

Middle Tennessee Electric



2029 – 2031 Blanket Power Transformer Design and Construction Specifications RFP

September 2025

TABLE OF CONTENTS

<u>SECTION NO. AND DETAILS</u>	<u>NO. OF PAGES</u>
Section 100 – Transformer Bid Invitation	2 Pages
Section 200 – Transformer Equipment Contracts	14 Pages
Section 300A – Transformer Manufacturer’s Proposal Information Sheet (25kV)	11 Pages
Section 300B – Transformer Manufacturer’s Proposal Information Sheet (13kV)	11 Pages
Section 400 – Technical Specifications for Power Transformers (25kV/13kV)	21 Pages

SECTION 100

TRANSFORMER BID INVITATION

September 29, 2025

Subject: 2029-2031 – Power Transformer Blanket RFP

Dear Prospective Bidder,

Middle Tennessee Electric (MTE) invites you to submit a proposal for the manufacture and commissioning of approximately six (6) to nine (9) new electrical substation power transformers, as outlined in the attached specifications. We anticipate procuring two (2) to three (3) transformers per year over a three-year period.

MTE utilizes two standard transformer designs:

- 36/48/60//67.2 MVA at 161.7/26.18 kV
- 25/33.3/41.7//46.9 MVA at 161.7/13.09 kV

Your proposal must include either:

- A firm fixed price, or
- An escalated price, accompanied by clear and complete details regarding the method of escalation.

The attached Power Transformer Specification outlines the required technical specifications, delivery schedule, and applicable penalties for non-compliance.

BID SUBMISSION INSTRUCTIONS

- Due Date and Time: Proposals must be received no later than 1:30 PM (Central Time) on Thursday, November 13, 2025.
- Submission Method: Electronic submission only. Please email your proposal to the address listed below. Hard copies are not required.
- Late Submittals: Proposals received after the specified time will not be considered and will be marked as late.

BID OPENING

All proposals will be publicly opened on Thursday, November 13, 2025, at 1:30 PM (Central Time) via a Webinar platform. Bidders wishing to attend the opening must provide a valid email address in advance to receive an invitation link.

PROPOSAL REQUIREMENTS

Your proposal must include the following:

1. Completed RUS documents (Section 200)
2. Completed Manufacturer's Information Sheet (Section 300)
3. A clearly labeled section titled "Exceptions", which lists any deviations from the specifications. MTE will evaluate each exception on its individual merit. Unless explicitly approved in writing, the Manufacturer shall adhere to MTE specifications without deviation.
4. Proposed performance specifications, layout drawings, and any other relevant documentation necessary for evaluating your bid.

EVALUATION AND AWARD

MTE will evaluate all proposals based on a variety of factors and is not obligated to accept the lowest bid. MTE reserves the right to:

- Determine the best overall bid in its sole discretion,
- Reject any or all proposals,
- Disregard proposals that do not meet submission requirements.

If you elect not to submit a proposal, we ask that you kindly return a copy of this letter, indicating your intent not to bid. Doing so will ensure your business remains eligible for future Requests for Proposal (RFPs).

If you have any questions regarding this RFP, please do not hesitate to contact me at LarryTaylor@mte.com.

We appreciate your interest and look forward to your proposal.

Sincerely,



Larry D. Taylor, PE
Engineering Technology Supervisor
Middle Tennessee Electric
1010 Haley Road
Murfreesboro, TN 37129

Initial _____ No Bid

SECTION 200

TRANSFORMER EQUIPMENT CONTRACTS

I. General

- A. The following details the contract agreements to be executed upon award of the transformer.

U.S. Department of Agriculture
Rural Utilities Service
EQUIPMENT CONTRACT
NOTICE AND INSTRUCTIONS TO BIDDERS

1. **Sealed proposals** for the furnishing and delivering **F.O.B. Power Transformer(s)**
Per MTEMC Specifications
of equipment for the rural electric project of **MTE 2029-2031 Power Transformers Blanket**
RUS designation **TN 19 Rutherford**, (hereinafter called the "Owner") will be received by the Owner on or before
1:30 o'clock PM., November 13, 2025, at its office at
1010 Haley Road, Murfreesboro, TN 37129 at which time and place the proposals will be
☒ publicly opened and read.

☐ privately opened. The Owner, subsequent to the bid opening, may elect to conduct clarifying discussions with the bidder to resolve any questions related to the substance of the bidder's proposal and to arrive at a final price for a responsive bid.

Any proposals received subsequent to the time specified will be promptly returned to the Bidder unopened.
2. **Obtaining Documents.** The Plans, Specifications, and Construction Drawings, together with all necessary forms and other documents for bidders may be obtained from the Owner, or from the Engineer **Larry Taylor**
at the latter's office at 1010 Haley Road, Murfreesboro, TN 37129
upon the payment of \$ 0.00, which payment will not be subject to refund. The Plans, Specifications, and Construction Drawings may be examined at the office of the Owner or at the office of the Engineer.
3. **Manner of Submitting Proposals.** Proposals and all supporting instruments must be submitted on the forms furnished by the Owner and must be delivered in a sealed envelope addressed to the Owner. The name and address of the Bidder and the date and hour of the opening of bids must appear on the envelope in which the Proposal is submitted. Proposals must be completed in ink or typewritten. No alterations or interlineations will be permitted, unless made before submission, and initialed and dated. The successful Bidder will be required to execute two additional counterparts of the Proposal.
4. **Due Diligence.** Prior to the submission of the Proposal, the Bidder shall make and shall be deemed to have made a careful examination of the Plans, Specifications, Construction Drawings, and form of Proposal, and shall review the location and nature of the proposed construction, the transportation facilities, the kind and character of soil and terrain to be encountered, the kind of facilities required before and during the construction of the project, general local conditions, environmental and historic preservation considerations, and all other matters that may affect the cost and time of completion of the work. Bidder will be required to comply with all federal, state, and local laws, rules, and regulations applicable to its performance, including those pertaining to the licensing of contractors, and the Anti Kick-Back Act of 1986 (41 U.S.C. 51 et seq).
5. **Proposals** will be accepted only from those pre-qualified bidders invited by the Owner to submit a proposal.
6. **The Time for Delivery of the Equipment** is of the essence of the Contract and shall be as specified by the Engineer in the Proposal.

7. **Evaluation Factors.** In estimating the lowest cost to the Owner as one of the factors in deciding the award of the Contract, the Owner will consider, in addition to the price quoted in the Proposals, the following:
See Section 400 – Loss Evaluation
See Section 400 - Delivery Schedule
8. **Debarment Certification.** The Bidder must provide to the Owner a suspension and debarment certificate in the form attached hereto.
9. **Contract is Entire Agreement.** The Contract to be effected by the acceptance of the Proposal shall be deemed to include the entire agreement between the parties thereto, and the Bidder shall not claim any modifications thereof resulting from any representation or promise made at any time by any officer, agent or employee of the Owner or by any other person.
10. **Minor Irregularities.** The Owner reserves the right to waive minor irregularities or minor errors in any Proposal, if it appears to the Owner that such irregularities or errors were made through inadvertence. Any such irregularities or errors so waived must be corrected on the Proposal in which they occur prior to the acceptance thereof by the Owner.
11. **Bid Rejection.** The Owner reserves the right to reject any or all Proposals.
12. **Definition of Terms.** The terms “Administrator” and “Engineer” as used throughout this Contract shall be as defined in Article VI, Section 1, of the Proposal.

Middle Tennessee Electric

Owner

By

Authorized Representative - Title

Date

PROPOSAL

TO:

MTE, 1010 Haley Road, Murfreesboro, TN 37129

(hereinafter called the "Owner").

ARTICLE I--GENERAL

Section 1. Offer to Furnish and Deliver. The undersigned (hereinafter called the "Bidder") hereby proposes to furnish and deliver the equipment (hereinafter called the "Equipment") described in the Plans, Specifications, and Construction Drawings for the following prices:

Item: Per Specification Price: _____

Item: _____ Price: _____

The prices of Equipment set forth herein shall include the cost of delivery to:

MTE Substation locations – varies

The prices set forth herein do not include any sums which are or may be payable by the Bidder on account of taxes imposed by any taxing authority upon the sale, purchase or use of the Equipment. If any such tax is applicable to the sale, purchase or use of the Equipment hereunder, the amount thereof shall be added to the purchase price and paid by the Owner.

Section 2. Materials and Equipment. The Bidder agrees to furnish and use in the construction of the project under this Proposal, in the event the Proposal is accepted, only such "fully accepted," "conditionally accepted," and "technically accepted" materials and equipment which have been accepted by RUS as indicated in the current RUS Informational Publication 202-1, "List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers," including revisions adopted prior to the Bid Opening. The use of "conditionally accepted" or "technically accepted" materials and equipment requires prior consent by the Owner or Engineer.

The Bidder will purchase all materials and equipment outright and not subject to any conditional sales agreements, bailment, lease or other agreement reserving unto the seller any right, title or interest therein. All such materials and equipment shall be new.

Section 3. Description of Contract. The Notice and Instructions to Bidders, Plans, Specifications, and Construction Drawings, which by this reference are incorporated herein, together with the Proposal and Acceptance constitute the Contract. The Plans, Specifications, and Construction Drawings, including maps, special drawings, and approved modifications in standard specifications are attached hereto and identified as follows:

MTE 2029-2031 Substation Power Transformer Blanket Design and Construction
Specifications RFP

Section 4. Due Diligence. The Bidder has made a careful examination of the Plans, Specifications, and Construction Drawings attached hereto, and has become informed as to the location and nature of the proposed construction, the transportation facilities, the kind and character of soil and terrain to be encountered, and the kind of facilities required before and during the construction of the project, and has become acquainted with the labor conditions, federal, state, and local laws, rules, and regulations applicable to its performance.

Section 5. Warranty of Good Faith. The Bidder warrants that this Proposal is made in good faith and without collusion or connection with any person or persons bidding for the same work.

ARTICLE II--DELIVERY AND WARRANTY

Section 1. Delivery. The Bidder shall deliver the Equipment:

_____ within _____ days after receipt of the written order or orders of the Owner.

_____ not later than _____, 20_____. **See Section 400 – Delivery**

The time for delivery shall be extended for the period of any reasonable delay due exclusively to causes beyond the control and without the fault of the Bidder, including, but not limited to, acts of God, fires, strikes, and floods.

Section 2. Defective Materials and Workmanship.

- a. All Equipment furnished hereunder shall be subject to the inspection, tests, and approval of the Owner and the Engineer, and the Bidder shall furnish all information required concerning the nature or source of any Equipment and provide adequate facilities for testing and inspecting the Equipment at the plant of the Bidder.
- b. The Equipment furnished hereunder shall become the property of the Owner upon delivery, provided, however, that the Owner or the Engineer, within one year after initial operation of the Equipment, or within the period for which the Equipment is guaranteed, whichever is longer, may reject any Equipment which does not comply with the Specifications attached hereto and made a part hereof or with the guarantees, if any, of the Bidder and the manufacturer. Upon any such rejection, the Bidder shall repair or replace such defective Equipment within a reasonable time after notice in writing from the Owner. If any such defective materials, equipment, or workmanship so replaced or repaired is found to be defective within one year after the completion of the replacement or repair, the Bidder shall replace or remedy such defective materials, equipment, or workmanship. In the event of failure by the Bidder so to do, the Owner may make such replacement and the cost

and expense thereof shall be paid by and recoverable from the Bidder.

- c. All manufacturers' guarantees of Equipment, if any, shall be transferred and assigned to the Owner upon delivery of any Equipment and before final payment is made for such Equipment. Such guarantees shall be in addition to those required of the Bidder by other provisions of this Contract.

ARTICLE III--PAYMENT

Section 1. Payments to Bidder.

- a. Upon the shipment of any Equipment hereunder, the Bidder shall submit to the Owner a detailed statement of the Equipment shipped. The Owner shall, upon receipt of the Equipment, pay the Bidder ninety percent (90%) of the contract price of the Equipment. When the Equipment has been installed, placed in satisfactory operation, tested and accepted by the Owner, the Owner shall make final payments therefore to the Bidder; provided, however, such final payment shall be made not later than **ninety (90)** days after delivery of the Equipment, unless such acceptance by the Owner shall be withheld because of the fault of the Bidder.
- b. No payment shall be due while the Bidder is in default in respect of any of the provisions of this Contract and the Owner may withhold from the Bidder the amount of any claim by a third party against either the Bidder or the Owner based upon an alleged failure of the Bidder to perform the work hereunder in accordance with the provisions of this Contract.

ARTICLE IV--PARTICULAR UNDERTAKINGS OF THE BIDDER

The provisions of this Article IV apply to any work performed by the Bidder at the project site.

Section 1. Protection to Persons and Property. The Bidder shall at all times take all reasonable precautions for the safety of employees on the project and of the public, and shall comply with all applicable provisions of federal, state, and local laws, rules, and regulations and building and construction codes, in addition to the safety rules and procedures of the Owner.

The following provisions shall not limit the generality of the above requirements:

- a. The Bidder shall at no time and under no circumstances cause or permit any employee of the Bidder to perform any work upon energized lines, or upon poles carrying energized lines, unless otherwise specified in the Notice and Instructions to Bidders.
- b. The Bidder shall transport and store all material in facilities and vehicles which are designed to protect the material from damage. The Bidder shall ensure that all vehicles, trailers, and other equipment used comply with all applicable licensing, traffic, and highway requirements.
- c. The Bidder shall conduct its operations to cause the least possible obstruction of public highways.

- d. The Bidder shall make good and fully repair all injuries and damages to the project or any portion thereof under the control of the Bidder by reason of any act of God or other casualty or cause whether or not the same shall have occurred by reason of the Bidder's negligence.
 - (i) To the maximum extent permitted by law, Bidder shall defend, indemnify, and hold harmless Owner and Owner's directors, officers, and employees from all claims, causes of action, losses, liabilities, and expenses (including reasonable attorney's fees) for personal loss, injury, or death to persons (including but not limited to Bidder's employees) and loss, damage to or destruction of Owner's property or the property of any other person or entity (including but not limited to Bidder's property) in any manner arising out of or connected with the Contract, or the materials or equipment supplied or services performed by Bidder, its subcontractors and suppliers of any tier. But nothing herein shall be construed as making Bidder liable for any injury, death, loss, damage, or destruction caused by the sole negligence of Owner.
 - (ii) To the maximum extent permitted by law, Bidder shall defend, indemnify, and hold harmless Owner and Owner's directors, officers, and employees from all liens and claims filed or asserted against Owner, its directors, officers, and employees, or Owner's property or facilities, for services performed or materials or equipment furnished by Bidder, its subcontractors and suppliers of any tier, and from all losses, demands, and causes of action arising out of any such lien or claim. Bidder shall promptly discharge or remove any such lien or claim by bonding, payment, or otherwise and shall notify Owner promptly when it has done so. If Bidder does not cause such lien or claim to be discharged or released by payment, bonding, or otherwise, Owner shall have the right (but shall not be obligated) to pay all sums necessary to obtain any such discharge or release and to deduct all amounts so paid from the amount due Bidder.
 - (iii) Bidder shall provide to Owner's satisfaction evidence of Bidder's ability to comply with the indemnification provisions of subparagraphs i and ii above, which evidence may include but may not be limited to a bond or liability insurance policy obtained for this purpose through a licensed surety or insurance company.
- e. Upon violation by the Bidder of any of the provisions of this section, after written notice of such violation given to the Bidder by the Engineer or the Owner, the Bidder shall immediately correct such violation. Upon failure of the Bidder so to do the Owner may correct such violation at the Bidder's expense: Provided, however, that the Owner may, if it deems it necessary or advisable, correct such violation at the Bidder's expense without such prior notice to the Bidder.

Section 2. Insurance. The Bidder shall take out and maintain throughout the period of its operations at the project site the following types and minimum amounts of insurance:

- a. Workers' compensation and employers' liability insurance, as required by law, covering all its employees who perform any of the obligations of the Bidder under

the contract. If any employer or employee is not subject to the workers' compensation laws of the governing state, then insurance shall be obtained voluntarily to extend to the employer and employee coverage to the same extent as though the employer or employee were subject to the workers' compensation laws.

- b. Public liability insurance covering all operations under the contract shall have limits for bodily injury or death of not less than \$1 million each occurrence, limits for property damage of not less than \$1 million each occurrence, and \$1 million aggregate for accidents during the policy period. A single limit of \$1 million of bodily injury and property damage is acceptable. This required insurance may be in a policy or policies of insurance, primary and excess including the umbrella or catastrophe form.
- c. Automobile liability insurance on all motor vehicles used in connection with the contract, whether owned, non-owned, or hired, shall have limits for bodily injury or death of not less than \$1 million per person and \$1 million each occurrence, and property damage limits of \$1 million for each occurrence. A single limit of \$1 million of bodily injury and property damage is acceptable. This required insurance may be in a policy or policies of insurance, primary and excess including the umbrella or catastrophe form.

The Owner shall have the right at any time to require public liability insurance and property damage liability insurance greater than those required in subsection "b" and "c" of this Section. In any such event, the additional premium or premiums payable solely as the result of such additional insurance shall be added to the Contract price.

The Owner shall be named as Additional Insured on all policies of insurance required in subsections "b" and "c" of this Section.

The policies of insurance shall be in such form and issued by such insurer as shall be satisfactory to the Owner. The Bidder shall furnish the Owner a certificate evidencing compliance with the foregoing requirements which shall provide not less than (30) days prior written notice to the Owner of any cancellation or material change in the insurance.

ARTICLE V--REMEDIES

Section 1. Liquidated Damages. The time of the delivery of the Equipment is of the essence of the Contract. Should the Bidder neglect, refuse or fail to deliver the Equipment within the time herein agreed upon, after giving effect to extensions of time, if any, herein provided, then, in that event and in view of the difficulty of estimating with exactness damages caused by such delay, the Owner shall have the right to deduct from and retain out of such moneys which may be then due, or which may become due and payable to the Bidder the sum of **See Section 400 - Delivery** dollars (_____) per day for each and every day that such delivery is delayed beyond the specified time, as liquidated damages and not as a penalty; if the amount due and to become due from the Owner to the Bidder is insufficient to pay in full any such liquidated damages, the Bidder shall pay to the Owner the amount necessary to effect such payment in full: Provided, however, that the Owner shall promptly notify the Bidder in writing of the manner in which the amount retained, deducted or claimed as liquidated damages was computed.

Section 2. Cumulative Remedies. Every right or remedy herein conferred upon or reserved to the Owner or the Government or the Administrator shall be cumulative, shall be in addition to every right and remedy now or hereafter existing at law or in equity or by statute and the pursuit of any right or remedy shall not be construed as an election: Provided, however, that the provisions of Section 1 of this Article shall be the exclusive measure of damages for failure by the Bidder to deliver the Equipment within the time herein agreed upon.

ARTICLE VI--MISCELLANEOUS

Section 1. Definitions.

- a. The term "Administrator" shall mean the Administrator of the Rural Utilities Service of the United States of America and his or her duly authorized representative or any other person in whom or authority in which may be vested the duties and functions which the Administrator is now authorized by law to perform.
- b. The term "Engineer" shall mean the Engineer employed by the Owner, to provide engineering services for the project and said Engineer's duly authorized assistants and representatives.

Section 2. Materials and Supplies. In the performance of this contract there shall be furnished only such un-manufactured articles, materials, and supplies as have been mined or produced in the United States or in any eligible country, and only such manufactured articles, materials, and supplies as have been manufactured in the United States or in any eligible country substantially all from articles, materials, or supplies mined, produced or manufactured, as the case may be, in the United States or in any eligible country; provided that other articles, materials, or supplies may be used in the event and to the extent that the Administrator shall expressly in writing authorize such use pursuant to the provisions of the Rural Electrification Act of 1938, being Title IV of Public Resolution No. 122, 75th Congress, approved June 21, 1938. For the purposes of this section, an "eligible country" is any country that applies with respect to the United States an agreement ensuring reciprocal access for United States products and services and suppliers to the markets of that country, as determined by the United States Trade Representative. The Bidder agrees to submit to the Owner such certificates with respect to compliance with the foregoing provision as the Administrator from time to time may require.

Section 3. Patent Infringement. The Bidder shall hold harmless and indemnify the Owner from any and all claims, suits and proceedings for the infringement of any patent or patents covering Equipment purchased hereunder.

Section 4. Compliance with Laws. The Bidder shall comply with all federal, state, and local laws, rules, and regulations applicable to its performance under the contract and the construction of the project. The Bidder acknowledges that it is familiar with the Rural Electrification Act of 1936, as amended, the Anti Kick-Back Act of 1986 (41 U.S.C. 51 et seq), and 18 U.S.C. §§ 286, 287, 641, 661, 874, 1001, and 1366, as amended.

The Bidder represents that to the extent required by Executive Orders 12549 (3 CFR, 1985-1988 Comp., p. 189) and 12689 (3 CFR, 1989 Comp., p. 235), Debarment and Suspension, and 7 CFR part 3017, it has submitted to the Owner a duly executed certification in the form prescribed in 7 CFR part 3017.

The Bidder represents that, to the extent required, it has complied with the requirements of Pub. L. 101-121, Section 319, 103 Stat. 701, 750-765 (31 U.S.C. 1352), entitled "Limitation on use of appropriated funds to influence certain Federal contracting and financial transactions," and any rules and regulations issued pursuant thereto.

Section 5. Equal Opportunity Provisions.

a. Bidder's Representations.

The Bidder represents that:

It has ____, does not have ____, 100 or more employees, and if it has, that it has ____, has not ____, furnished the Equal Employment Opportunity-Employers Information Report EEO-1, Standard Form 100, required of employers with 100 or more employees pursuant to Executive Order 11246 of September 24, 1965, and Title VII of the Civil Rights Act of 1964.

The Bidder agrees that it will obtain, prior to the award of any subcontract for more than \$10,000 hereunder to a subcontractor with 100 or more employees, a statement, signed by the proposed subcontractor, that the proposed subcontractor has filed a current report on Standard Form 100.

The Bidder agrees that if it has 100 or more employees and has not submitted a report on Standard Form 100 for the current reporting year and that if this Contract will amount to more than \$10,000, the Bidder will file such report, as required by law, and notify the Owner in writing of such filing prior to the Owner's acceptance of this Proposal.

b. Equal Opportunity Clause. During the performance of this Contract, the Bidder agrees as follows:

(1) The Bidder will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The Bidder will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotions or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection of training, including apprenticeship. The Bidder agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this Equal Opportunity Clause.

(2) The Bidder will, in all solicitations or advertisements for employees placed by or on behalf of the Bidder, state that all qualified applicants will receive

consideration for employment without regard to race, color, religion, sex or national origin.

- (3) The Bidder will send to each labor union or representative of workers, with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representative of the Bidder's commitments under this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
 - (4) The Bidder will comply with all provisions of Executive Order 11246 of September 24, 1965, and the rules, regulations and relevant orders of the Secretary of Labor.
 - (5) The Bidder will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
 - (6) In the event of the Bidder's noncompliance with the Equal Opportunity Clause of this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part, and the Bidder may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as provided by law.
 - (7) The Bidder will include this Equal Opportunity Clause in every subcontract or purchase order unless exempted by the rules, regulations, or order of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Bidder will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance; Provided, however, that in the event Bidder becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the Bidder may request the United States to enter into such litigation to protect the interests of the United States.
- c. Certificate of Non-segregated Facilities. The Bidder certifies that it does not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not permit its employees to perform their services at any location under its control, where segregated facilities are maintained. The Bidder certifies further that it will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it will not permit its employees to perform their services at any location, under its control, where

segregated facilities are maintained. The Bidder agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this Contract. As used in this certification, the term “segregated facilities” means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. The Bidder agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) it will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity Clause, and that it will retain such certifications in its files.

Section 6. Successors and Assigns. Each and all of the covenants and agreements herein contained shall extend to and be binding upon the successors and assigns of the parties hereto. The Owner and Bidder acknowledge that this Contract is assigned to the Government, acting through the Administrator, for security purposes under the Owner’s mortgage and security instrument.

Section 7. Independent Contractor. The Bidder shall perform the work as an independent contractor, not as a subcontractor, agent, or employee of the Owner. Upon acceptance of this Proposal, the successful Bidder shall be the Contractor and all references in the Proposal to the Bidder shall apply to the Contractor.

Section 8. Approval by the Administrator: This contract does _____, does not **X**, require approval of the Administrator. No acceptance of a Proposal for a contract upon which approval of the Administrator is required shall become effective until the contract has been approved by the Administrator; provided that no obligation shall arise hereunder unless such approval is given within one hundred twenty (120) days after the date set for the opening of the proposals. The acceptance of a Proposal for a contract upon which approval of the Administrator is not required shall become effective the date of acceptance by the Owner.

ATTEST:

Bidder

Secretary

President

Dated

Address

The Proposal must be signed with the full name of the Bidder. If the Bidder is a partnership, the Proposal must be signed in the partnership name by a partner. If the Bidder is a corporation, the Proposal must be signed in the corporate name by a duly authorized officer and the corporate seal affixed and attested by the Secretary of the Corporation.

ACCEPTANCE

Subject to the approval of the Administrator, if approval of the Administrator is required, the Owner hereby accepts the foregoing Proposal of the Bidder, _____

_____ for the following Equipment:

Power Transformers per specifications

for a total contract price of \$ _____ (_____ dollars.)

Owner

By _____
President

Secretary

_____, 20 ____
Date of Contract

SECTION 300A

TRANSFORMER MANUFACTURER'S PROPOSAL INFORMATION SHEET
(25kV)

I. General

- A. The following Transformer Manufacturer's Information Sheet shall be completed and submitted with the proposal. Failure to complete and submit the following information may result in rejection of the proposal.

II. Price and delivery

- A. Total price to manufacture, deliver, assemble, test, and commission F.O.B. site foundation.

Base Bid (750kV BIL/200kV BIL):

- B. Is the quoted price above firm? If not, explain:

- C. Can the manufacturer meet the specified delivery date? If not, explain:

- D. Explain the payment terms:

III. Transformer manufacturer, contractors, and material suppliers

A. Name, contact, and address of bidder:

B. Name, contact, and address of transformer manufacturing location:

C. Name, contact, and address of field service company:

D. Name, contact, and address of crane service provider:

E. Name, contact, and address of trucking company:

F. Name, contact, and address of oil provider:

IV. Design data

A. Type of transformer design (Core or Shell; if core, then state number of legs):

B. Guaranteed Core Flux Density (not to exceed 1.70T):

C. Winding design (Circular, rectangular, etc...):

1. High Voltage Winding:

2. Low Voltage Winding:

D. Winding material:

E. Guaranteed Coil Current Density (not to exceed 3.5 A/mm² at top rating):

F. Winding insulation level (BIL):

1. High Voltage Winding (kV):

2. Low Voltage Winding (kV):

G. Final weight of transformer (lbs):

H. Weight of heaviest piece shipped (lbs):

I. Weight of core (lbs):

J. Weight of core and coil assembly (lbs):

K. Weight of transformer tank and fittings (lbs):

L. Weight of oil (lbs):

M. Quantity of oil (gallons):

N. Type of oil:

O. Type of oil preservation system:

P. Will oil be shipped separately? If so, describe quantity and means of shipment:

Q. Provide approximate dimensions of the transformer:

1. Shipping height (in): _____

2. Shipping width (in): _____

3. Shipping depth (in): _____

4. Base width (in): _____

5. Base depth (in): _____

6. Overall assembled height (in): _____

7. Overall assembled width (in): _____

8. Overall assembled depth (in): _____

R. List items which will be shipped separately and assembled on site:

S. Manufacturer, catalog number, BIL rating, description of threads, and continuous current rating of bushings:

T. Manufacturer, catalog number, BIL rating, description of threads, and continuous current rating of low voltage bushings:

U. Manufacturer, catalog number, BIL rating, description of threads, and continuous current rating of low voltage neutral bushing:

V. Guaranteed losses at rated voltage per ANSI standards:

1. Total losses (kW):

2. Load losses (kW):

3. No load losses (kW):

4. Auxiliary losses (kW):

W. Guaranteed Impedance in per unit on base MVA rating:

X. Audible sound level:

1. @ 36 MVA (dB): _____

2. @ 48 MVA (dB): _____

3. @ 60 MVA (dB): _____

4. @ 67.2 MVA (dB): _____

5. Guaranteed maximum audible sound level (db): _____

Y. Excitation current at rated voltage (amps or %):

1. @ rated voltage: _____

2. @ 110% overvoltage: _____

V. Qualifications

A. Name, contact, address, year completed, and project name of references in which similar type of work was performed. Please list at least five (5) references.

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VI. Testing

- A. Detail the specific tests to be performed on the transformer and equipment to ensure compliance with the intended design (include both factory and field test):

VII. Field Service

- A. Detail the field service offering:

VIII. Warranty

- A. Describe the warranty for the transformer and equipment if different from the contract requirements:

IX. Shipping

- A. Proposed manner of shipment including a description of the type truck to be used, and the measures to be implemented to ensure no damage to the transformer and equipment during transit:

X. Exceptions

- A. Provide a detailed list of any exceptions taken to this specification document. If there are no exceptions, then the words “No Exceptions” must be written below.

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SECTION 300

TRANSFORMER MANUFACTURER'S PROPOSAL INFORMATION SHEET **(13kV)**

I. General

- A. The following Transformer Manufacturer's Information Sheet shall be completed and submitted with the proposal. Failure to complete and submit the following information may result in rejection of the proposal.

II. Price and delivery

- A. Total price to manufacture, deliver, assemble, test, and commission F.O.B. site foundation.

Base Bid (750kV BIL/150kV BIL):

- B. Is the quoted price above firm? If not, explain:

- C. Can the manufacturer meet the specified delivery date? If not, explain:

- D. Explain the payment terms:

III. Transformer manufacturer, contractors, and material suppliers

A. Name, contact, and address of bidder:

B. Name, contact, and address of transformer manufacturing location:

C. Name, contact, and address of field service company:

D. Name, contact, and address of crane service provider:

E. Name, contact, and address of trucking company:

F. Name, contact, and address of oil provider:

IV. Design data

A. Type of transformer design (Core or Shell; if core, then state number of legs):

B. Guaranteed Core Flux Density (not to exceed 1.70T):

C. Winding design (Circular, rectangular, etc...):

1. High Voltage Winding:

2. Low Voltage Winding:

D. Winding material:

E. Guaranteed Coil Current Density (not to exceed 3.5 A/mm² at top rating):

F. Winding insulation level (BIL):

1. High Voltage Winding (kV):

2. Low Voltage Winding (kV):

G. Final weight of transformer (lbs):

H. Weight of heaviest piece shipped (lbs):

I. Weight of core (lbs):

J. Weight of core and coil assembly (lbs):

K. Weight of transformer tank and fittings (lbs):

L. Weight of oil (lbs):

M. Quantity of oil (gallons):

N. Type of oil:

O. Type of oil preservation system:

P. Will oil be shipped separately? If so, describe quantity and means of shipment:

Q. Provide approximate dimensions of the transformer:

1. Shipping height (in): _____

2. Shipping width (in): _____

3. Shipping depth (in): _____

4. Base width (in): _____

5. Base depth (in): _____

6. Overall assembled height (in): _____

7. Overall assembled width (in): _____

8. Overall assembled depth (in): _____

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1. Total losses (kW): _____
2. Load losses (kW): _____
3. No load losses (kW): _____
4. Auxiliary losses (kW): _____

W. Guaranteed Impedance in per unit on base MVA rating:

X. Audible sound level:

1. @ 25 MVA (dB): _____

2. @ 33.3 MVA (dB): _____

3. @ 41.67 MVA (dB): _____

4. @ 46.9 MVA (dB): _____

5. Guaranteed maximum audible sound level (db): _____

Y. Excitation current at rated voltage (amps or %):

1. @ rated voltage: _____

2. @ 110% overvoltage: _____

V. Qualifications

A. Name, contact, address, year completed, and project name of references in which similar type of work was performed. Please list at least five (5) references.

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VI. Testing

- A. Detail the specific tests to be performed on the transformer and equipment to ensure compliance with the intended design (include both factory and field test):

VII. Field Service

- A. Detail the field service offering:

VIII. Warranty

- A. Describe the warranty for the transformer and equipment if different from the contract requirements:

IX. Shipping

- A. Proposed manner of shipment including a description of the type truck to be used, and the measures to be implemented to ensure no damage to the transformer and equipment during transit:

X. Exceptions

- A. Provide a detailed list of any exceptions taken to this specification document. If there are no exceptions, then the words “No Exceptions” must be written below.

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SECTION 400

TECHNICAL SPECIFICATIONS FOR POWER TRANSFORMERS

I. Introduction

This specification shall cover three-phase, automatic load tap changing, oil-immersed, ONAN/ONAF/ONAF, cooling class, and 60-hertz outdoor units. The Manufacturer of origin shall be the United States and/or Canada. Rated load capacity shall be:

Design A (25kV)

ONAN/ONAF/ONAF @ 55 degrees Celsius 36/48/60 MVA

ONAN/ONAF/ONAF @ 65 degrees Celsius 40.3/53.8/67.2 MVA

Design B (13kV)

ONAN/ONAF/ONAF @ 55 degrees Celsius 25/33.3/41.7 MVA

ONAN/ONAF/ONAF @ 65 degrees Celsius 28/37.3/46.7 MVA

The Manufacturer shall specify the transformer ratings with the quotation.

Transformers shall be complete with a thermally upgraded insulation system, bushings, tap changers, and other parts for continuous operation at these ratings without losing life expectancy. The high voltage rating shall be 161,700 volts with full capacity taps at 169,400/165,550/157,850/154,000 volts. HV windings are to be delta-connected. The low voltage rating shall be 26,180/15,115 volts or 13,090/7,560 volts for a four-wire wye operation with LTC and full capacity operation at all tap positions. High voltage BIL is to be 750kV. Low voltage BIL is to be 200kV for 25kV and 150kV for 13kV. The transformer is to be in accordance with **ANSI C57.12.10**, latest revision, and all other applicable ANSI, ASTM, NEMA, UBC, and IEEE standards, latest versions. A sealed tank oil preservation system shall be provided.

***Quote an optional dual voltage unit for Design B with the following:

- 161,700 volts High-Side to 26,180/15,115 volts - 13,090/7,560 volts Low-Side.

II. Site Conditions

The transformer, including the tank, radiators, core, coil assembly, and bushings provided, shall be designed for Seismic Zone 1 condition per the latest UBC Edition, 100 mph wind velocity per ASCE 7, and a Heavy loading NESC District. The transformer shall meet or exceed the requirements of IEEE 693, latest revision.

III. Submittals

Design calculations shall be submitted for review before the manufacture of the transformer to ensure compliance with the MTE transformer specification and the Manufacturer's guarantees.

A set of Approval Drawings shall be provided to MTE before the manufacture of the transformer. Approval by MTE shall not relieve the Manufacturer of the responsibility for the correctness of the drawings furnished by the Manufacturer nor compliance with the specifications and the latest ANSI, ASTM, NEMA, UBC, and IEEE standards unless so stated by MTE at the time of approval.

A set of Final Drawings and Documentation shall be provided to MTE at the time of delivery. One copy of the electronic files is to be supplied on a CD-R marked with a professional-looking label. All drawings shall be provided in AutoCAD format, and all other documents in Microsoft-compatible versions (aka Excel or Word format).

The Manufacturer shall provide digital pictures of the core and coil assembly taken from all sides and the top before tanking. Digital thermal images from the temperature-rise tests shall also be provided to MTE.

The transformer Manufacturer shall provide a complete bill of materials detailing the part's Manufacturer, quantities, and part's Manufacturer's catalog number. The bill of materials shall give enough detail to allow MTE to order any needed replacement parts throughout the transformer's life cycle. At a minimum, precise details shall be provided for the current transformers, bushings, arrestors, gauges, RPR relays, PRD devices, circuit breakers, contactors, and control switches.

IV. Electrical Design Criteria

A. The transformer core shall be constructed from high-quality, cold-rolled, grain-oriented, high-permeability silicon steel. A single grade of core steel, sourced from the same supplier, shall be used throughout to ensure uniform magnetic properties. Each lamination shall have an insulating coating on at least one side, and burr height shall not exceed 0.8 mils (0.020 mm). The core shall be designed such that the maximum flux density does not exceed 1.70 Tesla at 100% rated voltage and shall remain within acceptable limits during overvoltage conditions in accordance with ANSI/IEEE C57.12.00. A step-lap joint configuration shall be employed to reduce localized saturation, noise, and inrush current. A circular winding arrangement shall be used for optimal performance. The core shall be grounded through a single-point ground isolation lead, which must be externally accessible without tank entry. Core frames shall be isolated from the tank and grounded via dedicated external terminals. The core and coil assembly shall be equipped with provisions to allow lifting the complete unit from the tank for inspection or maintenance.

- B. All winding conductors shall be made from high-conductivity copper and insulated with a thermally upgraded paper system meeting applicable IEEE and IEC thermal class specifications. The maximum current density shall not exceed 3.5 A/mm^2 in any winding under full-load operation at rated conditions. Windings shall be of Helical Reverse-Voltage (RV) construction only, with no use of layer-type RV winding permitted. The transformer shall be designed for operation at a hot-spot winding temperature of 120°C and a top oil temperature of 105°C without reducing expected insulation life, consistent with IEEE C57.91 loading guidelines. The neutral conductor shall be rated for full load current capacity, including during through-fault events. Partial discharge (PD) shall be measured in accordance with IEC 60270. The maximum allowable PD magnitude shall not exceed 200 pC when measured at 1.5 times the rated phase-to-ground voltage ($U_m/\sqrt{3}$), and PD inception voltage (PDIV) shall be no less than 1.1 times $U_m/\sqrt{3}$. Certified PD test results shall be provided to verify compliance.
- C. The regulating winding shall be of a fully distributed, double-layered loop-type design, either electrically independent or mounted on a separate winding tube from the main windings. Any proposed deviation from this configuration must be supported by detailed electromagnetic modeling, thermal and dielectric stress analysis, and relevant calculations, which shall be submitted for MTE review and written approval before manufacturing.
- D. To ensure the structural integrity of the core, each leg shall be banded with a high-strength, non-conductive composite material before coil installation. Banding shall be applied at multiple locations to maintain tight lamination stacking over the transformer's service life. The use of epoxy coatings alone shall not be accepted for lamination restraint.

The completed coils shall undergo a thermal stabilization process using heat drying under continuous mechanical clamping pressure prior to loading onto the core. The entire core and coil assembly shall be subjected to vapor phase drying (VPD), which includes pulling a high vacuum for moisture removal, applying hot kerosene vapor to heat and dry internal insulation, continuing the drying process under heat and vacuum, and finally impregnating the hot, dry assembly with insulating oil. The transformer oil used for impregnation shall comply with IEC 60296 and be of inhibited or uninhibited type as specified elsewhere.

- E. The final moisture content of the insulation system shall not exceed 0.3% by weight, measured using Karl Fischer titration or an equivalent standardized method, at the time of final oil filling and tank sealing.
- F. Windings for each phase shall be rigidly supported top and bottom by coil clamping rings made of high-density, high-strength insulating material. The clamping pressure shall be designed to withstand the maximum short-circuit forces as determined through mechanical analysis or finite element modeling.
- G. Conductor splicing within windings shall be minimized. Where splices are unavoidable (e.g., at the end of a conductor reel), they shall be executed using beveled and lapped joints brazed with silver solder. All splicing operations shall be completed on the

winding machine while the conductor is under full winding tension. No splices shall be permitted after windings are removed from the mandrel, except for properly designed tap exits.

- H. The dielectric design shall be based on withstand values as prescribed in IEEE C57.12.00, C57.12.10, and C57.12.90. A minimum design margin of 20% shall be maintained in all critical insulation regions, including between windings, at winding ends, and at all lead exit points. Insulation distances and clearances shall be supported by recognized dielectric withstand curves, and design data shall be made available upon request for verification.
- I. High-current leads shall be carefully routed and mechanically secured using robust, high-strength insulating supports to prevent displacement during short-circuit events or vibration. All fasteners used in the construction of high-voltage lead assemblies shall be of corona-free, threaded polymer type or equivalent. The use of nylon ties, fabric wraps, or hand-tied restraints shall not be permitted. High-voltage leads shall be arranged to ensure stress-free transitions, sufficient electrical clearances, and insulation levels adequate to prevent partial discharge, all of which shall be confirmed through testing or simulation.

V. Bushings

High voltage bushings shall be 750kV BIL, and low voltage bushings shall be 200kV BIL. The bushings shall be cover-mounted – three (3) HV (H1, H2, H3) and four (4) LV (X0, X1, X2, X3). Bushings shall be per section 5.2 of ANSI C57.12.10, latest revision. The bushings shall be light gray Munsell 5 BG 7.0/0.4. The bushing stud size and thread are to be specified in the quotation. All bushings shall be fitted with a "screw-on" type 4-hole NEMA spade. The GE Type "U" Bushings are not acceptable. Provide ABB Style #161W0800AA for the high-side and ABB Style #034N3000AA for the low-side. Bushings shall meet or exceed all applicable electrical and mechanical requirements of IEEE standard C57.19.00, the latest revision; no exceptions will be allowed. Additionally, bushings shall meet all applicable dimensional requirements of the IEEE standard C57.19.01, the latest revision; no exceptions will be allowed.

VI. Surge Arresters

The surge arresters shall be tank-mounted. A quantity of three (3) high-side and three (3) low-side surge arresters is required. High-side surge arresters shall have the following ratings: 106kV MCOV, Station Class, and be rated to work at 169kV. Low-side surge arresters shall have the following ratings: 15.3kV MCOV for 25kV and 8.4kV MCOV for 13kV, Station Class, and be rated to operate at 26.18kV and 13.09kV, respectively. The surge arresters shall be Ohio Brass Dynavar Type EVP with the specified catalog numbers: Ohio Brass EVP-010600-3001 for the high-side, Ohio Brass EVP-001500-3001 for the 25kV low-side, and Ohio Brass EVP-000900-3001 for the 13kV low-side. Siemens equivalents will be considered, but prior approval is required. A solid copper bus shall be

installed with suitable supports from the high-voltage and low-voltage arrester's ground connectors to the separate ground pads at the transformer base.

VII. Noise Level

The transformer sound level shall meet **NEMA Standards Publication No. TR 1** and **ANSI C52.12.90**, latest revision. Transformer sound level guarantees are to be specified in the quotation. The results of these measurements shall be mailed to MTE along with the other test results.

VIII. Construction and Accessories

All standard requirements of **ANSI C57.12.10 Part A and Part B**, latest revision, shall be met. All standard accessories, as described in **Part A and Part B's** latest revision, shall be furnished with the following exceptions and additions to the requirements, referenced in **red**.

- A. An SEL-2414 Transformer Monitor part # 2414A1ACA91743A1130 shall be provided and used for cooling control and local annunciation. It shall be installed in the control cabinet swing panel such that there are at least four inches of side clearance and eight inches of rear clearance, and the wiring is entirely hand-accessible. Inputs to this device shall include the transformer alarms and RTD inputs for oil, winding, and ambient temperature. Alarm inputs include two sudden pressure relay inputs, oil levels, nitrogen pressure, etc. Its outputs will be used to control the stage 1 and stage 2 transformer cooling fans and initiate a winding temperature trip timer. The SEL-2414 will communicate with other station devices through its DNP3.0 serial or fiber-optic interface.

Control wiring to be as follows: (No substitutes allowed). MTE will provide design details and SEL programming to assist in the development of the electrical control design.

SEL-2414 Outputs:

- Out101 – (NO Contact) – Wired to cabinet terminal block for Sudden Pressure Trip
- Out102 – (NO Contact) – Wired to cabinet terminal block for Winding Temp. Trip
- Out103 – (NO Contact) – Wired to cabinet terminal block for Hot Oil Temp. Alarm
- Out301 – (NC Contact) – Spare
- Out302 – (NC Contact) – Fan Bank 1– Manufacturer to recommend temperature
- Out303 – (NC Contact) – Fan Bank 2– Manufacturer to recommend temperature

SEL-2414 Inputs:

IN101 – Spare
IN102 – Spare
IN601 – Main Tank/Pressure Relief LTC Paralleled Alarms (paragraph VIII. G)
IN602 – Sudden Pressure Relay 1 (63FP1 NO Contact) (paragraph VIII. L)
IN603 – Sudden Pressure Relay 1 (63FP1 NC Contact) (paragraph VIII. L)
IN604 – Sudden Pressure Relay 1 (63FP2 NO Contact) (paragraph VIII. L)
IN605 – Sudden Pressure Relay 1 (63FP2 NC Contact) (paragraph VIII. L)
IN606 – Low Oil Main Tank (paragraph VIII. B)
IN607 – Low Oil LTC (paragraph VIII. B)
IN608 – LTC MtraB Breather Error Alarm (paragraph IX)
IN301 – Gas Pressure High (paragraph VIII. V)
IN302 – Gas Pressure Low (paragraph VIII. V)
IN303 – Cylinder Pressure (paragraph VIII. V)
IN304 – LTC Motordrive Lockout (paragraph IX)

SEL-2414 RTD Inputs: 100 ohm, 4W Platinum to be used and manufactured by Reinhausen-Messko

RTD1 – Oil Temperature sensor (paragraph VIII. D)
RTD2 – Input reserved for future use
RTD3 – Ambient Temperature sensor (paragraph VIII. C)
RTD4 – LTC Oil Temperature sensor (paragraph VIII. D)

SEL-2414 Voltage Inputs: Monitor Control power and cooling load

VA-VN – Connected to the potential source powering the LTC Controller.
VN - shall be connected to the neutral "N" of the control cabinet AC supply.

SEL-2414 Current Inputs: Monitor cooling amp load and load current for winding temperature calculation

IB – 5 amp CT input from a low-voltage winding bushing CT for winding temperature calculation.

SEL-2414 Power - 125VDC

- B. 9.7 A magnetic-type liquid level indicator shall be as described and shall include low-level alarm contacts per 7.1 of ANSI C57.12.10, latest revision, in addition to the following requirements: Liquid level indicators shall be provided on both the main and LTC tanks. Form "C" contacts shall be provided and wired into the SEL-2414. The liquid level indicator is to alarm at least 2" before the critical oil level is reached. This device shall be designed to include UV-coated laminated safety glass and a built-in breather to avoid fogging. Approved devices are Reinhausen-Messko MTO series liquid level

indicator.

- C. Ambient temperature sensor: 100 ohms, 4W, platinum RTD to be wired to the SEL-2414. The transformer manufacturer shall prove RTD compensation values.
- D. Oil temperature sensor: 100 ohms, 4W, platinum RTD to be wired to the SEL-2414. Furnish one RTD for the main compartment and one for the LTC compartment. Both oil temperature sensors are to be wired into the SEL-2414.
- E. The SEL-2414 shall calculate the winding temperature. The transformer manufacturer must provide the following mathematical constants for each cooling stage for the transformer design:
 - a. Hot-Spot Thermal Time Constant (hrs)
 - b. Top-oil Rise/Ambient (Celsius)
 - c. Hot-Spot Cond. Rise/Top Oil (Celsius)
 - d. Ratio Losses
 - e. Oil Thermal Time-Constant (hrs)
 - f. Oil Exponent
 - g. Winding Exponent
- F. **5.5** Ground pads are to be furnished as described, except that they are to be copper-faced and that a third such ground pad shall be provided, which shall be welded to the main tank cover near the X0 bushing.
- G. **9.10** The pressure relief device shall include a mechanical operation indicator and form "C" contacts for electrical indication. The pressure relief device mechanism, including micro switches, must be fully protected by a cover featuring lateral openings for the transformer tank and OLTC. A yellow semaphore for visual indication shall be provided and be visible from ground level. A self-locking red signal pin must directly activate the trip contacts (insulation IP65). Utilized spring steel corresponds to class 1 according to EN 10270-1 and is synthetic coated according to DIN 2095. Device release time must be within 2ms. All essential parts, like trip contacts and springs, must be mounted inside the protective cover. A test report shall be provided from the Manufacturer specific to each PRD that indicates the tested relief pressure and leak tightness. Approved devices are the Reinhausen-Messko MPreC series LMPRD. One set of isolated Form A alarm contacts shall be wired into the SEL-2414.
- H. **5.9** Control of auxiliary cooling equipment shall be by the transformer monitoring system or by manually controlled selector switches. In addition, fan motors shall be provided with individual thermal protection and individual disconnecting means (terminal strip). All connections shall be made inside a weatherproof junction box, and all wiring shall be run inside a liquid-tight conduit. Fans shall be manufactured by Krenz-Vent or Paradoxe Corporation (PX3 Power Flo). Other manufacturers may be accepted after MTE approval. At a minimum, the fan assembly shall be outdoor certified and IP55 corrosion-resistant rated. The cages shall be hot-dipped galvanized. Provide a spare fan with each transformer supplied for future maintenance.

- I. **5.11** The power supply for transformer auxiliary equipment and controls shall be 240 VAC 60 hertz single phase. The DC station supply will be 125 VDC.
- J. Radiators shall be bolted on and have a valve to allow replacement without draining oil from the transformer. Radiators shall be arranged in two or more groups so that each group can be removed without taking the transformer out of service. A minimum of a 3/4-inch drain valve and a vent shall be provided on each radiator. Each fitting shall be closed with a brass plug. Radiators shall be constructed to withstand tank-operating pressure. Metric radiators shall be used with lifting eyes. Radiators shall be interchangeable and not match-marked. All radiators shall be seam-welded and hot-dipped galvanized. No other protective coating shall be applied on top of the galvanizing. An open seam at the edges is not acceptable.
- K. A 3/4-inch under-oil fill valve opposite the drain valve shall be provided to allow online drying.
- L. Two under-oil fault pressure relays suitable for 125 VDC operation shall be provided with gate valves. A valve shall be installed between the relay and the transformer tank. The relays shall be located on the diagonally opposite sides of the transformer. The relays shall be manufactured by Qualitrol Corporation and shall not have reset switches. Alternatives to Qualitrol Corporation are permitted but shall be submitted for approval before use. Two sets of isolated mechanical Form C contacts for each device are to be provided and wired directly into a terminal block. One set for one device is to be wired into the SEL-2414.
- M. A solid copper bus shall be installed with suitable supports from the X0 bushing to the separate ground pads at the base of the transformer. All connections and joints on the bus shall be cleaned on all sides to ensure proper electrical connection before installation. All copper buses shall be interconnected via a ground ring around the top of the transformer.
- N. All brackets, bracing, etc., mounted on the outer part of the transformer shall be enclosed. These items should be C Beams or Box Beams with cover plates on the ends.
- O. All conduits for forced-air cooling devices, temperature indication, alarms, current transformers, and the power supply for cooling devices shall be installed in a rigid galvanized steel conduit securely fastened to the transformer. All rigid conduits shall be connected to cooling devices, instruments, and other devices with liquid-proof flexible conduit. All conduit fittings shall have weatherproof, oil-resistant gaskets. As a practical matter, all conduits shall be grouped in one general location. There shall not be any type of exposed wire or cable on the transformer except as approved by the Engineer.
- P. AWS-qualified personnel shall perform all welding.
- Q. Using gun studs for any oil seal or air seal boundary is unacceptable.

- R. The cover shall be domed to shed water and welded to the tank. During final assembly, before any electrical testing, the cover shall be welded entirely in place with an inorganic gasket material between the cover and the tank flange, providing a hermetic seal of the main tank. Bolted covers are not acceptable. Temporary clamping during testing is not permitted.
- S. All tank seams shall be full penetration double-welded (inside and out) and shall be a minimum of six (6) inches from the corner. Corner welds are not acceptable. Welds shall be smooth and free from pits, burrs, and slag.
- T. All connections inside the main and LTC tank shall be two (2) hole connectors or larger and double crimped.
- U. The transformer, including the tank, radiators, core and coil assembly, ancillary equipment, and bushings, shall be designed and constructed to withstand the stresses from testing, loading, unloading, installation, and shipping via truck or railway without damage or distortion. Verification will be through the use of an impact recorder, SFRA testing, and visual inspection.
- V. A nitrogen inert-gas pressure system is required and shall be in accordance with **IEEE C57.12.00** per **Section 6.6.3**, latest revision. The nitrogen for use in the system shall be in accordance with **ASTM D1933-1997, Type III**. The nitrogen inert gas preservation system shall have at least two stages of pressure regulation, gauges to indicate tank pressure and nitrogen bottle pressure. The nitrogen system shall maintain a positive pressure above the insulating oil to prevent ingress of moisture and oxygen and shall be designed for reliable long-term operation.
- W. The nitrogen inert-gas pressure system shall consist of a nitrogen generator system. The nitrogen generator equipment shall be mounted in an easily accessible, weatherproof, lockable enclosure with adequate space. The enclosure shall have stainless steel hinges and a viewing window to see all gauges and valves without opening the enclosure door. The nitrogen generated and delivered shall achieve a greater than 99% purity with a -40° C dew point. The nitrogen generator system shall provide a regulated positive pressure and maintain a transformer tank pressure between 0.5 and 5.0 psi. The following alarm contacts, at a minimum, shall be provided: 1) low gas space pressure (lower than 0.2 psi), 2) high gas space pressure (exceeding 5.5 psi), 3) low nitrogen storage tank pressure (lower than 50 psi), and 4) generator temperature alarm (internal air space rises above 105° F or falls below 40°F). A nitrogen storage tank with a minimum of 3 gallons of reserve nitrogen shall be provided in the event of a loss of power. The nitrogen generator system shall have a pressure regulator panel, condenser assembly, and climate control module. The ambient operating conditions shall be -40° to + 40° C with a relative humidity of 100% at an altitude between 0 and 6000 ft. The nitrogen supply shall be 120 psi with a constant flow rate of 1.0 SLPM and a 5.0 SLPM purge. The max regulator pressure shall be 2.0 psi. The nitrogen generator system shall have a secondary nitrogen bottle, with a certificate of ownership, mounted in the nitrogen generator system cabinet, and shall have a full 200 lbs of gas. The supply line for the nitrogen tanks shall be a stainless steel flexible pigtail with brass connections (Western Part #PF2-4-

36). The regulator for the nitrogen tanks shall be a Smith Nitrogen Blanketing Regulator (Part #16347-3) or equivalent. Pressure switches indicating high/low tank pressure and low cylinder pressure are to be provided and wired into the SEL-2414. Shut-off valves shall be provided to seal the tank. The nitrogen generator system shall be Waukesha, part number N2GEN-300 or N2GEN-410.

*****Provide Option Pricing for the following:**

The nitrogen control equipment, including regulators, gauges, and associated valving, shall be housed in a **weatherproof, lockable, and corrosion-resistant enclosure**. This enclosure shall be securely mounted on the transformer tank and shall provide **adequate space to accommodate two nitrogen cylinders** with secure brackets or mounts. Two nitrogen bottles shall be provided as part of the delivery, each accompanied by a **certificate of ownership**. The nitrogen supply line shall be a **stainless steel flexible pigtail hose** with **brass fittings**, equivalent to **Western Part #PF2-4-36** or approved equal. All fittings and piping shall be rated for the intended service pressure and compatible with nitrogen gas. The system shall include pressure switches to monitor high tank pressures, low tank pressure, and low cylinder pressures. These pressure switches shall be factory-wired to the **SEL-2414 I/O module** for integration into the station SCADA system. Contact outputs from the SEL-2414 shall be configured for alarm and monitoring functions, as defined by the owner's protection and control scheme.

- X. The transformer shall be built on a channel support system such that the belly of the transformer does not lie on the foundation.
- Y. Stainless steel bolts with silicon bronze nuts shall be used for all bolted connections.
- Z. All hardware shall be stainless steel.
- AA. A device suitable for mounting a safety device in the approximate center of the tank cover and capable of supporting hardware, including harnesses utilizing gravity brakes, shall be provided. The device shall be Pelsue FB-SW3 and shall be welded to the top plate. Safety devices shall meet OSHA 1926.501(b)(1) requirements. MTE's safety harnesses have a 6-foot working radius. Multiple safety devices may be needed to provide coverage for the entire top of the transformer.
- BB. The transformer must be designed to sit on a 16' x 12' or smaller foundation.
- CC. The radiators, control cabinets, and auxiliary items shall be placed per MTE's standard placement design. See Attachment A. Exceptions to this **MUST** be clearly stated in the bid submittal and the proposed locations shown in the bid. MTE, at its sole discretion, retains the right to reject any bid offers and designs not meeting the MTE required locations.
- DD. Two auxiliary 1-1/2" ball valves shall be specified near the top oil and bottom oil as recommended by the Manufacturer exclusively for future online dissolved gas analysis (DGA) sampling.

- EE. An easily accessible, weatherproof, lockable enclosure with adequate space for two gas bottles shall also be supplied as a provision for any sample gases needed for a future online DGA system.
- FF. Bushings, gauges, and other field-replaceable parts shall be accessible through top-of-tank maintenance holes/access points. They shall be replaceable without pumping oil below the windings or removing major components such as internal leads or radiators.
- GG. The transformer will preferably have horizontally mounted maintenance holes. Side-mount maintenance holes below the top oil level will be considered, but must be stated in the bid submittal.
- HH. Provide drawings of all gaskets, seals, and O-rings, with locations for each and material specifications for each, including but not limited to material, hardness/durometer rating, and thermal rating.

IX. Load Tap Changing Equipment

The transformer shall be equipped with LTC equipment, which shall provide plus or minus 10 percent voltage regulation at the low voltage terminals of the transformer in sixteen 5/8% steps above and below rated low voltage.

The LTC shall be the RMVII-2500 from Reinhausen Manufacturing. The LTC shall be vacuum interrupting type rated for 500,000 operations, with capabilities up to 2500 amps continuous (without a series transformer), up to 72.5kV, capable of continuously carrying and switching the maximum load, including any specified overload requirements. It shall be located in the low-voltage winding. Reduced capacity taps, as defined by ANSI/IEEE C57.12.10, are acceptable.

Reinhausen MtraB Maintenance-free dehydrating breather or approved equivalent is required. The MtraB breather error alarm contacts shall be wired into the SEL-2414 for remote annunciation.

The transformer shall be equipped with a microprocessor-based Load Tap Changer (LTC) control system designed to provide reliable voltage regulation and advanced communications capabilities. The LTC system shall be fully compatible with utility SCADA and automation platforms and must support features such as load voltage regulation, tap position monitoring, and transformer paralleling operations. Middle Tennessee Electric (MTE) has standardized on the Beckwith Electric Company LTC control platform, and all LTC systems provided shall conform to this standard.

The LTC control system shall include the Beckwith Electric Company Type M-2001D Digital LTC Voltage Regulator Control (Part Number: M-2001D-6L4S2BFUPBX). This controller shall be mounted on a suitable control cabinet swing panel using the M-2067B Adapter Panel and configured to provide user-selectable paralleling functionality for independent operation or Peer-to-Peer/Master-Follower modes. Communications protocols supported

shall include, at a minimum, DNP3.0, IEC 61850, and Modbus, with connectivity options through Ethernet, serial, and fiber optic ports.

A Beckwith Electric M-2025D Current Loop Interface Module shall be provided. Additionally, the LTC system shall include a Beckwith Electric M-2948 Tap Position Sensor, designed to interface directly with the M-2025D Current Loop Interface Module and RMVII-2500 LTC to provide tap position to the M-2001D controller. An accurate indication of tap position is required for both local monitoring and SCADA integration.

A Beckwith Electric Company or equivalent auxiliary current transformer (ACT) with a 5A:0.2A ratio shall be supplied. This ACT must be capable of reducing measured current to a 200 mA scale and shall be capable of automatically shorting its 200 mA secondary in the event of an unintended open circuit, ensuring system safety and measurement integrity.

The LTC control system shall include local operator controls, consisting of a Raise/Lower switch, a "NORMAL (90)/MANUAL CS" mode selector switch, an LTC tap position indicator, and an electromechanical operations counter. Additionally, the M-2001D shall be wired to receive operation indications. In the NORMAL (90) position, the M-2001D controller shall be enabled to issue automatic control commands to the LTC. When placed in MANUAL CS mode, control voltage shall be redirected to the Raise/Lower switch and disconnected from the 90 relay. Remote/Local and Automatic/Manual control selections shall be operable via control switches on the control cabinet swing panel. Proper grounding of the LTC control shall be ensured using the manufacturer-supplied grounding nut and connection to the transformer control cabinet ground bus. At least one spare terminal block shall be reserved within the control cabinet for future LTC control wiring or expansion.

A Form C LTC lockout alarm contact shall be provided, wired into the transformer's control cabinet, and connected to the SEL-2414 transformer monitor for SCADA alarm indication and status tracking.

The transformer shall be equipped with a preventive autotransformer that is circular wound and rated for a minimum of 1.25% of the main unit current and 1.25% voltage. The autotransformer shall be field-removable for maintenance through a gasketed lid or equivalent means. Any exceptions to this requirement must be clearly stated in the "Exceptions" section of the bid.

The LTC motor drive cabinet shall be mounted such that the center of the cabinet is at an approximate height of six feet above grade, which may require the use of an extended drive shaft to connect to the LTC mechanism.

All LTC equipment, including auxiliary components such as current transformers and interface modules, shall be designed in accordance with ANSI C57.12.10 (latest revision), including Part A, Section 6, and Part B, Section 10. The system shall be appropriately rated and configured to operate reliably under transformer paralleling conditions.

X. Control Cabinet

The control cabinet for the LTC controls shall house auxiliary cooling controls, terminal boards, etc. This cabinet shall be per **Section 6.5 ANSI C57.12.10**, latest revision, and, in addition, shall have:

- A. A control cabinet of dual door dead-front construction made of heavy-gauge cold-rolled steel or stainless steel with stainless steel hinges, a 3-point latching system, and a bottom breather. The cabinet's exterior shall be coated to match the transformer, and the interior and all doors and panels shall be protected with durable white paint. The door shall have a storage compartment for the instruction manual and drawings.
- B. All switches, controls, relays, etc., shall be placed on a swing-out panel or panels. All open wiring (terminal blocks, etc.) shall be behind these panels. The swing-out panels shall be able to be secured in the open position.
- C. A lamp with a door-operated switch for cabinet illumination.
- D. Thermostatically controlled strip heater to prevent condensation in the cabinet. PTC heaters are acceptable.
- E. Hinged doors, which can be secured in the open position.
- F. The control cabinet shall be grounded and provide a copper ground bus that connects a No. 2 AWG copper cable to an external ground. All internal ground connections shall be brought to this ground bus.
- G. All devices shall be identified with a nameplate corresponding to the Manufacturer's drawings. The nameplate shall be fastened with at least two stainless steel screws. Adhesive nameplates are not acceptable.
- H. All necessary terminal boards shall be provided. Terminal boards shall be General Electric Type EB-25, except when larger terminals are required for the AC and DC supplies. The terminal block for the AC source shall be capable of receiving a No. 2 aluminum or copper wire. Internal wiring shall not be smaller than #14 AWG. All wiring shall be type SIS extra flexible copper and shall be constrained within wiring troughs to the extent possible. Screw-type terminals with barriers and marking strips shall be provided. Seamless UL-listed ring-type connectors shall be used. No more than two wires shall be connected at one point. All relay or device contacts shall be brought to the terminal boards for external connection. Terminal blocks shall provide at least 10% spare terminals.
- I. Short-circuiting terminal boards for all bushing-type CTs shall be provided in this cabinet. A provision shall be available to ground the CTs when shorted by the shorting screws. Either the shorting bar shall be permanently grounded, or an additional grounded terminal with a shorting screw shall be provided. Short-circuiting terminal boards shall be General Electric Type EB-27 or Marathon equivalent.

- J. A duplex convenience outlet (20 amp) with GFI protection.
- K. The bottom of the control cabinet shall have a removable plate mounted and gasketed on the inside of the cabinet for conduit entrance. The plate shall be at least 6 inches by 12 inches.
- L. Provide 20% extra spare volume to the cabinet for the owner's use.
- M. The LTC operational counter shall be located inside the cabinet.
- N. Shielded cable shall be adequately grounded to the ground bus at one end of the cable only and as close to the "powering source" as possible. The LTC control wiring demonstrated in Attachment B demonstrates proper shield grounding. Additionally, a 2" rigid conduit for communications from the main cabinet to the LTC cabinet shall be installed.

XI. Wiring

- A. Use a minimum size of No. 14 AWG stranded tinned copper conductor, 600 VAC class, type ETFE/FEP insulation for all secondary and control circuits.
- B. Use a minimum size of No. 10 AWG stranded tinned copper conductor, 600 VAC class, type ETFE/FEP insulation for all current transformer secondary circuits.
- C. Use a minimum size of No. 12 AWG stranded tinned copper conductor, 600 VAC class, type ETFE/FEP insulation for all ground circuits. The insulation color shall be green.
- D. Use a minimum size of No. 8 AWG stranded tinned copper conductor, 600 VAC class, type ETFE/FEP insulation for all fan circuits.
- E. Use a minimum size of No. 10 AWG stranded tinned copper conductor, 600 VAC class, type ETFE/FEP insulation for all power circuits.
- F. All wiring shall be permanently labeled using a "To/From-Wire name" method (e.g., 1AA-15/T+). Panduit LJSL series or equivalent labels shall be used.
- G. All wiring shall be rated for its intended use and environment.
- H. All inter-panel wiring shall be connected through terminal block points from each panel. Direct device-to-device wiring between panels is unacceptable.
- I. Terminations shall be made using insulated seamless ring-tongue connectors. Panduit, Thomas & Betts, Burndy, or Amp brand connectors shall be used. Use of any connector that is not UL-listed is unacceptable.
- J. A maximum of two (2) connections per terminal stud shall be followed.

- K. All terminations shall be made with the Manufacturer's suggested crimp tool. All crimp tools shall be tested and certified to the Manufacturer's specification. Wire terminations will be randomly tested upon receipt of the transformer. Failure of more than two (2) terminations may require the Manufacturer to provide an on-site visit to re-check all terminations.
- L. Panel wiring and terminations shall stay clear of the terminal block side(s) designated for field connections.
- M. Use of Panduit-style wireway is permitted. If a wireway is used, a minimum of 15% spare volume shall be provided on the Manufacturer's wireway side. The field cable connection side shall be empty.
- N. Physical wiring diagrams shall utilize a device coordinate method. A tabular method is not acceptable.
- O. Use of wire nuts or splices in the wiring shall not be allowed. All terminations shall be done using a terminal strip and ring-tongue lugs.
- P. Bootlace ferrules shall be used on any control wire entering a Phoenix-type connector or any control wire that does not have an insulated ring-tongue connector.

XII. Current Transformers

- A. Bushing current transformer per **Section 9.8 ANSI C57.12.10** latest revision, multi-ratio relay accuracy class 800 shall be provided as follows:
 - 1. Design A (25kV)
 - A. Two 600/5 ampere, C800 BCTs on each of the H1, H2, and H3 bushings.
 - B. Two 2000/5 ampere, C800 BCTs on each of the X1, X2, and X3 bushings.
 - C. Two 1200/5 ampere, C800 BCTs on X.O. bushing.
 - 2. Design B (13kV)
 - A. Two 600/5 ampere, C800 BCTs on each of the H1, H2, and H3 bushings.
 - B. Two 3000/5 ampere, C800 BCTs on each of the X1, X2, and X3 bushings.
 - C. Two 1200/5 ampere, C800 BCTs on XO bushing.
- B. ANSI-approved 1300/5 ampere winding current transformers shall be included on X1 and X2 for LTC control and top-oil temperature monitoring.
- C. The BCTs shall be wired to terminal boards in the control cabinets for external connection. Short-circuiting terminal blocks shall be provided at each terminal of the BCT leads. BCT terminal boards shall be separate from other circuitry. Use of wire nuts

or splices in the wiring shall not be allowed. All terminations shall be done using a terminal strip and ring-tongue lugs.

XIII. Testing

All factory and field test results shall be submitted to MTE for review. The transformer manufacturer shall coordinate scheduling to allow MTE observation if desired.

Factory Tests

- A. The transformer manufacturer shall schedule and organize visits to the test site for up to two (2) Middle Tennessee Electric (MTE) representatives to observe any pre-tanking or final factory testing. If only one representative is available at a time, the manufacturer shall coordinate multiple visits to accommodate two representatives. MTE must be notified at least two weeks in advance of all testing to allow observation opportunities. Failure to provide adequate notice may result in MTE refusing acceptance of the transformer. All factory test results, including Doble .sfra, .dta, .pdf files, and any other relevant Doble test files, shall be provided to MTE within two weeks following completion of testing.
- B. The transformer shall be fully assembled and tested with all accessories, devices, radiators, bushings, and other components installed as they will be in the field. All wiring, connections, and weldments must be completed in the shop before testing, and no welding shall be performed after factory testing. Use of test jigs, clamps, or fixtures during testing is prohibited. Dielectric and cooling fluids used during testing must be identical to those used in actual field operation (e.g., mineral oil, synthetic esters). Assembly procedures shall conform to the field installation manual. All controls, associated wiring, and accessories shall be fully installed and functionally tested without any temporary modifications.
- C. The following factory tests shall be conducted per the latest applicable standards:
 - Routine tests as specified by IEEE C57.12.90, ANSI C57.12.10 Section 4.8, ANSI C57.12.00 Sections 8.2 and 8.3, and Table 19.
 - Temperature-rise (heat run) test per IEEE C57.12.90 with the transformer fully assembled and filled with the final insulating fluid. Provide infrared thermal images of the transformer's performance.
 - Insulation power factor tests from winding to ground and winding to winding per ANSI C57.12.90 Section 10.10; any value above 0.40% corrected to 20°C requires MTE approval before shipment.
 - Corona test in accordance with IEEE Trial Use Standard 262b, not to exceed 150 μ V at 150% of maximum operating voltage.
 - Partial Discharge (PD) testing on the completed transformer to ensure PD levels are within acceptable limits, per IEEE standards and MTE requirements.

- Core-to-ground and winding-to-winding insulation resistance tests using a 1000-volt megger; minimum acceptable resistance shall be 25 MΩ at 25°C.
- Induced voltage (dielectric withstand) test per applicable IEEE standards to verify insulation integrity under high voltage stress.
- Impulse test to evaluate the insulation system's ability to withstand high voltage transients.
- Leakage Reactance test to measure the transformer's impedance.
- Excitation Current test to measure the excitation current for the specified voltage.
- Dielectric Frequency Response (DFR) test to assess the moisture content and condition of the insulation.
- 24-hour pressure test at 10 psi with radiators installed.
- Sweep Frequency Response Analysis (SFRA) testing per the latest Doble SFRA Connections Guide, including tests in both normal dressed/oil-filled and transit-ready states, with all results, including .sfra files, provided electronically and in hard copy.
- Turns Ratio Test (TTR) to verify the correct winding ratios and integrity of transformer windings.
- DC winding resistance measurements at all tap positions using a low-resistance ohmmeter, ensuring values fall within normal manufacturer limits.
- On-load tap changer (OLTC) functional test and timing to verify operation under load and meet timing requirements.
- Sound level measurement to ensure noise emission complies with applicable standards and specifications.
- No-Load and Load Losses tests to verify efficiency and design parameters.
- Cooling System test to verify the operation and performance of the fans and radiators.
- Oil tests, including Breakdown Voltage (BDV) and Dissolved Gas Analysis (DGA), to verify insulating oil quality before shipment.

Field Tests

- A. After delivery and on-site assembly, the transformer shall be subjected to field testing under the supervision or observation of MTE representatives, who shall be notified in advance. The manufacturer shall provide a detailed list of all proposed field tests in their proposal. Typical field tests shall include, but are not limited to:
 - DC winding resistance measurements at all on-load and off-load tap changer positions, using micro-ohm meters, to verify consistency with factory data.

- Core-to-ground insulation resistance measured onsite using a 1000-volt megger, with minimum acceptable values as defined for factory tests.
- Winding-to-winding and winding-to-ground insulation resistance tests.
- Leakage Reactance test to measure the transformer's impedance.
- Polarity and phase relation verification tests to ensure correct transformer connections.
- Functional testing of tap changers, protection devices, and accessories to verify operational readiness.
- Final Sweep Frequency Response Analysis (SFRA) testing after onsite assembly, including bushings installation and oil filling, with all related test files (.sfra, .pdf, etc.) provided to MTE. These results shall be compared with factory and transit-ready results. Any significant discrepancies shall be investigated and explained by the manufacturer.
- Power Factor and Capacitance tests on windings and bushings.
- Turns Ratio Test (TTR) to verify the correct winding ratios and integrity of transformer windings.
- Oil quality tests, such as moisture content, Breakdown Voltage (BDV), and DGA on oil samples taken after filling and initial operation.
- On-site induced voltage withstand tests, if required, to verify dielectric integrity post-installation.
- Any additional tests deemed necessary by MTE or required by site conditions.

Three (3) sets of full-color photographs, minimum 12 MP, JPG format, shall be provided electronically with the test report, including, at a minimum, the following:

- The completed core/coil assembly just after vapor phasing – one photo of each quadrant and one looking down onto the assembly.
- The core/coil assembly just after tanking, before placement of the cover – one photo from each side and end looking down at the clearances between the tank and the assembly.
- The fully assembled transformer on the test floor – one photo of each quadrant and one looking down onto the cover and bushings.

XIV. Fault Current Strength

The Manufacturer will be required to demonstrate adequate short circuit strength by a short circuit test performed on similar units or by an experience record that the transformer meets the requirements of **IEEE C57.12.00 Section 7**, latest revision. Data shall be submitted with the bid proposal as described in **RUS Bulletin 1742E-300**. The transformer shall be

capable of withstanding a bolted fault from an infinite bus. The only limitation to the through-fault current shall be the impedance of the transformer.

XV. Supplemental Loading

The transformer shall be capable of carrying supplemental loadings as recommended by ANSI "Guide for Loading Oil Immersed Distribution and Power Transformers" **C57.92** - latest edition and **NEMA Standard TR-58** - latest edition. Ancillary components and other construction features (cables, bushings, tap changers, oil expansion space, etc.) shall be supplied so that they, in themselves, will not limit the loading to less than the capability of the windings.

XVI. Gasketing Requirements

Gasketed joints at bushings, maintenance holes, hand holes, and compartment doors shall be made so that the gaskets will be installed in machined gasket retaining recesses and provided with metal-to-metal stops to control the compression of the gaskets. Gaskets shall be unaffected by hot (115 °C) insulating oil, retain their resiliency during the life of the associated equipment, and be unaffected by weather while maintaining oil and gas tightness. All gaskets for the main tank, LTC tank, or conservator shall be retained in a machined, compression-limiting groove. Acceptable gasket materials shall be rated for at least 150°C continuous operations and be thermally stable, retaining their elastomeric properties indefinitely at this temperature. They shall be unaffected by normal transformer dielectric fluids. Viton-a or approved equivalent is acceptable; neither nitrile, buna-n, nor coprene is acceptable.

XVII. Oil and Oil Handling Provisions

The transformer oil shall be Petro-Canada Luminol or Exxon Univolt type fluid with high paraffinic content. The transformer shall be filled to the normal operating level. According to the latest EPA regulations, the oil shall be certified Non-PCB and shall be in compliance with all applicable ANSI standards.

The Manufacturer shall furnish Field supervision of assembly. Filling the transformer will include heat, vacuum, and filtering. The oil temperature will be raised to a minimum of 50°C upon entry into the transformer tank.

VACUUM PROCESSING AND HOT OIL FILLING shall conform, as a minimum, to the recommendations of IEEE C57.93, latest edition. In particular, after determining a minimum leak rate as defined in that standard, minimum vacuum hold times shall be as stated below. Before oil filling, the Manufacturer shall ensure that the transformer's moisture content is less than 0.5%. If oil filling is done during cold weather, hot oil recirculation to heat the core/coil shall be done before the actual oil filling. Heated oil shall be introduced under vacuum through an upper filter press connection on the cover of the transformer diagonally opposite the vacuum connection.

Vacuum Hold Criteria

- Vacuum level: < 1mm Hg
- Vacuum Hold Time (Hrs): 48 Hours or more.

XVIII. Loss Evaluation

Transformer losses shall be capitalized according to the following formula:

$$E = 1.18 P + 3578 \text{ KWL} + 7155 \text{ KWN} + 1342 \text{ KWA}$$

Where E is the final comparative price

P is the quoted price

KWL is the load-loss less at the rated voltage in KW

KWN is the no-load loss at the rated voltage in KW

KWA is the auxiliary-load loss at the rated voltage in KW (Stage 1 + Stage 2)

XIX. Loss Penalty

If the actual transformer tested losses are greater than the guaranteed transformer losses specified in the bid submittal by the Manufacturer in any category, the Manufacturer would be penalized accordingly: The penalty will be the difference between the actual tested loss and the calculated bid loss in each particular category using the loss evaluation formula above. The difference will be credited toward the purchase price of the transformer.

XX. Performance Specification

The transformer's performance specification is to be furnished with the quotation.

XXI. Coating System

- A. All coatings shall be applied inside an environmentally controlled (air quality, temperature, and humidity) paint booth with ventilation and filtration provisions in full EPA compliance and in accordance with the coating manufacturer's requirements.
- B. All exterior and interior surfaces shall be thoroughly cleaned before coating application per the coating Manufacturer's recommended practice.
- C. Provide Touchup paint - (1) gallon plus non-skid additive.
- D. The top of the main tank and LTC compartment shall be a non-skid coating.
- E. The base and underside of the main tank shall be sprayed with an undercoat.

- F. Coating system paint shall meet all the coating requirements of IEEE C57.12.28. Additionally, before coating application, the tank shall be prepared by steel shot blasting and be free of all weld slag, grease, oil, and corrosion.
- G. The primer coat shall be a zinc-rich epoxy of 2.5 mils minimum dry thickness. The topcoat shall consist of two coats with a 2.5 mil minimum dry thickness. Total coatings shall be a minimum of 5 mils.
- H. The coating system test results shall be certified (from in-process, Manufacturer's samples) by independent laboratory tests performed under ASTM criteria. *Copies of the test results and certification shall be submitted for review.*
- I. Corrosion Resistance (Salt spray): Must pass a minimum of 150 hours per ASTM-B117.
- J. The transformer shall be painted outdoor light gray, ANSI Standard #70. The inside of the transformer tank shall be painted white.

XXII. Guarantee and Warranty

The Manufacturer shall warranty the transformer, including all equipment and work performed, against defects in material and quality for **five (5)** years after the transformer is successfully put in service (not to exceed **five and one-half (5.5)** years after successful installation).

XXIII. Shipment

Mineral oil-filled transformers may be shipped oil-filled (with a dry air blanket) or dry air-filled by truck. The Manufacturer shall provide the dew point reading just before shipment, and a dew point reading shall be taken just before unloading. In all cases, the dew point, corrected for temperature, shall be less than -50°C.

All items shall be delivered simultaneously: the main tank and all radiators, bushings, and accessories.

A 3-axis impact meter shall be directly attached to the transformer to record its shipment to the site. The impact meter shall have the ability to be tracked via GPS, and MTE provided a website login to track the transformer and associated impact meter readings. MTE retains the right to refuse any transformer should its impact meter reading be at an unacceptable level upon delivery to the site. No railcar shipments are allowed. The "with oil" and "without oil" center of gravity marks shall be permanently labeled on the transformer.

All items shall be carefully packaged and fully protected during shipment. Each item shall be clearly identified on the bill of lading, and each container shall be labeled externally with its contents. Internal to any crates, each item shall be clearly identified and packaged to

prevent any shipping damage. The main tank and all accessories shall be delivered simultaneously. Bushings shall be fully encased and protected; HV bushings shall be shipped at a slight incline relative to horizontal, each bushing in its own crate.

XXIV. Delivery

The price is to include FOB pad to MTE's substations, which are TBD at a later date. The actual delivery locations are subject to change within MTE's service territory as needed within the Middle TN region.

Transformer dress-out and testing shall occur within two (2) weeks of transformer delivery onsite. Liquidated Damages will be \$250 per day for each day late unless an extension is agreed upon in writing. The transformer manufacturer shall supply a guaranteed delivery date that shall only be altered in the event of an Act of GOD or war. Bid acceptance will be partially based upon the Manufacturer's delivery schedule.

The transformer manufacturer is responsible for offloading all items shipped to the site and providing all necessary personnel and equipment needed for this task. MTE shall be given a 72-hour notice of shipment before the transformer leaves the factory. The transformer manufacturer shall provide the shipper and oil tanker with exact directions to the site before leaving the factory. Last-minute, weekend, early morning, or late-night calls will not be answered for directions to the site. It is the responsibility of the transformer manufacturer to inspect the site for delivery to ensure that the proper equipment is provided for setting the transformer. If crane companies need access to the site for pricing, please call to make an appointment to see the site. A two (2) day notice is required for an appointment.

A timeline for dress-out and testing shall be provided before delivery. Contact information for the crew conducting this work will be provided with the timeline. Dress-out will occur no later than two weeks after delivery. Failure to adhere to the offered timeline will result in Liquidated Damages as above.

ATTACHMENT A

