratings @ 480Vac shall be as follows:

<table>
<thead>
<tr>
<th>Size (Amps)</th>
<th>Any 3 cycle Molded Case Breaker* (RMS Symmetrical Amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 150</td>
<td>10,000</td>
</tr>
<tr>
<td>225 - 400</td>
<td>35,000</td>
</tr>
<tr>
<td>600 - 1200</td>
<td>50,000</td>
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<tr>
<td>1600 - 4000</td>
<td>100,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size (Amps)</th>
<th>Current Limiting Fuse (RMS Symmetrical Amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 4000</td>
<td>200,000</td>
</tr>
</tbody>
</table>

*All values are at 415 volt (IEC), RMS symmetrical, less than 20% power factor.

4.02 Tests and Certification

**A.** The complete ATS shall be factory tested to ensure proper operation and ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with
the specification requirements. Provide copy of test documents in the O&M manual with each ATS

B. The manufacturer shall provide a line-by-line compliance review document showing the compliance of the proposed equipment to this specification. All exceptions and deviations to the specifications shall not be permitted without approval by the consulting engineer.

C. The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, and installation and servicing in accordance with ISO 9001.

D. UL 1008 listed and labelled.

4.03 Service Representation

A. The ATS manufacturer shall ensure Local and Global service capability for all transfer switch products. Manufacturer shall provide access to qualified service technicians on 24 hours a day, 365 days per year basis. Response time shall be 4 hours after receipt of contact.

B. The manufacturer shall maintain records on the construction and configuration at time of shipment for a minimum period of 20 years. If upgrades are made by the manufacture during the life of the product, these changes shall also be maintained through the life of the records retention time period.

14 Equipment Datasheets

<table>
<thead>
<tr>
<th>General Switchboard Datasheet</th>
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</thead>
<tbody>
<tr>
<td><strong>Section</strong></td>
</tr>
<tr>
<td>General</td>
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<tr>
<td>Site Conditions</td>
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**Feeders**

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  - Shunt Close: Yes
  - UV Relay: Yes
- Item No: 9
- Specification: External Accessories:
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  - Terminal Lugs: Yes
  - Multi-cable Terminal Lugs: Yes
  - Extended Terminal: Yes
  - Spreader Terminal: Yes
  - Rear Terminal: Yes
  - 25mm Phase barriers: Yes
  - Extended Phase barriers: Yes
  - Back Plates: Yes
  - DIN Mounting: Yes
  - Padlock: Yes
  - Terminal Cover: Yes
  - Direct Rotary: Yes
  - Variable Depth (Door): Yes
  - Flange Operator: Yes
  - Flange Cable: Yes
  - Motor Operator: Yes
  - Residual Current: Yes
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**Starters**

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## Starters: VFD (For 4No New Motors)

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**Control:**

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**Frequency accuracy:**

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<tr>
<td>50</td>
<td>Stop Modes</td>
<td>-</td>
<td>Ramp, Coast, DC-Brake, Ramp-to-Hold, Fast Braking and Current Limit Stop</td>
</tr>
<tr>
<td>51</td>
<td>Accel/Deccel</td>
<td>-</td>
<td>Two independently programmable times</td>
</tr>
<tr>
<td>52</td>
<td>S-Curve Time</td>
<td>-</td>
<td>0-100% ramp time (normal duty rating)</td>
</tr>
</tbody>
</table>

**Intermittent Overload:**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>Light duty</td>
<td>-</td>
<td>110% overload capability</td>
</tr>
<tr>
<td>54</td>
<td>Normal duty</td>
<td>-</td>
<td>110/150% overload capability</td>
</tr>
<tr>
<td>55</td>
<td>Heavy duty</td>
<td>-</td>
<td>150/180% overload capability</td>
</tr>
<tr>
<td>56</td>
<td>Current Limit Capability</td>
<td>-</td>
<td>20-160% of rated output current</td>
</tr>
<tr>
<td>57</td>
<td>Electronic Motor Overload Protection</td>
<td>-</td>
<td>Class 10 Motor Overload Protection (NEC Article 430)</td>
</tr>
</tbody>
</table>
## METERING – Digital Power Monitoring Meter with GSM Module

<table>
<thead>
<tr>
<th>Item No</th>
<th>Specification</th>
<th>Unit</th>
<th>MeTRH Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Temperature, operating</td>
<td>degC</td>
<td>-25 to 55 (EN62053-21, EN50470-1 and EN62053-23); noncondensing @40degC</td>
</tr>
<tr>
<td>2</td>
<td>Temperature, storage</td>
<td>degC</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Installation category</td>
<td>-</td>
<td>Cat III (IEC60664, IEC60664)</td>
</tr>
<tr>
<td>4</td>
<td>Dielectric strength</td>
<td>kV</td>
<td>4kV AC RMS for 1min</td>
</tr>
<tr>
<td>5</td>
<td>Noise rejection CMRR</td>
<td>dB</td>
<td>100dB, 48 - 62 Hz</td>
</tr>
<tr>
<td><strong>Standard compliance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Safety</td>
<td>-</td>
<td>IEC60664, IEC61010</td>
</tr>
<tr>
<td>7</td>
<td>Metrology</td>
<td>-</td>
<td>EN62053, EN50470</td>
</tr>
<tr>
<td>8</td>
<td>Pulse output</td>
<td>-</td>
<td>DIN43864, IEC62053</td>
</tr>
<tr>
<td>9</td>
<td>Approvals</td>
<td>-</td>
<td>CE</td>
</tr>
<tr>
<td>10</td>
<td>Material</td>
<td>-</td>
<td>ABS, self-extinguishing UL 94 V-0</td>
</tr>
<tr>
<td>11</td>
<td>Mounting</td>
<td>-</td>
<td>Panel mounting</td>
</tr>
<tr>
<td>12</td>
<td>Front</td>
<td>-</td>
<td>IP31, NEMA 12</td>
</tr>
<tr>
<td>13</td>
<td>Screw Terminals</td>
<td>-</td>
<td>IP20</td>
</tr>
<tr>
<td><strong>Input and Output Ratings</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Control Power</td>
<td>V,Hz</td>
<td>90-260V AC/DC (48-62Hz)</td>
</tr>
<tr>
<td>15</td>
<td>Voltage Sense Inputs (V1, V2, V3)</td>
<td>V</td>
<td>V1:Un:40-144V LN(70-250V LL); V2:Un:160-480V LN (277-830V LL)</td>
</tr>
<tr>
<td>16</td>
<td>Current Sense Inputs: I1, I2, I3</td>
<td>A</td>
<td>Continuous Current: 5A Max current(Imax): 6A Accuracy: 0.01 to 0.05In: +/-1.0% 0.05In to Imax: +/-.5%</td>
</tr>
<tr>
<td>17</td>
<td>Digital Output</td>
<td>-</td>
<td>Relay, SPDT Type, 1-5A at 250VAC 12-5A at 24VDC</td>
</tr>
<tr>
<td>18</td>
<td>Analog Output</td>
<td>mA</td>
<td>0-20mA</td>
</tr>
<tr>
<td><strong>Display, LEDs and Commands</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Display refresh time</td>
<td>ms</td>
<td>&lt;=100ms</td>
</tr>
<tr>
<td>20</td>
<td>Display:</td>
<td>-</td>
<td>4Lines, 4-DGT, 1 LINE, 10-DGT</td>
</tr>
<tr>
<td>21</td>
<td>Type</td>
<td>-</td>
<td>LCD, Single colour backlight</td>
</tr>
<tr>
<td>22</td>
<td>Instantaneous variables read-out</td>
<td>-</td>
<td>4-DGT</td>
</tr>
<tr>
<td>23</td>
<td>Energy variables read-out</td>
<td>-</td>
<td>10-DGT</td>
</tr>
<tr>
<td>24</td>
<td>Virtual alarms</td>
<td>-</td>
<td>4 red LED available in case of virtual alarm</td>
</tr>
<tr>
<td>25</td>
<td>Energy consumption</td>
<td>-</td>
<td>Red LED</td>
</tr>
</tbody>
</table>

MeTRH CE Low Voltage Switchboard Upgrade Page 119 of 145
<table>
<thead>
<tr>
<th>Item No</th>
<th>Specification</th>
<th>Unit</th>
<th>MeTRH Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Voltage</td>
<td>V</td>
<td>415</td>
</tr>
<tr>
<td>2</td>
<td>Ampere</td>
<td>A</td>
<td>1600</td>
</tr>
<tr>
<td>3</td>
<td>Poles</td>
<td>No</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Application</td>
<td></td>
<td>Util-Gen</td>
</tr>
<tr>
<td>5</td>
<td>Language</td>
<td></td>
<td>English</td>
</tr>
<tr>
<td>6</td>
<td>Enclosure</td>
<td></td>
<td>Integrated in switchboard</td>
</tr>
<tr>
<td>7</td>
<td>Electrical Operator</td>
<td></td>
<td>Momentarily energised high-speed mechanism</td>
</tr>
<tr>
<td>8</td>
<td>Mechanism</td>
<td></td>
<td>Mechanically held mechanical interlock</td>
</tr>
<tr>
<td>9</td>
<td>Neutral</td>
<td></td>
<td>Fully rated contacts</td>
</tr>
<tr>
<td>10</td>
<td>Contacts</td>
<td></td>
<td>Silver tungsten alloy with separate arcing contacts</td>
</tr>
<tr>
<td>11</td>
<td>Construction</td>
<td></td>
<td>Dual-processor, including high-speed serial and ethernet communications</td>
</tr>
<tr>
<td>12</td>
<td>Source sensing</td>
<td></td>
<td>Direct 120-690V</td>
</tr>
<tr>
<td>13</td>
<td>Display</td>
<td></td>
<td>VGA Colour graphic</td>
</tr>
<tr>
<td>14</td>
<td>Source failure/restore</td>
<td></td>
<td>Independently adjustable pickup and drop out of 3ph U/O voltage, frequency, balance and phase rotation</td>
</tr>
<tr>
<td>15</td>
<td>Time Delays</td>
<td></td>
<td>start, cool down, fast test, time delay for voltage tag</td>
</tr>
<tr>
<td>16</td>
<td>Remote access</td>
<td></td>
<td>Local(USB), Remote(serial and Ethernet)</td>
</tr>
<tr>
<td>17</td>
<td>Field programmable I/O</td>
<td></td>
<td>4Inputs, 4Outputs</td>
</tr>
<tr>
<td>18</td>
<td>Control switches</td>
<td></td>
<td>Test(on load, off load), fast test, alarm reset, auto/man transfer, time delay bypass</td>
</tr>
<tr>
<td>19</td>
<td>Event Recorder</td>
<td></td>
<td>256No Minimum</td>
</tr>
<tr>
<td>20</td>
<td>Outage and Test Report Screen</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>21</td>
<td>Communication</td>
<td></td>
<td>Serial and Ethernet</td>
</tr>
<tr>
<td>22</td>
<td>Integral surge protective device</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>23</td>
<td>Battery charger</td>
<td></td>
<td>Yes, 3A 12VDC</td>
</tr>
<tr>
<td>24</td>
<td>Lugs</td>
<td></td>
<td>Yes, compatible with LV Switchboard</td>
</tr>
</tbody>
</table>
## METERING & PROTECTION - Current Transformers

<table>
<thead>
<tr>
<th>Item No</th>
<th>Specification</th>
<th>Unit</th>
<th>MeTRH Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reference Standard</td>
<td>-</td>
<td>60044-1</td>
</tr>
<tr>
<td>2</td>
<td>Accuracy</td>
<td>-</td>
<td>1%</td>
</tr>
<tr>
<td>3</td>
<td>Primary Input Current</td>
<td>A</td>
<td>2000</td>
</tr>
<tr>
<td>4</td>
<td>Secondary Current</td>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Overload</td>
<td>No</td>
<td>1.5 In</td>
</tr>
<tr>
<td>6</td>
<td>Operating Voltage</td>
<td>V(max)</td>
<td>600</td>
</tr>
<tr>
<td>7</td>
<td>Test Voltage</td>
<td>KV</td>
<td>1.2</td>
</tr>
<tr>
<td>8</td>
<td>Frequency</td>
<td>Hz</td>
<td>50</td>
</tr>
<tr>
<td>9</td>
<td>Burden</td>
<td>VA(max)</td>
<td>40</td>
</tr>
<tr>
<td>10</td>
<td>Operating temperature</td>
<td>C</td>
<td>40</td>
</tr>
<tr>
<td>11</td>
<td>Markings</td>
<td>-</td>
<td>CE</td>
</tr>
<tr>
<td></td>
<td>Enclosure:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Flame retardant ABS</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>13</td>
<td>surface mounting or busbar mounting</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>14</td>
<td>Screw terminals</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Enclosure code</td>
<td>-</td>
<td>IP40</td>
</tr>
<tr>
<td>16</td>
<td>Insulation Class</td>
<td>-</td>
<td>E</td>
</tr>
</tbody>
</table>

## METERING & PROTECTION - Voltage Transformers

<table>
<thead>
<tr>
<th>Item No</th>
<th>Specification</th>
<th>Unit</th>
<th>MeTRH Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reference Standard</td>
<td>-</td>
<td>60044-1</td>
</tr>
<tr>
<td>2</td>
<td>Frequency</td>
<td>Hz</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>Primary Voltage</td>
<td>V</td>
<td>415</td>
</tr>
<tr>
<td>4</td>
<td>Secondary Voltage</td>
<td>V</td>
<td>110</td>
</tr>
<tr>
<td>5</td>
<td>Insulation level</td>
<td>-</td>
<td>0.6kV, 10kV BIL</td>
</tr>
<tr>
<td>6</td>
<td>Accuracy class</td>
<td>-</td>
<td>0.3</td>
</tr>
<tr>
<td>7</td>
<td>Thermal rating</td>
<td>-</td>
<td>500VA at 30degC</td>
</tr>
<tr>
<td></td>
<td>Enclosure:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Flame retardant ABS</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>9</td>
<td>surface mounting or busbar mounting</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>10</td>
<td>Screw terminals</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Enclosure code</td>
<td>-</td>
<td>IP40</td>
</tr>
<tr>
<td>12</td>
<td>Insulation Class</td>
<td>-</td>
<td>E</td>
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</table>

MeTRH Low Voltage Switchboard Upgrade
<table>
<thead>
<tr>
<th>UNIT</th>
<th>TYPE</th>
<th>LOAD/ UNIT TAG</th>
<th>LOAD (KW)</th>
<th>FULL LOAD A</th>
<th>TRIP A</th>
<th>Comments/ New Proposals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MAIN BREAKER</td>
<td>MAIN BREAKER</td>
<td></td>
<td></td>
<td></td>
<td>Increase to 2000A</td>
</tr>
<tr>
<td>2</td>
<td>KENYA POWER METERING</td>
<td>KPLC METERING</td>
<td></td>
<td></td>
<td></td>
<td>Sealed by Kenya Power (Utility Company)</td>
</tr>
<tr>
<td>3</td>
<td>INCOMING</td>
<td>INCOMING</td>
<td></td>
<td></td>
<td></td>
<td>Sealed by Kenya Power (Utility Company)</td>
</tr>
<tr>
<td>4</td>
<td>METERING</td>
<td>METERING</td>
<td></td>
<td></td>
<td></td>
<td>Contains Power Meter (MeTRH) CTs and VTs to be resized appropriately</td>
</tr>
<tr>
<td>5</td>
<td>SPACE</td>
<td>CABLE PASSAGEWAY</td>
<td></td>
<td></td>
<td></td>
<td>Passageway for cables</td>
</tr>
<tr>
<td>6</td>
<td>FEEDER</td>
<td>TO LAUNDRY ROOM</td>
<td></td>
<td></td>
<td></td>
<td>No change in rating</td>
</tr>
<tr>
<td>7</td>
<td>CAPACITOR Controller</td>
<td>POWER FACTOR CONTROLLER PFC</td>
<td></td>
<td></td>
<td></td>
<td>Contains feeder breaker and PFC System Ratings to be adjusted to incorporate new inductive loads</td>
</tr>
</tbody>
</table>
17 Equipment Supply

17.1 The Contractor shall ensure all equipment needed for this project are included in their bid document and supplied.

17.2 Any deficiency in equipment to the implementation of the project as stated shall be the responsibility of the contractor and as such he must thoroughly understand MeTRH requirements before tendering. No variations due to Contractors’ shortcoming with respect to this shall be entertained.

17.3 The Contractor shall supply all equipment, pay for shipping, insurance, taxes and duties necessary for the importation of the project equipment into Kenya and to project sites and any other supply requirements.
18 **Warranty**

18.1 The Contractor’s quotation shall be required to include a comprehensive warranty for a period of one (12 calendar months) year after commissioning for all equipment and systems supplied in this contract.

19 **Technical Drawings**

19.1 The contractor shall supply to MeTRH within two weeks all the system drawings, as built, on completion of the contract.

19.2 MeTRH shall determine the sufficiency of the supplied drawings for the maintenance of the system.

19.3 Any request for additional drawings shall be supplied by the contractor at no extra cost.

20 **Documentation**

20.1 The contractor shall supply four sets of any document in both soft and hard copy that is forming the equipment in this supply.

21 **Factory Acceptance Test and Training**

21.1 The equipment shall undergo a factory acceptance testing at the supplies premises prior to shipment to Kenya. The testing shall be carried out to confirm to MeTRH that the system to be supplied meets the tender/contract requirements

21.2 The factory acceptance tests shall be witnessed by 3 No. MeTRH Engineers in the vendor’s factory, and at the vendor’s expense. The tests shall be conducted over a period of at least three days for each Switchboard and shall comprise the following (In accordance with IEC 60694 and IEC 62271-200)

i. General visual inspection.

ii. Functional tests.

iii. Mechanical tests.

iv. Measuring devices accuracy tests.

v. Protective relays tests.

vi. Dielectric test

vii. Insulation resistance test

21.3 The Contractor shall make a proposal of the test procedure; explain in detail the desired results and the part of the tender/contract being tested. This FAT test procedure document shall be availed to MeTRH at least TWO weeks prior to the test date and MeTRH will be required to approve or otherwise. All testing, manuals and instructions shall be carried out in English language.

21.4 The Contractor shall meet the full cost of FAT, including return air tickets, transport during test period, meals and accommodation during the entire period of the tests and transit for the three MeTRH Engineers. An out of pocket allowance at approved GOK Rates shall be provided by the Contractor to each Engineer per day.
21.5 The Contractor will also train 6 No. MeTRH Engineers and technicians for at least 2 weeks at the Manufacturers’ premises and shall meet all costs of travel, accommodation, meals and out of pocket allowance at Government of Kenya rates for that country during the training period.
Section I: Appendix to Instruction to Tenderers

1. Performance Guarantee

The amount of Performance Security is at most 2 % of the Contract Price

2. Mandatory Requirements

Bidders must include copies of the following document with their submissions:

i. Copy of Certificate of Incorporation showing 100% Kenya citizen ownership.
   ii. Copy of Kenya Revenue Authority PIN
   iii. Copy of Kenya Revenue Authority valid Tax Compliance Certificate Tender/Bid
   iv. Bond (KES 190,000.00) valid for 120 days from reputable Bank/Insurance Company
   v. 2 Years Annual audited Records
   vi. NCA 4 and above contractor registration for Electrical works
   vii. Certificate of pre-tender site visit at MeTRH
   viii. Manufacturer Authorization Form for Original Equipment Manufacturers (OEMs) and/or Authorized Equipment Vendors
   ix. Bidders must paginate all their documents and initial each page
   x. Provide a signed declaration form
   xi. Warranty of hardware must be at least 12 months xii. Filled confidential business questionnaire.

3. Award Criteria

The tender for the **Supply, Installation and Commissioning of Electrical Low Voltage Switchboard at Meru Teaching and Referral Hospital (MeTRH)** shall be advertised accordingly. The Tenderers shall then tender and return the completed tender documents to the company as in the instruction to Tenderers in the tender document. These shall be opened and the tender evaluation exercise shall follow.

The tender evaluation criteria shall be based on the information communicated to the Tenderers on the tender document and shall comprise competence evaluation, technical evaluation, and financial evaluation. These shall be as in the table below. Ranking shall be in the order the marks scored.

**Note.** If any information requested for is not furnished, or the bidder fails to visit the site, or the bidder fails to bid for a substantial portion of the project, his tender shall be deemed non responsive. Non responsive tenders shall not be evaluated.
4. Work Plan and Methodology

Attach work plan and schedule of work together with the proposed no of staff. This shall be assessed and marks provided. The format should include a Gantt Chart developed from MS Project.

5. Manuals, Catalogues, Drawings, Datasheets

All catalogues, manuals, drawings, datasheets and any other documentation should be attached here. Preliminary design drawings of the switchboards must also be attached.

6. Schedule of Mandatory Spare Parts and Prices

Attach a list of mandatory spare parts and prices. This is an evaluation criteria and in case the spares list is not attached, no marks shall be awarded.

7. Curriculum Vitae of Key Staff

Attach CVs of the following staff:

- Company Director – At least 1 lead personnel must be a EBK/ERC and CAK Registered Professional on Electrical and Telecommunication works respectively.
- Project Manager – EBK registered Professional Engineer.
- Electrical Engineer – At least Class B Energy Regulatory Commission (ERC) Registered.
- Telecommunication Engineer - Communication Authority of Kenya (CAK) Registered.
- Software Engineering/Computer Engineering Personnel.
- Certified Energy Manager or Equivalent who understands Energy Audit.

At least ERC Class ‘B’ license for both the firm and one of the Electrical personnel.

8. References for Similar Works Carried Out in The Last 3 Years

Attach references for similar works carried out in the last 3 years

9. Training Program and Content

Attach training program and content here
10. Technical Evaluation
The responsive Tenders will be technically evaluated according to the table below:

TENDERING COMPANY NAME: ____________________________________________

<table>
<thead>
<tr>
<th>CRITERION</th>
<th>COMMENTS</th>
<th>MAX SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Compliance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical Specifications as in Tender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Proposed switchgear Type Tested and meeting specifications as to current, features, standards as per Data sheets</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>i. Full compliance (40 Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Partial compliance (0 Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: Documentary evidence of drawings, datasheets, brochures and manuals showing evidence of the offer as a solution to replace existing electrical switchboard.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub Total Score</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Experience and Past Performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Equipment Certification:</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>i. Vendor/manufacturer or Authorized dealer (5Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Re-Seller Or Partnership with Re-Seller (3Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii. Others (0Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Competence of personnel in switchgear installation. Submit CV of:</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>i. Project engineer with BSc. Electrical and more than 10 years’ experience in installation of Electrical Power Systems(7Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Project engineer with BSc. Electrical with 5-10 years’ experience in installation of Electrical Power Systems(4Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii. Project engineer with HND and 10 years’ experience. (2Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv. Others(0Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: The marks above shall be awarded only if CVs of Project Team members are availed. They shall include those of an Alternate Project Engineer with BSc. Electrical Engineering from a recognised university, Technician and other technical support staff.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Experience in Similar works as proposed by MeTRH; give at least four (4) referees of installations in the last five years.</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>i. Four similar projects (10Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Two or three similar projects. (5Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii. One similar project (2Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: Evidence of such experience shall be duly signed completion certificates or referee letters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Firm Licensing with NCA</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>i. Class 2-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ii. Class 4-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub Total Score</td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>
Bidders are required to submit two envelopes for technical and financial. The financial bid should be clearly marked ‘Financial Bid’ and ‘Do not open’. Bidders who score less than 80% in technical will be disqualified and their financial bid will not be evaluated. The financial evaluation will be least cost based, i.e. the lowest bidder among those that qualify in the technical evaluation and with completeness of BOQ will be awarded the tender.

<table>
<thead>
<tr>
<th>Financial Capability</th>
</tr>
</thead>
</table>
| Annual financial turnover during any one of the last 2 years. Scores shall be awarded as follows:  
| i. Over KSHs 20 million (10 marks)  
| ii. Between KSHs 20 million and KSHs 15 million (7 marks)  
| iii. Between KSHs 15 million and KSHs 12 million (4 marks)  
| iv. Below KSHs 12 million gets (0 marks)  
| Note: Documentary evidence shall be audited accounts for the last two years. |
| Sub Total Score | 10 |

<table>
<thead>
<tr>
<th>Draft Programme, Methodology of Works and Suitability of Offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. A Gantt chart developed from MS Project shall be required showing decommissioning of existing system, supply, installation, commissioning and completion of works within the defined time frame. It shall enlist milestones and project activities with their respective time frames.</td>
</tr>
</tbody>
</table>
| ii. Proposed training – Scheduling and Location:  
| □ At manufactures premise/personnel (5Marks)  
| □ Other locations (2Marks) |
| iii. Factory Acceptance Testing proposal  
| □ Structured as per data sheet (5Marks)  
| □ For others (0Marks) |
| iv. Suitability of solution, provision of spares and completeness of tender and warranty as recommended by manufacturer (5Marks)  
| Attach manufacturer recommendation and data sheet |
| Sub Total Score | 25 |

<table>
<thead>
<tr>
<th>TOTAL OVERALL TECHNICAL SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
</tr>
</tbody>
</table>

**Note:** Bidders are required to submit two envelopes for technical and financial. The financial bid should be clearly marked ‘Financial Bid’ and ‘Do not open’. Bidders who score less than 80% in technical will be disqualified and their financial bid will not be evaluated. The financial evaluation will be least cost based, i.e. the lowest bidder among those that qualify in the technical evaluation and with completeness of BOQ will be awarded the tender.
## Electrical Inspection and Test Checklist

### Communicating LV Switchboard

<table>
<thead>
<tr>
<th>Project No:</th>
<th>Project:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>Manufacturer:</td>
</tr>
<tr>
<td>Purchase order No:</td>
<td>Tag No:</td>
</tr>
<tr>
<td>Type:</td>
<td>Serial No:</td>
</tr>
<tr>
<td>Single line Diag No</td>
<td>Busbar rating:</td>
</tr>
<tr>
<td>Fault level</td>
<td>kA</td>
</tr>
<tr>
<td>Degree of prot</td>
<td>IP</td>
</tr>
<tr>
<td>Enclosure type</td>
<td>Arrangement Drg:</td>
</tr>
<tr>
<td>Supply cable tag no</td>
<td>System:</td>
</tr>
</tbody>
</table>

**Visual check:**

- Check switchboard against purchase order/data sheet
- Check equipment for mechanical damage
- Check equipment alignment
- Check equipment foundations
- Check switchboard against GA drawing
- Check identification labels
- Check feeder termination
- Check equipment earthing
- Check circuit labelling
- Ensure all spare cable gland entries are plugged
- Ensure busbar bolts are torqued correctly
- Ensure bus bar chambers are free from dust/debris
- Ensure correct operation of all bus bar shutters
- Measure resistance of switchboard earth to substation earth
- Conductivity test bus bar bolted connections
- Insulation resistance test of anti condensation heaters
- Insulation resistance test of control wiring
- Insulation resistance test of bus wiring
- Check magnitude of dc supplies
- Attach primary test injection results
- Attach circuit breaker test results

### LV Switchboard: Busbar assembly conductivity Test spout to Spout

<table>
<thead>
<tr>
<th>Cubicle reference</th>
<th>1-2</th>
<th>2-3</th>
<th>3-4</th>
<th>4-5</th>
<th>5-6</th>
<th>6-7</th>
<th>8-9</th>
<th>10-11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Insulation resistance tests(1000V): Ensure VT removed**

<table>
<thead>
<tr>
<th>Before HV Test</th>
<th>After HV Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-YBE</td>
<td></td>
</tr>
<tr>
<td>Y-RBE</td>
<td></td>
</tr>
<tr>
<td>B-RYE</td>
<td></td>
</tr>
</tbody>
</table>

**HV Pressure test**

<table>
<thead>
<tr>
<th>Checked by:</th>
<th>Comments</th>
</tr>
</thead>
</table>

*MeTRH Low Voltage Switchboard Upgrade*

Page 132 of 145
### Electrical Inspection and Test Checklist
#### LV Switchboard

<table>
<thead>
<tr>
<th>Test Voltage:</th>
<th>2/2.5 kV ac/dc</th>
<th>1 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase</td>
<td>RY YB BR RE YE BE</td>
<td></td>
</tr>
<tr>
<td>Leakage mA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**

<table>
<thead>
<tr>
<th>Contractor’s inspection engineer</th>
<th>MeTRH’S inspection engineer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print Name</td>
<td>Print Name</td>
</tr>
<tr>
<td>Signature</td>
<td>Signature</td>
</tr>
<tr>
<td>Co Name</td>
<td>Co Name</td>
</tr>
<tr>
<td>Inspection date</td>
<td>Inspection date</td>
</tr>
</tbody>
</table>

### TEST SHEET FOR LV CABLE

**PROJECT:**

**LOCATION:**

**CONTRACTOR:**

**PROJECT No.:**

<table>
<thead>
<tr>
<th>Cable No.</th>
<th>Insulation Resistance, 500v Tester, Min. 25 Megohms</th>
<th>Earth loop imp</th>
<th>Glanding</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Y</td>
<td></td>
<td>R/Y/B/N-E</td>
<td>End A</td>
<td>End B</td>
</tr>
<tr>
<td>R-B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y-B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Remarks:**

<table>
<thead>
<tr>
<th>Contractor’s inspection engineer</th>
<th>MeTRH’S inspection engineer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print Name</td>
<td>Print Name</td>
</tr>
<tr>
<td>Signature</td>
<td>Signature</td>
</tr>
<tr>
<td>Co Name</td>
<td>Co Name</td>
</tr>
<tr>
<td>Inspection date</td>
<td>Inspection date</td>
</tr>
</tbody>
</table>

---

*MeTRH Low Voltage Switchboard Upgrade*
Section J: Tender Form, Schedule of Requirements and Price Schedules

(i) Form of Tender

Date____________________

To: The County Secretary
County Government of Meru
P. O. Box 120 – 60200
Meru - Kenya

Supply, Installation, Testing and Commissioning of a Communicating Electrical Low Voltage Switchboard at Meru Teaching and Referral Hospital (MeTRH)

Gentlemen and/or Ladies:
1. Having examined the tender documents including Addenda Nos ……………………… [Insert numbers], The receipt of which is hereby duly acknowledged, we, the undersigned, offer to supply and deliver …………………………….[Description of materials and spares]. In conformity with the said tender documents for the sum of………………………..[Total tender amount in words and figures] or such other sums as may be ascertained in accordance with the Schedule of Prices attached herewith and made part of this Tender.

2. We undertake, if our Tender is accepted, to deliver the materials and spares in accordance with the delivery schedule specified in the Schedule of Requirements.

3. If our Tender is accepted, we will obtain the guarantee of a bank in a sum equivalent to _____ percent of the Contract Price for the due performance of the Contract, in the form prescribed by Meru Teaching and Referral Hospital.

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

5. Until a formal Contract is prepared and executed, this Tender, together with your written acceptance thereof and your notification of award, shall constitute a binding Contract between us.

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

Dated this ______________ day of ______________ 20____

_____________________________ __________________________
[Signature] [In the capacity of]

Duly authorized to sign tender for and on behalf of

MeTRH Low Voltage Switchboard Upgrade
i. Schedule of requirements for equipment
   a. As per specification sheets attached

ii. Price schedule for equipment
    a. As per specification sheets attached
## PRICE SCHEDULE FOR EQUIPMENT

### Communicating Electrical LV Switchboard Panel

<table>
<thead>
<tr>
<th>No.</th>
<th>Item Description</th>
<th>Quantity</th>
<th>Unit Price KES</th>
<th>Total Price KES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Decommissioning of existing Low Voltage Switchboard Panel and mobilisation works</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Supply and install 1600A Incomer Breaker and its control components</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Supply and install backup power and charging system for the existing Automatic Power Transfer Switch.</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Supply and install Power Factor Correction (PFC) System and its control components</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Supply and install Power Monitoring and Analytical System and its control components</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Supply and install 6NO. 400A MCCBs, 10NO. 250A MCCBs, 4NO. 200A MCCBs and 2NO. 150A MCCBs. Provide listed schedule.</td>
<td>LOT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Supply and install 5No. Digital meters with GSM module with real-time communication to MeTRH Medical Engineers.</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Supply and Install 4NO. feeders for existing and new electric loads,and 1NO. spare capacity at Meru Teaching and Referral Hospital (Provide listed schedule)</td>
<td>LOT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Supply and install CP Panel as per the switchboard requirements</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Supply and install DB Panel as per the switchboard requirements</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Control wiring</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Works needed to provide temporary power during the installation. (Provide schematic (optional)).</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Any other items not included above, but necessary for successful installation and commissioning (describe in detail).</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Testing and commission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Documentation</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Supply and install smart meters on highly loaded feeders</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Price KES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Carried to summary sheet)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3. General Items

<table>
<thead>
<tr>
<th>No</th>
<th>ITEM</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Training of Five (5) engineers/technicians</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>FAT three (3) No. Engineers For 10 days each, including Air-tickets (if outside Kenya),-accommodations and USD 300 out of pocket allowance.</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2 Years maintenance spares as per manufacturer’s recommendations plus the following: a) assorted LV breakers and relays (list them)</td>
<td>LS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Special maintenance tools as follows (i) 2 No. Laptop for programming the equipment (ii) Any other tools</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MeTRH Low Voltage Switchboard Upgrade**
**Summary**

<table>
<thead>
<tr>
<th>No</th>
<th>ITEM</th>
<th>Total price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Communicating Electrical LV Switchboard Panel</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>General</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>VAT@16%</td>
<td></td>
</tr>
</tbody>
</table>

Total (Carried to form of tender)

**NOTE:**

i. All Tenderers must bid for all items listed in the tables above. Any bid that leaves out any of the items will be regarded as non-responsive as the tender will be incomplete.

ii. All prices given in foreign currency shall be converted to Kenya shillings based on the prevailing Central Bank of Kenya rate 30 days prior to the final date of closing of this tender. The Tenderer is to include any costs that they envision to be necessary for the completion of the project.

Name of Tenderer __________________________

Tender Number .................. Page____ of ____

Signature of Tenderer
APPENDIX TO FORM OF TENDER

(This appendix forms part of the tender)

<table>
<thead>
<tr>
<th>CONDITIONS OF CONTRACT</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tender Security (Bank Guarantee only)</td>
<td>KES 190,000.00</td>
</tr>
<tr>
<td>Amount of Performance Security (Unconditional Bank Guarantee)</td>
<td>2% percent of Tender Sum in the form of Unconditional Bank Guarantee</td>
</tr>
<tr>
<td>Program to be submitted</td>
<td>Not later than ___ days after issuance of Order to Commence</td>
</tr>
<tr>
<td>Cash flow estimate to be submitted</td>
<td>Not later than ___ days after issuance of Order to Commence</td>
</tr>
<tr>
<td>Minimum amount of Third Party Insurance</td>
<td>KES</td>
</tr>
<tr>
<td>Period for commencement, from the Engineer’s order to commence</td>
<td>14 days</td>
</tr>
<tr>
<td>Time for completion</td>
<td>_________________weeks</td>
</tr>
<tr>
<td>Amount of liquidated damages</td>
<td>KES 50,000 per week</td>
</tr>
<tr>
<td>Limit of liquidated damages</td>
<td>KES 1,000,000</td>
</tr>
<tr>
<td>Defect Liability period</td>
<td>6 Months</td>
</tr>
<tr>
<td>Percentage of Retention</td>
<td>10% of Interim Payment Certificate</td>
</tr>
<tr>
<td>Limit of Retention Money</td>
<td>10% of Contract Price</td>
</tr>
<tr>
<td>Minimum amount of interim certificates</td>
<td>KES144,000</td>
</tr>
<tr>
<td>Time within which payment to be made after</td>
<td></td>
</tr>
<tr>
<td>Interim Payment Certificate signed by Engineer</td>
<td></td>
</tr>
<tr>
<td>Time within which payment to be made after</td>
<td></td>
</tr>
<tr>
<td>Final Payment Certificate signed by Engineer</td>
<td></td>
</tr>
<tr>
<td>Appointer of Arbitrator</td>
<td>Chief Justice of The Republic of Kenya</td>
</tr>
<tr>
<td>Notice to Employer and Engineer</td>
<td></td>
</tr>
<tr>
<td>The County Secretary</td>
<td></td>
</tr>
<tr>
<td>County Government of Meru</td>
<td></td>
</tr>
<tr>
<td>P. O. Box 120 – 60200, Meru, Kenya.</td>
<td></td>
</tr>
<tr>
<td>The County Engineer for Health</td>
<td></td>
</tr>
<tr>
<td>County Government of Meru</td>
<td></td>
</tr>
<tr>
<td>P. O. Box 120 – 60200, Meru, Kenya.</td>
<td></td>
</tr>
</tbody>
</table>

Signature of Tenderer........................................ Date........................................
Section K: Confidential Business Questionnaire

Part 1 – General:

Business Name
Location of business premises
Plot No                      Street/Road
Postal Address               Tel No
Fax                          Email
Nature of Business
Registration Certificate Number
Maximum value of business which you can handle at any one time:
KES
Name of your bankers          Branch

Part 2 (a) Sole Proprietor:

Your name in full
Age
Nationality                 Country of origin
Citizenship details

Part 2 (b) Partnership:

Give details of partners as follows:
Name            Nationality      Citizenship Details      Shares
1.
2.
3.
4.

Part 2 (c) Registered Company:

Private or Public
State the nominal and issued capital of company:
Nominal  KES
Issued   KES
Give details of partners as follows:
Name            Nationality      Citizenship Details*      Shares
1.
2.
3.
4.
*If a Kenya Citizen, indicate under “Citizenship Details” whether by Birth, Naturalization or registration.

Date                      Signature of Candidate
Section L: Tender Security Form

Whereas………………………………………… [Name of the Tenderer] (Hereinafter called “the Tenderer”) has submitted its tender dated …………………… [date of submission of tender] for the Supply, Installation, Testing and Commissioning of a Communicating Electrical Low Voltage Switchboard at Meru Teaching and Referral Hospital (MeTRH) (Hereinafter called “the Tender”)……………………………………………………….KNOW ALL PEOPLE by these presents that WE………………………………………

Of……………………………………………………..

Having our registered office at ……………………… (Hereinafter called “the Bank”), are bound unto Meru Teaching and Referral Hospital in the sum of ………………… For which payment well and truly to be made to the said Meru Teaching and Referral Hospital, 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 the Tenderer withdraws its Tender during the period of tender validity specified by the Tenderer on the Tender Form; or

2. If the Tenderer, having been notified of the acceptance of its Tender by Meru Teaching and Referral Hospital during the period of tender validity:

   (a) Fails or refuses to execute the Contract Form, if required; or

   (b) Fails or refuses to furnish the performance security, in accordance with the Instructions to Tenderers;

We undertake to pay to Meru Teaching and Referral Hospital up to the above amount upon receipt of its first written demand, without Meru Teaching and Referral Hospital having to substantiate its demand, provided that in its demand Meru Teaching and Referral Hospital will note that the amount claimed by it is due to it, 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 above date.

_______________________________________
[Signature of the bank]
Section M: Contract Form

THIS AGREEMENT made the _____ day of __________ 20____ between Meru teaching and Referral Hospital of Kenya of the one part and………………………… [Name of Tenderer] of………… [City and Country of Tenderer] (Hereinafter called “the Tenderer”) of the other part:

WHEREAS Meru Teaching and Referral Hospital invited tenders for certain materials and spares, viz,…………………………… [Brief description of materials and spares] and has accepted a tender by the Tenderer for the supply of those materials and spares in the sum of………………………………………………… [Contract price in words and figures] (Hereinafter called “the Contract Price”).

NOW THIS AGREEMENT WITNESSED 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 referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.:

   (a) the Tender Form and the Price Schedule submitted by the Tenderer;
   (b) the Schedule of Requirements;
   (c) the Technical Specifications;
   (d) the General Conditions of Contract;
   (e) the Special Conditions of Contract; and
   (f) Meru Teaching and Referral Hospital’s Notification of Award.

3. In consideration of the payments to be made by Meru Teaching and Referral Hospital to the Tenderer as hereinafter mentioned, the Tenderer hereby covenants with Meru teaching and Referral Hospital to provide the materials and spares and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. Meru Teaching and Referral Hospital hereby covenants to pay the Tenderer in consideration of the provision of the materials and spares 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 hereto have caused this Agreement to be executed in accordance with their respective laws the day and year first above written.

Signed, sealed, delivered by ___________ the ________ (for Meru Teaching and Referral Hospital)

Signed, sealed, delivered by ___________ the ________ (for the Tenderer)

In the presence of ____________

MeTRH Low Voltage Switchboard Upgrade
Section N: Performance Security Form

To: Meru Teaching and Referral Hospital

WHEREAS ……………………………………… [Name of Tenderer] (Hereinafter called “the Tenderer”) has undertaken, in pursuance of Contract No.____________ [reference number of the contract] dated ____________ 20____ to supply……………………………………………..………………………………………… [Description of materials and spares] (Hereinafter called “the Contract”).

AND WHEREAS it has been stipulated by you in the said Contract that the Tenderer shall furnish you with a bank guarantee by a reputable bank for the sum specified therein as security for compliance with the Tenderer’s performance obligations in accordance with the Contract.

AND WHEREAS we have agreed to give the Tenderer a guarantee:

THEREFORE WE hereby affirm that we are Guarantors and responsible to you, on behalf of the Tenderer, up to a total of……………………………………………………………… [amount of the guarantee in words and figures], and we undertake to pay you, upon your first written demand declaring the Tenderer to be in default under the Contract and without cavil or argument, any sum or sums within the limits of…………………………………… [Amount of guarantee] as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until the _____ day of __________ 20____.

Signature and seal of the Guarantors

________________________________________________________________________

[Name of bank or financial institution]

________________________________________________________________________

[Address]

________________________________________________________________________

[Date]
Section O: Bank Guarantee for Advance Payment

To: Meru Teaching and Referral Hospital

Supply, Installation and Commissioning of Electrical Low Voltage Switchboard at Meru Teaching and Referral Hospital (MeTRH)

Gentlemen and/or Ladies:

In accordance with the payment provision included in the Special Conditions of Contract, which amends the General Conditions of Contract to provide for advance payment, .................................................. [Name and address of Tenderer] (Hereinafter called “the Tenderer”) shall deposit with Meru Teaching and Referral Hospital a bank guarantee to guarantee its proper and faithful performance under the said Clause of the Contract in an amount of ................................................................. [Amount of guarantee in figures and words].

We, the .................................................. [bank or financial institution], as instructed by the Tenderer, agree unconditionally and irrevocably to guarantee as primary obligator and not as surety merely, the payment to Meru Teaching and Referral Hospital on its first demand without whatsoever right of objection on our part and without its first claim to the Tenderer, in the amount not exceeding ........................................... [Amount of guarantee in figures and words].

We further agree that no change or addition to or other modification of the terms of the Contract to be performed thereunder or of any of the Contract documents which may be made between Meru Teaching and Referral Hospital and the Tenderer, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition, or modification.

This guarantee shall remain valid and in full effect from the date of the advance payment received by the Tenderer under the Contract until ......................... [Date].

Yours truly,

Signature and seal of the Guarantors

[Name of bank or financial institution]

[Address]

[Date]
Section P: Manufacturer’s Authorization

To Meru Teaching and Referral Hospital

WHEREAS ........................................................ [name of the manufacturer] who are established and reputable manufacturers of ........................ [name and/or description of the goods] having factories at ........................................... [address of factory] do hereby authorize ...................... [name and address of agent] to submit a tender, and subsequently negotiate and sign the Contract with you against tender No. ................................ [reference of the tender] for the above goods manufactured by us.

We hereby extend our full guarantee and warranty as per the General Conditions of Contract for the goods offered for supply by the above firm against this Invitation for Tenders.

______________________________________________

[Signature for and on behalf of manufacturer]
DECLARATION FORM

To: The County Secretary,
County Government of Meru
P. O. Box 120 – 60200,
Meru, Kenya

Date: 

The tenderer i.e. (name and address)

………………………………………………………………………………………………………………
………………………………………………………………………………………………………………
………………………………………………………………………………………………………………
………………………………………………………………………………………………………………

declare the following:

a) Has not been debarred from participating in public procurement.

b) Has not been convicted or involved in and will not be involved in corrupt
   and fraudulent practices.

c) Has not been insolvent, in receivership, bankrupt or is not in the process of
   being wound up and is not the subject of legal proceedings relating to the foregoing.

d) Is not guilty of any serious violation of fair employment Laws and
   practices.

Name Signature Date

(To be signed by authorized representative and officially stamped)