

**GREENVILLE UTILITIES COMMISSION
GREENVILLE, NORTH CAROLINA**

**SPECIFICATIONS AND BID DOCUMENTS FOR
230 KV AUTOTRANSFORMER FOR
GREENVILLE POD NO. 3**

ISSUED FOR BIDS



12/18/15

Booth & Associates, LLC
Consulting Engineers
5811 Glenwood Avenue, Suite 109
Raleigh, North Carolina 27612
Firm License No. F-0221

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**GREENVILLE UTILITIES COMMISSION
GREENVILLE, NORTH CAROLINA**

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GREENVILLE POD NO. 3**

TABLE OF CONTENTS

REQUEST FOR PROPOSAL

Notice to Prospective Bidders.....	N-1
Definitions	D-1
Instructions to Bidders	IB-1
General Conditions	GC-1

FORM OF PROPOSAL

Terms and Conditions.....	P-2
Bid Schedules	P-4
Supplementary Information	P-5
Affidavit of Bidder	P-6
Form of Exceptions.....	P-7
Bid Bond.....	P-8
E-Verify Compliance.....	P-9
Addenda / Clarifications / Manufacturer’s Material / Equipment Specifications.....	P-11

TECHNICAL SPECIFICATIONS

1.0	Scope	S-1
2.0	General Conditions	S-1
3.0	Special Conditions	S-1
4.0	Standards	S-2
5.0	Shipping of Transformers	S-2
6.0	Manufacturer’s Field Representative.....	S-3
7.0	Transformer	S-4
8.0	Additional Features.....	S-16
9.0	Tests.....	S-17
10.0	Guarantees	S-20
11.0	Transformer Bid Evaluation	S-20

APPENDICES

1. Typical Current Transformer Arrangement for Power Transformers
2. Power Transformer Neutral Support Bracket Detail
3. Typical AC Circuit & Alarm Connections
4. Vicinity Map

NOTICE TO PROSPECTIVE BIDDERS

Sealed Proposals for the furnishing and delivery of all materials and equipment (except materials and equipment specified to be furnished by the Owner) complete and conforming to the bid documents for a 230 kV Autotransformer for the Greenville POD#3, as set forth in the Bid Schedules, will be received by Greenville Utilities Commission (hereinafter referred to as the Owner) at the offices of the Buyer II, Greenville Utilities Commission, 401 S. Greene St, Greenville, North Carolina 27834, on or before **2:00 PM, local time, Wednesday, January 27, 2016**, at which time the Proposals will be opened and read. Any Proposal received subsequent to that time will be promptly returned to the Bidder unopened. **Bids submitted in a fax or e-mail in response to this Invitation for Bids will not be acceptable. All questions concerning this bid must be received by January 15, 2016.**

Instructions for submitting bids and complete specifications will be available in the Office of the Buyer II, Greenville Utilities Commission, 401 S. Greene Street, Greenville, North Carolina during regular office hours, which are 8:30AM – 5:00PM Monday through Friday. Greenville Utilities Commission reserves the right to reject any or all bids.

Each bidder must submit a proposal on the enclosed bid forms. **The bid must be signed by an authorized official of the firm. Return only the attached Proposal Form. Do not return the Advertisement for Bids, Instructions to Bidders or Specifications.**

Bids must be in sealed envelopes clearly marked on the outside with the name of the bid and the bid opening date and time. Bid shall be addressed to BUYER II, GREENVILLE UTILITIES COMMISSION, 401 S. GREENE STREET, GREENVILLE, NORTH CAROLINA, 27834.

Bids will be opened promptly and read at the hour and on the date set forth in the advertisement in the Office of the Buyer II, Greenville Utilities Main Office, 401 S. Greene Street, Greenville, North Carolina. Bidders or their authorized agents are invited to be present.

Prior to the submission of the Proposal, the Bidder shall make and shall be deemed to have made a careful examination of the bid documents on file with the Owner and with the Engineer and of all other matters that may affect the cost and the time of the work.

The name and address of the Bidder, its license number (if a license is required by the State), and the following description must appear on the envelope in which the Proposal is submitted:

**PROPOSAL FOR 230 kV AUTOTRANSFORMER
FOR GREENVILLE POD NO. 3
NOT TO BE OPENED UNTIL
2:00 PM, WEDNESDAY, JANUARY 27, 2016"**

Each Proposal shall be accompanied by cash, cashier's check, or certified check drawn on a bank insured with the Federal Deposit Insurance Corporation or the Savings Association Insurance Fund, payable to the Owner, in an amount not less than five percent (5%) of the total bid as a guarantee that a Contract, if awarded, will be accepted. In lieu thereof, a Bid Bond may be submitted by the Bidder in an amount not less than five percent (5%) of the total bid (see attached Bid Bond form). The total bid price for which the five percent (5%) applies shall be the total of all schedules.

The Owner reserves the rights to (1) 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 prior to its acceptance by the Owner; (2) reject any or all Proposals and to hold any or all Proposals for a period of sixty (60) days from the date of opening thereof; (3) accept the bid, in its opinion, that represents the lowest responsible, responsive bid from the standpoint of quality, performance, delivery and price; and (4) award Contracts to Bidder(s) for any Schedule(s) individually or collectively from the Bid Schedules.

**GREENVILLE UTILITIES COMMISSION
GREENVILLE, NORTH CAROLINA**

By: Anthony C. Cannon Date: _____
General Manager / CEO

DEFINITIONS

Whenever the following terms or pronoun in place of them are used in these "Instructions to Bidders", "Form of Proposal", "Technical Specifications", "Contract", bond, etc., the intent and meaning shall be interpreted as follows:

Owner	Greenville Utilities Commission Greenville, North Carolina
General Manager / CEO	Anthony C. Cannon
Consulting Engineer	Booth & Associates, LLC
Observer	An authorized representative of the Owner assigned to make any or all necessary observations of work performed and equipment and/or apparatus furnished by the Bidder
Bidder	Any individual, firm, or corporation submitting a Proposal for the work contemplated, acting directly or through a duly authorized representative; or party of the second part of the Contract, acting directly or through a duly authorized representative
Subcontractor	An individual, firm, or corporation who contracts with the Bidder to perform part of the latter's Contract
Surety	The body, corporate or individual, approved by the Owner, which is bound with and for the Bidder who is primarily liable and which engages to be responsible for his acceptable performance of the work for which he has contracted
Form of Proposal, Proposal	The approved, prepared form on which the Bidder is to submit or has submitted his Proposal for the work contemplated
Bid Security	To all bids there shall be attached cash, cashier's check, or certified check from the Bidder upon a bank or trust company insured by the Federal Deposit Insurance Corporation or the Savings Associates Insurance Fund, or in lieu thereof, a Bid Bond
Plans, Drawings	All Drawings or reproductions of Drawings pertaining to the construction under the Contract
Technical Specifications	The directions, provisions, and requirements contained herein pertaining to the method and manner of performing the work or to the quantities and qualities of materials to be furnished under the Contract
Contract	The agreement covering the furnishing of equipment and/or apparatus and the performance of the work. The Contract shall include the "Instructions to Bidders", "General Conditions", "Form of Proposal", "Plans", "Technical Specifications", and Acknowledgments
Performance Bond (Not Required)	The approved form of security to be approved by the Owner furnished by the Bidder and his Surety as a guarantee of good faith on the part of the Bidder to accept the work in accordance with the terms of the Specifications and Contract

**Payment Bond
(Not Required)**

The approved form of security to be approved by the Owner furnished by the Bidder and his Surety as a guarantee for payment of all Subcontractors on the part of the Bidder in acceptance of the work in accordance with the terms of the Specifications and Contract

Work

The performance of the project covered by the Specifications or the furnishing of labor, machinery, equipment, tools, or any other article or item being purchased by the Owner

Emergency

A temporary unforeseen occurrence or combination of circumstances which endangers life and property and calls for immediate action or remedy

Work at Site of Project

Work to be performed, including work normally done on the location of the project

Bid Documents

Include all sections of the Request for Bids, Form of Proposal, Technical Specifications and Appendices, Addendum/Clarifications/Bulletins, and Drawings

The subheadings in these Specifications are intended for convenience or reference only and shall not be considered as having any bearing on the interpretations thereof.

INSTRUCTIONS TO BIDDERS

1.0 Bidder Qualification

- 1.1. Bids will be accepted only from Bidders deemed by the Owner or the Engineer to be qualified to provide the materials, equipment, and services described by these Specifications. The experience of Bidders in providing the same or similar materials, equipment, and services will be a major factor in determining qualification. The Bidder shall include information to establish qualifications.
- 1.2. Prospective Bidders who wish to submit a bid, but are not presently qualified, may receive consideration by submitting a completed Bidder's Qualification Form, which requires product line and user list, to the Engineer at least ten (10) days prior to the specified bid opening date and time. The Bidder's Qualification Form may be obtained from the Engineer.

2.0 Proposals

- 2.1. To warrant consideration, Proposals must comply with these instructions. Strict adherence to these Specifications and Drawings is requested to facilitate review and consideration of the Proposal.
- 2.2. Bids not received on Booth & Associates, LLC Form of Proposal contained herein will be considered unresponsive. The forms shall be filled out complete; any omissions may cause the entire Proposal to be rejected.
- 2.3. Proposals must be made on the Form of Proposal provided herein and must not be altered, erased, or interlined in any manner. The Bidder shall fill in the Form of Proposal as detailed in the Terms and Conditions. The Bidder may retain one (1) copy, but the original, fully executed, must be inserted in or attached to the Bid Documents. Also, one (1) additional copy of all executed forms and supporting information shall be supplied.
- 2.4. The Bidder shall furnish certain information, as required by the Bid Documents regarding the equipment on which he is bidding. Two (2) copies of the information, together with the manufacturer's literature setting forth the guarantees and describing the equipment on which he is bidding shall be included as part of the Proposal. If one manufacturer is bidding through two or more agents or representatives, descriptive literature, guarantees, etc., may be submitted in duplicate in one sealed envelope, which will be considered and treated as though it contained a sealed bid. This envelope shall contain a list of the names of Bidders to whom the information applies. Each sealed Bid Proposal without this information shall state the name of the manufacturer who is furnishing the information. Additional sets of the Specifications may be obtained upon a payment of Fifty Dollars (\$50) non-refundable deposit by approved Bidders.
- 2.5. Bids may be modified by the Bidder's removal of his original and the submittal of a completely revised bid package in full compliance with the Bid Documents if received prior to the time of opening bids and if included in the public reading of such bids. No oral or telephonic Proposals will be considered.
- 2.6. Proposals shall include a Form of Exceptions utilizing forms provided which shall itemize each and every exception from the Bid Documents. The Form of Exceptions shall state the section, subsection, and paragraph designations from the part of the Specifications to which exception is taken and explain in detail the nature of the exception. A copy of this Form of Exceptions is included in the Form of Proposal. Exceptions will not necessarily eliminate a Bidder from consideration, even if bids without exceptions are received from others. The treatment of exceptions will be based entirely on the overall best interests of the Owner. **Certain exceptions, e.g., failure to provide rigging and unloading at the site, or failure to properly provide field assembly on testing may result in the entire Bid Proposal being rejected.**
- 2.7. Should the Bidder find discrepancies in the documents or fail to understand their meaning, he shall immediately notify the Engineer, who will send written instructions to

all Bidders. Neither the Owner nor the Engineer will be responsible for any oral instructions.

- 2.8. The Bidder shall be the manufacturer of the equipment, or the Bidder shall submit with the Form of Proposal a notarized statement that the Bidder is authorized by the manufacturer to tender the Proposal as submitted and that the manufacturer will guarantee the suitability and adequacy of the equipment proposed, and will be bound by the Specifications, as though the manufacturer had submitted the Proposal.
- 2.9. In the event that the Bidder proposes any change or deviation from the Engineer's Plans and Specifications, such Proposal changes or deviations must be submitted at the time bids are opened. The Owner reserves the right to reject any such proposed changes or deviations. All exceptions must be stated on the Form of Exceptions. Failure to submit a Form of Exceptions will imply strict adherence to the Plans and Specifications.
- 2.10. No Bid Proposal may be withdrawn after the scheduled closing time for the receipt of bids for a period of sixty (60) days pending the execution of a Contract by the successful Bidder. Should the successful Bidder default and not accept a Contract, then the Contract may be offered to the next lowest responsible, responsive Bidder whose Proposal is evaluated as acceptable
- 2.11. The Contract, when accepted, shall be deemed to include the Specifications for the equipment, and the Bidder shall not claim any modification thereof resulting from any representative or promise made at any time by an officer, agent, or employee of the Owner or by any other person.
- 2.12. Firm quotations should be based upon placement of an order within sixty (60) days from bid date.
- 2.13. The Owner reserves the right to select or reject any or all schedules, adders, or deducts (or combination thereof) listed in the Form of Proposal. Base quotations for the transformer shall include the risk of delivery to the site.
- 2.14. The Owner will provide reasonable roadway access to the sites.
- 2.15. Exceptions taken to the testing performed as outlined above may result in rejection of the Bidder's proposal.

3.0 Bid Security

- 3.1. Each Proposal shall be accompanied by a cash deposit, cashier's check, or certified check drawn on a bank or trust company insured by the Federal Deposit Insurance Corporation or Savings Association Insurance Fund, or a Bid Bond in an amount not less than five percent (5%) of the Proposal. The Owner will retain said deposit as liquidated damages in the event of failure of the Successful Bidder to execute the Contract within ten (10) days after the award.
- 3.2. Bid Bond shall be conditioned that the Surety will, upon demand, forthwith make payment to the Obligee upon said Bond if the Bidder fails to execute the Contract in accordance with the Bid Bond, and that upon failure to forthwith make payment, the Surety shall pay to the Obligee an amount equal to double the amount of said Bond.
- 3.3. Only one (1) bid security is required, the amount of which shall be based on the total amount of the bid. The value for the bid security shall be based on the Bid Schedule of maximum total amount.

4.0 Performance Bond/Payment Bond

A Performance Bond/Payment Bond is not required for this project.

5.0 Bulletins and Addenda

Any bulletins or addenda to the Specifications issued during the time of bidding are to be considered covered in the Proposal, and in executing a contract, they will become a part thereof.

Receipt of addenda shall be acknowledged by the Bidder on the Form of Proposal.

6.0 Award of Contract

- 6.1. The Award of Contract will be made to the lowest responsible, responsive Bidder as soon as practical, provided that in the selection of materials and equipment a Contract may be awarded to a responsible Bidder other than the lowest in the interest of standardization, or ultimate economy if the advantage of such standardization or ultimate economy is clearly evident. The Owner reserves the right to reject any and all bids.
- 6.2. 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. The Owner must correct any such irregularities or errors so waived on the Proposal prior to its acceptance.
- 6.3. Timely delivery of the transformers is an essential part of the evaluation process for an award of a contract. The Bidder is requested to meet the delivery schedule as outlined in the specification, and provide details of the time frame in the Form of Proposal utilizing calendar days after receipt of a contract.
- 6.4. 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 prices quoted in the Proposal, the following:
 - a. Cost of Ownership, including financing and losses for the power transformer
 - b. Equipment delivery date
 - c. Transformer core and winding losses
 - d. Adherence to the Plans and Technical Specifications
 - e. Suitability of materials and equipment
 - f. Firm prices
 - g. Additional extended warranty
 - h. Standardization of equipment.
 - i. Accessibility of service facilities and personnel
 - j. History of delivery performance for past twelve months
 - k. History of prior equipment performance
 - l. Guaranteed PCB dielectric level

7.0 Approval Drawings

- 7.1. Before proceeding with fabrication, the manufacturer shall submit for approval sufficient Drawings to demonstrate that all parts conform to the requirements and intent of the Specifications.
- 7.2. Approval of Drawings shall not be held to relieve the manufacturer of obligations to meet all requirements of the Specifications, of responsibility for correctness of the Drawings, or responsibility to meet original shipping promise on basis of customer's being allowed three (3) weeks for approval. Receipt of Approval Drawings by the Bidder constitutes authorization for manufacture only, based upon corrections found thereon.
- 7.3. Receipt of Approval Drawings by the Bidder constitutes authorization for manufacture predicated upon the Drawings and corrections found thereon. After the return of Approval Drawings, release for shipment is to be granted by either the Owner or its Engineer, based upon the Manufacturer's compliance with the following:
 - a. Three (3) weeks prior notification of tests, so the Owner may have representatives present for witness of the tests.
 - b. Thirty (30) days notification of tentative shipping schedule and forty-eight (48) hours notification prior to delivery.
- 7.4. Electronic transmittal of approval drawings is preferred

- 7.5. Each sheet of each set of Drawings shall be labeled with Greenville Utilities Commission and the appropriate substation name in addition to other identifying information.
- 7.6. Approval Drawings shall be submitted directly to the Owner's Engineer, Booth & Associates, LLC, 5811 Glenwood Avenue, Suite 109, Raleigh, North Carolina 27612, Attention: Michael L. Clements, PE (ClementsML@Booth-Assoc.com).

8.0 Outline Drawings

The Outline Drawings shall show dimensions of equipment, including bushings, radiators and cooling equipment, base, and all other important external features. These Drawings shall show weights, bushings, catalog numbers, and ampere ratings, description of top bushing terminals, and arrangement of all external accessory devices. All Drawings submitted shall be a minimum of a "D" (24" x 36") size print. Submittal of Drawings smaller than "D" size will be immediately returned stamped "not approved" and proper size Drawings will have to be submitted. All dimensions shall be stated in inches or feet and inches.

9.0 Final Drawings

- 9.1. Contingent upon Approval Drawing review and product manufacture, the Bidder shall issue final documentation for the transformers as follows:
 - a. One (1) complete set of all Drawings, revised to "as-built" status, released on paper media.
 - b. Two (2) complete sets of all Drawings, revised to "as-built" status, released on two (2) separate CD-ROMs, compatible with AutoCad®, Release 2010.
 - c. Five (5) copies of applicable instruction books, including one (1) print each of all Drawings representing physical and electric details as furnished per these instructions.
 - d. Two (2) copies of certified test reports corresponding to functional performance measurements after final assembly.
 - e. All Drawings are to be certified correct and supplied within a reasonable length of time prior to shipment of the equipment. Each set of Drawings and documentation shall include the following information:
 1. Outline and Assembly Drawings showing size and location of major components and all principal dimensions.
 2. Control cabinet front view.
 3. Details of bushing and bushing terminal connectors.
 4. Diagram of bushing current transformers, connection, number of turns, polarity marking, ratios, and bushing orientation.
 5. Current transformer performance characteristic curves and data for all relay accuracy CTs.
 6. Details of control housing.
 7. Panel connection diagram showing exact connection for all components furnished.
 8. Ac and dc elementary circuit diagrams for all relay and control equipment furnished.
 9. Wiring control and schematic diagrams.
 10. Instruction books, including LTC operations manual(s), if applicable.
 11. Renewal parts catalog.
 12. Two (2) copies of certified test reports.
 13. Nameplate datasheet

10.0 Shipment and Delivery

- 10.1. Time is of essence with respect to all deliveries under this Agreement. A Delivery Schedule is included in the *Form of Proposal* on which the Bidder shall indicate the delivery schedule for his materials and equipment. Strict adherence to the quoted delivery schedule is expected. Furthermore, the Bidder shall match his scheduled deliveries to the schedule preferred by the Owner if noted in the *Form of Proposal*.
- 10.2. The prices quoted shall include delivery of the equipment F.O.B. Point of Delivery to the substation site and unloading onto a permanent concrete pad (or temporary arrangement of timbers supplied by the Owner). The Bidder is responsible for all highway permits and associated fees from point of origin to the site. Refer to Vicinity Map in *Appendices* for station site location. The substation is located at 2646 Mills Rd., Greenville, NC 27858.
- 10.3. The Bidder shall include the cost for complete rigging, and setting in place, utilizing a hydraulic crane of at least twice the capacity of the weight of the transformer. Bidder shall provide any necessary top-off oil, all equipment required to add oil, and complete assembly.
- 10.4. The transformer shall be shipped by truck or rail and shall be oil-filled (if possible) with the low-voltage bushings installed unless clearly stated otherwise by the Bidder at the time of the bid. If oil-filling is required subsequent to delivery, the Bidder shall be responsible for all labor, equipment and oil necessary to refill the unit on site.
- 10.5. Delivery of all items of equipment shall be made at such time as to permit unloading between the hours of 9:00 a.m. and 3:00 p.m., Monday through Thursday, holidays excluded. Ultimate delivery shall be at the discretion of the Owner. All components for the transformer shall be delivered at one time.
- 10.6. Coordinated shipment shall be made to reduce storage by the Owner and to facilitate the accumulation of component parts. Small partial shipments at scattered times will not be acceptable. In the event that delays occur, the Bidder shall be responsible for all shipping demurrage unless such delays are caused solely by the Owner.
- 10.7. All oil-filled materials and equipment shall be certified in writing and by permanently-affixed nameplates to have a non-detectable level of PCB dielectrics, i.e., less than 2 ppm, in compliance with Federal Register (44FR31514), May 31, 1979.
- 10.8. Proposals shall include the following:
 - a. Catalog numbers, manufacturer, ratings, characteristics, types, sizes, etc., of all materials and equipment included. A simple statement that all necessary materials and equipment will be provided is not satisfactory.
 - b. Performance data for the specified item(s) as set forth in the *Technical Specifications*.
 - c. The Bidder shall state in his Proposal the manner in which the transformers will be shipped--namely, truck or rail; whether units shall be oil-filled or dry-air-filled; and whether bushings will be installed or removed.
 - d. Prices shall include the cost of delivery to the substation site, unloading, and complete dress-out / installation as per Instructions to Bidders. A vicinity map is included in the appendices.

11.0 Manufacturer's Field Representative

The manufacturer shall provide (and include in his base bid) the services of a Field Service Engineer for the necessary time required to offload, assemble, and test each unit. The manufacturer is responsible for all travel time. The duties of the Field Service Engineer shall include supervising installation of component parts removed for shipment and field testing.

Additional time required shall be provided at the per-day rate quoted in the Bidder's Proposal. The same rate shall apply as a deduct for any days included in the base bid that are not used.

The manufacturer's representative will perform a number of field tests, draw oil sample(s) from the units, and be responsible for conducting both an ASTM dielectric test and a dissolved gas test. Reports shall be mailed in duplicate to the Owner and the Owner's engineer for reference. Exceptions taken to the testing performed as outlined above may result in rejection of the Bidder's proposal.

12.0 Short Circuit Testing

The Bidder shall furnish evidence of short circuit testing on similar units having the same basic ratings and designs. Short circuit tests shall comply with appropriate IEEE regulations.

13.0 Payment

13.1. Payment by the Owner of ninety (90) percent of the purchase price to the Successful Bidder shall be made in a lump sum following delivery and verification that the equipment meets the *Technical Specifications*. Compliance to *Technical Specifications* shall be verified within ninety (90) days of the date of delivery.

13.2. There shall be a ten-percent (10%) retainage on invoices until all equipment, with proper instruction books per Specifications, and certified test reports have been approved and accepted by the Owner and the Engineer. The Owner reserves the right to hold this retainage for a period of up to ninety (90) days without penalty to verify completeness of delivery. A ten-percent (10%) Performance Bond may be provided in lieu of retainage provisions. Deviation from the foregoing payment provisions will be considered less than responsive.

13.3. Invoices shall be submitted in triplicate to the Engineer for review and approval. The address for submittal of all invoices is: Booth & Associates, LLC, 5811 Glenwood Avenue, Suite 109, Raleigh, North Carolina 27612, Attention: Michael L. Clements, PE (ClementsML@Booth-Assoc.com)

14.0 Transformer Energization or In Service Date

14.1. The transformer energization or in service is scheduled on December 2017.

GENERAL CONDITIONS

1.0 Drawings and Specifications

The Drawings and Specifications are complementary, one to the other. That which is shown on the Drawings or called for in the Specifications shall be as binding as if it were both called for and shown. The intention of the Drawings and Specifications is to include all labor, materials, transportation, equipment, and any and all other things necessary to do a complete job. In case of discrepancy or disagreement in the Contract Documents, the order of precedence shall be: Purchase Order, Technical Specifications, Large-Scale Detail Drawings, Small-Scale Drawings.

2.0 Clarifications and Detail Drawings

In cases where the nature of the work requires clarification by the Engineer, such clarification shall be furnished by the Engineer with reasonable promptness by means of written instructions or Detail Drawings or both. Clarifications and Drawings shall be consistent with the intent of Purchase Order Documents and shall become a part thereof.

3.0 Copies of Drawings and Specifications

The Engineer will furnish free of charge to the Bidder one (1) copy of Plans and Specifications. Additional copies may be obtained from the Engineer for a fifty-dollar (\$50.00) non-refundable payment.

4.0 Ownership of Drawings and Specifications

All Drawings and Specifications are instruments of service and remain the property of the Engineer whose name appears thereon. The use of these instruments on work other than this Purchase Order without permission is prohibited. All copies of Drawings and Specifications other than Purchase Order copies shall be returned to the Engineer upon request after completion of the work.

5.0 Royalties, Licenses, and Patents

It is the intention of the Bidding Documents that the work covered herein will not constitute, in any way, an infringement on any patent whatsoever. The Bidder shall protect and save harmless the Owner against suit on account of alleged or actual infringement. The Bidder shall pay all royalties and/or license fees required on account of patented articles or processes, whether or not the patent rights are evidenced hereinafter.

6.0 Uncorrected Faulty Work

The Bidder shall be notified of faulty or damaged work and shall have the option to respond in a reasonable period of time. Should the correction of faulty or damaged work be considered inadvisable or inexpedient by the Owner or the Engineer, the Owner shall be reimbursed by the Bidder for the same by a deduction in the Contract prices arrived at by a fair estimate of the probable cost of connection, approved by the Engineer.

7.0 Liquidated Damages

The Bidder shall commence manufacture upon issuance of a Contract from the Owner, and shall fully complete delivery as per the Delivery Schedule in the *Form of Proposal*. For each day in excess of the proposed dates, the Bidder shall be made payable to the Owner the sum of five hundred dollars (\$500.00) as liquidated damages (and not as a penalty), reasonably estimated in advance to cover the losses to be incurred by the Owner by reason of failure of said Bidder to complete delivery within the time specified, such time being in the essence of this Contract and material consideration thereof.

8.0 Delays and Extension of Time

The time to be allowed for delivery is stated in the *Form of Proposal*. The Bidder, upon notice of award of the Contract, shall prepare a delivery schedule based on the allowed time and submit such schedule to the Engineer for approval.

If Bidder is delayed at any time in the progress of the work by any act of negligence by the Owner or the Engineer, by any separate Bidder employed by the Owner, or by changes ordered in the work, then the time of completion shall be extended for such reasonable time as the Engineer may decide.

No extension of time for completion will be made for ordinary delays and accidents. Extensions may be granted for delays ordered by the Engineer if the request has been made in writing within forty-eight (48) hours after the order to cease work has been given.

9.0 Assignments

The Bidder shall not assign any portion of this Contract nor subcontract in its entirety except as fully explained in the Form of Proposal and accepted by the Owner. No funds or sums of money due or to become due the Bidder under this Contract may be assigned.

10.0 Guarantee

The Bidder shall guarantee his materials and workmanship against defect due to faulty materials, faulty workmanship, or negligence for a period of five (5) full years from the date of energization. He shall make good such defective materials or workmanship and any damages resulting therefrom without cost to the Owner. Each class of equipment shall carry a full five (5) year warranty against defects from the date of energization.

11.0 PCB Dielectrics

All oil-filled materials and equipment shall be certified in writing and by permanently-affixed nameplates to have a non-detectable level of PCB dielectrics, i.e., less than 2 ppm, in compliance with Federal Register (44FR31514), May 31, 1979.

12.0 Change in Plans and/or Specifications

The Owner, or the Engineer on behalf of the Owner, may make changes to Plans and/or Specifications after award of the Contract or while construction is in progress. The compensation for such changes shall be agreed upon in writing between the Bidder and the Owner prior to commencement of work involving the change. No payment shall be made to the Bidder for correcting work not in compliance with Specifications.

13.0 Insurance

During the term of the Contract, the Bidder at its sole cost and expense shall provide commercial insurance of such type and with such terms and limits as may be reasonably associated with the Contract. As a minimum, the Bidder shall provide and maintain the following coverage and limits:

- 13.1. Worker's Compensation - The Bidder shall provide and maintain Worker's Compensation Insurance, as required by the laws of North Carolina, as well as employer's liability coverage with minimum limits of \$1,000,000.00, covering all of Bidder's employees who are engaged in any work under the Contract. If any work is sublet, the Bidder shall require the subcontractor to provide the same coverage for any of his employees engaged in any work under the Contract.
- 13.2. 13.2 Commercial General Liability - General Liability Coverage on a Comprehensive Broad Form on an occurrence basis in the minimum amount of \$1,000,000.00. Combined Single Limit. (Defense cost shall be in excess of the limit of the liability.)
- 13.3. 13.3 Automobile - Automobile Liability Insurance, to include liability coverage, covering all owned, hired, and non-owned vehicles, used in connection with the Contract. The minimum combined single limit shall be \$150,000.00 uninsured/under insured motorist; and \$1,000.00 medical payment.
 - Public Liability Insurance for bodily injury or death \$1,000,000 for one person, and \$2,000,000 for each accident.

- Property Damage Insurance \$2,000,000 for each accident and \$2,000,000 aggregate for accidents during the policy period.
- 13.4. Motor Vehicle Liability Insurance shall be for not less than the following amounts:
- Bodily injury or death \$1,000,000 for one person and \$2,000,000 for each accident.
 - Property damage is \$2,000,000 for each accident.
- 13.5. Copies of Certificates of Insurance for all aforementioned policies shall be furnished by the Bidder and shall be attached to the respective pages of the Contract Agreement at the time of signing.
- 13.6. It shall be understood that the above-required insurance shall not be canceled or changed until thirty (30) days after written notice of such termination or alteration has been sent by registered mail to GUC Buyer II.

BUYER II:
 Greenville Utilities Commission
 401 South Greene Street
 Greenville, North Carolina 27835

13.7. Each certificate must not terminate before the contract completion date.

Requirements - Providing and maintaining adequate insurance coverage is a material obligation of the Bidder and is of the essence of this Contract. All such insurance shall meet all laws of the State of North Carolina. Such insurance coverage shall be obtained from companies that are authorized to provide such coverage and that are authorized by the Commissioner of Insurance to do business in North Carolina. The Bidder shall at all times comply with terms of such insurance policies, and all requirements of the insurer under any such insurance policies, except as they may conflict with existing North Carolina laws or this Contract. The limits of coverage under each insurance policy maintained by the Bidder shall not be interpreted as limiting the Bidder's liability and obligations under the Contract.

14.0 Inspection at Bidder's Site

The Owner reserves the right to inspect, at a reasonable time, the equipment/item, plant or other facilities of a prospective Bidder prior to Contract award, and during the Contract term as necessary for the Owner's determination that such equipment/item, plant or other facilities conform with the specifications/requirements and are adequate and suitable for the proper and effective performance of the Contract.

15.0 Advertising

Bidder agrees not to use the existence of this Contract or the name of the Owner as part of any commercial advertisement.

16.0 Access to Persons and Records

An independent auditor shall have access to persons and records as a result of all Contracts or grants entered into by the Owner in accordance with General Statue 147-64.7 insofar as they relate to transactions with the Owner.

17.0 Equal Employment Opportunity, Minority Business Participation Program

During the performance of this Purchase Order, the Bidder agrees as follows:

- 17.1. The Bidder will not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, political affiliation or belief, age, or physical handicap. The Bidder will take affirmative action to insure that applicants are employed and that employees are treated during employment without regard to race, color, religion, sex, national origin, political affiliation or belief, age, or physical handicap. Such action shall include but not be limited to the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or

termination, rates of pay or other forms of compensation and selection for training, including apprenticeship. The Bidder agrees to post in conspicuous places available to employees and applicants for employment notices setting forth the provisions of the nondiscrimination clause.

- 17.2. 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, national origin, political affiliation or belief, age, or physical handicap.
- 17.3. The Bidder will send to each labor union or representative of workers with which he has a collective bargaining agreement or other Contract or other understanding, a notice advising the labor union or workers' representative of the Bidder's commitments under the Equal Employment Opportunity Section of this Contract and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- 17.4. In the event of the Bidder's noncompliance with the nondiscrimination clauses of this Contract or with any of such 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 Owner Contracts.
- 17.5. The Bidder will include the provisions of this section in every Subcontract or Contract unless exempted by rules, regulations, or orders of the Owner, so that such provisions will be binding upon each Subcontractor.
- 17.6. Owner has adopted an Affirmative Action and Minority and Women Business Enterprise Plan (M/WBE) Program. Firms submitting a proposal are attesting that they also have taken affirmative action to ensure equality of opportunity in all aspects of employment, and to utilize M/WBE suppliers of materials and/or labor.

18.0 Indemnification

Bidder agrees to indemnify and save Greenville Utilities Commission of the City of Greenville, Pitt County, North Carolina, and the City of Greenville, North Carolina, its co-owners, joint-venturers, agents, employees, and insurance carriers harmless from any and all Third Party claims, actions, costs, expenses, including reasonable attorney fees, judgments, or other damages resulting from injury to any person (including injury resulting in death), or damage (including loss or destruction) to third party tangible property arising out of the negligent performance of the terms of this Contract by Bidder; including, but not limited to, Bidder's employees, agents, subcontractors, and others designated by Bidder to perform work or services in, about, or attendant to, the work and services under the terms of this Contract. Bidder shall not be held responsible for any losses, expenses, claims, subrogations, actions, costs, judgments, or other damages, directly and proximately caused by the negligence of Greenville Utilities Commission of the City of Greenville, Pitt County, North Carolina. Insurance covering this indemnity agreement by Bidder in favor of Greenville Utilities Commission of the City of Greenville, Pitt County, North Carolina, and the City of Greenville, North Carolina, shall be provided by Bidder.

19.0 Mediation/Binding Arbitration

In the event of any dispute between the Parties, the Parties agree to submit any dispute to non-binding mediation before a mutually agreeable Mediator prior to initiating litigation. If the Parties are unable to agree upon a Mediator within thirty (30) days after demand therefore, either Party may petition a Court of competent jurisdiction for the designation of a qualified Mediator for these purposes. Each Party shall bear its own costs and expenses of participating in the mediation (including, without limitation, reasonable attorneys' fees), and each Party shall bear one-half (1/2) of the costs and expenses of the Mediator. Unless otherwise agreed, the Parties will hold the mediation in Greenville, North Carolina. The matters discussed or revealed in the mediation session shall not be disclosed in any subsequent litigation.

In the event the matter is not resolved in mediation, either Party may request arbitration. The parties shall jointly select an Arbitrator, and shall be bound by the decision of the Arbitrator with

respect to any dispute between the parties with respect to this Agreement. If the parties are unable to mutually agree upon an Arbitrator, the Parties shall each select an Arbitrator, and the two Arbitrators so selected shall select a third Arbitrator, and the decision of the majority of the Arbitrators shall be conclusive and binding upon the Parties. The Parties at all times agree to equally split the costs of any Arbitrator(s) selected in an effort to resolve the dispute between the Parties. Any party desiring to resolve a dispute under the terms of this Agreement shall notify the other Party in writing, and the Parties shall seek to agree upon a mutually agreed-upon Arbitrator within a period of ten (10) days from the date of such written demand. If the Parties are unable to agree within such ten (10) day period, the Parties shall each select an Arbitrator, and the two (2) Arbitrators so selected shall select a third Arbitrator within fifteen (15) days from the date of the written demand for arbitration, and a decision shall be rendered by the Arbitrator(s) so selected within five (5) days after such Arbitrator(s) is selected.

20.0 Government Restrictions

In the event any Governmental restrictions may be imposed which would necessitate alteration of the material, quality, workmanship, or performance of the items offered on this bid prior to their delivery, it shall be the responsibility of the successful Bidder to notify the GUC Buyer II, at once, indicating in its letter the specific regulation which required such alterations. GUC reserves the right to accept any such alterations, including any price adjustments occasioned thereby, or, in the sole discretion of GUC, to cancel the contract.

21.0 Patents And Copyrights

The Bidder shall hold and save GUC, its officers, agents, and employees, harmless from liability of any kind, including costs and expenses, including reasonable attorney fees, on account of any copyrighted articles or any patented or unpatented invention, device or appliance manufactured or used in the performance of this contract.

22.0 Patent And Copyright Indemnity

The Bidder will defend or settle, at its own expense, any action brought against GUC to the extent that it is based on a claim that the product(s) provided pursuant to this agreement infringe any U.S. copyright or patent; and will pay those costs, damages, and attorney fees finally awarded against GUC in any such action attributable to any such claim, but such defense, settlements, and payments are conditioned on the following: (1) that Bidder shall be notified promptly in writing by GUC of any such claim; (2) that Bidder shall have sole control of the defense of any action on such claim and of all negotiations for its settlement or compromise; (3) that GUC shall cooperate with Bidder in a reasonable way to facilitate the settlement of defense of such claim; (4) that such claim does not arise from GUC modifications not authorized by the Bidder or from the use of combination of products provided by the Bidder with products provided by GUC or by others; and (5) should such product(s) become, or in the Bidder's opinion likely to become, the subject of such claim of infringement, then GUC shall permit Bidder, at Bidder's option and expense, either to procure for GUC the right to continue using the product(s), or replace or modify the same so that it becomes non-infringing and performs in a substantially similar manner to the original product.

23.0 Exceptions

All proposals are subject to the terms and conditions outlined herein. All responses will be controlled by such terms and conditions and the submission of other terms and conditions, price catalogs, and other documents as part of a Bidder's response will be waived and have no effect on this Request for Proposal or any other contract that may be awarded resulting from this solicitation. The submission of any other terms and conditions by a Bidder may be grounds for rejection of the Bidder's proposal. The Bidder specifically agrees to the terms and conditions set forth in this set of Terms and Conditions by affixing its name on the signatory page contained herein.

24.0 Confidential Information

Except as provided by statute and rule of law, GUC will keep trade secrets, which the Bidder does not wish disclosed, confidential. Each page shall be identified in boldface at the top and bottom as “CONFIDENTIAL” by the Bidder. Cost information shall not be deemed confidential. The determination of whether a matter is confidential will be determined by North Carolina law.

25.0 Assignment

No assignment of the Bidder’s obligations or the Bidder’s right to receive payment hereunder shall be permitted without the express written consent of GUC, provided however, upon written request approved by the GUC Buyer II, solely as a convenience to the Bidder, GUC may:

- 25.1. Forward the Bidder’s payment check directly to any person or entity designated by the Bidder, and
- 25.2. Include any person or entity designated by Bidder as a joint payee on the Bidder’s payment check.
- 25.3. In no event shall such approval and action obligate GUC to anyone other than the Bidder, and the Bidder shall remain responsible for fulfillment of all contract obligations.

26.0 Availability Of Funds

Any and all payments of compensation of this specific transaction and any continuation or any renewal or extension are dependent upon and subject to the allocation of GUC funds for the purpose set forth in this Agreement.

27.0 Governing Laws

All contracts, transactions, agreements, etc., are made under and shall be governed by and construed in accordance with the laws of the State of North Carolina.

28.0 Administrative Code

Bids, proposals, and awards are subject to applicable provisions of the North Carolina Administrative Code.

29.0 Execution

In the discretion of GUC, failure of a duly authorized official of Bidder to sign the Signatory Page may render the bid invalid.

30.0 Clarifications/Interpretations

Any and all questions regarding these Terms and Conditions must be addressed to the GUC Buyer II. Do not contact the user directly. **These Terms and Conditions are a complete statement of the parties’ agreement and may only be modified in writing signed by Bidder and the GUC Buyer II.**

31.0 Situs

The place of all contracts, transactions, agreements, their situs and forum, shall be North Carolina, where all matters, whether in contract or tort, relating to the validity, construction, interpretation, and enforcement shall be determined.

32.0 Termination Of Agreement

GUC or Bidder may terminate this Agreement for just cause at any time. Bidder will be paid for all time and expenses incurred as of the termination date. Termination for just cause by either party shall be by certified letter and shall be effective thirty (30) days after signed and acknowledged receipt of said letter. Just cause shall be based on reasonable grounds, and there must be a fair and honest cause or reason for such action. The causes for termination, include, but are not limited to: (1) Bidder’s persistent failure to perform in accordance with the Terms and Conditions, (2) Bidder’s disregard of laws and regulations related to this transaction, and/or (3) Bidder’s substantial violation of the provisions of the Terms and Conditions

33.0 Force Majeure

Neither party shall be considered in default in the performance of its obligations hereunder to the extent that the performance of any such obligation is prevented or delayed by any cause, existing or future, which is beyond the reasonable control of such party. In any such event of force majeure, the parties shall advise each other of such event, and the parties shall negotiate an equitable adjustment to their respective obligations under this Agreement.

34.0 Integrated Contract

These Terms and Conditions, Instructions to Bidders, Specifications, and the selected Bidder's bid represents the entire contract between the Parties. No verbal or other written agreement(s) shall be held to vary the provisions of this Agreement.

35.0 Contract Provisions

Each of the provisions of these Terms and Conditions shall apply to the full extent permitted by law, and the invalidity in whole or in part of any provision shall not affect the remainder of such provision or any other provisions.

36.0 E-Verify

E-Verify - I understand that E-Verify is the federal E-Verify program operated by the United States Department of Homeland Security and other federal agencies, or any successor or equivalent program used to verify the work authorization of newly hired employees pursuant to federal law in accordance with NCGS §64-25 et seq. I am aware of and in compliance with the requirements of E-Verify and Article 2 of Chapter 64 of the North Carolina General Statutes. To the best of my knowledge, any subcontractors employed by me as a part of this contract are in compliance with the requirements of E-Verify and Article 2 of Chapter 64 of the North Carolina General Statutes.

37.0 Notices

Notices to the Parties should be sent to the names and addresses specified below:

Mr. Cleve Haddock
Purchasing, Buyer II
Greenville Utilities Commission
P.O. Box 1847
Greenville, NC 27835-1847

**GREENVILLE UTILITIES COMMISSION
GREENVILLE, NORTH CAROLINA**

**230 KV AUTOTRANSFORMER FOR
GREENVILLE POD NO. 3**

FORM OF PROPOSAL

*(Provide **one** original and **one** copy)*

Respectfully submitted this ____ day of _____, 2016.

OWNER:	BIDDER:	
Greenville Utilities Commission 401 South Greene Street Greenville, NC 27834 P.O. Box 1847 Greenville, NC 27835-1847 Mr. Cleve Haddock Purchasing, Buyer II Office: 252-551-1533 Cell: 252-551-3302		
	NAME	TITLE
	STREET ADDRESS	
	CITY/STATE/ZIP	
	PHONE:	
	FAX:	
E-MAIL:		
SUPPLIER OF PROPOSED EQUIPMENT	SIGNATURE	
MANUFACTURER		
STREET ADDRESS		
CITY / STATE / ZIP		

TERMS AND CONDITIONS

1. The undersigned (hereinafter called the "Bidder") hereby proposes to sell and deliver to the Owner upon the terms and conditions herein stated, the materials, equipment, and services (hereinafter called the "Material") specified in the Bid Schedule(s) attached hereto, and by this reference made a part hereof, for the Materials for the Owner, and:
 - a. These Bid Documents, which include *Notice to Prospective Bidders, Instructions to Bidders, General Conditions, and Technical Specifications.*
 - b. Manufacturer's specifications, both as set forth herein and in Manufacturer's literature (two [2] sets) attached hereto, or furnished separately as provided for in the *Instructions to Bidders*;
 - c. Legal negotiations, with low bidder only, after bids are opened, for budgetary compliance.
2. The prices as quoted herein:
 - a. Are firm unless otherwise stated.
 - b. Are FOB delivery location(s)
 - c. Do include the cost of delivery, unloading, dress-out, and testing at the site at the Bidder's Risk
 - d. Do not include any tax
3. Invoice shall list the appropriate state sales tax as a separate item
4. The Bidder further declares that he has examined the site of the work and informed himself fully regarding all conditions pertaining to the location where the Material is to be delivered; that he has examined the *Technical Specifications* for the work and Bid Documents relative thereto; has read all special provisions furnished prior to the opening of the bids; and that he has satisfied himself relative to the work to be performed.
5. The Bidder proposes and agrees if the following Bid Schedule(s) in this Proposal is accepted, to contract with the Owner, in the form of a Contract specified, to furnish all necessary equipment and materials, except materials and equipment specified to be furnished by the Owner, complete in accordance with the Bid Documents, to the full and entire satisfaction of the Owner, with a definite understanding that no money will be allowed for extra work except as set forth in the *General Conditions*, and as filed on Change Order Forms.
6. The materials will conform to the *Technical Specifications* attached hereto and made a part hereof.
7. The Material prices set forth herein do not include any sums which are or may be payable by the Bidder on account of State Sales Tax upon the sale, purchase or use of the material. If any such tax is applicable to the sale, purchase or use of the material hereunder, the amount thereof shall be added to the purchase price and paid by the Owner after the Bidder has ascertained the actual sales tax to be included in the Contract price.
8. The Owner reserves the right to accept any schedule, combination of schedules, or any portion of a schedule
9. The prices quoted shall include delivery F.O.B. of Material by open-top truck as described in the *Instructions to Bidders*, and include unloading, supervision, reassembly, and testing of the Material as outlined in the *Instructions to Bidders*. Delivery will be considered as part of the award of Contract.
10. The services of a Manufacturer's Field Service Engineer shall be included in the base quotations for at least enough time per Material item to complete the offloading, assembly and testing, and shall be supplied at a per day rate for additional time. All travel time and expenses shall be included in the daily rate.

11. A *Form of Exceptions* to the *Technical Specifications*, prepared in accordance with the *Instructions to Bidders*, is attached hereto. The Bidder shall document any exceptions with deviation from the bid documents and specifications in the *Form of Proposal*. Otherwise, the complete compliance is assumed.
12. The time for delivery may be extended for the period of any reasonable delay due exclusively to causes beyond the control and without fault of the Bidder, including acts of God, fires, floods, strikes and delay in transportation.
13. This Proposal is made pursuant to the provisions of the *Notice* and *Instructions to Bidders* and the *Technical Specifications*, and the Bidder agrees to the terms and conditions thereof.
14. Proposals shall include a complete bill of materials, identifying each item by catalog number, manufacturer, ratings, characteristics, types, sizes, etc., of all materials and equipment included. A simple statement that all necessary materials and equipment will be provided is not acceptable.
15. The Bidder warrants the accuracy of all statements contained in the Bidders Qualifications, if any shall be submitted, and agrees that the Owner shall rely upon such accuracy as a condition of the Contract in the event that this Proposal is accepted.
16. Title to the materials shall pass to the Owner upon delivery to the points above specified.
17. The Bidder warrants that the Materials will conform to the performance data and guarantees, which are attached hereto and by this reference made a part thereof.
18. By the submission of this bid, the Bidder certifies that:
 - a. The bid has been arrived at by the Bidder independently and has been submitted without collusion with any other Bidder of materials, supplies, or equipment of the type described in the *Notice to Prospective Bidders* or the *Technical Specifications*, and
 - b. The contents of the bid have not been communicated by the Bidder, nor, to its best knowledge and belief, by any of its employees or agents, to any person not an employee or agent of the Bidder or its Surety on any Bond furnished herewith, and will not be communicated to any person prior to the official opening of the bid.
19. The Bidder further agrees that in case of failure on his part to accept said Contract within ten (10) consecutive calendar days after written notice has been given of the award of the Contract, the Bid Security accompanying this bid, and the monies payable thereon, shall be paid into the funds of the Owner account set aside for this project, as liquidated damages for such failure; otherwise the check or cash accompanying the *Form of Proposal* shall be returned to the Bidder.
20. If, in submitting this Proposal, the Bidder has made any change in the *Form of Proposal*, the Bidder understands that the Owner may evaluate the effect of such change as they see fit or they may exclude the Proposal from consideration in determining the award of the Contract.
21. Delivery of all items of equipment shall be in accordance with *Technical Specifications*, Section 5.0.

BID SCHEDULES

BID SCHEDULE NO. 1 – GREENVILLE 230 POD NO. 3 – Base Bid

Description	Quantity	Unit Price	Total Price
Autotransformer, rated 120/160/200//224 MVA, 230kV wye primary voltage, 115kV grounded wye secondary voltage, including specified five- (5) year warranty, all in accordance with the Specifications.	1 Each	\$ _____	\$ _____
		Delivery to pad, rigging/off-loading:	\$ _____
		Assembly, supervision, and field testing:	\$ _____
		Oil-filling (if required):	_____
		Miscellaneous Items:	\$ _____
		BASE BID:	\$ _____
		Sales Tax (if applicable)	\$ _____

BID SCHEDULE NO. 1 – Manufacturer’s Field Engineering Services (Daily Rate)

Daily Rate (including expenses) for field service engineering for additional days: \$ _____ per day

Delivery Schedule

The prices of the materials and equipment set forth herein shall include the cost of delivery to the site at the Bidder's risk. The time of delivery shall be as follows:

	<u>Delivery (Days)*</u>
Approval Drawings	_____
Final Drawings**	_____
Delivery of Material ^{1**}	_____

* Number of consecutive calendar days after receipt of written order from the Owner.

** Allow two (2) weeks for receipt and return of Approval Drawings.

¹Equipment required **October 2016**

MAXIMUM GUARANTEED LOSSES AND OTHER DATA PER TRANSFORMER⁽¹⁾⁽²⁾

Maximum Guaranteed Losses And Other Data Per Transformer	LTC 1R Pos.	LTC ⁽¹⁾ Avg. 15R&16R Pos.	
Maximum guaranteed no-load kW losses, 100% voltage, 75°C, at base MVA load ⁽²⁾			kW
Maximum guaranteed load losses (not total losses), 75°C, at base MVA load			kW
Maximum guaranteed total kW losses, 75°C, at base MVA load ⁽²⁾			kW
Auxiliary kW losses, first-stage cooling			kW
Auxiliary kW losses, second-stage cooling			kW
Exciting current at rated voltage			amps
Shipping weight of transformer			lbs
Gallons of oil required			gal
Impedance, %			%
Maximum Guaranteed PCB Dielectric Level (measured at site prior to and after oil filling of transformer)			ppm

MAXIMUM GUARANTEED PCB DIELECTRIC LEVEL⁽¹⁾

Measured at site prior to and after oil-filling of transformer _____ ppm

⁽¹⁾These levels will be considered in evaluating the bids.

⁽²⁾No-load and total losses are to be guaranteed per IEEE standards.

SUPPLEMENTARY INFORMATION

Manufacturer and Type _____

Place of Manufacture _____

Nearest Shop Repair Facility _____

Nearest I&SE Facility _____

Other Utilities Purchasing Recent Units of Same Design _____

Method of Shipment: _____

Type of Shipment: Oil-Filled:: _____ Dry-Air-Filled: _____

(Attach separate supplemental sheets if necessary)

AFFIDAVIT OF BIDDER

The final payment of retained amount due the Bidder on account of the Contract shall not become due until the Bidder has furnished to the Owner through the Engineer an affidavit signed, sworn, and notarized to the effect that all payments for Material, services, or any other reason in connection with this Contract have been satisfied and that no claims or liens exist against the Bidder in connection with this Contract. In the event that the Bidder cannot obtain similar affidavits from Subcontractors to protect the Bidder and the Owner from possible liens or claims against the Subcontractor, the Bidder shall state in his affidavit that no claims or liens exist against any Subcontractor, and if any liens or claims appear afterward, the Bidder shall save the Owner harmless on account thereof.

Bidder: _____

By: _____

Date: _____

BID BOND

KNOW ALL MEN BY THESE PRESENT, THAT WE _____

as Principal, and _____
as Surety, who is duly licensed to act as Surety in North Carolina, are held and firmly bound unto the
Greenville Utilities Commission, Greenville, North Carolina, as Obligee, in the penal sum of _____
_____ DOLLARS (\$ _____
_____) (5% Bid Bond), lawful money of the United States of America, for the payment of which, well
and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns,
jointly and severally, firmly by these present.

SIGNED, Sealed and dated this _____ day of _____, 2016

WHEREAS, the said Principal is herewith submitting a Proposal for

230 kV AUTOTRANSFORMER FOR THE GREENVILLE 230 KV POD NO. 3

and the Principal desires to file this Bid Bond in lieu of making the cash deposit as required by the
bidding documents contained herein;

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such that if the principal shall be awarded the Contract for which the bid is submitted and shall accept the Contract within ten (10) days after the award of same to the principal, then this obligation shall be null and void; but if the principal fails to so accept such Contract as required by the bidding documents contained herein, the Surety shall, upon demand, forthwith pay to the Obligee the amount set forth in the first paragraph hereof, and upon failure to forthwith make such payment, the Surety shall pay the Obligee an amount equal to double the amount of this Bid Bond as set forth in the first paragraph hereof. Power of Attorney from the Surety to its Attorney-in-Fact is attached hereto.

Principal

By _____ (SEAL)

Corporate Surety

By _____ (SEAL)

Letter of Compliance to E-Verify for Greenville Utilities Commission

1. I have submitted a bid for contract or desire to enter into a contract with the Greenville Utilities Commission;
2. As part of my duties and responsibilities pursuant to said bid and/or contract, I affirm that I am aware of and in compliance with the requirements of E-Verify, Article 2 of Chapter 64 of the North Carolina General Statutes, to include (mark which applies):
 - a. ____ After hiring an employee to work in the United States I verify the work authorization of said employee through E-Verify and retain the record of the verification of work authorization while the employee is employed and for one year thereafter; or
 - b. ____ I employ less than twenty-five (25) employees in the State of North Carolina.
3. As part of my duties and responsibilities pursuant to said bid and/or contract, I affirm that to the best of my knowledge and subcontractors employed as a part of this bid and/or contract, are in compliance with the requirements of E-Verify, Article 2 of Chapter 64 of the North Carolina General Statutes, to include (mark which applies):
 - a. ____ After hiring an employee to work in the United States the subcontractor verifies the work authorization of said employee through E-Verify and retains the record of the verification of work authorization while the employee is employed and for one year thereafter; or
 - b. ____ Employ less than twenty-five (25) employees in the State of North Carolina.

Specify subcontractor: _____

_____ (Company Name)

By: _____ (Typed Name)

_____ (Authorized Signatory)

_____ (Title)

_____ (Date)

GREENVILLE UTILITIES COMMISSION

By: _____
Anthony C. Cannon

Title: General Manager/CEO
(Authorized Signatory)

Date: _____

Attest: _____

Name (Print): Amy Carson Quinn

Title: Executive Secretary

Date: _____

(OFFICIAL SEAL)

COMPANY NAME:

By: _____

Name (Print): _____

Title: _____
(Authorized Signatory)

Date: _____

Attest: _____

Name (Print): _____

Title: Secretary

Date: _____

(OFFICAL SEAL)

This instrument has been pre-audited in the manner required by the Local Government Budget and Fiscal Control Act.

By: _____
Jeff W. McCauley

Title: Chief Financial Officer

Date: _____

APPROVED AS TO FORM AND LEGAL CONTENT:

By: _____
Phillip R. Dixon

Title: General Counsel

Date: _____

INSERT

ADDENDA / CLARIFICATIONS / BULLETINS

Instructions to Bidders, 5. Bulletins and Addenda

**GREENVILLE UTILITIES COMMISSION
GREENVILLE, NORTH CAROLINA**

**230 KV AUTOTRANSFORMER FOR
GREENVILLE POD NO. 3**

TECHNICAL SPECIFICATIONS

1.0 Scope

- 1.1 The work shall include furnishing all equipment and materials, as set forth in the Bid Schedules and as specified herein.
- 1.2 Bids will be received for the transformer as shown in the *Form of Proposal*. The Owner intends to purchase one (1) 230 to 115 kV autotransformer equipped as evaluated with any or all adders/deducts. Firm quotations should be based upon placement of an order within sixty (60) days from bid date.
- 1.3 The Owner reserves the right to reject any or all Proposals and to select any or all schedules or combinations or portions thereof listed in the Bidder's Proposal.

2.0 General Conditions

- 2.1 All materials and equipment shall be new and shall be manufactured in the continental United States or Mexico.
- 2.2 These Specifications describe the type, size, and characteristics of the various materials and equipment required to be furnished, and the Drawings indicate general arrangement, equipment location, and spacing.
- 2.3 Strict adherence to these Specifications and Drawings is requested to facilitate review and consideration of the Proposal.
- 2.4 Proposals shall include the following:
 - 2.4.1 Catalog numbers, manufacturer, ratings, characteristics, types, sizes, etc., of all materials and equipment included. A simple statement that all necessary materials and equipment will be provided is not satisfactory.
 - 2.4.2 Performance data and evidence of short circuit testing for similar designs for the several items as set forth in the Detailed Specifications.
 - 2.4.3 The Bidder shall state in his Proposal the manner in which the transformers will be shipped--namely, truck or rail; whether units shall be oil-filled or dry-air-filled; and whether bushings will be installed or removed.
 - 2.4.4 Prices shall include the cost of delivery to the substation site, unloading, and installation as per Instructions to Bidders.
- 2.5 It is the intent of these Specifications that the transformer shall be complete and fully operable. Any details not mentioned in the Specifications but required for satisfactory operation shall be furnished and installed by the Bidder.
- 2.6 Station power available at the Owner's substation will be 120/240 ac volts, 60 Hz, single-phase. Control voltage at the substation site will be 125 volts dc.
- 2.7 The equipment on the transformer shall coordinate with these voltages as appropriate.

3.0 Special Conditions

- 3.1 Indemnity Provisions - The Bidder shall hold harmless and indemnify the Owner, its agents, and employees from any and all claims, suits, and proceedings for infringement of any patent or patents covering materials and equipment purchased hereunder. The Bidder shall defend any suit or proceeding brought against the Owner, its agents, or employees

based upon a claim that the materials and equipment or any part thereof constitute an infringement of any patent, or if the Bidder shall fail to defend such suit or proceeding, the Owner may do so and the Bidder shall make reimbursement for the expense of such litigation. If the materials and equipment or any part thereof are held to constitute infringement and the use thereof is enjoined, the Bidder shall, at its own expense, either procure for the Owner the right to continue to use the materials and equipment, or such part thereof, or shall replace the materials and equipment, or such part thereof, with non-infringing materials and equipment.

3.2 Defective Materials, Equipment, and Workmanship

3.2.1 All materials and equipment furnished hereunder shall be subject to the inspection, tests, and approval of the Owner, and the Bidder shall furnish all information required concerning the nature or source of any materials and equipment and provide adequate facilities for testing and inspecting the materials and equipment at the plant of the Bidder.

3.2.2 The materials and equipment furnished hereunder shall become the property of the Owner when delivered at the point to which shipment is to be made, provided, however, that the Owner may reject any such materials and equipment that do not comply with the Specifications for materials and equipment and warranties of the Bidder and manufacturers. Recognition and subsequent rejection of any defective materials and equipment may occur either before or after incorporation of such materials and equipment into the facilities, provided such rejection is made within one year of date of delivery of the materials and equipment. Upon any such rejection, the Bidder shall replace the rejected materials and equipment with materials and equipment complying with the materials and equipment and warranties, FOB truck at suitable destination. The Owner shall return the rejected materials FOB truck at the same destination. In the event of the failure of the Bidder to so replace rejected materials and equipment, the Owner may make such replacement, and the cost and expense thereof shall be paid by and recoverable from the Bidder.

3.2.3 The transformer to be provided herein shall include a full five- (5) year warranty together with all parts. This warranty shall extend for five (5) years from the date of energization (or sixty-six (66) months from delivery). A deduct may be offered for the utilization of manufacturer's standard twelve- (12) month or three- (3) year warranty in lieu of the five- (5) year warranty. However, any base bid not including at least a full five (5) year warranty shall be considered less responsive.

4.0 Standards

4.1 All equipment and materials covered by these Specifications and all tests applied thereto shall, unless otherwise stated herein, be in accordance with the applicable provisions of the latest editions of the Standards of the ASTM, IEEE, AEIC, NEMA, OSHA, IEEE, and the latest revision in the National Electrical Safety Code.

4.2 Where the term "Standards" is used in the Specifications, it shall be understood to refer to the above Standards.

5.0 Shipping of Transformers

5.1 The transformer shall be shipped to the selected substation site. The Bidder will be responsible for the complete rigging and setting in place of each unit onto temporary timbers or the permanent concrete pad. The Bidder will provide equipment and labor to perform dress-out, oil-filling (if needed), and testing.

5.2 Before shipment, the transformer shall be completely assembled to determine that all

parts fit properly. Parts removed for shipment shall be marked so as to permit easy identification when reassembling. Assembly of any component parts removed for shipment will be performed by the manufacturer's personnel under the supervision of the manufacturer's field service engineer.

- 5.3 Method of packing and loading shall be such as to protect all parts from dampness, corrosion, breakage, or vibration injury that might reasonably be encountered in transportation, storage, and handling.
- 5.4 Release for shipment is to be granted by either the Owner or the Owner's Engineer based upon the manufacturer's compliance with the following:
 - 5.4.1 Fourteen (14) consecutive days of prior notification of tests, so the Owner may have a representative present for witness of the tests. Testing on like units shall be arranged the same day, on back-to-back days to facilitate witnessing.
 - 5.4.2 Furnishing of the requisite number of copies of the Final Drawings as called for in the Specifications. Furnishing of the requisite number of copies of the test reports as called for in the Specifications.
 - 5.4.3 Thirty (30) days notification of tentative shipping schedule and three (3) days notification prior to delivery.
- 5.5 A three-direction electronic impact recorder shall be installed on the transformer for shipment and shall remain on the unit until it is unloaded on the transformer pad regardless of whether the unit is shipped by truck or rail. The impact recorder shall measure longitudinal, lateral, and vertical motion. The impact recorder shall have GPS and remote monitoring capability. The impact recorder shall be read prior to unloading, at the rail-siding, if applicable, on the trailer prior to transportation to the site, and after arrival at the site.
- 5.6 Transformers shall be shipped by rail or truck, oil-filled (if possible) with the low-voltage bushings (if possible) installed. Manufacturer shall state method of shipment, and this shall be evaluated when awarding the Contract. If shipped by rail, Hydra-Cushion rail car shall be utilized.
- 5.7 If the transformer is not shipped oil-filled, it shall be shipped dry-air-filled and equipped with proper pipe connections for checking and filling under vacuum. Positive pressure shall be maintained from the manufacturer's facility to the GUC delivery site. The oil shall be shipped by tanker with the unloading facility (pump) furnished. The unloading facility shall have been flushed free of undesirable contaminants by flushing with the same type oil provided for the transformer. The Bidder shall furnish all equipment and labor required for vacuum filling utilizing hot oil processing, and the Bidder shall coordinate timing and arrangements.
- 5.8 Type of shipment (rail or trucked, oil-filled or dry-air-filled) shall be specified in the Proposal.

6.0 Manufacturer's Field Representative

- 6.1 The manufacturer shall provide (**and include in his base quotation**) the services of a Field Service Engineer for a period of at least enough time to offload, assemble, and test each unit at the site. The manufacturer is responsible for all travel time. The duties of the Field Service Engineer shall include supervising installation of component parts removed for shipment, which may include but not be limited to bushings, radiators, lightning arresters, and oil. He shall perform field tests after assembly including (but not limited to) testing as described in Section 9.
- 6.2 The Manufacturer's representative shall draw an oil sample and shall be responsible for conducting (1.) the tests as specified in Section 9, and (2.) Dissolved gas tests, to establish initial benchmark controls for future transformer maintenance. Reports shall be

mailed in duplicate to the Owner and the Owner's Engineer for reference. Additional time required shall be provided at the per-day rate quoted in the Bidder's Proposal. Exceptions taken to the testing performed, as outlined above, may result in rejection of the Bidder's quotation.

7.0 Transformer

The following requirements shall apply to all Bid schedules except where explicitly noted otherwise.

7.1 Type and Rating

- 7.1.1 The transformer shall be 60 Hertz, suitable for outdoor service at an altitude less than one kilometer (3300 feet) above sea level.
- 7.1.2 **Windings shall be copper, circular concentric construction, utilizing helical type or disc type windings to ensure maximum strength during short circuits. Coil construction consisting of layered sheets shall not be allowed.**
- 7.1.3 The 230 kV autotransformer shall be a three-winding autotransformer with a buried delta tertiary. The autotransformer high voltage shall be 230,000 volts grdY/132,800 volts at 900 kV BIL. The autotransformer low voltage shall be 115,000 grdY/66,400 volts at 550 kV BIL. The tertiary shall be buried and rated 13.8 kV delta at 110 kV BIL minimum with provisions for testing the impedance of the tertiary winding. The 230 kV autotransformer shall be designed and built such that the power flow through the transformer is from high voltage to low voltage. The 230 kV autotransformer will be operated with the H₀X₀ bushing terminal tied solidly to ground. All windings shall be copper.
- 7.1.4 The transformer shall be oil immersed for continuous self-cooled/forced air/forced air cooled operation ONAN/ONAF/ONAF with two (2) stages of fan cooling and shall be furnished complete with oil in accordance with the requirements of ASTM D3487. Fans shall be included with the transformer; operating voltage for fans shall be 230 volts, single-phase, and shall be thermally protected against overload failure. Forced-oil pumping facilities resulting in similar ratings may be offered as an alternate to fans.
- 7.1.5 Transformer ratings, when loaded in accordance with the latest IEEE C57.91 "Guide for Loading Mineral Oil-Immersed Transformers and Step-Voltage Regulators," shall be as follows:

230 kV Autotransformer	
Cooling	Rating (kVA)
55°C rise, ONAN	120,000
55°C rise, ONAN/ONAF	160,000
55°C rise, ONAN/ONAF/ONAF	200,000
65°C rise, ONAN/ONAF/ONAF	224,000

- 7.1.6 The transformer shall be capable of carrying rated current continuously at five percent (5%) above rated secondary voltage without exceeding an average winding temperature rise of 55/65°C above a 40°C maximum ambient and 30°C average ambient over twenty-four hours.
- 7.1.7 The transformer shall be 55/65°C construction where the average winding temperature rise by resistance will not exceed 55/65°C; hottest-spot winding temperature rise will not exceed 65/80°C; suitable for loading in accordance

with the latest IEEE C57.91 "Guide for Loading Mineral Oil-Immersed Transformers and Step-Voltage Regulators."

7.2 High Voltage Taps

7.2.1 The transformer to be provided shall have full capacity, high voltage taps, at rated kVA, and shall be provided as follows:

230 kV Autotransformer
241,500 volts
235,750 volts
230,000 volts
224,250 volts
218,500 volts

7.2.2 A weatherproof external hand operated tap changing mechanism shall be provided, suitable for de-energized operation, with one (1) external handle that may be operated from the transformer base level and have provision for locking in any position. An external indicator shall clearly display the tap position that is set.

7.3 Case and Cover

7.3.1 The transformer tank design shall observe the following criteria for location of external equipment and accessory hardware:

- a. The control cabinet housing all low voltage wiring associated with current transformer secondaries, automatic fan control, alarms, LTC control etc. shall be located on the side of the tank in Segment 1 as identified by IEEE C57.12.10.
- b. The LTC compartment shall be located on the side of the tank in either Segment 1, 2 or Segment 4 as identified by IEEE C57.12.10.
- c. Placement of radiators shall not obstruct the operator's view of any indicating dial or gauge located within Segment 1 of the transformer.
- d. Final placement of the control cabinetry, LTC compartment, LTC position indicator, radiators, and all other external auxiliary equipment shall be subject to the approval of the City or the City's Engineer. Relocation of these components will be required only as necessary to physically comply with standard facilities design for foundations, oil containment systems, and surrounding substation structures.

7.3.2 Tank shall be designed and braced for full vacuum and be suitable for filling, with oil under a vacuum of 28 inches of mercury, in the field.

7.3.3 Containing case shall not leak oil. Welded joints and seams shall be employed whenever practicable.

7.3.4 Main transformer cover shall be welded. Gasketed joints for manhole covers, bushings, and other bolted attachments shall be sealed with a durable and reusable gasket material (ordinary cork or corkprene not approved), and shall be designed so as to permit their being made oil tight in reassembly. Mechanical stops shall be provided to prevent crushing, (controlled compression).

7.3.5 Transformer base shall be suitable for skidding the transformer in a direction

parallel to either centerline of the tank, and shall be capable of supporting the transformer on a two-pier foundation.

- 7.3.6 All surfaces of case and covers, both exterior and interior, shall be thoroughly cleaned by means of shot-blasting or by any other equally effective method. Primer and at least three (3) coats of exterior paint are to be applied. Total paint thickness on the transformer tank and control box shall be 5 mils minimum. Interior of tank shall be painted white.
- 7.3.7 The exterior surface of all bolts, nuts, and washers shall be primed and painted as above or such parts shall be stainless steel or galvanized. No exposed cadmium-plated or zinc chromate-plated parts will be allowed.
- 7.3.8 Exterior paint shall be standard light gray IEEE, No. 70 and certified as lead free.
- 7.3.9 The bottom of the transformer tank shall not bear on the concrete pad in the finished installation. The bottom shall be primed and painted as described above. Flat-bottom transformers shall be furnished with permanently welded supporting spacer beams. The dimensions and locations of these beams shall be shown in the manufacturer's Drawings.
- 7.3.10 Mounting brackets shall be supplied along the transformer tank as necessary to support 4/0 AWG copper grounding conductor from the base of all high-side and low-side surge arresters. The supports must provide for attachment of the grounding conductor from the arresters to the 1/4-inch x 4-inch copper ground bus and to the tank grounding pads located on the front and rear corners of the tank. The grounding conductor shall be 4/0 AWG copper conductor and Anderson Type "TLS" connectors for attachment of the conductor to the support brackets. See Appendix 2 for details.
- 7.3.11 The transformer tank shall provide two grounding pads per the latest IEEE C57.12.10, suitable for attachment of NEMA two-hole bronze connectors. The connectors shall be suitable for use with 4/0 through 500 kcmil, 37-strand copper conductor. The pads shall be located on diagonally opposite front and rear corners of the tank, and shall be located approximately twelve (12) inches above the transformer base.
- 7.3.12 A grounding bus (loop configuration) shall be supplied by the manufacturer for the transformer including attachment to the neutral bushing, the base of all surge arresters and to two tank ground pads as shown in Appendix 2.
- 7.3.13 The tank shall include a 1/4-inch x 4-inch minimum copper ground bus to connect on each diagonal corner to the grounding pads located at the base of the transformer. The ground bus shall be supported along the surfaces of the tank by the necessary quantity of 5 kV style insulators. The ground bus shall be connected to the neutral bushing using a 1200-ampere flexible copper shunt to a 4-hole NEMA bushing terminal pad. The ground bus shall be connected to the NEMA 2-hole grounding pad at the base of the transformer using a 600-ampere flexible copper shunt. The copper ground bus shall provide four-hole NEMA drilling at the lower end for attachment of the substation ground grid. The bus shall also provide two-hole NEMA drilling located appropriately for attachment of bonding conductors from the bases of the transformer-mounted surge arresters.

7.4 Impedance

The transformer impedance at normal base rating shall be as close as possible to the values stated below at 75°C with IEEE Standards tolerances of 10.0% for power autotransformers.

7.5 Sound Level

- 7.5.1 The transformer will be designed so that the average sound level will be in accordance with the latest revision of NEMA TR-1.
- 7.5.2 The sound level at the 120 MVA self-cooled rating shall not exceed 72 dBA when factory-tested in accordance with the procedures stated in NEMA TR1-9.04.

7.6 Bushings and Terminals

- 7.6.1 All transformers shall be provided with three (3) primary and four (4) secondary cover-type bushings constructed of high strength wet process porcelain. All bushings shall be manufactured by either PCORE or ABB.
- 7.6.2 All high-voltage bushings shall be oil-filled and dimensionally interchangeable between circuit breakers and transformers according to latest revisions of IEEE Standard C76. The high-voltage bushings shall be condenser type and have provisions for power factor testing. Bushings for all schedules shall be draw lead type rated as follows:

HV Bushings (kV/kVBIL)	HV Bushings (Amp)	LV Bushings (kV/kVBIL)	LV Bushings (Amp)
230/1050	800	115/550	1,600

- 7.6.3 Primary and secondary bushings shall be provided with copper thread studs sited in accordance with their respective current ratings. A connection suitable for flat spade connection with NEMA four-hole drilling shall be either built into the bushing or furnished as a separate item. High-voltage and low-voltage terminal studs and flat spade terminal connectors shall have silver-plated contact surfaces.
- 7.6.4 Low voltage neutral bushings shall be rated 25 kV/150 kV BIL and provided with a connection for flat spade connections with NEMA four-hole drilling and connected to a 4" x 1/4" (minimum) copper bus extending from the terminal to a tank ground pad for direct connection to the station ground system.
- 7.6.5 The bushings shall be spaced to comply with, or exceed, minimum phase-to-phase and phase-to-ground external clearances between live parts in accordance with IEEE Standard C57.12.00. All external bushing mounting hardware shall be stainless steel. All connections shall be suitable for either copper or aluminum connectors.

7.7 Auxiliary Cooling

- 7.7.1 Cooling equipment shall be furnished in accordance with IEEE standards for transformer self-cooled and forced air-cooled ratings of ONAN/ONAF/ONAF.
- 7.7.2 Provisions shall be made for cooling radiators to be mounted independently of one another on the transformer, and individually removable from the transformer tank and provided with valves on the transformer tank side so that one cooler may be removed from operation or replaced while the transformer is in service without interfering with the operation of the other coolers (radiators). Radiators shall be designed and braced to withstand all vibration and operating forces. Radiators shall be galvanized. No painted radiators will

be allowed.

- 7.7.3 Radiator mounting flanges on the transformer tank shall each be equipped with valves to permit the removal or replacement of an individual cooling radiator or bank of radiators without loss of either oil or, gas above oil, in the transformer tank.
- 7.7.4 Each cooling radiator shall be equipped with a fill valve at the top and a drain valve at the bottom of the unit.
- 7.7.5 All cooling fans (and/or pumps) shall be equipped with automatic control via an SEL-2414 transformer monitor to provide the operation of all cooling stages based on the sensing of transformer winding temperature. Each fan (and/or pump) shall be driven by an enclosed, waterproof induction motor rated 230 volts ac, single-phase, 60 Hertz. Each motor shall be equipped with thermal overload protection. Each fan (and/or pump) shall be dynamically balanced for vibration-free operation. All fan guards shall be stainless steel and meet OSHA Safety Standards.
- 7.7.6 The SEL-2414 shall provide for the transfer of cooling operation from automatic to manual control. All cooling system controls shall be enclosed in the transformer control cabinet, complete with all conduit and inner wiring to the fans. Fans shall be wired such that at least one bank will be fail safe in nature (fans operate if 2414 fails).
- 7.7.7 The SEL-2414 transformer monitor inputs/outputs are detailed in the appendix.
- 7.7.8 All cooling fans shall be located at sufficient height to permit their operation when the transformer is embedded in snow up to 30 inches from its base.

7.8 Lightning Arresters

- 7.8.1 Lightning arresters shall be of the station class type, transformer mounted for the high and low voltage side on each phase of the transformer and shall be rated:

System Voltage	Conventional Arrester Rating	MCOV Arrester Rating
230 kV, 900 kV BIL	192 kV	152 kV
115 kV, 550 kV BIL	108 kV	88 kV

- 7.8.2 Metal oxide lightning arresters are rated either in terms of maximum continuous operating voltage (MCOV) or by the conventional arrester rating which they replace. MCOV ratings are assumed here for metal oxide arresters. However, metal oxide arresters which are given conventional ratings may be furnished if the MCOV equivalent ratings are as specified here.
- 7.8.3 The lightning arresters shall be located with relation to one another and the bushings to comply with, or exceed, minimum phase-to-phase and phase-to-ground clearances between live parts in accordance with IEEE Standard C57.12.00. They shall not be mounted on radiators or hand-hole covers. The location shall be such that the entire electrical path from connectors to ground pads can carry, without damage, the specified rated discharge current of the arrester.
- 7.8.4 The lightning arresters shall be provided with connections to the line-side bushing terminals with connections equivalent to the full capacity of the transformer. Ground conductors equivalent at minimum to 4" x 1/4" copper bus shall also be furnished and carried to the transformer ground pads with

loop configuration as shown on the Drawing in Appendix 2.

7.8.5 The body of the lightning arresters shall be wet process porcelain, light gray, IEEE No. 70.

7.8.6 The lightning arresters shall comply with IEEE Standard C-62.11.

7.9 Current Transformers

7.9.1 The transformer shall be equipped with bushing type current transformers mounted inside the main case on terminals (H₁, H₂, H₃, X₁, X₂, X₃) and Neutral (H₀X₀) with all secondary leads brought to identified terminals in a control cabinet mounted for nominal working height from ground level. Terminal blocks shall have short-circuiting devices which will maintain a continuous CT secondary circuit while tap positions are being changed. Each CT shall be connected to a separate six-point terminal block; terminal designations shall comply with the CT Drawing included in the Appendices of these Specifications. The sixth terminal of each block shall be permanently wired to the ground bus on the internal side of the block to facilitate the customer grounding unused CTs.

7.9.2 All bushing type current transformers shall be standard multi-ratio, 5 leads, 10C800 relaying accuracy, 2.0 thermal factor, except when specified otherwise.

7.9.3 Bushing type current transformers to be furnished on terminals shall be as follows:

- a. High Voltage Bushings
Provide two (2) each 600/5A BCT on H₁, H₂, and H₃ bushings.
- b. Low Voltage Bushings
Provide two (2) each - 1200/5A BCT on X₁, X₂ and X₃ bushings.
- c. Neutral Bushing
Provide one (1) each - 1200/5A BCT, on the neutral H₀X₀.
- d. Tertiary Winding
Provide two (2) each -- 1200/5A BCT, in the tertiary winding.

7.9.4 If the current transformers are mounted in a removable current transformer adapter, the current transformer shall be shipped in the main transformer mounted in the adapters. The current transformer secondary leads shall be permanently connected to the terminal blocks in the Control Cabinet. No splicing of secondary current transformer leads shall be required after delivery to the Owner. Marking of leads and locations of shorting-type terminal boards control panel shall be in accordance with the CT drawing included in the Appendices. A CT metal diagram instruction plate shall be provided. Turns progression and accuracy class of bushing current transformer shall be shown on the nameplate.

7.10 Control Cabinet

7.10.1 A weatherproof NEMA 3R control cabinet shall be furnished enclosing control circuits, signal circuits, protective relays, individual transformer alarm indicators, a 120-volt ac convenience duplex receptacle, a 40 watt incandescent light with guard, and a suitable 230-volt, 60 Hertz heater with double pole thermal circuit breaker.

7.10.2 The cabinet shall be furnished with swing door(s) complete with handle and three-point latching mechanism and provisions for padlocking. The door(s) shall be equipped with provisions to fix the swing in the open position.

Bolted door covers will not be accepted. Door shall be opened without use of tools.

- 7.10.3 All wire into the control cabinet shall have 600-volt flame-resistant, moisture-proof insulation and shall be enclosed in rigid metallic conduit. All conductors into the control cabinet shall terminate on a clearly marked and properly identified terminal board. Terminal boards for C.T. leads shall be shorting type, all terminal boards shall be equipped with non-magnetic split type lock washers and ring type compression lugs.
- 7.10.4 The weatherproof control panel shall be centrally located in Segment 1 per IEEE C57.12.10 near the bottom of the tank at a location to be approved by the Owner. A dead-front control panel in the control cabinet shall contain the necessary switches, circuit breakers, relays, indicating lamps, etc. Target relays and alarm indicating lamps shall be visible through a Lexan window in the outer door(s).
- 7.10.5 Breathers for the LTC housing shall be silica gel type.
- 7.10.6 All cabinets attached to the transformer shall be solidly grounded to the transformer case.
- 7.10.7 The control cabinet heater shall be equipped with guards and thermostatically controlled so that the guard temperature cannot exceed 120°F. The 240-volt electric terminals at the heater shall be covered.
- 7.10.8 Control cabinet shall provide a cover plate for the entrance of conduit. Detail drawings showing bottom of cabinet shall be provided.

7.11 Wiring

- 7.11.1 All power wiring shall be made with #10 AWG stranded tinned copper wire or larger sized wire. The primary insulation jacket of all wiring shall be 600 volt, 90°C, water, oil, and flame resistant. Control wiring shall be 45 or 65 mil stranded cable and not smaller in size than #14 AWG tinned copper wire, with the exception that wiring to alarm auxiliary relays and indicating lights may be smaller in size. SIS control wire is recommended. All current transformer leads are to be #10 AWG stranded tinned copper or larger.
 - a. Power wiring shall be sized as required in accordance with the National Electrical Code.
 - b. All connections for wiring shall utilize locking terminals such that screws or nuts do not loosen. Acceptable inherently locking terminals include: screws with integral locking washers (e.g. screws on Marathon 1500 series terminal blocks), Sems pressure saddle screws with external lock washers (e.g. screws on SEL relays). All connections for wiring which do not have inherently locking terminals shall be made using silicon bronze, split-type lockwashers, screws, and nuts.
 - c. All wires shall be identified at each end with legible permanent labels.
 - d. Wiring connections between fixed and hinged sections shall be minimum 41-stranded wire.
 - e. Seven-stranded control wire is not acceptable.
 - f. All terminal connections for conductor sizes #10 AWG in size and smaller shall be made with pre-insulated full-ring tongue, compression-type lugs. Lugs shall be Burndy Type YAV, or approved equivalent.

Spade-type terminals or slip-on connectors are not acceptable.

- g. All terminal connections for conductors sizes #2 AWG through #9 AWG shall be made with Burndy Type YAV or approved equivalent.
- h. All terminal connections for conductor sizes larger than #2 AWG shall be made with two-hole, long-barrel, double-indent, crimp-type lugs: Burndy Hylug Type YA or approved equivalent. (Single-hole lugs may be used only where necessary).

- 7.11.2 Grommets shall be provided for all openings in metal barriers used for wiring.
- 7.11.3 Uninsulated exposed conductor or terminal lug shall not extend beyond the sides of the terminal block or its insulating barriers.
- 7.11.4 All leads for multi-ratio current transformers shall be wired to terminal blocks in the control cabinet. If junction boxes are required in wiring between current transformer and control cabinet, terminal blocks shall be used for wiring connections. In-line-type disconnecting terminals such as American Petroleum Institute (API) No. 32488 or Burndy No. YZ10 will not be acceptable.
- 7.11.5 If accidental short circuiting of certain wires can result in malfunction of equipment, these wires shall not be terminated on adjacent terminal block points.
- 7.11.6 No more than two (2) wires per terminal point are permissible.

7.12 Terminal Blocks and Fuseholders

- 7.12.1 Molded-type terminal blocks, rated 600 volts and 30 amperes, for all external control connections shall be provided. Terminal blocks with self-contained pressure-type connectors are not acceptable.
- 7.12.2 Marathon 1500 DJ series or General Electric Type EB-25 terminal blocks shall be provided furnished with white marking strips for identification of terminal wires for all connections except current transformers. The terminals shall be identified with legible permanent markings.
- 7.12.3 Marathon 1500 SC series or General Electric Type EB-27 terminal blocks shall be provided for current transformer leads with at least three shorting screws per terminal block. A separate short-circuit-type terminal block shall be provided for each set of current transformer leads.
- 7.12.4 One three-pole terminal block sized for #6 to #2/0 AWG wire for Owner's single-phase, three-wire, 120/240 volt, control power leads shall be furnished.
- 7.12.5 A minimum of 15 percent spare (but not less than 12 points) terminal points shall be provided in the control cabinet. These terminal points shall be furnished with all screws and lockwashers.
- 7.12.6 Fuseholders shall be Marathon (RF30AXS for 30A and RF60AXS for 60A) series fuseblocks with hard-gripping fuse clips (reinforcing member) and straight-slotted silicon bronze screws on each terminal, or approved equivalent. Terminals to be supplied without ears.
- 7.12.7 A full set of fuses for all types and sizes shall be provided for and secured within the control cabinet.

7.13 Alarms and Relays

- 7.13.1 The transformer shall be equipped with various alarms and an alarm annunciator(s) to provide visual indication of abnormal conditions as

designated herein. Each alarm shall be in the form of a normally open contact wired to terminal blocks in the transformer control cabinet via paired wire leads. The alarm annunciator shall be flush-mounted on the control panel within the transformer control cabinet and shall be wired to the designated alarms brought to the terminal blocks for customer's use.

- 7.13.2 The annunciator(s) shall be a ten window annunciator model SEL-2533 as manufactured by Schweitzer Engineering Laboratories, Inc. The annunciator(s) shall use a 125 Vdc power supply, 125 Vdc control voltage, and having 14 digital inputs and 7 digital outputs. The full model number shall be 2533012100XA2X0 Key Code 7051. See Appendix 3 for typical input and output wiring.
- 7.13.3 The transformer shall be equipped with a Schweitzer SEL-2414 transformer monitor, Model No. 2414-21ACA9X3A850000, Key Code 0563; 125 VDC power supply, 125 VDC control voltage.
- 7.13.4 The typical alarms are to be as identified in Appendix 3.
- 7.13.5 Contact outputs from the annunciator(s) shall be wired to terminal blocks for customer use as shown in Appendix 3.
- 7.13.6 The transformer undervoltage relay inputs to the annunciator shall be delayed by means logic internal to the annunciator. To avoid undervoltage nuisance alarms, the condition should be active for 60 seconds before the annunciator target is sealed in.

7.14 Fault Pressure Relay

- 7.14.1 Two (2) fault pressure relays shall be provided; one (1) for the transformer main tank and one (1) for the LTC compartment for the detection of rapid rates of positive increase in transformer tank pressure. The fault pressure relaying shall also provide contacts for the alarm to the SEL-2533 and remote initiation of transformer lockout to a relay panel provided by the Owner.
- 7.14.2 Contacts supplied for alarms and initiation of station lockout shall be dry, normally-open, latching operation with manual hand reset. Contacts shall be suitable for use at 125 volts dc. Current shall be limited to 20 amps resistive.
- 7.14.3 Contact leads for alarm and trip shall be brought to a terminal block for field connection to the Owner's relay switchboard.
- 7.14.4 All relay coils associated with fault pressure detection shall be driven by the Owner's 125 volts dc.
- 7.14.5 The fault pressure detection relay shall be Qualitrol Series 900 with Qualitrol Seal-in Relay Model Number 909-200-01. All associated auxiliary relays shall be mounted within the transformer control cabinet.
- 7.14.6 The fault pressure relay shall be located on the transformer so as to avoid false trip operation during through-fault conditions. The fault pressure relay shall be located under oil.

7.15 Oil Preservation System

- 7.15.1 The transformer shall be equipped with a complete oil-preservation system, which shall include appropriate abnormal condition relays and alarms. The proper amount of oil for cooling and insulation and sufficient amount of inert gas for initial purging and oil filling shall be included.
- 7.15.2 The Materialman shall describe in the Proposal the type of oil-preservation system. A complete description of the system, a listing of all involved parts,

and a description of operation and maintenance requirements must be submitted with the Proposal.

- 7.15.3 The oil-preservation system shall be a conservator-tank type with a bladder in the conservator to prevent exposure of oil to outside air. There shall be separate liquid level gauges and alarms on the conservator and main tank.

7.16 Oil and Winding Temperature Measurement

- 7.16.1 Visual indication of transformer top oil temperature and winding temperature shall be provided by Qualitrol Model 104 temperature indicators. The system shall be provided with six inch (6") remote thermometers with an armored capillary and winding temperature current transformer per IEEE standards.
- 7.16.2 The top oil temperature display shall be capable of measuring and displaying a range of 0° to 120° Celsius. The winding temperature display shall be capable of measuring and displaying a range of 0° to 180° Celsius.
- 7.16.3 In addition to the visual indication, the temperature control shall be accomplished using a SEL 2414 transformer monitor. An RTD to sense top oil temperature shall be furnished and installed. An RTD to sense ambient temperature shall be furnished and installed. An RTD to sense LTC top oil temperature shall be furnished and installed. All RTDs shall be 100 Ohm Platinum. The ambient temperature RTD shall be Qualitrol model 103-047, or approved equal, properly located and away from the wash of air from cooling fans.
- 7.16.4 Programming shall be done by the Owner's engineer.
- 7.16.5 The SEL 2414 and input/output drawing is included in the appendix.
- 7.16.6 The full model number of the temperature indicators and transformer monitor shall be shown on the drawings.

7.17 Load Tapchanger (LTC) for Transformer Secondary

- 7.17.1 The power autotransformer and power transformer shall provide an automatically-controlled vacuum Load Tapchanger (LTC) for regulating the output voltage of the transformer secondary windings. The LTC shall consist of the following subassemblies:
- a. Secondary winding tap leads and auxiliary transformers (as may be required by manufacturer's design), all housed within the main transformer tank.
 - b. An oil-filled compartment separately partitioned from the main transformer tank and housing the mechanical tap selector switch, taps switch contactors, and reversing switch contactors as necessary for switching the tapped leads of the transformer secondary windings.
 - c. A motor drive assembly compartment housing the ac service-voltage drive motor, service voltage wiring, and related switches, interlocks, and motor drive controls necessary to electrically and mechanically operate the tapchanger mechanism.
 - d. Electronic control modules for the automatic sensing of transformer secondary voltage and automatic loop control of the drive motor thereby regulating the transformer secondary voltage. All control modules shall be located inside the transformer's main control cabinet. Refer to Section 7.19 or details regarding the automatic voltage control modules.

- 7.17.2 The LTC and all tests applied thereto shall conform to the latest standards of the IEEE, IEEE, NEMA, and NESC.
- 7.17.3 Assuming a constant voltage at the nominal rating of the transformer primary windings, the secondary load tapchanger shall provide automatic voltage regulation ranging from ten percent below (-10%) nominal secondary tap voltage to ten percent above (+10%) nominal secondary tap voltage while under any load current up to the maximum forced ratings of the transformer windings.
- 7.17.4 The full range of voltage regulation (+/- 10%) shall be accomplished by the LTC in sixteen (16) tap steps either side of the neutral (nominal) tap position. Each tap step shall provide an equally distributed 5/8-percent change in voltage in either the raise ("boost") or lower ("buck") direction.
- 7.17.5 For voltage regulation ranging between nominal and ten percent above ("raise" or "boost" tap positions), the LTC shall have capacity to deliver the full kVA rating of the transformer.
- 7.17.6 For voltage regulation ranging between nominal and ten percent below ("lower" or "buck" tap positions), the LTC shall have capacity for secondary load current corresponding to rated transformer kVA and the selected voltage tap position.
- 7.17.7 The LTC shall be designed to withstand full-voltage short-circuit conditions, and complete automatic operation of any tapchange under such conditions without failure of the tap-changer mechanism or tap-changer windings.
- 7.17.8 The tap-changer contact assembly of all LTC mechanisms shall be housed in an oil-filled compartment separately partitioned from the main transformer tank. The contact assembly shall include the tap selector switch and contactor mechanism, together with the reversing switch necessary for transfer from the neutral position to the raise or lower tap positions. The assembly shall provide mechanical stops to limit the travel of the switch movement within appropriate tolerances. The oil in this compartment shall provide dielectric strength for insulation. The compartment shall be designed to prevent any contamination of main tank oil from oil contained within the tapchanger assembly.
- 7.17.9 The oil-filled tapchanger compartment shall be outfitted with the following auxiliary equipment:
- a. Temperature-compensated Qualitrol dial-type liquid level gage with low level alarm contacts wired out for customer use.
 - b. Compartment breather shall be a Waukesha Auto-Recharging Dehydrating Breather, Model ARDB2.
 - c. Drain and filling valves, each one-inch (1") screw-end globe type.
- 7.17.10 The tapchanger may incorporate the following techniques to suppress contact arcing during tapchanges under load:
- a. preventive reactor winding;
 - b. resistance bridging device with oil filtration system;
 - c. vacuum interruption chamber (required).
 - d. The Manufacturer must clearly identify in the Proposal those arc suppression techniques and features that will be incorporated in the tapchanger assembly. Preventive reactor windings, where used, shall be

located with the core and coil assembly in the main tank of the transformer.

- 7.17.11 The Manufacturer's Proposal shall identify the guaranteed minimum number of maintenance-free tapchange operations provided by the LTC mechanism. Mechanisms providing less than 500,000 operations between maintenance service will be evaluated as an unresponsive bid.
- 7.17.12 The secondary windings of the transformer shall be tapped as necessary to provide the desired number of tap steps and percent voltage regulation. A series transformer may be incorporated into the design of the main core and coil assembly if necessary to achieve the appropriate regulation.
- 7.17.13 The compartment housing the motor drive assembly shall provide the following features and accessories:
 - a. Mechanism drive motor, 120 Vac service voltage input, with power supply cut-off switch, thermal overload protection, and complete with all service voltage terminal blocks and wiring. Refer to Section 7.19 for information regarding the automatic voltage regulation modules which control the drive motor.
 - b. Manual hand-crank operation of the mechanism drive shaft, electrically interlocked to prohibit operation of the drive motor when hand crank is in use.
 - c. Electrical transfer switch to block automatic control of the drive motor and provide electrical raise and lower control of the drive motor locally at the motor control compartment.
 - d. Mechanically-driven dial-type position indicator displaying the current tap position of the LTC. The indicator dial shall be clearly graduated for every step position from 16L to 16R including N demarcation for neutral position. At least every fourth step position shall be numerically identified on the dial.
 - 1) The position indicator shall be equipped with electrically resettable drag hands indicating the maximum travel of the tapchanger in the lower and raise positions.
 - 2) The position indicator shall provide upper (16R) and lower (16L) limit switches to remotely alarm the full travel of the LTC mechanism in either direction. The alarm contacts shall be fully wired to the main control compartment annunciator.
 - 3) The position indicator shall be mounted on the transformer in a location clearly visible and legible from average eye level while standing at the tap changer mechanism cabinet.
 - e. Tap-changer operations counter either mechanically- or electrically-triggered and mounted for unobstructed view at eye level within the compartment.
 - f. 120 vac duplex convenience outlet, ground fault protected in accordance with the National Electric Code.
 - g. 120 vac thermostatically-controlled low wattage strip heater, complete with overcurrent circuit breaker, for protection against condensation within compartment.
 - h. 120 Vac compartment lamp with plunger switch activated by compartment door, and protected by overcurrent circuit breaker.

- i. Selsyn-type transmitter as required for current-loop interface to the automatic tapchanger control equipment for indication of LTC tap position.
 - j. All wiring necessary for interconnection between the components of the motor control compartment and the automatic voltage control equipment shall be provided by the Manufacturer.
- 7.17.14 SEL-2414 device shall have thermowell probes in both the main and LTC tanks for monitoring the condition of the LTC.

7.18 Automatic Voltage Regulation Equipment for LTC's

- 7.18.1 The transformer shall provide microprocessor-based automatic control of the LTC for load-compensated voltage regulation. The automatic LTC controller shall be a BECKWITH MODEL M-2001D-6L4S2BF0S00 Digital Tap-changer Control as manufactured by Beckwith Electric Company, Inc. of Largo, Florida. No substitutions will be accepted.
- 7.18.2 The Beckwith 2001 tapchanger control shall be mounted in the main control cabinet of the transformer using a BECKWITH M-2270 faceplate panel. All BECKWITH M-2270 faceplate panel features shall be electrically operable and fully functional. Features of the faceplate panel shall include:
- a. One pair of combination "banana plug/ binder post" test terminals for sensing voltage input;
 - b. One pair of combination "banana plug/ binder post" terminals for external motor voltage input;
 - c. One pair of combination "banana plug/ binder post" terminals for external sensing voltage input;
 - d. Separate fuses in front-mounted fuse holders for each pair of test and input terminal posts;
 - e. RAISE/OFF/LOWER manual switch control;
 - f. AUTO/OFF/MANUAL selector switch control;
 - g. VOLTAGE SOURCE selector switch between internal and external sources;
 - h. DRAG HANDS RESET pushbutton;
 - i. NEUTRAL LIGHT indicator;
 - j. Built-in current transformer shorting protection whenever the M-2001 tapchanger control is disconnected from the wiring harness.
- 7.18.3 To accommodate bus voltage regulation in parallel with a future LTC transformer, a parallel current balancing control module shall be provided in conjunction with the Beckwith Model M-2001D. The parallel balancing module shall be a BECKWITH MODEL M-0115 control. No substitutions will be accepted.
- 7.18.4 To accommodate the current loop interface between the Selsyn-type transmitter in the motor control compartment and the M-2001, a BECKWITH M-2025 Current Loop Interface module and an INCON Model 1250 position monitor/transducer shall be provided.
- 7.18.5 To accommodate digital access to the digital tapchanger control memory, one copy of the BECKWITH M-2029 "TapTalk" communications software shall be provided.
- 7.18.6 The transformer shall provide a current transformer for line-drop compensation measurement by the tapchanger control.

- 7.18.7 The current transformer shall provide dual taps for ratios of 1000:0.2 and 600:0.2. The current transformer shall be located on the X1 bushing within the main transformer tank.
- 7.18.8 Sensing voltage input to the tapchanger control will be supplied by an Owner-furnished externally-mounted potential transformer.
- 7.18.9 The Manufacturer shall provide all interconnection wiring between the control modules, current transformers, auxiliary equipment, and field termination blocks to achieve a completely functional automatic voltage regulating system. Terminations shall include all interconnections between the available I/O functions of the digital tapchanger control and field termination blocks. These functions include, but are not limited to, the following:
 - a. External sensing voltage input;
 - b. Paralleling connections to future transformer;
 - c. Self-test alarm contact outputs;
 - d. User-programmable alarm contact outputs;
 - e. Tapchange inhibit contact input;
 - f. Multi-step voltage reduction.

8.0 Additional Features

Transformer shall include, but is not limited to, the following mechanical and electrical features:

- 8.1 Two (2) ground pads per the latest IEEE C57.12-10 with connectors for 4/0 through 500 kcmil, 37-strand copper conductor.
- 8.2 Ground bus and grounding accessories, consisting of two (2) transformer tank grounding pads with connectors for 4/0 through 500 kcmil, 37-strand copper conductor; appropriate mounting brackets; 4/0 Cu bonding conductors; and 1/4-inch x 4-inch copper ground bars to connect the Xo bushing to the tank grounding pad and station ground grid as shown in the Appendices.
- 8.3 Main transformer core ground pad with connection accessible through top handhole.
- 8.4 Magnetic liquid level gauge with alarm contacts. (Liquid temperature indicator.)
- 8.5 Pressure vacuum gauge and bleeder device with sampling and purging valve. Devices shall be mounted at eye level.
- 8.6 Pressure relief device with alarm contacts and visual alarm on top of unit.
- 8.7 Upper valve for filter-press connection, one-inch, with NPT threads and pipe plug.
- 8.8 Combination lower valve for filter-press connection, with 3/8-inch oil sampling device, and two-inch (2") drain and filter valve, with NPT threads and pipe plug.
- 8.9 Pressure-vacuum bleeder.
- 8.10 One or more handholes or manholes in cover. Round manholes shall have a diameter of 18-inches minimum. Oval or rectangular manholes shall be dimensioned 10 inches x 16 inches minimum. Core ground to be brought to manhole for testing.
- 8.11 Lifting lugs on tank, lifting eyes on cover, and provisions for jacking. Location of jack bars shall be a minimum of 13" above the transformer base line.
- 8.12 Nameplates in accordance with IEEE Standards, located on the main tank, non-corrosive.
- 8.13 Non-corrosive diagram instruction plate. Turn progression and accuracy class of bushing current transformers shall be shown on nameplate.
- 8.14 Tap Changer instruction nameplate, stainless steel for the high-voltage tap changers.
- 8.15 Undervoltage relay to detect and alarm for the loss of all phases of cooling power.

- 8.16 All valves shall have silicone rubber (or better) packing to prevent leaking.
- 8.17 Insulating oil, with associated PCB certification and nameplate as per General Conditions.
- 8.18 Single-phase, 60 Hertz, 230 volts cooling fans (and/or oil pumps as an alternate).
- 8.19 All alarm contacts shall be suitable for 125 volts dc with separate wiring from all terminals of each device to a terminal board located in the transformer control cabinet. All control wiring and CT terminals to be equipped with nonmagnetic split type lock washers and ring type compression lugs. All current transformer leads to be No. 10 or larger and terminated on shorting type terminal blocks in the control cabinet.
- 8.20 Each removable cooling radiator shall be provided with a fill valve and a drain connected at top and bottom and transformer valves for detachable tank mounted radiators. The quantity of oil in each radiator shall be included on the nameplate.
- 8.21 All transformer oil supplied shall have antioxidant oil inhibitor added. The manufacturer may supply 0.3% wt DBPC or 0.3% wt DBP inhibitor. Installation of inhibitor shall be in accordance with the latest IEEE C57.106.
- 8.22 A 1" globe valve shall be installed near the top of the oil for a GE Kelman Minitrans on-line oil monitoring system with COMM02025 DNP3 over RS232. Valve shall be capped with a cast iron plug, if system is removed during shipment. GE Kelman system is to be supplied with transformer.
- 8.23 No tripping relays shall be mounted on a swinging panel. All tripping relays shall have covers.
- 8.24 Core ground pocket bushing with protective cover.

9.0 Tests

- 9.1 Transformer shall receive standard commercial tests in accordance with IEEE Standards.
- 9.2 Transformer shall receive standard IEEE impulse tests, including full wave and chopped wave on each high-voltage line terminal and on each low-voltage line terminal including neutral terminal. Copies of oscillograms and a formal report will be submitted as a record of the tests.
- 9.3 Transformer shall receive a Sweep Frequency Response Analysis during factory testing. This test shall be repeated during site testing. Results shall be compared and a report provided with explanation for any differences in results.
- 9.4 The loss measurement system used to measure losses shall state in the test report the measurement error traceable to the National Bureau of Standards by means of a procedure described in NBS Technical Note 1204 or an approved equivalent procedure. This shall be applicable to the test system used to measure both the no-load and load losses for the transformers specified herein. The approach outlined in NBS Technical Note 1204 or an approved equivalent procedure shall be used to insure the traceability of measurements. The measurement error determined through the procedure outlined in Technical Note 1204 or an equivalent procedure will be added to the measured losses determined during the test prior to the determining if the loss guarantee has been met. Should the Bidder (manufacturer) be unable to comply with this provision, he shall clearly so state in the section entitled "Form of Exceptions".
- 9.5 All transformer losses, including auxiliary losses, shall be shown on the test reports.
- 9.6 Insulation power factor tests shall be made and shall be one-half percent (½%) or less corrected to 20°C by the IEEE temperature correction curve.

- 9.7 Prior to shipment, the assembled transformer shall be liquid-filled and pressure-tested for at least eight (8) hours at the maximum operating pressure for detecting the presence of leaks.
- 9.8 The transformer shall be tested for no-load losses at rated voltage both before and after the impulse test.
- 9.9 The transformer shall be tested for a temperature rise at the base ONAN and the maximum ONAF ratings. The temperature rise test shall include a DGA before and after the test.
- 9.10 The load-loss and impedance testing shall include the following tap position combinations:

T1-16L	T3-1R
T3-16L	T3-8R
T5-16L	T3-15R
T3-8L	T1-16R
T1-N	T3-16R
T3-N	T5-16R
T5-N	

- 9.11 The no-load loss testing shall include the following tap positions:

16L	15R
N	16R
1R	

These are to be tested both before and after impulse testing.

- 9.12 The transformer sound level shall be tested in accordance with NEMA TR1-2013, 0.03, "Audible Sound Levels."
- 9.13 No transformer will be accepted for shipment until approved by the Owner or the Owner's Engineer.
- 9.14 **The Owner reserves the option of having a representative witness any or all tests.**
- 9.15 All impedances between windings shall be shown on the test reports. Test reports shall also include Insulation Resistance Readings, Core Ground Resistance Readings, and DGA before and after dielectrics.
- 9.16 The Bidder's field engineer shall perform a series of tests on the transformer after installation at the substation. These tests shall include:
- a. sweep frequency response analysis,
 - b. transformer power factor tests,
 - c. bushing power factor tests,
 - d. transformer turns ratio tests for all tap positions,
 - e. insulation megger tests,
 - f. current transformer checks (polarity, turns ratio, and connections), and
 - g. oil tests as follows:
 - 1) Specific gravity,
 - 2) dielectric,
 - 3) moisture content,
 - 4) acidity,
 - 5) interfacial tension, and
 - 6) PCB content
- 9.17 The Bidder shall provide a complete dissolved gas in oil analysis on the oil installed in the transformer after final assembly.

- 9.18 The Bidder's field engineer shall give approval for energizing the transformer, and a manufacturer's representative shall be on site to observe the entire energization process.
- 9.19 Tests for core grounds are to be performed after tanking and just prior to leaving the factory using a 1000-volt megger tester. Resistances measured are to be included in a certified test report and reported to the Engineer prior to shipment. The Bidder may offer in his quotation deductions for substitution of manufacturers' standard tests in lieu of those specified. However, the basic quotation must include all tests specified.
- 9.20 The Owner reserves the option of having a representative present to inspect the core and coils prior to tanking and to witness any or all tests.
- 9.21 Without limiting in any way any obligation of the Bidder under this agreement, the Bidder shall demonstrate to the satisfaction of the Owner that the transformer proposed to be furnished under this Specification shall have sufficient mechanical strength to withstand without failure all fault currents. The Bidder shall demonstrate that the transformers meet this requirement by one of the following methods:
- 9.22 Certified test data showing that a transformer with a core and coil identical in design and construction and identical or similar with respect to kVA capacity, kV ratings, BIL, impedance and voltage taps has been tested without failure for short-circuit strength. A description of the test code under which the transformer was tested for short-circuit strength will be provided by the Bidder to the Owner.
- 9.22.1 A history of successful experience with transformers of identical or similar ratings, design, and construction. The Bidder shall list all transformers in service with core and coils which are essentially identical in design, construction, and manufacture to the transformer covered by this specification and provide information on the date of installation, location, and failures, if any. Where such transformers have not been built or the cumulative service record is less than twenty (20) transformer years, a list of transformers in service which represent the closest approximation to the transformer covered by this specification shall be submitted. The information submitted shall be representative of the total experience of the manufacturer with the design of the transformer it proposes to furnish and shall include the dates of installation or shipping, the ratings of the transformers, and the failures and causes of failure, if any have been experienced.
- 9.22.2 The Bidder shall submit with his Proposal a complete listing of all full-size transformers of his manufacture, in ratings 30,000 through 300,000 kVA, which have been short-circuit tested. The list shall include all full-size units tested, whether they were development tests or tests of customer units. Complete ratings shall be given of each unit and each shall be noted as to whether copper or aluminum windings were used for comparison with that winding material offered on this bid.
- 9.23 In the case of units tested for or by the ultimate customer, indication shall be given on each unit as to whether the test was successful or unsuccessful and, if tested more than once, each subsequent test shall be so listed and appropriate comments given as to design changes made, if any.
- 9.24 If the Bidder cannot furnish such test data, he shall so state on the Proposal.

10.0 Guarantees

Included with the data on transformer to be submitted by the Manufacturer with his Proposal shall be the following:

- 10.1 Efficiencies at 1/4, 1/2, 3/4 and full load at unity power factor and 75°C.
- 10.2 No-load loss in watts (include losses at 16L, N, 1R, 15R and 16R).

- 10.3 Total full-load loss in watts at ONAN, ONAN/ONAF, ONAN/ONAF/ONAF rating at 55°C rise and ONAN/ONAF/ONAF rating at 65°C rise, including auxiliary losses (include losses at 16L, N, 1R, 15R and 16R).
- 10.4 Full load regulation at 100 percent and 80 percent power factor.
- 10.5 Exciting current at rated frequency in percent of the rated voltage and rated kVA.
- 10.6 Cooling fans, (or oil pumps) H.P. rating, and voltage.
- 10.7 Net weight including insulating oil plus weights of tank and oil separately.
- 10.8 Shipping weight.
- 10.9 Gallons of oil required per transformer.
- 10.10 Limiting dimensions of transformer including tank wall thickness.
- 10.11 Copies of the transformer test reports shall be furnished to the Owner's Engineer at the time the transformers are shipped.
- 10.12 Certification that the transformer and all oil-filled equipment meet all EPA requirements and each unit shall be certified as operational with less than two parts per million, PCB.

11.0 Transformer Bid Evaluation

- 11.1 Bids submitted shall be evaluated for "Equivalent First Cost" utilizing initial cost, transformer losses, and the cost of financing over a twenty-year (20-year) evaluation of ownership. The formularization is as follows:

$$\text{"Equivalent First Cost"} = (\text{Unit Cost}^*) + (\text{No-Load Losses} \times A) + (\text{Winding Losses} \times B)$$

**Including escalation if any and cost of insurance ⁽¹⁾ if less than a five-year warranty is quoted or other adjustments to quoted prices are necessary to evaluate equal offerings.*

- 11.2 For the purpose of evaluating transformer losses both for the purpose of award and determination of compliance after manufacturing and test, the following will apply for the no-load and winding losses:
- 11.3 No-load losses will be evaluated using the average of quoted losses at LTC 1R position and LTC average 15R and 16R position.
- 11.4 Winding losses will be evaluated using the quoted losses at LTC average 15R and 16R position.
- 11.5 The Cost of Losses will be evaluated using the following kW charge:

MVA*	Cost per kW No-Load Losses (A Factor)	Cost Per kW Winding Losses(B Factor)
120 MVA	\$5,879	\$820

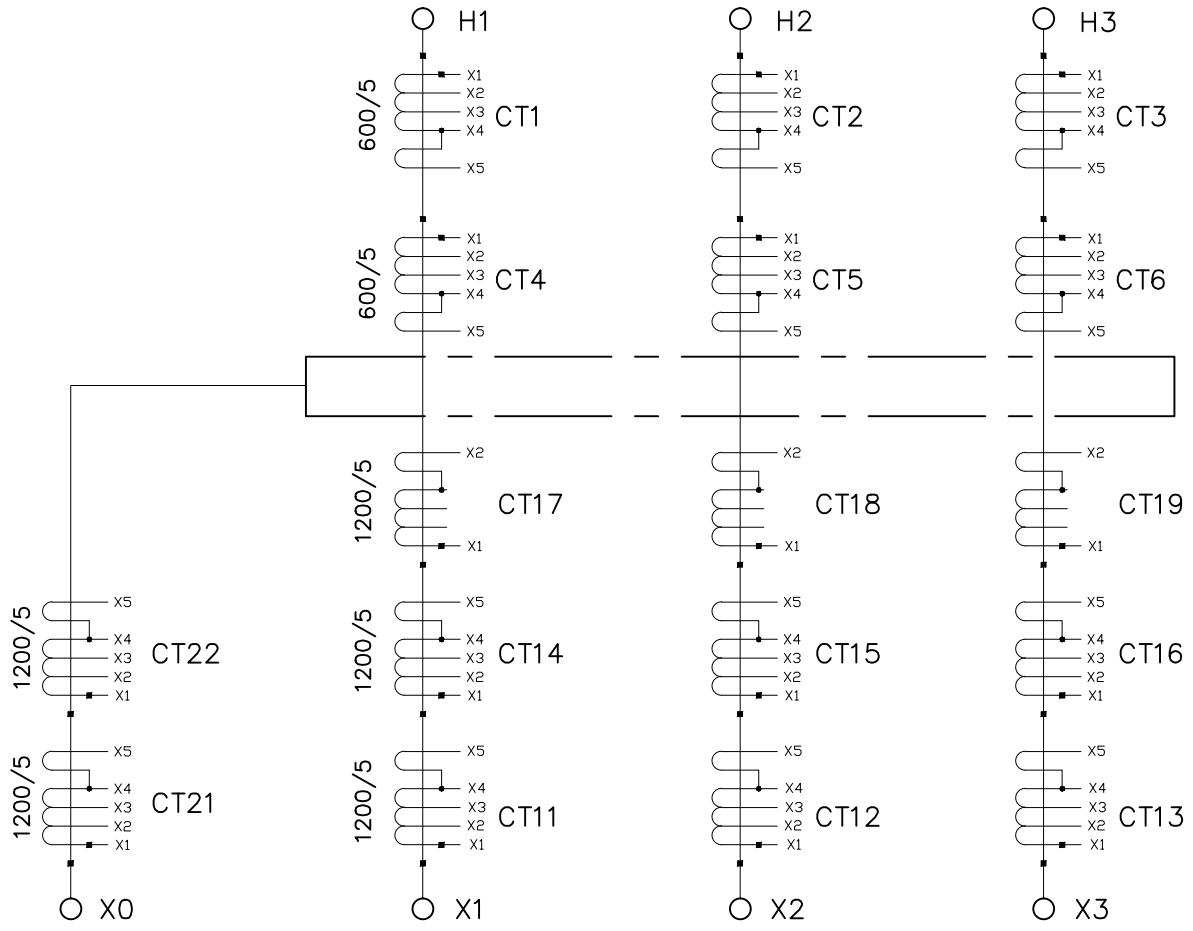
- 11.6 The Owner reserves the right to change at any time the no-load loss and winding loss charge values given above insofar as these values are used to evaluate bids. Such changes might be necessary to reflect changed conditions and are not expected to be more than ±20% of the values shown above. Nevertheless, liquidated damages as described below will be based on the values given above.
- 11.7 The No Load and Winding Losses quoted by the Bidder are of the essence of the Contract. Should the Bidder neglect, refuse, or fail to meet the quoted losses herein provided, in the 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 monies which may be then due or which may become due and payable to the Bidder the sum equal to the difference in quoted loss values and the actual loss values as verified by the certified test reports provided after manufacture computed in dollars utilizing the

No Load Loss and Winding Loss values listed above as liquidated damages and not as a penalty. In no event shall the adjustment factor under this provision result in a net price increase to the Owner. 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.

11.8 For the purpose of evaluation, those manufacturers who fail to provide prompt and thorough responses to installation or service problems will be assessed a penalty. This penalty will be assessed for present and future problems. It is in the best interest of the Greenville Utilities Commission to receive equipment which is placed into service easily and does not continue to experience service problems. The current Adder for evaluation is four percent (4%), which will be added to the purchase price of those manufacturers, who in the exclusive opinion of the Greenville Utilities Commission have documented installation and service problems.

11.9 The following adders will be applied during the evaluation process for any quotation having a warranty of less than five years.

One-year warranty in lieu of five years	=	\$ 7,200.00
Three-year warranty in lieu of five years	=	\$ 4,500.00



H1	H1	X1	X1	X1	X0
1X1	4X1	11X1	14X1	17X1	21X1
1X2	4X2	11X2	14X2	17X2	21X2
1X3	4X3	11X3	14X3	17X3	21X3
1X4	4X4	11X4	14X4	17X4	21X4
1X5	4X5	11X5	14X5	17X5	21X5

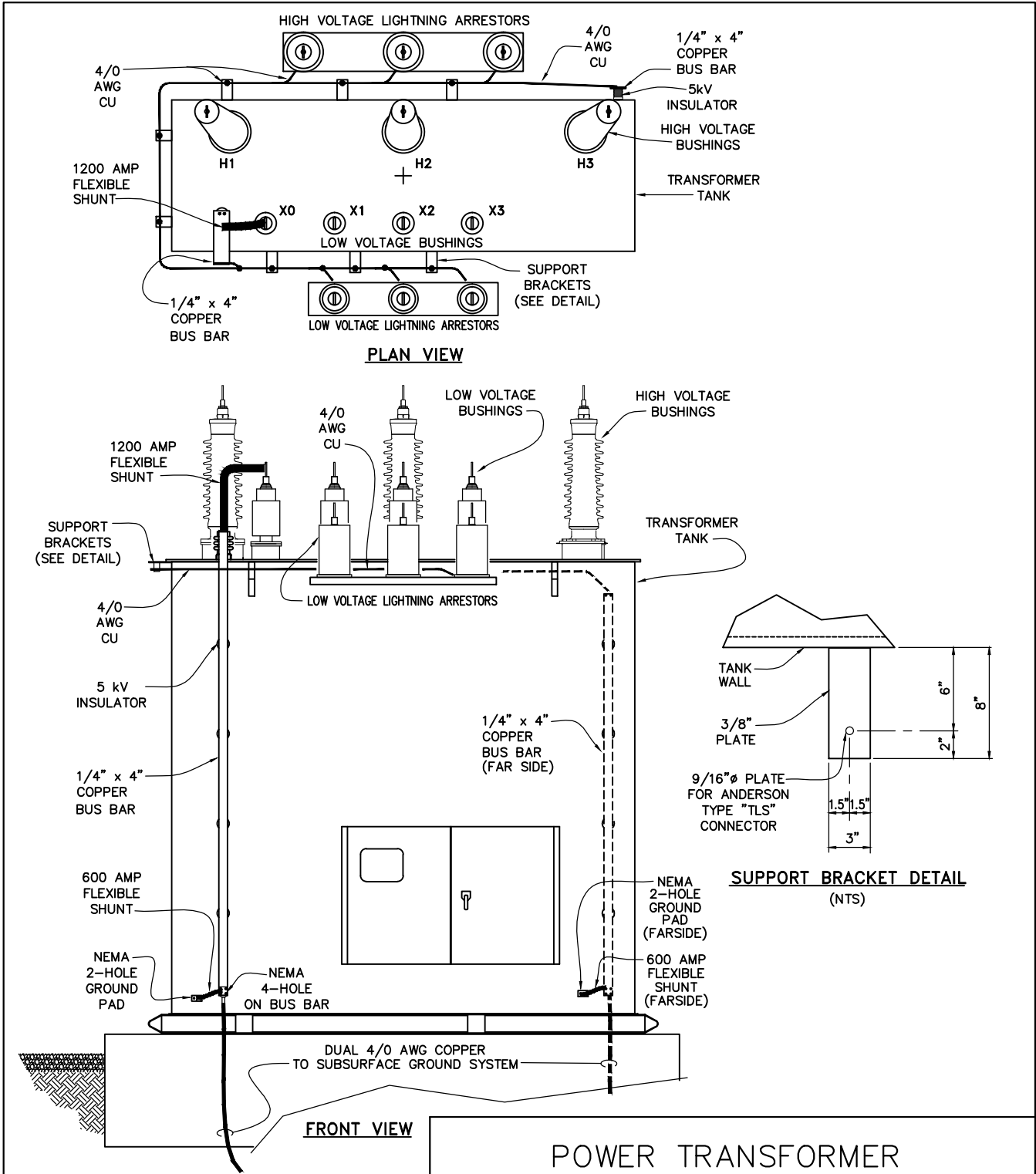
H2	H2	X2	X2	X2	X0
2X1	5X1	12X1	15X1	18X1	22X1
2X2	5X2	12X2	15X2	18X2	22X2
2X3	5X3	12X3	15X3	18X3	22X3
2X4	5X4	12X4	15X4	18X4	22X4
2X5	5X5	12X5	15X5	18X5	22X5

H3	H3	X3	X3	X3
3X1	6X1	13X1	16X1	19X1
3X2	6X2	13X2	16X2	19X2
3X3	6X3	13X3	16X3	19X3
3X4	6X4	13X4	16X4	19X4
3X5	6X5	13X5	16X5	19X5

CONNECTION FOR MULTI-RATIO BUSHING CURRENT TRANSF.			
LEADS ON	NOMINAL RATIO		
	600/5BCT	1200/5BCT	2000/5BCT
X1-X5	600/5	1200/5	2000/5
X2-X5	500/5	1000/5	1600/5
X3-X5	450/5	900/5	800/5
X1-X4	400/5	800/5	1500/5
X2-X4	300/5	600/5	1100/5
X3-X4	250/5	500/5	300/5
X4-X5	200/5	400/5	500/5
X1-X3	150/5	300/5	1200/5
X1-X2	100/5	200/5	400/5
X2-X3	50/5	100/5	800/5
ACCURACY CLASS	10C800	10C800	10C800

APPENDIX 1

			BOOTH & ASSOCIATES STANDARD	
			TYPICAL CURRENT TRANSFORMER ARRANGEMENT FOR POWER TRANSFORMERS	
			Booth&Associates Inc. <small>3811 Glenwood Avenue Raleigh, NC 27612 CONSULTING ENGINEERS NC F-0221</small>	
			DWN. BNC	DATE 08/22/13
CKD. JEN	APPD. CHW			
NO.	REVISION	DATE	SCALE: AS SHOWN	



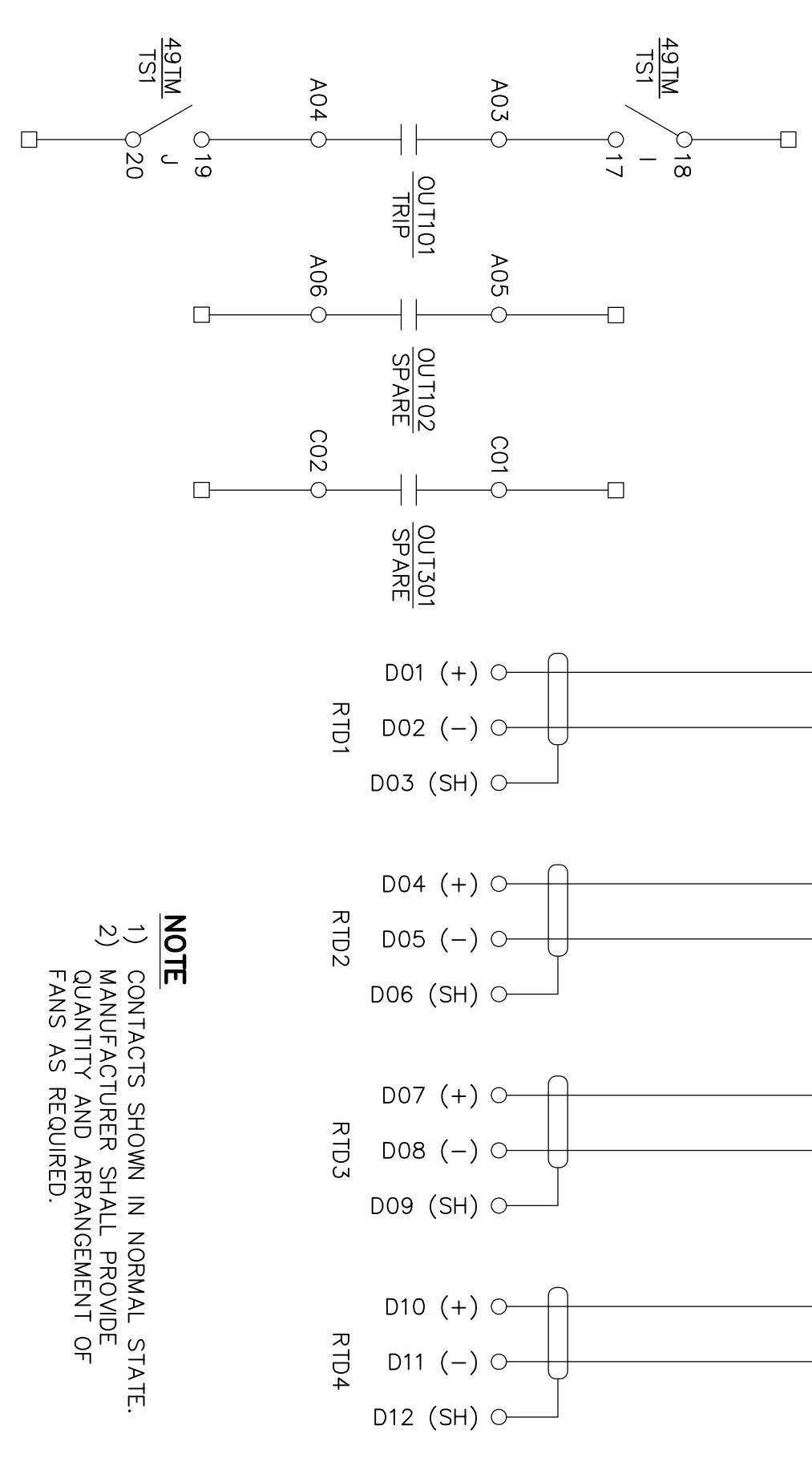
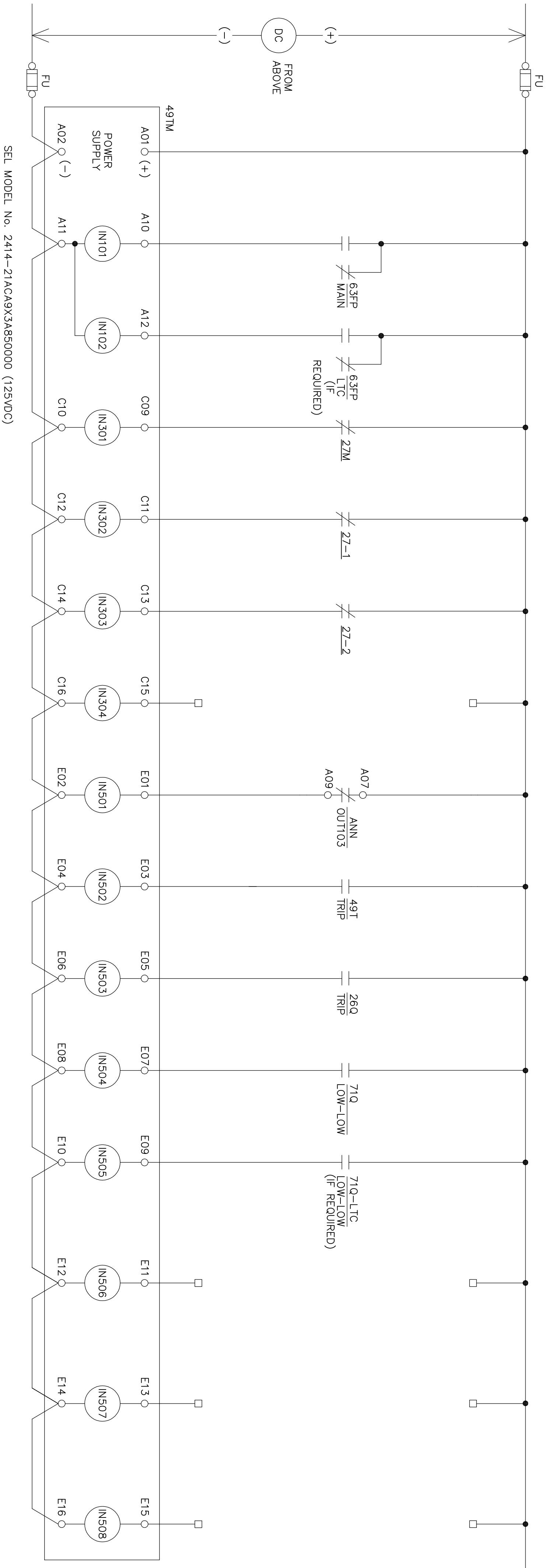
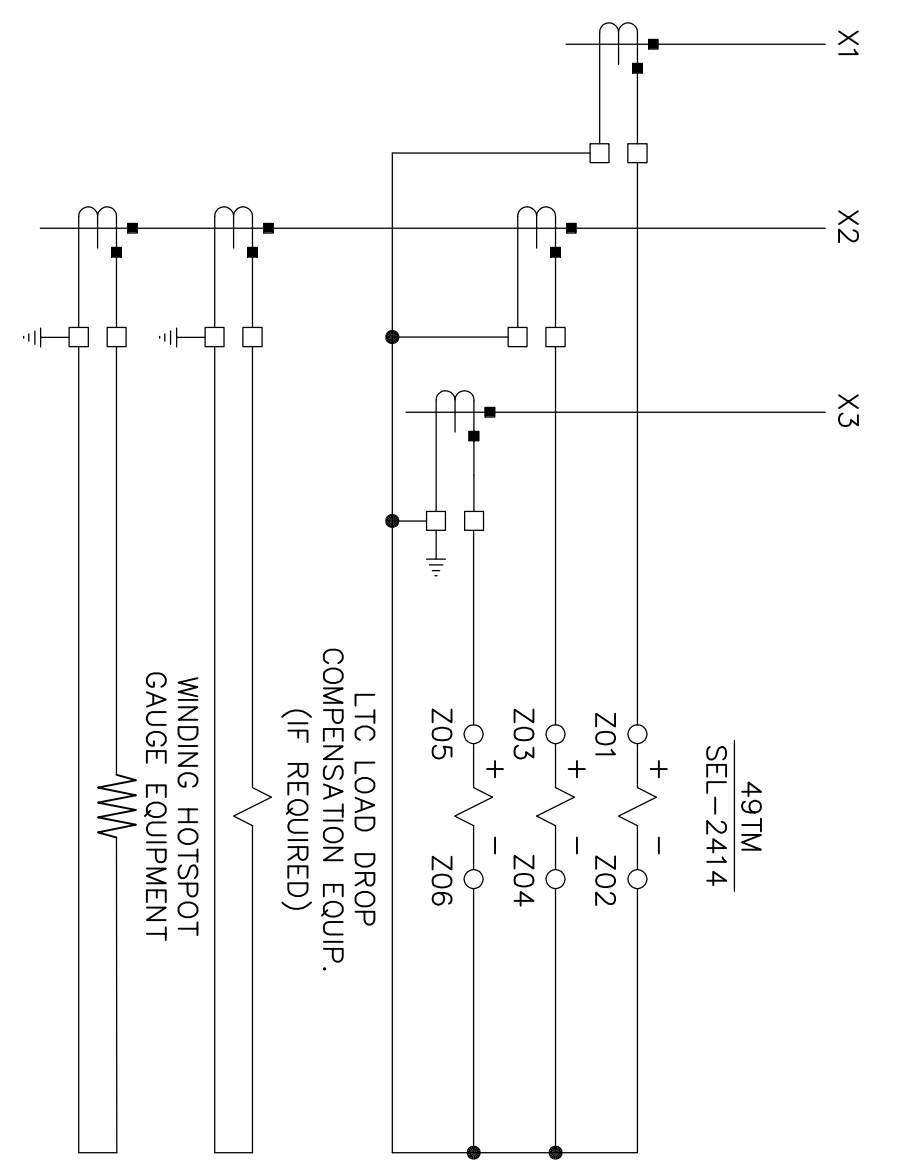
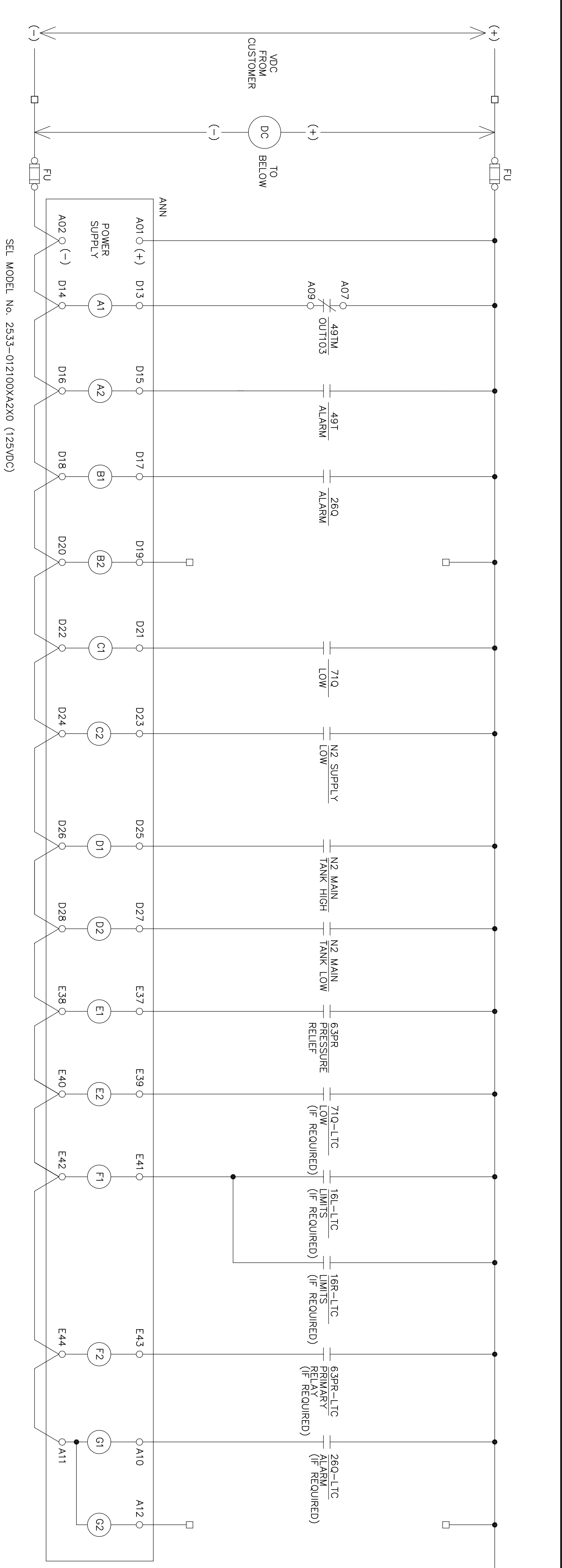
APPENDIX 2

**POWER TRANSFORMER
NEUTRAL SUPPORT BRACKET DETAIL**

Booth & Associates, Inc.

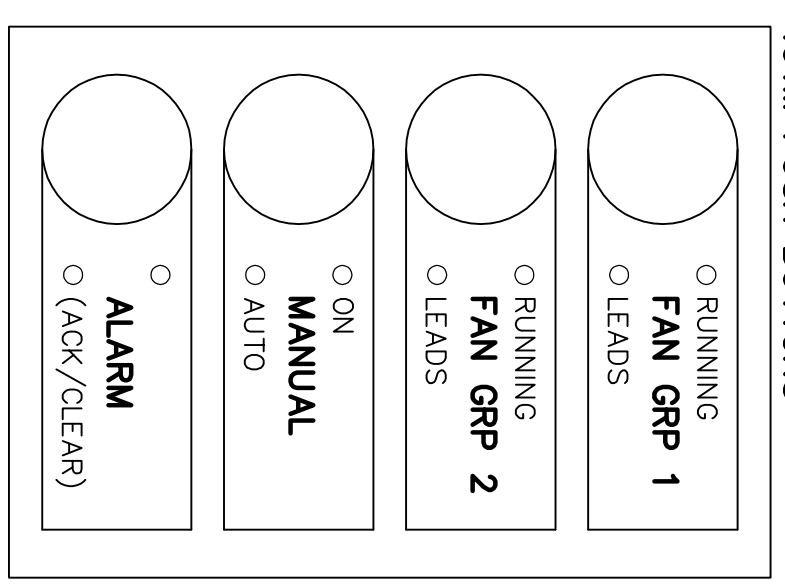
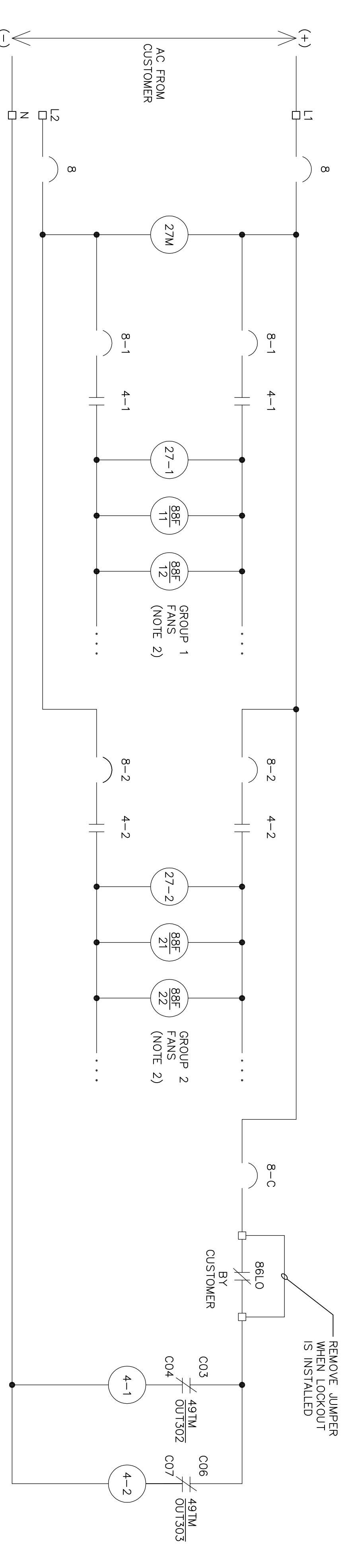
5811 Glenwood Avenue | Raleigh, NC 27610 CONSULTING ENGINEERS NC F-0221

DWN. KRG	DATE 8/28/13	DWG. NO. XO-1 10000X01
CKD. MLC	APPD. MLC	
SCALE NONE	PLOT: 1=48	

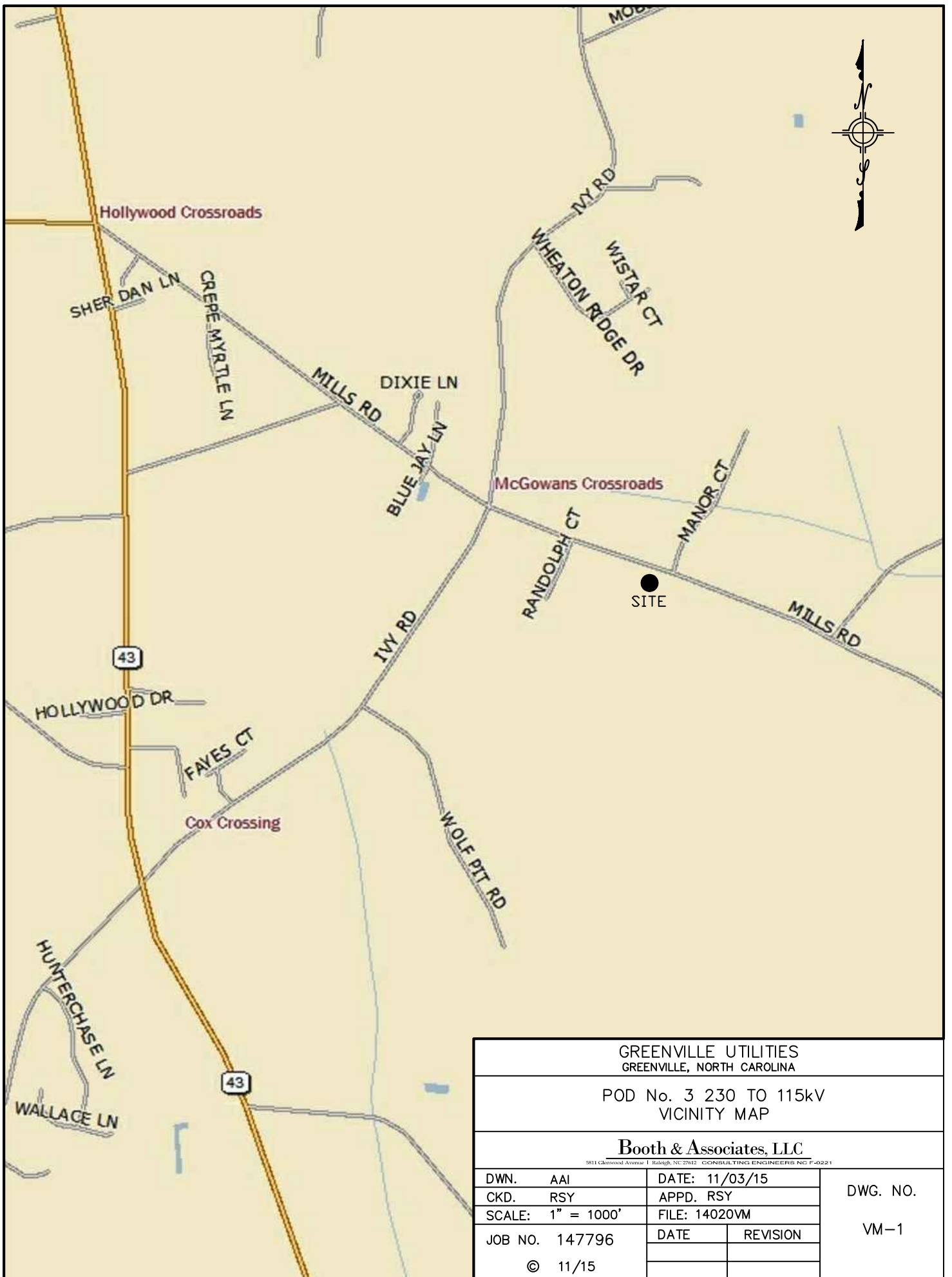


NOTE
 1) CONTACTS SHOWN IN NORMAL STATE.
 2) QUANTITY OF WINDING HOT SPOT GAUGE EQUIPMENT OF FANS AS REQUIRED.

LEGEND
 ○ DEVICE TERMINAL POINT
 □ TERMINAL POINT



PRELIMINARY - DO NOT USE FOR CONSTRUCTION		NO.		DATE		SCALE NONE	
		A		12/08/15		DWM, BCW CAD, BCW	
GREENVILLE UTILITIES GREENVILLE, NORTH CAROLINA		GREENVILLE SOUTH 230KV POD #3 TRANSFORMER SPEC APPENDIX 3 TRANSFORMER AC & ALARMS		DWG. NO. 154022		DIVC. NO. TX APPENDIX 3	
Booth & Associates, LLC 1000 W. 10th Street Greenville, SC 29615		DATE: 12/08/15 APPD. BCW		SCALE NONE		PROJECT: 14022-TX APP3 (ID: 35843).DWG	



GREENVILLE UTILITIES GREENVILLE, NORTH CAROLINA			
POD No. 3 230 TO 115kV VICINITY MAP			
Booth & Associates, LLC <small>5811 Glenwood Avenue Raleigh, NC 27612 CONSULTING ENGINEERS NC F-0221</small>			
DWN.	AAI	DATE:	11/03/15
CKD.	RSY	APPD.	RSY
SCALE:	1" = 1000'	FILE:	14020VM
JOB NO.	147796	DATE	REVISION
©	11/15		
			DWG. NO. VM-1