SUBSTATION TRANSFORMER SPECIFICATION

for

Shadow Glen Substation

April 1, 2020

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GENERAL INFORMATION

Scope

This Substation Transformer Specification covers the design, construction, testing, inspection, shipping, performance, and warranties of power transformers and accessories.

Owner and User

The potential Owner of equipment covered in this Substation Transformer Specification is Bluebonnet Electric Cooperative, Inc., referred to as the Owner, or designated hereinafter as Bluebonnet. The potential User of equipment covered in this Specification is also Bluebonnet.

Bid response by mail or electronic correspondence shall be sent to the following address no later than **May 1, 2020**:

Bluebonnet Electric Cooperative, Inc.
P. O. Box 240
Giddings, Texas 78942
Attention: Sheryl Pratt
Sheryl.pratt@bluebonnet.coop

Any questions referring to a needed explanation or interpretation of this Specification should be directed to Brian Mitschke or Phillip Ellis (brian.mitschke@bluebonnet.coop or phillip.ellis@bluebonnet.coop).

The Substation Transformer Specification included hereunder has been prepared by the Owner.

Utilization of Equipment

The transformer (33 MVA) will be installed at the Owner's Shadow Glen Substation. This unit will be utilized as a 138 kV to 26,180 Grd Y/15,115 kV (nominal) step-down transformer. This unit will serve residential load, commercial and motor loads.

Transformer Specification

Latest versions of each of the following specific standards shall become a part of this specification. When requirements in these specifications are more stringent than those given in the standards, these specifications shall apply.

American National Standards Institute (ANSI) V-1 - Compressed Gas Cylinder-Valve Outlet and Inlet Connections

ANSI C57.12.00 - General Requirements for Distribution, Power, and Regulating Transformers

ANSI C57.12.10 - Requirements for Transformers 230,000 Volts and below, 833/958 through 8333/10,417kVA, Single Phase, and 759/862 through 60,000/80,000/100,000 kVA, Three Phase

ANSI C57.12.70 - Terminal Markings and Connections for Distribution and Power Transformers

ANSI C57.12.90 - Test Code for Distribution, Power, and Regulating Transformers

ANSI C57.13 - Requirements for Instrument Transformers

ANSI C57.19.00 - General Requirements and Test Procedure for Outdoor Power Apparatus Bushings

ANSI C57.19.01 - Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings

ANSI C57.19.101 - Trial Use Guide for Loading Power Apparatus Bushings

ANSI C57.92 - Guide for Loading Oil Immersed Distribution and Power Transformers

ANSI C57.98 - IEEE Guide for Transformer Impulse Test

ANSI C57.106 - Guide for Acceptance and Maintenance of Insulating Oil in Equipment

ANSI C62.11 - Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits

ANSI C62.22 - Standard Guide for the application of Metal-Oxide Surge Arresters for Alternating-Current Systems

Institute of Electrical and Electronic Engineers (IEEE) STD 4- Standard Techniques for High Voltage Testing

IEEE 80 - Guide for Safety in Substation Grounding

Seller Specifications

The Seller shall include the completed Bid Form (Exhibit A) based off of transformer unit sheet provided (Exhibit B) and all technical data on the proposed transformers that are necessary for the Owner to establish that this Specification is met.

Any proposed deviation from the Specification must be listed in the Exceptions Table (Exhibit C); otherwise, proposals will be considered in complete compliance with this Specification.

If the information supplied herein is not sufficient for the manufacturer to adequately design and manufacture the transformers, it is the manufacturer's responsibility to request additional information.

GENERAL SPECIFICATIONS

Electrical Equipment

All electrical equipment furnished under this Substation Transformer Specification shall be designed, constructed, and rated in accordance with the standards of the IEEE, USASI, ASTM, NEMA, ANSI, and RUS. The equipment shall be delivered completely engineered, fabricated, inspected, tested, and ready for final preparation, installation, and connection of external wiring. In selecting capacities of equipment, it shall be assumed that the equipment may be operated continuously at conditions of maximum power and short circuit requirements stated herein. Under these conditions of maximum stress and power requirements, deleterious effects shall not exceed those permitted by the most stringent of the above applicable standards.

Materials

All materials shall be new and high quality in order to provide long life and reliable operation. Parts subjected to high temperature duty cycle shall be designed so that appreciable deformations do not occur within the normal life of the equipment. All equipment shall be modern in design and shall not have been in prior service, except as required by factory tests.

Workmanship

All work shall be performed and completed in a thorough workmanlike manner and shall follow the best, modern practices in the manufacturing process of high quality apparatus, notwithstanding any omissions from this Specification. All parts shall be made accurately to American Standard gauges in order to facilitate maintenance, replacement, and repairs.

Equipment Drawings and Instructions

Preliminary drawings of this equipment shall be submitted with each copy of the Seller's proposal at the time the bids are opened. Transformer drawings shall show all the basic dimensions of the transformer, bushing stud size, number and size of fans, principal dimensions, complete wiring, etc. Copies of each drawing required shall also show detailed arrangements of equipment, base plate dimensions, conduit connection locations, and weight with and without oil.

The Seller shall submit two (2) copies of all catalog cuts and two (2) sets of prints of all drawings to the Owner for signature and approval within 45 calendar days after the date that the contract is awarded. Each drawing submitted shall also include an electronic media with the drawings formatted in AutoCAD 2015 or later and Adobe PDF. The drawings and catalog cuts shall be accompanied by a letter of transmittal. The transmittal letter shall include a list of the numbers and dates of the drawings, the contract number, and the item number. Drawings shall bear the date, the appropriate name, project number, drawing number, and the Seller's stamp of approval. One (1) set of the Seller's drawings will be returned to the Seller, marked with corrections to be made, if any; the other set will be retained by the Owner.

Drawings shall include, but not be limited to, the following:

- Transformer, bushing and arrester outline drawings and transformer internal drawings
- Nameplate drawing (one plate with all pertinent data)
- Schematic and wiring diagrams
- Mounting diagrams and installation instructions for fans, surge arresters, radiators, and other external components
- Current transformer (CT) excitation curves
- Inert gas system diagram and installation instructions

The Seller shall furnish three (3) copies of all drawings for construction as soon as practical after the return of the approved drawings to the Seller. Such should be provided in both hard copy and on an electronic media using AutoCAD 2015 or later and Adobe PDF. These construction drawings and instruction books shall in no event be delivered after site delivery of the transformers. The Seller shall send one set of all reproducible copies to the Owner at the same time as the construction drawings are sent.

The Seller shall also submit one (1) reproducible set and two (2) sets of prints of any future or field corrected drawings to the Owner. All changes made by the Seller, after such drawings have been checked, shall be resubmitted in the same manner.

Delivery of final drawings, instruction books, and certified copies of factory test reports is a requirement for final acceptance.

The manufacturer shall furnish three (3) copies of bound instruction books and one (1) reproducible copy of electronic media written in the English language and containing outline and nameplate drawings, plus books covering all phases of operation of the equipment. These instruction books shall be illustrated with cuts and drawings to describe adequately the construction and the adjustment of the various parts of the equipment and to facilitate the ordering of spare and renewal parts. All units of measurements herein shall be expressed in American standard terms.

All work done by the Seller on items or portions of items for which drawings are required, before receipt of copies of such drawings signed by the Owner, shall be at the Seller's risk.

All drawings, prints, and instruction books shall be clearly written only in the English language and utilizing American standard units of measurement.

Drawings and catalog cuts shall be provided by the Seller where specified or directed; however, the Seller will not be required to supply drawings, which in the opinion of the Seller will disclose proprietary design or confidential manufacturing information. Seller shall submit with his bid a listing of any types of specifications or drawings which will be considered proprietary.

Inspections

Inspection of the apparatus may, at the discretion of the Owner, be at the Seller's factory. The equipment shall not be prepared for shipment or shipped before the Owner has either inspected the equipment or waived inspection. The waiving of inspection shall in no way relieve the Seller of the responsibility of furnishing apparatus in accordance with this Specification.

Inspectors representing the Owner shall be given every opportunity to inspect the work during all stages of the manufacturing process, testing, and shipment. They shall have free access at all times during working hours to all parts of the Seller's factory involved in the manufacturing process of material covered by these Specifications. Copies of all manufacturers' specifications or orders for material, fabrication, testing, shipping, or other data that are requested by the Owner to enable inspectors to keep in close touch with every step in the manufacturing process of the apparatus shall be furnished promptly at the time such requests for such data are first issued. In case of revisions, additions, or cancellations, the Owner shall either be notified in writing or given revised copies of said order or specification.

Packing and Shipment

All equipment shall be carefully packed to prevent damage in shipment. All units and containers shall have the appropriate external identification with project name, procurement contract number, installation locations, and the appropriate unit number.

Truck shipment is preferred and rail shipment is discouraged. The Seller is required to install a vibration recorder on the transformers to maintain an adequate record of vibration during transit. The recorder must be available for inspection by Owner's agent, prior to the removal of the transformers from the truck or rail car.

No equipment purchased hereunder shall be shipped prior to receipt in writing, by Seller, of "Notice to Ship", as issued by Bluebonnet. Seller shall notify the Owner in sufficient time, before proposed shipping date, so that "Notice to Ship" can be appropriately issued. Shipments made without this prior approval will be returned "Freight Collect".

The Seller may elect to ship bushings, arresters, radiators, and other appurtenances in separate containers for simplified field installation. Each proposal shall list all items that are so scheduled, including oil, nitrogen filling cylinders, and additional gas.

Owner shall be advised if it is anticipated that the transformers will be shipped without oil due to weight considerations. In this case, oil of acceptable grade and in sufficient quantity will be provided by the Seller and shipped separately. In such event, the transformers shall be sealed and filled with inert gas, under sufficient gas pressure to assure a detectable pressure reading on gages at the time of delivery. Internal dewpoint shall be measured and recorded at the factory and provided to Owner at the time of shipment. The transformers can then be vacuum processed and filled with oil, through drain valves in each compartment, and gas bled off as filling is accomplished. Should detectable gas pressure not be present upon delivery, Seller shall provide such additional gas as Seller shall determine, to adequately purge all compartments and/or dry out all internal components prior to insertion of oil by Owner.

Fourteen (14) days prior to the actual delivery of the units, the Owner shall be notified with a complete delivery schedule on all equipment parts. The transformers shall be shipped prepaid to the Owner's Substation.

The delivery dates expected by Bluebonnet are:

1) Shadow Glen Substation: no later than September 1, 2021. Exact date will be determined in August of 2021 for delivery.

Bid consideration will be given (during bid evaluations) to the quoted delivery date and to the expected reasonable ability of the Seller to meet such a delivery date. The Seller shall be assessed a $1,000/day penalty by the Owner for each day by which the actual on-site delivery of these transformers exceed the delivery date stated in the proposal. (See Exhibit D for special delivery instructions)

It is the responsibility of the vendor to notify all contract carriers/shippers of Owner's 48-hour prior advance notice requirements.

Assembly and Field Testing

The Seller shall provide a service engineer to inspect the transformers before they are removed from the carrier and to file any claims with carriers. The Seller shall delegate such representative to the job site as shall be qualified to supervise the installation of the transformer units, and/or the re-assembly of any items or appurtenances that were removed for shipment; such as vacuum processing, filling with oil, and purging with nitrogen bottles. Such representative's qualifications shall include necessary communications skills.

The Seller shall supervise all necessary tests required to initially place the transformer units in operation and shall be responsible for all changes on the transformers which may result from manufacturing discrepancies and deficiencies. If required to make the transformers conform to this Specification, the Seller's representative shall be available for services to the Owner until the transformer units are completely installed, tested, and operates to the Owner's satisfaction.

Performance tests to be performed in the field shall be made at times and under conditions, including cost-sharing, to be mutually agreed upon by the Owner and the Seller.

All equipment furnished under this Specification shall be checked in the field by the Seller after it is assembled. The checks shall be of such breadth as is necessary to demonstrate accuracy for meters, instruments, and relays; prove proper operation of all control and protective devices; prove proper operation of control circuits; prove proper operation of various mechanical features such as doors and switch operations; prove proper insulation resistance; and show that each item of equipment may be safely placed in service.

The Owner shall not be deemed to have given final acceptance of equipment until sufficient tests have been given to determine that all of the requirements of this Specification have been met. Such tests shall be made within one (1) month of the date that the unit is completely installed and ready for use. If

inspection or tests show any deficiency of equipment or any part thereof, not to be as represented or specified, the Owner may refuse acceptance until the Seller has corrected such deficiencies at the Seller's expense.

The Seller shall quote only a single, totally inclusive, 24-hour/day charge for the service outlined in this section. No "included days", transportation, meals, lodging, or overtime charge methods will be accepted as a cost basis. The number of days actually "on-site" will be utilized to determine payment.

Warranty-Repair and/or Replacement of Defective Portions

All equipment furnished by the Seller is to be guaranteed to operate satisfactorily without undue wear, excessive vibration, excessive noise, excessive lubrication, or undue attention required from its operating personnel. In the event of failure of any component of the equipment during the warranty period, or failure of the equipment to meet its guarantees, including the operative guarantees, the Seller shall furnish at his own expense all labor, parts, tools, etc., required for correcting the defective equipment. The Seller shall be responsible for any repairs or replacements caused by defective materials, workmanship, or equipment, assuming use as specified herein, plus normal and proper maintenance for a period of at least five (5) years from and after the date of final acceptance by the Owner. If certain portions are shown to be defective within the original warranty period, the warranty period on those portions shall be extended one (1) year from and after such time that all defects are corrected. The Seller shall make, with due diligence, the aforesaid repairs and/or replacements within ten (10) days after receiving written notice that such repairs or replacements are necessary. If the Seller shall neglect to begin such repairs or replacements within this period, or in case of emergency, wherein the judgment of the Owner delay would cause serious loss or damage, the repairs and/or replacements may be made by the Owner and charged to the Seller.

The foregoing Warranty is exclusive and in lieu of all other warranties whether written, oral, or implied, including any warranty of merchantability or fitness for purpose.

The Owner is interested in any available extension of this initial warranty period.

DETAILED SPECIFICATIONS

Loading

The transformers shall be capable of emergency overload conditions per ANSI C57.92. The appurtenances such as bushings, bushing leads, and load tap changer shall not limit this overload capacity. It is understood that there will be some loss of life associated with this overload condition. That loss of life shall be approximated using ANSI C57.92.

Transformer Taps (where required)

Four (4), full capacity, no-load taps (two above rated voltage and two below rated voltage) shall be provided in the high voltage winding configuration per NEMA Standards. The tap changer shall have two (2) 2 1/2% steps above and two (2) 2 1/2% steps below nominal rated voltage.

Low side tap changing under load equipment shall be provided as follows:

Tap Range Above Normal	10%
Tap Range Below Normal	10%
Taps Above Normal	16
Taps Below Normal	16

Over Voltage Rating Requirements

The transformers shall be capable of delivering rated output in kVA at 15% above the output voltage rating of the transformer on any tap. The transformers shall also be capable of operating at 15% above the output voltage rating of the transformers on any tap at any load. Both these requirements should be met without exceeding the specified temperature rise.

Note: The above is in excess of NEMA standards.

Finish

The tank coating shall meet all requirements in the IEEE C57.12.28 standard, including a uniform finish of ANSI No. 70 Sky Grey.

Special Test Data

Specific test data shall be furnished for the transformers included herein, from tests performed on the manufactured unit specified herein, in accordance with IEEE C57.12.00-2015 and C57.12.90-2015 or the latest revision thereof.

Certified copies of test reports involving all performance tests made on the transformer units shall be furnished to the Owner, regardless whether or not Owner has been present at the test. Test reports shall

show that the transformer units complied with this Specification herein and with all applicable standards. Certified copies of test reports are required no later than one (1) week after transformer shipment. These test reports shall be available for comparison during on-site testing.

The costs of all factory performance tests shall be borne by the Seller.

Short Circuit Strength

The Seller shall state if the transformers quoted are designed to meet or exceed the requirements of IEEE C57.12.00 and C57.12.90, Section 10, Short-Circuit Characteristics, or its latest revision.

Without limiting in any way any obligation of the Seller under this agreement, the Seller shall demonstrate to the satisfaction of the Owner that the transformers proposed to be furnished under this Specification shall have sufficient mechanical strength to withstand, without failure, all through-fault currents. The Seller shall demonstrate that the transformers meet this requirement by one of the following methods:

- 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 rating, 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.

- A history of successful experience with transformers of identical or similar ratings, design, and construction. The Seller shall list all transformers in service with core and coils which are essentially identical in design and construction to the transformers covered by this Specification. The Seller will also provide information on the date of installation, location, and failures, if any. If such transformers have not been built, or the cumulative service record is less than 20 transformers in service, information submitted shall be representative of the total experience of the manufacturer with the design of the proposed transformers. Information should include the dates of installation or shipping, the ratings of the transformers, and the failures and causes of failure, if any, that have been experienced.

Audible Sound Levels

The transformer units shall be so designed that the sound level will not exceed NEMA standards, as per paragraph TR1-0.05.

Transformer Accessories

The transformers shall be furnished with the accessories listed below.

- The transformers shall be supplied with all equipment for the forced air rating including the fans with automatic control from winding temperature. All control equipment, conduit, thermometer contacts, fan contactor, wiring, control switches, etc. shall be furnished. Controls for low velocity fans are to be automatically initiated by a winding temperature device. The

device shall have three (3) contacts: one to start the first stage of cooling, one to alarm before the second stage cooling is initiated, and one to initiate the second stage of cooling fans. The Owner reserves the right of approval with respect to quantity, fan motor size, overload relays, and contactors proposed to be utilized.

- The transformers shall be supplied with mounting brackets for the installation of lightning arresters on both the high voltage and low voltage sides. The low voltage arrester mounting brackets shall be in-line with the low voltage bushings. The height over the low voltage arrester mounting brackets with relation to the height of the low voltage bushing tops shall be shown on the outline drawings. In order to provide the mounting brackets, manufacturer and catalog numbers for the lightning arresters to be furnished by Owner will be provided to the transformer manufacturer, if requested.

- 2" diameter upper filter press connections and globe valves, for each compartment; plus two (2) additional valves on top of tank for connection of vacuum gauge during processing.

- 2" diameter drain globe and sampling valves, for each compartment.

- One (1) dial-type liquid thermometer with alarm contacts wired to the control cabinet. The thermometer is to be readable and resettable from ground level. Two (2) electrically separate form C contacts shall be provided.

- One (1) dial-type hot spot thermometer with CT in one (1) winding and alarm contacts wired to the control cabinet. The thermometer is to be readable and resettable from ground level. Two (2) electrically separate form C contacts shall be provided.

- Self-resealing, cover-mounted pressure relief device with mechanical signal for indication of device operation and with two (2) electrically separate form C contacts wired to the control cabinet. The pressure relief device is to be shipped uninstalled (loose and unmounted) with a cover plate over the hole in order to be suitable for vacuum processing.

- The transformers included herein shall be provided with a fault pressure, or sudden pressure relay, which shall be mounted on the transformers with suitable range for adjustment of pressure, if applicable. The sudden pressure relay shall have 125 VDC rated voltage and current contacts, terminal block, and necessary external cable connections. The sudden pressure relay shall be Qualitrol or approved equal. A seal-in lockout relay package with reset shall be furnished complete with electrically separate form C contacts.
    - **Qualitrol – Seal-in-Relay (Item # 909-300-01)**
    - **Qualitrol – Rapid Pressure Rise w/ vent (Item # 910-014-02)(shall be mounted on the side of the unit on the top left side)**
    - **Qualitrol – 120” 16/3 cable (Item # Con-659-11)**

- Vacuum pressure gauge with two (2) electrically separate form C contacts and a bleeder/ relief valve.

- Magnetic liquid level gauge with alarm contacts wired to control cabinet. Two (2) electrically separate form C contacts for low and critically low liquid level shall be provided.

- Inert nitrogen positive pressure gas preservation equipment is to be furnished for each separate tank. This equipment shall be complete with two (2) electrically separate form C contacts wired to the single control cabinet, regulator, pressure gauges, gas sample valve, etc. for a completely operable system. One (1) initial charging gas cylinder and three (2) spare 200 cubic foot gas cylinders are to be provided by the Seller. The cylinder in operation shall be housed in a weatherproof cabinet.

- Lifting lugs or eyes for cover, core, tank, and each radiator.

- Sealed tank construction with welded cover.

- A single control cabinet shall be furnished to house all control equipment and terminal blocks for Owner connections. This control cabinet shall have sufficient space to facilitate the Owner's wiring, all factory-mounted devices, and future devices. All alarms, controls, CTs, thermometers, LTC, nitrogen system points, etc. are to be wired into this single control cabinet. All terminations in this single control cabinet shall be permanently and appropriately identified. Terminal blocks and wiring shown on drawings shall match the actual internal cabinet wiring and identifications. Relays and terminal blocks mounted to the inside of cabinet door shall be protected from personnel contact and miss-operation from opening/closing or working inside access door.

- Wiring terminals for external single-phase, 120/240 volt, 3-wire, 60 Hertz, control power for fans and/or FA/FA equipment shall be housed in an enclosure suitable for outdoor installation. Fans and pumps must operate at this specified voltage and frequency. Wiring and all alarm contact terminals shall be provided in a single control cabinet. Owner reserves the right to request relocation of such terminal blocks from Seller's first proposed locations as shown on approval drawings. The control power terminal block shall accept connection of #2 copper cable (maximum). The actual load requirements for this external supply shall be specified by Seller.

- Junction boxes and/or terminals for bushing CT cable connections and for control/alarm circuit cable connections shall be provided at points where such cables are not continuous.

- Name plate and other instruction plates shall be installed no more than 6' above ground level. Nameplate shall include insulating paper weight and a 2D or 3D barcode that will contain the manufacturer serial number for the unit.

- Jacking facilities shall be provided with a service area width of 6" and plate height of 13" above the base.

- Base shall be designed for skidding in any direction. Tank must have provisions for pulling in any direction to centerline segments. The tank of the transformer shall be marked permanently, designating the center line of the unit and the center of gravity.

- Sufficient number and size of manholes shall be provided to install the bushings without difficulty. A minimum of two (2) manholes shall be furnished each with a minimum diameter of 18". Owner reserves the right to request relocation of such manholes from Sellers standard locations as shown on approval drawings. The location of the manholes should provide the best

access to the inside of the tank.

- Top and bottom butterfly radiator valves, capable of being fixed in open or closed position with indication, and detachable radiators are to be supplied.

- The transformers will be supplied by the Seller with seven (7) pad-type bushing connectors. The pads shall be a minimum of 4" square and 3/8" thick. Each bushing connector shall have a standard 4-hole pad.

- External tap changer handle/handles are to be installed on the side of the tank at no more than 6' above ground level. They are to be operated with the transformer de-energized. The operating handles are to have each position clearly marked and have provisions for locking in any position using a standard 7/8" clearance shackle-opening padlock. No lock set or cover is to be included.

- Accessories requiring DC voltage are to operate at 125 VDC.

- Thermostatically controlled space heaters shall be provided in the quantity and capacity required to maintain the temperature inside each cabinet above dew point temperature for the conditions of operation specified. A suitable thermal magnetic circuit breaker shall be provided for connection of the heaters to a 120-volt, single-phase, 60 Hertz, power source.

- The Seller shall furnish one (1) complete set of all specified maintenance tools and all unusual installation tools or accessories, lubricating devices, test gauges, etc., as required for reliable and safe operation. Tools shall be new and of first-class quality. Tools shall be shipped in a container marked to identify the use of the tools contained.

LTC Equipment

- LTC or TCUL (Load Tap Changing or Tap Changing Under Load) equipment shall be furnished as specified. The LTC unit shall be manufactured by Reinhausen, Model RMV-II. LTC equipment shall provide ±10%, in phase, voltage regulation at the low voltage transformer terminals in 5/8% steps. The interruption mechanism utilized is to be indicated. The equipment shall be designed to withstand a full voltage short circuit.

- LTC equipment shall be housed in a separate oil-filled compartment with oil completely separate from the transformer tank oil. This separate compartment shall include all standard NEMA accessories, such as magnetic type liquid level gauge with alarm contacts, temperature gauge with alarm contacts, filter press input and drain globe valves, oil sampling valve, etc., the same as are required for the transformer tank. An inspection door to this compartment shall be provided with an oil tight seal, with gaskets made of such material as not to deteriorate under service conditions.

- A Beckwith #M2001D control system with a backup LTYC control for automatic voltage adjustment shall be furnished. The control system shall include first customer protection circuitry that will prevent the LTC from raising the load voltage above a preset level for the first customer. The first customer protection circuitry shall also cause the LTC to step-down if the source voltage increases beyond a preset value after the first customer protection circuitry has

prevented the LTC from raising the load voltage. The control system shall include protection circuitry that will prevent the LTC from lowering the load voltage below a preset level. The protection circuitry shall also cause the LTC to step-up if the source voltage decreases beyond a preset value after the protection circuitry has prevented the LTC from lowering the load voltage. The manufacturer and model number of such control shall be specified with bid. (Beckwith controls are preferred). Complete schematic drawings shall be furnished as an integral part of primary drawing, not as separate sheets. A two-step voltage reduction control shall also be included.

- Although not a specific requirement for bid purposes, separate consideration will be offered to any proposal that provides LTC equipment designed (in a separate compartment) to permit operation of the main transformer unit while LTC equipment is in a disabled mode of operation.

- Suitable thermal magnetic circuit breakers shall be provided for connection of LTC operating equipment to an external 120/240 volt, single phase, 60 Hertz power source for LTC motor, heaters, and lights. An additional 120-volt single-pole circuit breaker shall be provided in the potential transformer (PT) secondary circuit wiring from an externally mounted PT. Circuit breakers are to be mounted and terminated in the single control cabinet.

- The LTC equipment shall be equipped with all necessary devices to accomplish parallel or individual operation of the LTC when transformers are operating in parallel, or individually, using the circulating current method of parallel operation.

- Tap changer controls shall include voltage sensing devices, tap changing counter, regulator supply breakers, and other equipment as required for self-contained operation (excluding externally supplied 120/240 volt single phase control power). An internally mounted CT on X1 phase for line drop compensation (LDC) shall be included. An externally mounted PT connected to the X0 and X1 bushings for operating the voltage regulating relay will be furnished by Owner.

The following additional LTC accessories shall be included:

- Tap Position Indicator (electric reset if the indicator cannot be reset manually while an operator is standing at ground level). Such indicator is to be readable while operating LTC by hand.

- Individual-Parallel Selector Switch (for parallel operation)

- Automatic-Manual Selector Switch with monitoring contacts for supervisory control operation in transformer control cabinet

- Remote-Local selector switch with provision for supervisory contacts

- Raise-Lower switch

- Means of manual operation by a hand crank with an electrical interlock circuit

- Hinged cover for tap changing compartments

- Heater for mechanism

- Light and 120 volt receptacle

- Remote control circuits which will allow the LTC to be operated and monitored by a supervisory control system. All connections to the supervisory system shall be terminated on terminal blocks.

- All necessary devices for LTC position indication to a supervisory control system utilizing an Incon Model #1250 auxiliary position monitor in conjunction with the Incon Model #1292KS synchro-rotary position indicator and auxiliary contacts to indicate "on tap-off tap" status. A discrete signal change shall be produced by each tap position change.

- A maintenance free dehydrating breather that recharges and dries automatically is to be installed on the LTC mechanism and control cabinets.

- The LTC compartment shall have a self-resealing and resetting pressure relief device. The device shall have two (2) electrically separate form C contacts wired to the single control cabinet and shall also provide a visual alarm signal visible from the ground.

- Means to provide LTC "lockout" in position to be maintained when low voltage breaker opens (to be sensed by external circuit breaker "52a" contact).

- A differential temperature monitor, similar to Qualitrol Series #110-001, is to be installed as a predictive indicator of potential LTC problems.

- All contacts, control/indication points, mechanism switches, tap position, and power inputs shall be wired into the single control cabinet.

- The LTC current rating shall be based on the rated nominal output voltage.

Oil Specifications

Insulating oil in sufficient quantity to adequately fill the power transformers, included in this Specification shall be furnished by the Seller and may be shipped separately. The insulating oil shall have no detectable amounts of PCBs. The insulating oil shall meet the IEEE C57.106-2015, or its latest revision.

Loss Evaluation/Penalty

Maximum guaranteed losses (at the OA rating) should be quoted. All loss evaluations will be based on transformer losses corrected to 75° C (for 55° C rise rating.) Certified test reports are required for the transformers purchased. The certified test reports shall show no-load, full load, and total losses.

The following dollar values per kW will be placed on losses in the evaluation of the transformer quotations:

No-load losses	$3,226
Load losses	$1,463
Auxiliary losses	$1,400

It is preferred that the actual losses of the transformers not exceed the quoted losses. If actual losses of the transformers exceed the quoted losses, a penalty will be subtracted from the purchase price. For example, if the actual no-load losses exceed the quoted no-load losses by 3 kW, an amount of 3 X $3,226 or $9,678 will be subtracted from the purchase price. No premium will be paid for actual losses lower than quoted losses.

LITIGATION AND PAYMENT

Governing Law & Venue Litigation

Owner and Seller submit that all specifications and transactions hereunder shall be construed under the laws of the State of Texas. Any legal action for enforcement or otherwise related to this specification shall be brought and heard in Bastrop County, Texas and Owner and Seller hereby submit to jurisdiction in Bastrop County, Texas.

Terms of Payment

Such is preferred to be a one-time payment in full following the satisfactory completion of requirement. No other form of "Progress Payment" schedule will be acceptable to the Owner.

Proposals submitted should indicate a price which is good for at least 90 days from date provided.

BID FORM

Submittal of this Bid Form (plus any additional pages) must be completed and returned with your quotation in order to receive consideration.

ITEM	PRICE EACH
1. Manufacturer Name	_____
2. Location unit Manufactured at	_____
3. Supplier	_____
4. Transformer base price (Including any fees and packaging)	_____(US $)
5. Price addition for FOB Transformer Pad (If any)	_____(US $)
6. Price addition for firm price (If any)	_____(US $)
7. (If no entry, #3 above is assumed to be "Firm".)	
8. Price adder for Spare High Voltage Bushing	_____(US $)
9. Price adder for Spare Low Voltage Bushing	_____(US $)

	138 kV	25 kV	Neutral
a. Spare bushings to be provided herein:			
b. Manufacturer	ABB	ABB	ABB
c. Catalogue Number	_____	_____	_____
d. Drawing Number	_____	_____	_____

(Furnish one copy of drawing for above with bid)

10. Price addition for 8% impedance (If any)	_____(US $)
11. Price adder for Off-Loading	_____(US $)
12. Price Adder for Extended Vacuum requirements	_____(US $)
13. Standard warranty period (months)	_____(US $)
14. Price adder to have 5 year warranty, if not standard	_____(US $)

15. Service Engineer Price per day for two days _____(US $)

16. Method of shipment (Truck or Rail or both) _____(US $)

17. List all items removed for shipment _____

_____

18. Delivery date (maximum allowable) _____

19. Payment structure _____

20. Losses

    a. Auxiliary Equipment (Fans, etc.) Losses_____/_____ (13kv & 26kv) kW

    b. No Load Losses_____/_____ (13kv & 26kv) kW

    c. Full Load Losses_____/_____ (13kv & 26kv) kW

    d. Total Losses_____/_____(13kv & 26kv) kW

    e. *A certified test report showing the above losses is a requirement of this Specification. The owner reserves the right to witness the above loss tests*.

21. Quantity of oil to be supplied or provided for filling unit and LTC_____(Gallons)

22. Maximum total length and width and height of transformer (Including radiators) ____X_____X_____(Feet)

23. Weight of core steel _____(Pounds)

24. Weight of copper (windings and leads) _____(Pounds)

25. Total weight (with oil and accessories) _____(Pounds)

26. Number of fans and horsepower of each motor to be provided.

    a. Number of Fans_____

    b. Vendor_____

    c. Horse Power (ea)_____

    d. Number of Radiators_____

    e. Number of Radiators with shutoff valves_____

27. Any recommended additional special tests? (If so, list and price.)

28. Any recommended spare parts? (If so, list and price.)

29. Preliminary bushing arrangement, actual bushing drawings, and vector diagram drawings should be included as total bid submittal package.

I verify that the material quoted above is in accordance with the Specification with the following exception(s): (if none, write "No exceptions")._____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Offer is to be valid until (at least 90 days) _____

Proposal prepared by:

Signature: _____

Typed name: _____

Title: _____

Company: _____

Date: _____

Bluebonnet Electric Cooperative Transformer Bid Exception list

(Appendix A)

Specification Document	Requirement Number and Requirement Title	Exception/ Clarification/ Alternative Proposed	Comments

Off-Loading Destination Address

(Appendix B)

1. 911 Address of location to Off-Load: ___13508 N FM 973_____

   ___Manor, Texas__

2. Contact person to notify before shipping: ___Brian Mitschke_____

   ___979-540-7818_____

3. Contact person on site: ____Chad Siegmund_____

   _____979-540-7010_____

4. Directions to site: _____.5 miles North on FM 973_

   _____ in Manor Texas____

   _____

   _____

5. Special instructions for Off-Load site: _____

   _____

   _____

   _____

18/24/33.6 MVA, HV 138 KV, LV 26,180 Grd Y/15,115, Load Tap Controlled Power Transformer

3 PHASE	**60 HZ**	**OIL-INSULATED**			
TYPE	ONAN/ONAF/ONAF				
MVA	18/24/33.6		**TEMP RISE**	55/65	
HV	138 KV DELTA		**VOLTS BIL**	650	
LV	26,180 Grd Y/15,115		**VOLTS BIL**	150	
LV NUETRAL	150 KV		**HV CT'S**	600:5 Relaying (2) 2000:5 Relaying (1)	
IMPEDANCE	8%-10.5% @MVA BASE		**LV CT'S**	1200:5 Relaying (2); 400/800:5 RF 2.0/1.5 Metering (1)	600:5 Relaying (1)
HV ARRESTORS	88 MCOV		**LV ARRESTORS**	17 MCOV	

NOTE: Quantity of Current Transformers per phase is indicated in parenthesis.

2000:5, 1200:5 and 600:5 Relaying Current Transformers, C800, MR

200/400:5 Metering Current Transformers, 0.3% accuracy, 1.8 burden, 2.0/1.5 RF

300/600:5 Metering Current Transformers, 0.3% accuracy, 1.8 burden, 2.0/1.5 RF

400/800:5 Metering Current Transformers, 0.3% accuracy, 1.8 burden, 2.0/1.5 RF

600/1200:5 Metering Current Transformers, 0.3% accuracy, 1.8 burden, 2.0/1.5 RF

800/1600:5 Metering Current Transformers, 0.3% accuracy, 1.8 burden, 2.0/1.5 RF

CT placement sequence on lead from winding to bottom of H bushing from bottom to top is 2000:5, 600:5, 600:5 CT placement sequence on lead from winding to bottom of X bushing from bottom to top is metering, relay, relay.