TRANSFORMER SPECIFICATIONS

St. George Energy Services
Distribution Substation
69-13.2Y/7.62 kV, 15/28 MVA Power Transformers
Inquiry Number: 17-0041

August 2017

St. George City Energy Services
175 East 200 North
St. George, UT 84770
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NOTICE TO BIDDERS

NOTICE TO BIDDERS:

Sealed proposals will be received by St. George Energy Services (SGES), at its offices located at 175 East 200 North, St. George, UT 84770 until 2:00 p.m. on Tuesday, September 5, 2017 for the furnishing of two (2) 69-13.2 kV, 15 MVA, Power Transformers. This bid shall include the option of an On-Load Tap Changer (LTC).

The project schedule is as follows:

Bid due date: **Tuesday, September 5, 2017**

69-13.2Y/7.62 kV, 15/28 MVA Power Transformers Delivered to the project site on or before: **February 12, 2018**

Owner shall enter into only one contract for the transformer for the Project.

SGES reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of SGES.

Instructions, specifications, and proposal blanks will be on file in the St. George City offices, (“Owner”) 175 East 200 North St. George, Utah 84770, where they may be consulted or secured for the purpose of bidding.

INSTRUCTIONS TO BIDDERS

1. **SCOPE OF CONTRACT**
   a. Bidder shall be fully responsible for all labor, material, and equipment necessary for complete construction of the equipment as required in the Contract Documents.

2. **SECURING AND COMPLIANCE WITH BIDDING DOCUMENTS**
   a. Specifications and other bidding documents may be obtained at the time and place indicated on the Notice to Bidders. Bidders shall comply with all conditions stipulated in such bidding documents.
3. INTERPRETATION OF DRAWINGS AND DOCUMENTS
   a. If any bidder is in doubt as to the true meaning of any part of the Contract Documents, or finds errors, discrepancies, or omissions in them, he shall at once request interpretation or correction from the Engineer.
   b. The Engineer will promptly clarify the area in question and issue written instructions to all prospective bidders. Verbal instructions or interpretations will have no validity, regardless of source.
   c. Request for such clarifications must be in the office of the Engineer a minimum of three (3) days prior to bid opening.

4. PREPARING AND SUBMITTING BIDS
   a. Bids shall be prepared on the forms as found in this specification.
   b. Bids will bear no marks, erasures, or writing changes, other than those provided or requested.
   c. No verbal or telephone bid modifications or cancellations will be considered.
   d. The bidder guarantees there shall be no revisions or withdrawal of bid amount for a period of 90 days after bid opening.
   e. Bid shall be signed by a Principal duly authorized to make contracts.
   f. Bid proposals shall reflect the cost of all work required by the bidding documents, plus additions, deletions, or modifications required by addenda issued prior to bid opening.
   g. Bids shall be submitted in opaque envelopes that bear bidders name, and be sealed and addressed as indicated in Part 1 of the specifications.
   h. It is bidder’s sole responsibility to see that his bid is received at the proper time and place. Any bid received after scheduled bid opening will be considered non-responsive.

5. BID WITHDRAWALS
   a. Prior to the bid opening, bidders may withdraw a bid by written request or by reclaiming bid envelopes.

6. BID OPENING AND DATE
   a. Bid opening time and date is as per the Notice to Bidders founds in this Contract Document.
1 GENERAL REQUIREMENTS

1.1 SCOPE

A. The purpose of this specification is to furnish the specific data and requirements pertaining to the purchase, design, inspection, shipment, service engineering, and the testing of the power transformer as specified herein to be purchased by St. George Energy Services.

1.2 CORRESPONDENCE

A. All proposals shall be addressed to:

Purchasing Department
St. George City
175 East 200 North
St. George, Utah 84770
Telephone: (435) 627-4000

B. Technical questions shall be addressed to

Barb Berrett or Tom Birrell
St. George Energy Services
175 East 200 North
St. George, UT 84770
Telephone: (435) 627-4800
Cell: (435)

1.3 BID PROPOSAL

A. Firm prices shall be quoted. The Bidder’s proposal shall not include sales or use taxes. Any price escalation factors employed to establish an invoice price are to be clearly stated and fully explained on the "Price Data" form.

B. All bids shall be marked: “Distribution Substation 69-13.2Y/7.62 kV, 15/28 MVA, Power Transformer” Inquiry No. 17-0041.

C. The Purchaser reserves the sole right without cause to accept or reject any or all bids, or any portion thereof.
D. The Purchaser reserves the right to waive minor irregularities or minor errors in any proposal if it appears to the Purchaser that such irregularities or errors were made inadvertently. Any such irregularities or errors so waived must be corrected in the Proposal in which they occur prior to the execution of any contract which may be awarded thereon.

E. **Bidder shall supply three (3) copies of proposals (one [1] original, two [2] copies).**

F. All Bidders will be notified of any changes in the specifications in addendum letters. Receipt of addendum letters must be acknowledged in the bid proposal.

1.4 **BID EVALUATION**

A. The Purchaser will consider the prices and delivery dates as only two elements making up the total value of the material to be purchased. In order to properly evaluate other factors, we request the Supplier to provide answers to the following questions in his proposal:

1. Where is the nearest factory authorized repair shop capable of repairing equipment of the size and type proposed?
2. Where are the nearest factory trained Service Engineers located who can provide field service for the proposed equipment?
3. How much (if any) of the Service Engineer's service are included in the quoted price for the equipment proposed? If not included in the quoted price, the Field Engineering Service cost should be given in paragraph 4.5.B.

B. Other items which will be considered in the bid evaluation are:

1. The Bidder's past performance(s) in providing substation equipment and meeting quoted deliveries.
2. Construction methods and materials proposed to be used in the transformer.
3. The Bidder's past ability and willingness to solve problems that have arisen in a satisfactory and complete manner.
4. The Bidder's deviations from the specifications.
5. Warranties available and associated costs for 12 months, 18 months, 24 months, 36 months, 48 months, and 60 months.
6. Manufacturer's cancellation policy.
1.5 PURCHASE ORDER

A. It is anticipated that a purchase order will be issued to the successful Bidder(s) within ninety (90) days after the due date for the receipt of the proposals. All bids shall be valid for this period of time.

1.6 DELIVERY AND SHIPPING

A. The Purchaser requires delivery as indicated below unless otherwise mutually agreed to by both parties. Firm delivery dates shall be of prime concern during the bid evaluation. Date of shipment shall be as promised by the Bidder, based upon prompt receipt of all necessary information. The date of shipment shall be defined as the date the bill of lading is signed by the carrier.

<table>
<thead>
<tr>
<th>Earliest Delivery</th>
<th>Latest Delivery</th>
</tr>
</thead>
</table>

Note: Other bid time frames will be considered. Bidders proposed delivery timeframe must be clearly indicated with the bidder’s proposal.

B. Any change in the delivery date shall be reported immediately by telephone, followed by a written confirmation and explanation thereof. The delivery date shall be extended for the period of any reasonable delay due exclusively to causes beyond the control and without the fault of the Seller.

C. Shipping shall be FOB job site. The title to the material and apparatus furnished hereunder shall pass to the Purchaser at the destination point; unless, acceptance by the purchaser of the suppliers bid adder to unload and dresses the transformer (1.6.D and 1.6.E). If the supplier becomes responsible for unloading and dressing the transformer, title of the material and apparatus is to occur after the transformer is set, dressed, oil filled, and tested.

D. As part of his proposal, the Supplier shall provide, as a separate cost item, the cost for the supplier to place the transformer on the Owner supplied pad and to assemble any parts not shipped attached to the transformer (i.e., bushings, radiators, fans, etc.). See paragraph 2.7 for additional shipping delivery and transformer dressing requirements.

E. The apparatus shall be shipped in assembled units insofar as is consistent with good shipping practice. The apparatus shall be carefully packed for shipment. If items must be disassembled for shipment, they shall be "match-marked". All units and their containers
shall be "piece-marked" and shall show the purchase order number. It is preferred to have the transformer shipped with the secondary bushings installed. The Supplier shall indicate if the unit will be shipped completely assembled or will require on-site assembly. If on-site assembly is required please indicate parts requiring assembly.

F. On the same day that any shipment to the Purchaser is originated, a transmission, including the following, shall be forwarded to the Purchaser:

1. Packing List - Two (2) copies.
2. Bill of Lading - Original and two (2) copies.
3. Packing list shall also accompany each shipment.

G. Purchaser shall be notified as to the whereabouts of the transformer 72 hours prior to their schedule arrival at the destination point. Bidder shall pay any costs associated with unloading in the event that the transformer is not on site at this notified time.

H. Failure to deliver prior to 1:00 p.m. on a Friday will not guarantee unloading until the following Monday. Layover costs will be paid by the Supplier.

I. As part of his proposal, the Supplier shall provide a cost to place the transformer on the Owner supplied pad.

J. The Supplier shall indicate the costs to assemble any parts not shipped attached to the transformer (i.e. bushings, radiators, fans, etc.). The assembly costs shall also include on-site testing of the transformer.

1.7 INVOICING

A. Invoices shall be submitted in triplicate form to:

St. George Energy Services  
Attn: Barb Berrett  
175 East 200 North  
St. George, UT 84770

1.8 TITLE

A. The title to the material and apparatus furnished hereunder shall be listed as follows:
1.9 PAYMENT

A. Upon the shipment of any equipment hereunder, the Seller shall submit to the Purchaser a detailed invoice in duplicate of the equipment shipped. After delivery of the equipment the Purchaser shall make payment therefore to the Seller.

1.10 CANCELLATION

A. In the event the Purchaser shall be required, or deems it advisable, to suspend or terminate the work being performed pursuant to this Specification, the Purchaser may do so at any time by written notice to the Seller. In such cases, the Seller would take whatever action with respect to work in process as would minimize its claim against the Purchaser. The Purchaser would pay the Seller a reasonable suspension or termination charge for all disbursements or expenses which the Seller has incurred or become obligated for prior to the date of notice of cancellation, less the reasonable resale value of the materials, equipment, and apparatus which shall have been obtained or ordered to become an integral part of the work, and excluding any allowance for anticipated profits on the unperformed portion of the work. Reimbursement portions of this section would not apply to cancellations caused by design changes by the Manufacturer not authorized by the Purchaser or caused by delivery of material beyond the quoted delivery date(s) not authorized by the Purchaser.

1.11 EXCEPTIONS

A. Any exceptions to this Specification shall be clearly stated in the Bidder's proposal and as provided for in Section 4.7. The fact that there are exceptions will not necessarily preclude the selection of the Bidder's proposal. Any exceptions will be itemized in the evaluation of the proposal. If no exceptions to this Specification are taken by the Bidder, this shall also be clearly stated.

B. Alternative offerings will be considered, but they must clearly be indicated as alternatives.

1.12 WARRANTY
A. Manufacturer shall warrant to Purchaser that the apparatus or services to be furnished hereunder shall be newly manufactured and of the highest quality and free from defects in material, workmanship, and title and will be of the kind designated in the pertinent purchase order. The Manufacturer’s minimum warranty shall be effective for a period of twelve (12) months after date of energization or eighteen (18) months after the date of shipment to Purchaser, whichever is less. Terms of Manufacturer's warranty shall be included in the bid proposal, as provided for in Section 4.5, and will be a criterion for evaluation of the proposal. Extended warranties available and their costs shall be supplied with the bid. Any on site pre-energization tests or inspections required by the manufacturer for warranty purposes shall be performed by the manufacturer or its representative. The associated cost for required on-site inspections or testing shall be included in the Bidders' proposal.

1.13 STANDARDS

A. Unless otherwise stated, the latest revisions of the standards of ANSI, NEMA, IEEE, ASTM, NEC, and UL, shall be met in design, testing, and manufacture of the equipment covered by this Specification. In the event a conflict occurs between these codes and the specifications which will follow, the more stringent requirements shall govern.

B. The transformer shall be designed, fabricated, and tested in accordance with IEEE C57.12 series, NEMA TR 1, and this specification.

C. In case of conflict between the requirements of the various parts of this specification, the requirements of the different parts shall govern to the extent of such conflict in the following sequence: mandatory governmental regulations, codes, and standards; Transformer Specification and Data Sheets; this section; and the referenced industry codes and standards.

1.14 INSPECTION

A. A representative of the Purchaser shall be allowed free access at all reasonable times to the Manufacturer's shops and those of his suppliers for inspection of the equipment, or any of its parts, and to obtain information on the progress of the work. Any work or material found to be defective or which does not meet the requirements of this Specification may be rejected and shall be replaced by the Manufacturer at his own expense. Such inspection, however, shall not relieve the Manufacturer from responsibility for the quality and correctness of the work.
B. At the cost of the manufacturer, two representatives of the Purchaser will travel to the plant to witness final testing of the transformer. The Manufacturer shall notify the Purchaser of the planned testing dates and any changes of testing dates to allow sufficient time to make necessary travel arrangements. The Manufacturer shall make every effort to schedule testing dates which coincide during a single work week to eliminate unnecessary delays. The associated travel costs are to be included in the transformer base bid price. Travel costs shall include flights, car rental, hotel, and per diem.

1.15 FIELD ENGINEERING AND TESTING

A. The power transformer shall be assembled and tested at the factory for satisfactory alignment, operation, and electrical integrity. Two (2) certified copies of the test reports shall be mailed to the Purchaser following testing of the power transformer including oscillograph of transformer in rush or in rush calculations, and positive and negative impedance valves, expressed in percent impedance (%Z) with resistance and reactance components valves indicated. Also include photos of the coil assembly.

B. The costs and expenses associated with the Sellers required standard field engineering services at the time of installation shall be included in the firm price quoted for the transformer.

C. At the owner’s option, field tests at time of installation shall be made at the expense of the Purchaser. If for any reason whatsoever the equipment furnished and installed hereunder, does not meet in any respect the warranties hereof and/or the performance specified by the Bidder in the proposal, and it becomes necessary for the Manufacturer to make alterations for the purpose of meeting those warranties and/or performances, additional tests required to show the effects of such alterations shall be performed at the expense of the Manufacturer. Any costs and expenses associated with field service personnel required, by the manufacturer, for warranty purposes shall be included in the transformer price.

1.16 DRAWINGS AND DESCRIPTIONS

A. The following drawings and descriptions shall accompany the Bidder's proposal:

1. General arrangement drawings showing the overall dimensions and relative location of all principal parts.
2. General description of type of materials used for the principal parts.
3. General description of the construction including drawings, photographs, or cuts which show the general construction.
4. General description and diagrams showing the equipment mounting and handling facilities and clearance requirements.
5. Base drawings in sufficient detail to assist the Purchaser in making preliminary foundation layout plans.

B. Following award of the contract and prior to fabrication or manufacture of equipment, the contractor shall submit drawings in accordance with 1.16 E (below), to the Owner for verification of general conformity to the specification. No work shall be performed in connection with the fabrication or manufacture of equipment and materials until the drawings and data therefore have been reviewed by the Owner except at the contractor's own risk and responsibility. Work may proceed when the drawings have been returned marked with "No exceptions" by the Owner. Final construction drawings (in electronic AutoCAD files format) shall be provided to the Owners engineer when completed.

C. Within two weeks prior to the shipment of the equipment, the Manufacturer shall furnish to the Owner:

St. George Energy Services
Attn: Barb Berrett or Tom Birrell
175 East 200 North
St. George, UT 84770

1. One (1) set of certified, reproducible drawings on CD in AutoCAD 2015 format.
2. Four (4) sets of Installation, Operations and Maintenance Manuals.
3. Four (4) sets of Equipment Specification Sheets and Parts Lists.

D. In addition, Manufacturer shall ship one (1) complete set of equipment drawings; Installation, Operations and Maintenance Manuals; and Specifications Sheets and Parts Lists with the transformer. This material shall be enclosed in a weather-proof package securely attached to the unit and protected from loss or damage.

E. The drawing list shall include, at the minimum, the following:

1. Completely dimensioned Outline including complete materials list which contains bushing stud size and lightning arrestor terminal description.
2. Base.
3. Diagrammatic Name Plate.
4. HV Bushing.
5. LV Bushing.
6. Accessory Schematic Diagram AC & DC.
7. Control Cabinet Wiring Diagram AC & DC.
8. Point to Point Wire Charts.
9. Location of Bushings and Lightning Arrestors.
13. Current Transformer Name Plate Drawings.

F. Wiring Diagrams. Each device connection shall have near each termination, conductor identification consisting of the opposite end destination. The wiring diagrams shall be drawn with all devices indicated in their relative physical locations and shall represent the equipment and terminals arranged as they would appear to a person wiring the equipment.

Wiring diagrams shall be prepared on 24 inches by 36 inches sheets. Where interconnecting wiring from different items of equipment or sectional wiring diagrams of the same item of equipment appear on different wiring diagram sheets, all interconnections shall be clearly identified. Where sectional wiring diagrams are required for a single item of equipment, that section of the panel which is represented by each individual wiring diagram sheet shall be keyed on that sheet in a manner acceptable to the Purchaser.

Information indicated on the Manufacturer’s drawings shall include wiring of the individual panel items as they actually will appear in the control cabinet, contact arrangements of switches, and internal wiring of relays and instruments.

Elementary diagrams shall be cross-referenced to terminal markings on the connection and interconnection diagrams, but need not indicate complete details of circuits external to the panels. Each item of panel mounted equipment indicated on the diagrams shall be identified by item number and name.

Sufficient space shall be left on the Purchaser’s side of outgoing terminal blocks for adding field cables.

2 SPECIFICATIONS - SPECIFIC
2.1 TRANSFORMER RATINGS

A. The power transformer shall be designed and manufactured for installation outdoors in a non-hazardous area over an ambient temperature range of -20°F to 125°F at an altitude of 3300 feet above sea level. The ratings to follow apply at 3300 feet above sea level.

1. Number of transformers required...................................................... 2
2. Transformer type................................................................................. two winding
3. Number of phases............................................................................ 3
4. Frequency ........................................................................................ 60 Hz
5. High voltage (delta) ...................................................................... 69 kV
6. High voltage BIL ............................................................................. 350 kV
7. Low Voltage (wye) ....................................................................... 13.20Y/7.62 kV
8. Low Voltage BIL............................................................................ 110 kV
9. Coolant ......................................................................................... Oil
10. kVA rating*:
    a) (OA) at 55°C rise @ 3300 ft....................................................... 15,000 kVA
    b) (OA/FA) at 55°C rise @ 3300 ft.................................................. 20,000 kVA
    c) (OA/FA/FA) at 55°C rise @ 3300 ft ........................................... 25,000 kVA
    d) (OA/FA/FA) at 65°C rise @ 3300 ft ......................................... 28,000 kVA
11. The transformer is to be furnished with a thermally stabilized system of insulation which shall permit the transformer to be continuously loaded to 112 percent of rated capacity with a temperature rise of 65°C and normal loss of life as determined in IEEE C57.91.

*NOTE: The peak summer average daily temperature for Washington County is 89°F.

12. Seismic Requirements:
    (a) The transformer shall be designed to withstand the magnitude of seismic loads established by the IBC, Chapter 16 with the following values:
        - Site Class D
        - SS=0.519 g, SMs=0.719 g, SDS=0.479 g
        - S1=0.159 g, SM1=0.344 g, SD1=0.229 g

2.2 HIGH VOLTAGE TAP CHANGER
A. A full capacity HV Tap Changer for de-energized operation, with an operating handle brought out through the side of the tank at a convenient height is to be supplied.

Tap voltages shall be:

<table>
<thead>
<tr>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>72.45 kV</td>
</tr>
<tr>
<td>70.73 kV</td>
</tr>
<tr>
<td>69.00 kV</td>
</tr>
<tr>
<td>67.23 kV</td>
</tr>
<tr>
<td>65.55 kV</td>
</tr>
</tbody>
</table>

2.3 BUSHINGS

A. The bushings are to be supplied with terminals and are to be rated as shown below:

1. HIGH VOLTAGE  Std. AMPS  Std. kV  TERMINALS FOR 4 Hole NEMA Pad
2. LOW VOLTAGE  Std. AMPS  Std. kV  TERMINALS FOR 4 Hole NEMA Pad
3. NEUTRAL      Std. AMPS  Std. kV  TERMINALS FOR 350 MCM Copper

B. The bushing terminal STUD size shall be 2-inch diameter 12 thread/inch. Exceptions to the STUD size shall be indicated.

2.4 LIGHTNING ARRESTORS

A. Lightning arrestors in accordance with the following table are to be supplied with, mounted on, and connected to the transformer.

<table>
<thead>
<tr>
<th>No.</th>
<th>Class</th>
<th>Rating kV</th>
<th>System Voltage kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>HV: 3</td>
<td>Station</td>
<td>54</td>
</tr>
<tr>
<td>2.</td>
<td>LV: 3</td>
<td>Station</td>
<td>10</td>
</tr>
</tbody>
</table>

2.5 CURRENT TRANSFORMERS

A. Each bushing shall be furnished with multi ratio current transformers (CT’s) as follows:

1. High Voltage: No. Two  Ratio: 600/5  Accuracy: C400
2. Low Voltage:  No. Two  Ratio: 1200/5  Accuracy: C400
3. Neutral:      No. One  Ratio: 600/5  Accuracy: C400
2.6 **IMPEDEDANCE**

A. The transformer shall be designed with the minimum standard impedance required to make the transformer self-protected, in accordance with IEEE Standards, when a bolted fault occurs on the high voltage bus and on the low voltage bus, assuming an infinite bus.

B. The Manufacturer shall provide the guaranteed values of impedance with the quotation.

2.7 **SHIPPING DATA**

A. The transformer shall be shipped to the project site by: truck and/or rail. A three dimensional impact recorder shall be attached to the shipping car or trailer carrying the transformer from the factory. The car shall be equipped with hydraulically cushioned couplings. A transformer shipped and received where the impact recorder failed to record the entire shipment period will require an immediate on-site inspection by a factory field service engineer at the Manufacturer’s expense. The recorder shall be Manufacturer owned or leased impact recorders. Railroad or trucking company owned meters shall not be used. All impact meter charts shall become the property of the Owner at time of delivery of the transformer. **If shipped without oil the manufacture is responsible for filling the transformer with oil on site.**

B. The transformer may be shipped without oil and, if so, will be shipped filled with dry air with adequate provision for maintaining a positive pressure for all ambient conditions which will be encountered during shipment. The shipping notification shall have the pressure and temperature at charging noted on it.

C. All bushings, radiators, fans, and other transformer accessories shall be shipped with the transformer.

D. All terminal boards, insulators, current transformers and other attachments shall be so fastened to the main structure that they will withstand normal rough handling in transit.

E. Radiators, packed separately for shipment, shall be blind-flanged and gasketed to prevent entrance of moisture. Blind flanges shall be bolted, not welded, to the radiators.

F. The transformer will be delivered to the job site by the transformer manufacturer.

G. The Manufacturer shall indicate the costs for off-loading the transformer at the Owner’s substation sites as part of the proposal.

3 **SPECIFICATIONS – GENERAL**
3.1 TANK

A. The transformer tank shall be manufactured from heavy steel plates with welded seams capable of withstanding, without injury, the stress associated with shipment and operation. It shall conform to the requirements of IEEE C57.12.10 (latest revision) Section 5.8.

B. The tank shall have bent corners. All tank seams shall be double welded (inside and outside) and shall be a minimum of six (6) inches from the corner. Corner welds are NOT acceptable.

C. The transformer tank shall be provided with a welded on cover with lifting eyes for lifting cover only. Cover to contain manholes, minimum diameter of 20 inches in sufficient quantity to allow access to the complete top of the core and coils and to facilitate the removal and installation of bushings and current transformers, and to provide access to the terminal board without disturbing the leads, detanking the transformer, or removing the cover. All tank bolts to have standard threads.

D. All gaskets shall be of nitrile rubber with gasket retainers provided on all oil tight gasketed joints. Stops shall be provided so that over compression of the gaskets cannot occur. One (1) set of spare gaskets shall be provided for the manhole covers and all bushings and openings.

E. Suitable devices shall be provided to facilitate tanking and detanking without damage to the windings, core, or tank. Devices shall also prevent movement of the core assembly when in transit or during seismic disturbances. On multiple section tanks, alignment guides shall be provided on each section to facilitate field erection.

F. The center of gravity of the transformer with and without oil shall be permanently and plainly marked on two adjacent sides of the tank. Metal plates shall be used for this purpose.

G. Secondary bushing spacing shall be maximized within constraints of normal transformer tank design. This is intended to provide the maximum phase to phase, and phase to neutral spacing available, without requiring a non-standard tank design.

H. The tank cover shall be designed to shed water. The tank base shall be designed and to prevent damaging corrosion of the exterior of the bottom of the transformer tank and shall have skid beams.
3.2 GROUNDING

A. Grounding pads shall consist of two copper-faced steel pads, which are drilled, tapped, and attached to the tank per IEEE C57.12.10 (latest revision) Section 5.5.

B. In addition:

1. A ground bar shall be installed from each ground pad at the base up to and connected each arrestor and neutral bushing. The ground bar shall be sized a minimum ampacity rating of three times (3x) transformer full rate load current (secondary side).
2. Ground bar shall be supported every three (3) feet.
3. A ground pad shall be welded to the tank near the neutral bushing.

3.3 FACILITIES FOR LIFTING, MOVING, JACKING, AND ANCHORING

A. Facilities for lifting, moving, jacking, and anchoring the complete transformer (with oil), as well as for separately lifting the cover, and for lifting the core and coil assembly from the tank, shall be provided in compliance with IEEE C57.12.10 (latest revision) Section 5.3.

B. Minimum dimensions and clearances for jacking provisions shall be specified in the Manufacturer’s drawings.

C. The transformer base shall be designed to permit seismic anchoring (see 2.1.A.12 for Seismic requirements) to a concrete foundation and anchor bolts. The Manufacturer shall indicate on its outline drawing the dimensions of the transformer base in order that the existing foundation design can be evaluated. The transformer base shall be designed to allow for skidding or rolling in a direction paralleled to either center line.

3.4 CORE

A. The core shall be circular and constructed of the highest quality, non-aging, cold-rolled, grain-oriented, stress-free, thin-silicone-steel or amorphous metal laminations having high permeability and low hysteresis loss. The steel shall be manufactured with the laser scribed process. Each sheet shall have an insulated surface which is impervious to hot transformer oil. The core shall be rigidly clamped and blocked to prevent deteriorating vibrations, interference with oil circulation, short circuits, objectionable noise levels, and shipment distortions. Any internal blocking or bracing used which is to be removed from the transformer at its destination shall be painted a bright color, such as red or yellow, clear external markings indicating their presence shall be provided. The core shall be
securely grounded to the tank in a location accessible from the cover without lowering the oil. A means shall be provided for properly handling the core assembly when it is untanked.

B. The core shall be designed such that total harmonic distortion at 110% of rated voltage does not exceed 2.5%, wave distortion at 105% applied voltage should not be evident through oscillography and total harmonic distortion at less than 1.25% to obtain the desired results, the ratio of the percent exciting current between 110 and 100% applied voltage shall not exceed 3.0:1. Maximum excitation current at 110% voltage shall be 1.0%.

C. If actual test data indicates wave shape distortion or total harmonic distortion greater than the specified values, a penalty of up to 10% of total bid value will be assessed based on percent deviation from specified values. No penalty for 1% deviation from specified voltage wave distortion; 1% penalty for each 5% deviation thereafter, up to a total of 10% penalty.

3.5 WINDINGS

A. Transformer windings, including all core and coil assemblies, shall be power class, round core/circular coil design and construction. High voltage and low voltage windings for the main core/coil assembly shall be either disk or helical construction, layer/barrel windings are not acceptable. All windings shall be copper conductor and either rectangular magnetic wire or continuously transposed cable (CTC).

B. The windings shall be capable of withstanding the dielectric tests specified in Section 3.16 of this Specification.

C. The conductors and insulation shall be designed so that the formation of corona will be prevented, not only at the operating voltage, but also during the dielectric tests.

D. Conductors shall be made of copper and shall be designed to assure mechanical strength and also to minimize electrostatic flux concentration. The conductors shall be smooth and free of scale, burrs and slivers. Joints in conductors shall be brazed or welded. Joints shall be properly formed and finished, and carefully insulated to conform to the basic insulation.

E. To meet 65°C rise and 80°C hot spot rise, thermally upgraded paper insulation is required, as indicated in IEEE Standard C57.12.00-2010. Thermally upgraded crepe paper shall be
used on CTC conductor, and preferable on all winding conductors. Insulation material type shall be indicated in Bid Proposal.

F. All coils shall have each turn supported at frequent intervals by means of insulating spacers which shall be permanently secured in place and so arranged as to assure positive and effective oil circulation. To assure that the coil stacks remain permanently tight, all such insulation spacers shall be dried and compressed at high pressure before placing them in the coil stacks.

G. There shall be no deformation to the completed winding assembly by the stresses incident to shipment or short circuits. The Manufacturer shall state in detail the steps taken in the design to overcome the effects of shipping and short circuit forces on both core and coils.

H. If the coils are impregnated, the insulating compound used shall be nonhygroscopic, insoluble in, and not acted upon by, the transformer oil at overload temperatures. All varnish and other insulating materials used shall be unaffected by ordinary petroleum distillates having flash points above 170°C.

I. The assembled core and coils shall be dried in vacuum to assure proper moisture removal as reflected by the best insulation resistance or lowest power factor obtainable. Immediately after drying, the assembly shall be immersed in dry oil, or if the assembly is to be impregnated, it shall be done immediately after drying and then immersed in dry oil.

J. Winding temperature rise by resistance and hottest-spot winding temperature rise shall be in accordance with IEEE C57.12.90 (latest revision) for a 55°/65°C insulating system.

K. Winding Leads shall be readily accessible from a manhole in the tank cover.

3.6 BUSHINGS

A. All bushings shall be in accordance with ANSI Standards 21-76 and 24-84 and ANSI C76.1 and C76.2. All bushings shall safely withstand transformer test levels. All bushings shall have a power factor test tap.

B. All bushings shall be removable without removal of the tank cover. Primary bushings shall be cover mounted in accordance with IEEE C57.12.10 (latest revision). All bushings shall be so designed that there will be no undue stressing of any parts due to temperature changes.
C. Both high and low voltage bushings shall be of the oil impregnated and paper insulated type.

D. All oil filled bushings shall have a sealed reservoir with magnetic oil gauge, Lapp or General Electric glass bowl reservoir, Ohio Brass oil level indicator, or General Electric prismatic sight gauge.

E. All bushings shall be furnished with silver-plated external contact surfaces.

F. The color of all bushings shall be ANSI No. 70 grey.

G. Current ratings of all bushings shall be suitable for the ratings specified.

H. Standard threaded terminal studs and specified NEMA pads suitable for overhead cable connection shall be in accordance with NEMA standards.

I. Bushings shall be one piece porcelain under compression only. Porcelain used in the bushings shall be manufactured by the wet process and shall be homogeneous, free from laminations, cavities, or other flaws affecting its mechanical strength or dielectric quality; it shall be well vitrified, tough, and impervious to moisture. The glazing of the porcelain shall be free from imperfections, such as blisters or burns.

J. All bushings of like voltage shall be interchangeable.

K. Bushings shall be rated for operation at an altitude of 3300 feet above sea level.

L. All primary bushings shall be mounted such that the distance from the live parts to the bottom of the transformer tank shall meet or exceed the minimum clearance requirements as specified in IEEE C2 (latest revision) Section 12 Paragraph 124.

M. The bushings shall be equipped with multi-ratio bushing current transformers as specified in paragraph 2.5.

3.7 DE-ENERGIZED HIGH VOLTAGE TAP CHANGER

A. The transformer shall be furnished with five (5) full capacity taps on the high voltage winding. Two taps shall be provided above and below 69.0 kV. Each tap shall represent a voltage change of 2-1/2 percent. The tap representing the greatest transformation ratio shall be designated by the number 1 or the letter A. Actual tap voltages shall be as indicated in Section 2.2.
B. The tap changer shall be capable of operating only while the transformer is de-energized. It shall be hand-wheel operated with a position indicator and located on the transformer tank at a level so it may be operated from the transformer base. Facilities for locking in any tap position shall be provided.

C. The tap changer shall be capable of withstanding transformer short circuits.

3.8 ON-LOAD TAP CHANGER (LTC)

A. The transformer shall be complete with a load tap changer having a range of 10 percent above and 10 percent below normal voltage in 32 equal 5/8 percent steps.

B. The tap changer shall have full rated kVA on taps above normal and a current rating corresponding to the full load current of rated voltage on taps below normal voltage. The LTC shall be connected to and regulate the low voltage winding.

C. The LTC mechanism shall be Vacuum Reactance and designed for 500,000 electrical and mechanical operations before contact or vacuum bottle replacement is required. A contact life curve for the load tap changer being provided shall be supplied with the bid documents.

D. If the tap changing system quoted requires a preventive auto transformer or a series transformer, they shall be power class, circular core/coil design and construction, and all windings shall be copper.

E. The tap changer mechanism shall be mounted in a separate oil filled compartment, capable of withstanding full vacuum in the main tank, without the use of bypass piping and equipped with:

1. Liquid level gauge with alarm contacts.
2. Pressure control switch with trip contacts.
3. Cover mounted mechanical pressure relief device.
4. Drain valve with sampling device.
5. Tap selector with 33 operating positions.
6. Filling plug located at the top of the compartment.
7. LTC tank bottom shall be sloped to drain oil away from the door.
8. LTC compartment shall include a lip to prevent oil spills after draining compartment and opening the door.
9. All gauges shall be clearly marked either transformer main tank or LTC.

F. The tap changer mechanism shall be located at operator height and equipped with:

1. Operating mechanism with motor drive. The drive motor shall be easily accessible and not immersed in oil.
2. Local position indicator.
3. The cover on the oil filled compartment, regardless of weight of the cover, shall be hinged to support itself when open.

G. The manufacturer shall include (in the main transformer tank) a current transformer for input to the line drop compensator. The Purchaser will provide a potential sensing source for operating the voltage regulating control, which will consist of one or three line to ground potential transformer (i.e. X1 and X0), as required, with a secondary voltage of 120 volts. The successful manufacturer will be required to indicate phase requirements for VT input for proper LTC control operation (average voltage measurement technique preferred).

H. The following equipment shall be supplied, and mounted in a cabinet attached to the transformer tank:

1. Voltage regulating control (see section 3.8N)
   a. If the load tap changer operation sequence is susceptible to interruption and consequently can be stopped in the “off-tap” position, the preventive auto-transformer shall be designed to carry the maximum current available in the “off-tap” position indefinitely. The transformer shall also be equipped with and alarm to be activated if the “off-tap” position occurs.
4. Voltage testing terminals.
5. The equipment required for parallel operation by the circulating current method.
6. Control compartment heater with switch.
7. Terminal board in control compartment for termination of control and wiring.
8. Drill plate in bottom of cabinet for attachment of City’s conduit.

I. The drive mechanism shall be designed such that the load tap changer can be manually operated, while energized under full load, safely with no potential harm to the operator or transformer.
J. If the drive mechanism can be stalled in the “off-tap” position, it shall be designed to include an alarm with remote contacts and be capable of maintaining full load indefinitely.

K. If the number of openings, gasketed or bolted, between the main tank and load tap changing compartment exceeds seven (7) written explanation shall be provided.

L. The desiccant container shall be located at operator level for ease of maintenance.

M. LTC performance shall be based on entire range of operations (±16) and maximum nameplate rating unless otherwise specified by the owner.

N. LTC CONTROL FEATURES

1. The LTC control shall be equipped with at least the following features:
   
   a. Microprocessor-based control.
   b. Position indicator with drag hands and reset device.
   c. Neutral indicator light actuated only when the LTC is in the neutral position.
   d. The LTC control shall be housed in the transformer control cabinet.
   e. Adjustable bandwidth (1.0-6.0 volts ± 0.5 volts).
   f. Adjustable voltage level (105-135 volts ± 1 volt).
   g. Band edge indicating lights (high, low or balanced).
   h. Adjustable line drop compensation (Resistance: 0-24 volts, ± 1 volt reactance, coarse and fine; 0-24 volts, ± 1 volt).
   i. Compensatory polarity switch.
   j. The control shall have the equipment required for parallel operation with a second LTC transformer using the circulating current method.
   k. Voltage test terminals.
   l. Operation Counter.
   m. Adjustable time delay (5-120 seconds ± 10 seconds).
   n. Control switch for automatic, manual control or off. Also, raise and lower control switch for use when in manual operation.
   o. Reverse power flow detector with indicating light.
   p. Control power switch.
   q. Internal-External power supply for de-energized LTC operation and testing at 120 volts. Switch should prevent energization of the high voltage winding from this source.
   r. CT to PT phasing correction adjustable from 0° to 330° in 30° increments.
s. Full regulating range to values from ± 10 percent to provide for full transformer capacity.
t. Control cabinet heaters.
u. “Voltage limit protection” voltage protection adjustable from 105-120 volts ± 1 volt on lower limit and 121-135 volts ± 1 volt on upper limit.
v. Capability to display and provide the following information.

1) Power factor indicating leading or lagging with drag hand for leading and lagging maximum values.
2) Instantaneous current and drag hand for maximum values.
3) Instantaneous voltage and drag hand for lowest and highest voltage.
4) Demand metering simply read and extracted.

w. Both current and voltage harmonic metering to the eleventh harmonics.
x. Data port for extraction of data.
y. The control shall be “SCADA Ready” and provide for digital communication for the following features:

1) Remote operation (Raise/Lower)
2) Remote integration and programming of operating parameters.
3) A security system to assure only authorized personnel can access and change operating characteristics of the regulator control.
4) Communication Protocol shall be DNP 3.0.
5) The connection type provided shall be ST type fiber connectors.
6) Alarm contacts for operation when system or LTC limits are exceeded.

z. Voltage reduction capabilities.

3.9 INSULATING AND COOLING SYSTEM

A. Oil

1. The Manufacturer is responsible for filling the transformer with oil. Only new oil shall be used to fill the transformer. The Manufacturer shall provide certified test results verifying that the transformer oil is free from all polychlorinated biphenyl (PCB) fluids.
2. Oil shall be pure, unadulterated, mineral oil obtained by the fractional distillation of petroleum. Oil shall be prepared and refined especially for use in transformers, having a minimum flash point of 145°C. It shall be free from moisture, acid, alkali, and injurious sulphur compounds. The oil shall not form a deposit under normal operating temperatures. The minimum allowable dielectric strength of the oil shall be 30 kV
when measured in accordance with American National Standard Methods of Testing Electrical Insulating Oils, C59.2 (latest revision).

3. If filled on site, a sufficient quantity of oil shall be furnished with the transformer for filling each tank and radiator to the proper level.

4. If required, the transformer oil shall be shipped in tank trucks having sealed oil pumps and hoses. The tank trucks shall be certified clean and dry.

5. If shipped without oil, the manufacturer shall coordinate with the owner a schedule for delivery of the oil and tank filling.

B. Valves

1. A combination drain and lower filter valve shall be provided on the tank. This valve shall provide for drainage of oil to within one inch of the tank bottom and for outlet of the oil to a filtering means. The size of the drain valve shall be two inches and have two inch NPT threads with a pipe plug in the open end. The drain valve should have a built-in 3/8 inch sampling device which should be located in the side of the valve between the main valve seat and the pipe plug. This sampling device shall have a 5/16 inch – 32 male thread and be equipped with a cap.

2. An upper filter valve of the globe type shall be located below the 25°C liquid level and shall be suitable for the return of filtered oil. The size of the upper filter shall be one inch and have one-14-inch NPT threads with a pipe plug in the open end.

3. There shall be a filling valve with a minimum size of two inches.

C. Oil Preservation System. The Manufacturer’s standard oil preservation system for 69 kV, equipped with a pressure-vacuum bleeder device set to operate at the maximum operating pressures (positive and negative) indicated on the name plate, shall be employed. A bleed tube for gas blanket dew point measurement shall be provided. Suitable valves shall be provided to permit purging the gas space and testing the seal on the tank by admitting dry nitrogen under pressure.

D. Cooling System. The transformer cooling fans shall be operated in stages as required, controlled from winding temperature devices and from a manual switch (Auto / ON). All auxiliary relays, devices, etc., required for the operation shall be furnished.

1. A transfer switch shall be provided in the transformer control cabinet to permit a choice of which fan set to operate in the first stage (if appropriate).

2. Each tank shall be provided with radiators and each bank of radiators shall be connected to the tank through upper and lower indicating shut-off valves welded to the tank. Remotely mounted radiators will not be acceptable.

3. The radiator shut-off valves shall be supplied by the Manufacturer with properly gasketed, oil-tight flanges to permit removal of any radiator while the transformer is
in service and to permit easy access to all gasketed joints without requiring the transformer tank to be drained. Each valve-operating stem shall be provided with an adjustable stuffing gland and designed so that packing glands can be serviced without removing the valves.

4. Lifting eyes shall be provided on each radiator to facilitate removal of the radiator without interfering with the operation of the transformer.

5. Drain plugs shall be provided in each radiator.

6. Vent plugs shall be provided in radiator headers to positively assure against any air being injected into the transformer tank.

7. Radiators shall be braced to withstand the vibrations and impacts which occur during shipment, and also to withstand the vibrations which prevail during operation. The bracing of the radiators shall not interfere with or present hazards to personnel engaged in reading meters or gauges.

8. The arrangement of radiators shall be such as to permit easy installation of the fans and pumps.

9. All groups of cooling equipment shall operate in parallel from the same power source, but means shall be provided for de-energizing and isolating the individual groups while the other or others continue in operation. The groups shall be arranged so that the controls may be interchanged among like cooling elements to allow for varying the sequence in which the groups are energized. This arrangement is intended to ensure continuity of service of the equipment and to facilitate maintenance and equalize wear and life of its component parts.

10. Cooling equipment motors shall be 120/240 volt, 1-phase, 60 Hz. The fan motors and motor overload protection provided shall be totally enclosed and weatherproof. Motor bearings shall be designed for a continuous as well as intermittent duty. Provisions shall be made for suitable lubrication and, where required, for bearings to withstand end thrust. Manual-resetting overload protection shall be supplied for each individual motor unless the motors are capable of withstanding full-stalled rotor current continuously without damage. The fan leads shall be weatherproof, or totally enclosed in a weatherproof flexible conduit. The leads or conduits shall be terminated at one end with a suitable waterproof connector and, on the other end, with a waterproof plug to be inserted into a receptacle mounted on the transformer tank. Fan blades shall be of aluminum alloy, stainless steel or other corrosion-resistant material and shall have surfaces designed to keep fan noise to a minimum. The fan unit, including motor and fan blades, shall be dynamically balanced so that the operation of the fan assembly will be essentially free of vibration and thereby safeguard the motor bearings against excessive wear. All fans shall be provided with adequate guards.

3.10 SURGE ARRESTORS
A. “Metal Oxide” type surge arrestors shall be provided. They shall be sized as previously stated at pertinent nominal system kV. Arrestors shall be adequate for transformer protection at an altitude of 3300 feet above sea level.

B. Surge arrestors for installation on the transformer shall meet the requirements specified in the NEMA Publication LA1 and ANSI C62.1. The completely assembled base-mounted surge arresters shall be fully self-supporting without the use of additional suspension, bracing or supporting insulators. All arrestors shall be of station class type. Surge arresters will be provided one per bushing on the high side and one per bushing on the low side. The arresters will be mounted on base mounting brackets attached to the transformer tank. The color of all surge arresters shall be ANSI No. 70 Light Grey.

C. All arrestors shall be mounted to meet or exceed the clearance requirements of IEEE C2 – (latest revision), section 12, paragraph 124. The distance to live parts shall be measured from the bottom of the transformer tank.

D. G.E. Tranquell, Ohio Brass Dyna Var, or Cooper arrestors are acceptable.

3.11 MULTI-RATIO BUSHING CURRENT TRANSFORMERS

A. The current transformers shall be manufactured and tested in accordance with IEEE C57.13. Each multi-ratio bushing CT shall have standard taps in accordance with IEEE C57.13 Table 10.

B. All current transformer leads from bushing type CT’s including taps shall be connected to shorting type terminal blocks inside the control cabinet housing. Current transformer leads shall be a minimum No. 10 AWG standard copper.

3.12 ACCESSORIES

A. The height of all gauges and indicators shall be 5’ – 7’ above the transformer base plate. All gauges and indicators shall be positioned to allow for easy reading and maintenance.

B. Liquid Level Indicator. The transformer shall be equipped with a magnetic liquid-level indicator. The indicator shall have a dark-faced dial with light markings and a light-colored indicating hand. Dial markings shall show the 25°C level and the maximum and minimum levels. The words “liquid level” shall be on the dial. Low level alarm contacts shall be provided suitable for 48/125 Volts DC. The instrument shall be direct read. The contact wiring shall be brought to a terminal block in the control cabinet.
C. Liquid Temperature Indicator. A dial-type thermometer shall be mounted on the side of the tank. The thermometer shall have a dark-face dial with light markings, a light-colored indicating hand, and an orange-red maximum indicating hand with provisions for resetting. The dial markings shall cover a range of 0°C to 120°C. The words “liquid temperature” shall be on the dials. The liquid temperature indicator shall be a two switch device with contacts provided suitable for 48/125 Volts DC. The contact wiring shall be brought to a terminal block in the control cabinet. The indicator shall have a removable cover and shall not be located more than six feet above the transformer base line.

D. Loss of AC and DC Voltage Alarm Relays. A loss of voltage alarm relay shall be provided to indicate a loss of power condition at fan motors and DC circuits. Alarm contacts shall be suitable for 125 VDC. The loss of voltage relay shall operate on time delay and include contacts for alarming 4 minimum per relay.

E. Alarm Contacts. Non-grounded alarm contacts (N/O and N/C) for liquid level and temperature, loss of AC or DC power, winding temperature, nitrogen system level and tank high and low pressure indicators shall be furnished and be suitable for:

1. Operating protective relaying
2. 48V or 125 DC V operation
3. The liquid level indicator alarm contacts shall be non-adjustable and shall be set to close at the minimum safe operating level of the liquid. The liquid-temperature indicator alarm contacts shall be adjustable over a range of 65°C to 110°C.
4. The liquid-temperature indicator trip contacts shall be set to close at the maximum safe operating temperature of the liquid. The liquid temperature alarm contacts shall be set at a suitable alarm temperature.
5. The winding temperature alarm contacts shall be non-adjustable and shall be set to close at the maximum safe operating temperature of the winding. The winding temperature indicator alarm contacts shall be adjustable over a range of 65°C to 120°C.
6. Loss of AC or DC power shall be normally open and close on loss of power.

F. Pressure Vacuum Gauge. A pressure vacuum gauge shall be furnished. The diameter of the dial (inside bezel) shall be 3-1/2 inches +/- ¾ inch. The gauge shall have a dark-faced dial with light markings and light-colored pointer. The scale range for the pressure gauge shall be between 10 psi positive and 10 psi negative. The gauge shall be direct read.

G. Pressure Relief Device. A self-resetting mechanical type pressure relief device with alarm assembly containing SPDT switch suitable for 48/125 volts DC shall be provided to permit
the escape of gas or oil when the internal pressure becomes abnormal. The pressure at which this device opens shall be no greater than 25% above the highest internal pressure allowed for the oil preservation system supplied. The pressure-relief device shall be such that when pressure has been relieved the relief cover will reset itself and keep out moisture. The device shall be equipped with a semaphore device which shall remain in the observable position after an operation until manually reset. One set of N/O, N/C contacts for Owners use shall be provided. The contact wiring shall be brought to a terminal block in the control cabinet.

H. Sudden Pressure Relay

1. A sudden pressure relay complete with auxiliary seal-in relay mounted on the top of the transformer tank for detection of abnormal increase in transformer operating pressure shall be provided. The seal-in relay shall have two separate sets of N/O and N/C indicating contacts suitable for lockout relay operation at 48/125 volts DC. The relay shall not actuate due to normal pressure variations, vibration, mechanical shock or pump surge. The relay shall be capable of withstanding full vacuum and a positive pressure of at least 15 psi without damage. The relay shall be mounted and valved so that it may be removed without de-energizing the transformer. It shall not be mounted on the drain valve. The relay, auxiliary and reset switch shall be located in the transformer control panel.

2. Power for this circuit will be 48/125 VDC supplied by the Owner. The Manufacturer shall provide a sudden pressure auxiliary relay with reset switch and amber light. The reset switch, and amber light shall be easily accessible. The auxiliary relay shall provide two normally open contacts for the trip and alarm function.

I. Winding Temperature Indicator

1. Dial type indicator shall be mounted on the side of the tank. The indicators shall have a dark-faced dial with light markings, a light-colored indicating hand, and an orange-red maximum indicating hand with provisions for resetting. The dial markings shall cover a range of 0°C to 120°C. The word “temperature” shall be on the dial with nameplates indicating the appropriate winding. Indicators shall be provided for the main and secondary windings. Two (2) sets of N/O and N/C contents shall be provided for alarm and trip functions.

J. Auxiliary Power Supply. The Owner will provide 120/240 volt 1-phase 60 Hz power for auxiliary equipment and controls in accordance with ANSI C84.1 (latest revision). The Manufacturer shall provide auxiliary equipment and controls in accordance with ANSI C84.1 (latest revision).
K. Control Cabinet

1. A NEMA 3R weatherproof control cabinet shall be furnished to house the cooling control equipment and field wiring interconnection points. The cabinet shall be furnished with hinged gasketed doors with lockable latching mechanism. The cabinet shall be installed at a location accessible to a man standing at the level of the transformer base. The door shall provide access to all control devices and have provisions for padlocking. The cabinet shall be of sufficient size to house terminal blocks for termination of each of the various leads of the various current transformers in the transformer. All devices housed within the cabinet shall be back or side panel mounted; no inner swing door is allowed. The five major taps of each CT are to terminate on a six point shorting type terminal block (one shorting block per CT) located in the control panel. Terminal blocks shall also be provided for all alarm and relay contacts, in the control cabinet. The cabinet shall have a removable bottom plate of sufficient size for entrance of the Owner’s cables. The cabinet shall be equipped with a light, breather and heaters of sufficient capacity to prevent harmful moisture condensation. Heaters shall be equipped with a guard. A thermostat shall be provided to maintain the temperature inside the cabinet at the low temperature extreme. Each heater shall be protected by a two pole or single pole single throw circuit breaker. The cabinet is to be shock mounted to reduce vibration. Other methods to prevent condensation may be acceptable to the Owner. If an alternate method is proposed, details shall be provided with the proposal.

2. All devices and wiring within the control cabinet are to be labeled to correspond to the wiring diagram. All devices and termination block to have permanently engraved labels that correspond to the manufacturer’s drawings and devices designation.

3. Control circuits for cooling equipment shall operate from 240/120 volts AC with at least 20% of spare capacity available supplied by the Manufacturer in the control cabinet. All AC equipment shall be suitable for continuous operation between 90 and 110 percent of rated voltage.

4. A standard 20A GFI protected convenience outlet shall be provided in the control cabinet.

5. Wire for control and power circuits shall be rated for use in conduits as well as cabinets, and shall utilize insulation which is both fire resistant and resistant to transformer insulating oil.

6. Interior of control cabinet shall be gloss white.

L. Enclosure. All enclosures shall be designed to prevent the accumulation of standing water or water freezing along panel doors.
M. **Wiring**

1. All control, auxiliary power, and alarm circuits including spare contacts, shall be completely wired by the Manufacturer. Wiring shall not be smaller than No. 14 AWG stranded copper conductor with Type MTW, 600-volt, 90°C insulation. All wiring shall be capable of passing the IPCEA Flame Resisting Test, IPCEA Publication No. S-61-402, Section 6.5. Wiring shall be run in rigid metallic raceways except that fan motor connections may include flexible, interlocked, watertight armored cable. All connections to the Owner’s external circuits shall be brought to the control cabinet. Current transformer wiring shall not be smaller than No. 10 AWG. All wiring shall be terminated with crimp type connectors installed with a ratcheting crimping tool.

2. The terminal blocks shall be provided with permanently engraved markings corresponding to those of the Manufacturer’s wiring diagram and shall have space provided on the marking strip for inscription by the Owner. Terminal blocks shall have at least 20 percent spare positions.

3. Wiring shall be marked using the remote end tagging system. Wire labels are to be heat shrinkable and permanently marked.

4. All wiring leaving an enclosure shall leave from terminal blocks and not from other devices in the enclosure.

5. Auxiliary equipment such as terminal blocks, auxiliary relays, or contactors shall be readily accessible. Auxiliary equipment shall be located in compartments, enclosures, or junction boxes in such arrangement that a serviceman will have direct access to the equipment without removal of barriers, cover plates, or wiring.

6. Terminal blocks for external connections shall be grouped in the instrument and control compartment for easy accessibility unrestricted by interference from structural members and instruments. Sufficient space shall be provided on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block. Arrangement of circuits on terminal blocks shall be such that all connections for one circuit plus any spare conductors shall be on adjacent terminals.

7. A shorting type terminal block shall be installed at an accessible location for each set of current transformers supplied with the equipment furnished under these specifications. The shorting terminal block shall be the one nearest the current transformers. No other shorting type terminal blocks are required unless specified otherwise.

8. Those portions of any secondary wiring in the control box, or those portions which pass through conduit, shall not be spliced. Junction boxes with terminal blocks shall be used to extend secondary wiring outside the transformer tanks.

9. All control, indicating, and signal devices including spare contacts, shall be completely wired to terminal blocks in the transformer control cabinet, using conduit as necessary for wiring protection.
10. Non-insulated ring tongue terminals shall be used for control and secondary wiring. Spade, slotted spade, flanged spade and hooked terminals are not acceptable. AMP Diamond Grip ring tongue terminals distributed by American Pamcor Incorporation (API), Burndy Hylug terminals are typical of the type of terminal desired by the Purchaser. These or other Engineer approved terminals are acceptable. The terminals shall be sufficiently strong to prevent their breakage under conditions of vibration inherent in the equipment in which they are installed. All terminals shall have nylon insulated ferrules.

11. To ensure positive electrical connections, and to avoid damage to the ferrules, it is mandatory that the proper crimping tool (ratchet type) be used in accordance with instructions for its use and that the proper terminal and crimping tool be used for each wire size.

12. The terminals shall be fastened to the contact strips of terminal boards with machine screws. The contact strips shall be separated by insulated barriers. Terminal blocks with clamp type fittings are not acceptable.

13. Each terminal block, terminal, conductor, relay, breaker, fuse block, and other auxiliary device shall be permanently labeled to coincide with the identification indicted on the drawings. All terminals provided for termination of external circuits shall be identified by inscribing circuit designations on the terminal block marking strips with black paint. All other wiring terminations shall be identified by printing on conductor identification sleeves. A conductor identifications sleeve shall be provided on each end of each internal conductor. Each sleeve shall be marked with the opposite end of each internal conductor. Conductor identification sleeves shall be not less than ¼ inch long. Conductor identification shall be machine lettered, stamped or engraved on the sleeve. Conductor identification shall be permanent, unaffected by heat, solvents, or steam, and not easily dislodged. Adhesive labels are not acceptable. All connections requiring disconnect plug and receptacle type devices shall be provided with factory terminated conductors on each plug and receptacle. Plugs and receptacles shall be factory wired into junction boxes containing terminal blocks for external connections. All conductors on the disconnect portion of plug-receptacle assemblies shall be in a common jacket. All temporary wiring installed in the factory for equipment testing shall be removed prior to shipment of the equipment.

14. Terminal blocks shall be furnished with white marking strips and, shall be without covers. Spare unused terminals shall be furnished on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable. Not less than two spare unused terminals shall be furnished for every 10 terminals used. Fuses shall not be mounted on terminal blocks. Neither step type terminal blocks nor angle mounting of terminal blocks will be acceptable. All terminal blocks shall be rated 600 volts minimum and shall have strap screw terminal blocks for 10
AWG. Terminal blocks for auxiliary power shall be sized for larger wire sizes or higher voltage incoming conductors as necessary.

N. Special Tools and Spare Parts

1. A complete set of special tools necessary for installation and maintenance shall be furnished for each piece of equipment supplied. These tools and their intended use shall be identified in the assembly instructions. A special tool shall include but not be limited to the following:

   (a) Any metric tool larger than 32mm.
   (b) Any tool which is not easily purchased in the vicinity of the shipping destination.

2. Any metric bolts, nuts, pins, washers and other similar items used in equipment assembly shall have 10 percent or one (1) spare pieces, whichever is greater, shipped as part of the equipment.

3. The Manufacturer shall submit a recommended list of spare parts which shall be itemized with type and Manufacturer with each part individually priced by item. Any parts which are purchased by the Owner as part of this order shall be packaged for long term storage. Delivery of spare parts shall be in accordance with specifications in the purchase order.

4. The Manufacturer shall furnish, on request, repair or replacement parts for a period of at least ten (10) years by keeping in storage all necessary spare parts or templates, gauges, patterns, records, etc., from which necessary parts may be made.

O. Extras. Any “extras” suggested by the Manufacturer should be included in the proposal as additions to the base quote.

3.13 INSPECTION

1. A representative of the Owner shall be allowed free access at all reasonable times to the Manufacturer’s shops and those of his suppliers for inspection of the equipment, or any of its parts, and to obtain information on the progress of the work. Any work or material found to be defective or which does not meet the requirements of this Specification may be rejected and shall be replaced by the Manufacturer at his own expense. Such inspection, however, shall not relieve the Manufacturer from responsibility for the quality and correctness of the work.

2. A representative of the Owner will be available to witness final testing of the transformer or tanking of the core and coil assembly. The Manufacturer shall notify the Owner of the planned testing dates and any changes of testing dates to allow
sufficient time to make necessary travel arrangements. The Manufacturer shall make every effort to schedule testing dates which coincide during a single work week to eliminate unnecessary delays.

3. As indicated in Section 1.14 B, the Bidder’s price shall include the necessary costs and expenses required to send two (2) representatives of the Owner to the Manufacturer’s plant to witness the final testing of the transformers or inspection of the core and coil assemblies prior to tanking. Manufacturer is to provide 8X10 photographs of the core and coil assemblies during fabrication and tanking process.

3.14 ASSEMBLY INSTRUCTIONS

Detailed instruction shall be provided for the assembly of the equipment at the destination point. These instructions and details shall consist of, but not be limited to, the following:

1. Equipment Inspection Report and Material list to be used by Owner and/or Contractor upon receipt of the equipment to determine possible carrier damage or missing items.
2. The Material List shall include all items shipped. The list shall correspond to identification markings made in English on each separate item. The carrier’s bill of material shall not qualify as this Material List.
3. Parts which are shipped in crates shall be identified by an items number for that crate and each part shall be so tagged.
4. All item numbers for parts shall be identified on the equipment outline drawing or the erection outline drawing.
5. The Installation, Operation and Testing Instruction Manual shall provide detailed information on the assembly of those items and parts identified for assembly. The procedure shall be step by step to ensure that no omissions occur.

3.15 NAME PLATE

A. A durable corrosion-resistant metal name plate shall be affixed to the transformer by the Manufacturer. It shall bear the information listed in Section 5.12 and Table 9B, IEEE C57.12.00 (latest revision).

B. The following information shall also be included:

1. Maximum positive and negative operating pressures of the oil preservation system.
2. All current transformers ratios including CT’s for use with dial type and remote winding temperature recorders.
3. Pounds of vacuum filling pressure for which the tank is designed.
4. Oil level in inches below the top surface of the highest point of the manhole flange at 25°C. Oil level change in inches per 10°C change in oil temperature.
5. Transformer weight (filled and empty of oil).
6. Positive and Zero Sequence Impedance.
7. Winding configuration, voltage, ratings
8. Any other information which the Manufacturer deems necessary for proper installation, maintenance, and operation of the transformer.

3.16 FINISHING AND PAINTING

A. The transformer tank, bushings, radiators, and control cabinets shall be ANSI No. 70, light grey. The interior of the control cabinets shall be white. The dry film thickness of the paint shall not be less than 5 mils. The manufacturer shall furnish 1 gallon of “touch up” paint or 10 spray cans of paint.

B. Radiators shall be hot dipped galvanized.

3.17 TESTS

A. Transformer tests shall be performed for the transformer in accordance with IEEE C57.12.90, and shall include all routine tests in accordance with IEEE C57.12.00. In cases where apparatus is tested at the manufacturer’s factory, the Owner/Engineer shall have the right to be present at such tests and shall be given advance notice as required in Section 3.12. The cost of all required material tests and factory performance tests shall be borne by the Manufacturer.

B. Tests shall not be limited to the following; however, the Manufacturer may perform additional tests which he deems necessary under his quality control program. The Manufacturer shall furnish the Owner with Two (2) copies of guaranteed performance data and test reports which define the tests and list the certified test results. The cost of all factory tests required to be performed by the Manufacturer shall be included in the firm price quoted in the Manufacturer’s proposal.

1. Resistance measurements of all windings on the rated voltage connections and the tap connections.
2. Ratio tests on the rated voltage connections and on all tap connections.
3. Polarity and phase-relation tests on the rated voltage connections.
4. No load losses and excitation current at rated voltage and rated frequency on the rated voltage connections.
5. Exciting current at rated voltage and rated frequency on the rated voltage connections.

6. Dielectric Tests

   (a) Applied Voltage Tests
   (b) Induced Voltage Tests
   (c) Quality Control Impulse Tests B this should include Chopped Wave Test, Full Wave Test, and Reduced Full Wave Test.
   (d) Insulation Power Factor Tests
   (e) Insulation Resistance Tests

7. Impedance and load loss at rated current on the rated voltage connections and on the tap extremes.

8. Audible Sound Tests. No test will be required. The transformer shall be designed to meet the required NEMA sound level.

9. Zero Phase Sequence Tests
   (a) The sequence network shall be provided as part of the certified data.

10. Temperature Test.
    (a) Temperature tests shall be made for each stage of cooling, including the maximum kVA rating given on the name plate. (A cost deduct for not performing this test and providing data on similar units shall be indicated in the proposal.)

11. Short Circuit Test.
    (a) 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 in regard to this Specification shall have sufficient mechanical strength to withstand without damage or failure all through-fault currents in accordance with IEEE C57.12.00-1987 Section 7. The Bidder shall demonstrate that the transformer meets this requirement by at least one of the following methods:

    (1) 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 under maximum short-circuit conditions without failure. A description of the test code under which the transformer was tested for short-circuit strength shall be provided by the Bidder to the Owner.

    (2) 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 that are essentially identical in design, construction,
and rating to the transformer covered by this Specification and shall 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 20 transformer years, a list of transformers in service that represents the closest approximation to the transformers 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 transformers to be furnished and shall include the dates of installation (or shipment, if not installed), the ratings of the transformers, and a list of failures and causes of failures, if any have been experienced.

(b) The Owner shall be immediately notified of any unusual damage occurring during construction of the transformer and all tests which do not meet specified or standard values. The Owner shall be permitted, at his option, to personally inspect such damages and/or test failures.

12. Sweep Frequency Response Analysis Test.

C. The Manufacturer may perform additional tests deemed necessary under its quality control program. The Manufacturer shall furnish the Purchaser with four (4) copies of guaranteed performance data and test reports which define the tests and list the certified test results. The cost of all factory tests required to be performed by the Manufacturer shall be included in the firm price quoted in the Manufacturer’s proposal.

D. The Owner shall be immediately notified of any unusual damage occurring during construction of the transformer and all tests which do not meet specified or standard values. The Owner shall be permitted, at his option, to personally inspect such damages and/or test failures.

3.18 LOSS EVALUATION

A. Load and no-load losses will be evaluated as follows:

<table>
<thead>
<tr>
<th>No-load Core Losses</th>
<th>Load Losses (Copper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$7,500/kW</td>
<td>$2,000/kW</td>
</tr>
</tbody>
</table>

B. Evaluated losses will be calculated by multiplying the appropriate dollars/kW values by guaranteed maximum load losses at 55°C rise at OA rating and no-load losses at 100 percent voltage. The products will be added to the bid price for evaluation.
C. If the actual tested loss values exceed the guaranteed maximum loss values stated in the proposal of the Successful Bidder, the Successful Bidder will be charged a penalty value for every kilowatt by which the actual tested transformer losses exceed the guaranteed maximum losses upon which the proposal was evaluated. This penalty value will be the difference between the total actual test loss evaluation and the total guaranteed bid loss evaluation based on the evaluation factors as follows:

<table>
<thead>
<tr>
<th>No-load Loss Penalty</th>
<th>Load Loss Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>$7,500/kW</td>
<td>$2,000/kW</td>
</tr>
</tbody>
</table>

4 BID SCHEDULE & MANUFACTURER’S DATA

As part of the manufacturer’s proposal, the manufacturer shall complete or provide data as provided for in this section.
### 4.1 BID SCHEDULE

<table>
<thead>
<tr>
<th>NO.</th>
<th>ITEM</th>
<th>UNIT</th>
<th>UNIT PRICE</th>
<th>LOSS KW</th>
<th>QTY</th>
<th>EXTENDED PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Transformer</td>
<td>Ea.</td>
<td>N/A</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No Load Loss</td>
<td>kW</td>
<td>$7,500/kW</td>
<td>kW</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1a</td>
<td>Load Loss</td>
<td>kW</td>
<td>$2,000/kW</td>
<td>kW</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Placement of Transformers on Owner Furnished Pad (optional)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>On-Site Transformer Assembly (optional)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>With Load Tap Changer (optional)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL OF BID</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$______________</td>
</tr>
</tbody>
</table>

Items #1, #1a and #1b will be added for a total loss evaluated bid price. The actual price paid will be the base bid price given in Item #1, 2, 3 and 4. (See Section 3.17 in the Technical Specifications for more information on the Loss Evaluation.)

**Value Analysis Factors (VAF) (To be completed by Owner)**

- **Technical Support**: -0 - 5%
- **Service Shop**: -0 - 2%
- **Service Engineer**: -0 - 2%
- **Short Circuit Test**: -0 - 1%
- **Product Quality and Performance**: -0 – 10%

**Total VAF**

The bid prices will be evaluated by the Value Analysis Factors to insure that the Purchaser is getting the best product from a reputable manufacturer with adequate service capabilities. The bid will be awarded based on the overall evaluated price.

**Total Evaluated Transformer Price**

\[
(1 + 1a + 1b + \text{VAF}) = _______________{\text{value}}
\]

**Transformer Delivery from Receipt of Purchase Order (Date)**

________________________
I/We acknowledge receipt of the following addenda:

<table>
<thead>
<tr>
<th>Addenda No.</th>
<th>Date Received</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dated at: __________________________ this ___ Day of ________ 20 ___.

Bidder __________________________ (SEAL)

By ________________________________ (Signature)

________________________________ (Printed or Typed)

Title ______________________________

Attest:

Complete Business Address of Bidder: ______________________________

State of Incorporation: ______________________________

Complete Address of Principal Offices: ______________________________

Name, Address and Telephone Number of Person to Contact Regarding this Proposal. ______________________________

Include both Mail and Street Addresses: ______________________________

Telephone: ______________________________

______________________________
4.2 PERFORMANCE DATA

A. Losses.
   1. Guaranteed losses for the transformer are to be provided:

<table>
<thead>
<tr>
<th>Excitation</th>
<th>No Load</th>
<th>Load</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% V</td>
<td>kW</td>
<td>kW</td>
<td>kW</td>
</tr>
<tr>
<td>100% V</td>
<td>kW</td>
<td>kW</td>
<td>kW</td>
</tr>
</tbody>
</table>

   2. The losses will be evaluated as follows:
   - No Load Losses: $7,500/kW (See Section 3.17)
   - Load Losses: $2,000/kW

   (a) Evaluated losses for each transformer will be calculated by multiplying the corresponding dollars/kW values listed above times the guaranteed load losses at the 55EC load rating and no-load losses at 100 percent voltage, with the products added to the bid price for evaluation.

B. Efficiencies

<table>
<thead>
<tr>
<th>Load</th>
<th>Full Load</th>
<th>3/4 Load</th>
<th>1/2 Load</th>
<th>1/4 Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>_____ %</td>
<td>_____ %</td>
<td>_____ %</td>
<td>_____ %</td>
</tr>
</tbody>
</table>

C. Percent Regulation
   1. 100% PF _____ %
   2. 80% PF _____ %

D. Percent Exciting Current
   1. 100% Voltage _____ %
   2. 110% Voltage _____ %

E. Percent Impedance Volts
   1. %IZ Between windings H-X at _____ kVA _____ %

F. Sound Level
   1. Transformer kVA _____ dB
   2. Maximum kVA (with fans) _____ dB

G. Core Steel Grade

---

St. George Energy Services  
Substation Power Transformer  
Page 40
H. Winding Conductor Type: High side winding: ____ Low side winding: __

I. Winding Insulation Paper: High side winding: ____ Low side winding: __

4.3 MECHANICAL DATA

A. Overall height: ____________ IN.

B. Overall width: ____________ IN.

C. Overall depth: ____________ IN.

D. Height over cover: ____________ IN.

E. Untanking height: ____________ IN.

F. Core and coil weight: ____________ LBS.

G. Tank and fittings weight: ____________ LBS.

H. Liquid weight: ____________ LBS.

I. Total weight: ____________ LBS.

J. Gallons of liquid: ____________ GAL.

K. Core/Coil Design: Circular Disk Layer (required)

L. Expected number of operations before contact or vacuum bottle replacement: ______

M. Can the LTC be manually operated safely without de-energizing the transformer? ______

N. Regulating voltage winding tapped or fully distributed? ______________________

O. Type of oil preservation system (describe): ________________________________

P. Bushing Spacing
1. High Voltage Phase-to-phase ................................................................. _____ in.
2. Low Voltage Phase-to-phase ............................................................... _____ in.
3. Low Voltage Phase-to-neutral ............................................................. _____ in.
4.4 DIELECTRIC TEST

A. Applied Voltage
   H Winding: ______ kV
   X Winding: ______ kV

B. Induced Voltage
   Line to Line: ______ kV
   Line to Ground: ______ kV

4.5 PRICE DATA

A. Total Base Bid price, per transformer: $_______________________ (delivered to project site)

B. Total Base Bid price, per transformer with LTC $_______________________ (delivered to project site)

C. Field Engineering Service (flat rate per diem): $__________

D. Note: Escalation factors, if any

E. Extended warranties available and associated costs:

   1. 18 months: $__________
   2. 24 months: $__________
   3. 36 months: $__________
   4. 48 months: $__________
   5. 60 months: $__________

   NOTE: All required field engineering for warranties must be included in prices indicated.

F. Cost to unload transformer on Owner’s Pad: ________________
G. Will the transformer be shipped completely assembled?
Yes □ No □

If no, please indicate specific items requiring assembly:
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

H. Cost to provide on-site assembly of unit: $ ______________

I. Deduct cost to delete the “heat run” $ test on the transformer: ______________

J. The transformer will be manufactured at our plant located in ________________

4.6 OTHER SPECIAL FEATURES AND REQUIREMENTS
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

4.7 EXCEPTIONS

A. All exceptions taken to items in this specification are to be listed below. The paragraph number and title should be stated, followed by an explanation of the exception to be taken. (Attach additional sheets if necessary.)
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
AGREEMENT

THIS AGREEMENT, made and entered into this ______ day of ________________ 20____,
by and between St. George Energy Services, hereinafter called “Owner” and ______________
hereinafter call the "Bidder".

WITNESSETH:

WHEREAS: The Owner intends to have certain equipment supplied as outlined below, and

WHEREAS: the Bidder is able and willing to provide such equipment, NOW THEREFORE: The
Owner and the Bidder for the consideration hereinafter provided, agree as follows:

ARTICLE I. SCOPE OF WORK

The Bidder shall furnish all of the materials and equipment as required in the Contract
Documents entitled: St. George Energy Services Distribution Substation 69-13.2Y/7.62 kV, 15
MVA Power Transformers.

ARTICLE II. THE CONTRACT DOCUMENTS

The Specifications entitled St. George Energy Services Distribution Substation 69-13.2Y/7.62
kV, 15 MVA Power Transformers, Inquiry Number 17-0041 and

Addendum No. __________ dated __________,
Addendum No. __________ dated __________,
Addendum No. __________ dated __________,
Addendum No. __________ dated __________,

Together with this Agreement, form the Contract and are fully a part thereof as if attached
hereto or repeated herein.

ARTICLE III. THE CONTRACT SUM

The Owner shall pay and the Bidder shall accept as full payment of the Contract, the sum of:

_________________________________________________ DOLLARS ($___________)

Subject to additions and deductions provided in the Contract.
ARTICLE IV. TIME OF COMMENCEMENT AND COMPLETION

Work under this Contract shall commence upon written notice to proceed from Owner, and be delivered, completed, and ready for Owner's final inspection within the specified shipping and receiving dates. Time is of the essence.

ARTICLE V. INSPECTION

The fact that any particular equipment has been inspected shall not be considered a waiver of the requirement of strict compliance with the Contract Documents.

ARTICLE VI. CONTRACTOR NOT AGENT OF OWNER

It is expressly agreed that Bidder is not the agent or employee of Owner, but that he is an independent contractor.

ARTICLE VII. PAYMENTS

Payments shall be made in accordance with applicable sections of the Contract Documents.

ARTICLE VIII. ASSIGNS

Neither party to the Contract shall assign the Contract or submit it as a whole without the written consent of the other. Bidder shall not assign any moneys due or to become due to him hereunder nor shall he pledge or attempt to pledge the credit of Owner or bind the Owner to any third party.

ARTICLE IX. ACCEPTANCE

The Equipment supplied shall be inspected for acceptance by the Owner promptly upon receipt of notification from the Bidder that all equipment is delivered to the job site and ready for inspection. The equipment supplied shall be at the Bidder’s risk until accepted by the Owner in writing.

ARTICLE X. DEFAULT AND ATTORNEY'S FEES

Should any dispute arise between the parties hereto, with regard to performance of their respective obligations under the Contract Documents, which dispute cannot be settled
between the parties and litigation is commenced, then the losing party in the litigation agrees to pay all costs and attorney's fees of the prevailing party.

IN WITNESS WHEREOF, the parties have executed this Agreement, the day and year first above written, binding themselves, their heirs, successors, executors, administrators, and representatives to the full performance of the Contract.

<table>
<thead>
<tr>
<th>OWNER</th>
<th>BIDDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner's name</td>
<td>Name of Bidder</td>
</tr>
<tr>
<td>By</td>
<td>By</td>
</tr>
<tr>
<td>Authorized Agent</td>
<td>Signature and Title</td>
</tr>
<tr>
<td>License Number</td>
<td></td>
</tr>
</tbody>
</table>