SECTION III

PART I

CITY OF ST. CHARLES, IL
CITY HALL SUBSTATION
3T2
34.5 - 12.47 kV TRANSFORMER
SPECIAL CONDITIONS

1.0 SUBMITTAL OF PROPOSAL

Sealed proposals for the **34.5-12.47 kV Substation Step-Down Power Transformer** as described in the accompanying technical specification, shall be received **before 10:00a.m, Friday, May 23rd** at the City of St. Charles City Hall, Two East Main Street, St. Charles, IL 60174, Attention: Mike Shortall, Purchasing Department. At that time and place the proposals will be publicly opened and read. Any proposal received subsequent to the time specified will be promptly returned to the Bidder unopened.

Interested Bidders shall "register" with Mike Shortall and provide name, phone number, and e-mail address.

Any questions shall be submitted to both Erika Drennan (Engineer) and Mike Shortall (Purchasing) via e-mail to the following e-mail addresses:

edrennan@stcharlesil.gov

mshortall@stcharlesil.gov

before Thursday, May 15th, 2014

Upon receipt of questions prior to May 15th, the bidder shall receive a reply e-mail acknowledging the receipt of the question. Response to the question shall be as soon as practical. Should the question result in a clarification that requires addenda, such addenda will be issued to all registered bidders as soon as practical.

Questions submitted after May 15th, 2014 shall not be acknowledged or answered. Bidder shall take all necessary steps to propose questions prior to May 15th.

City reserves the right to extend the due date. Should an extension be necessary, communication of such shall be e-mailed to all registered bidders.

All equipment provided with the transformers shall be clearly identified with the equipment tag number, the purchase order number, and an item list. The substation modification project is under development by the City of St. Charles, IL (hereinafter interchangeably called the "CITY," "Owner, " and "Purchaser") and is known as the City of St. Charles, City Hall Substation – 3T2.

For the purposes of these specifications, the terms "Bidder," "Manufacturer," and "Vendor" may be regarded as interchangeable to refer to the Party of Agency responding to the Owner's request for bids under this project.

2.0 DESCRIPTION OF PROJECT

The scope of the work includes, but is not limited to the following:

A. Providing a comprehensive set of approval drawings to the CITY Engineers for approval prior to manufacture in AutoCAD format.

The CITY Engineers will have two (2) weeks to review and return approval drawing with all required corrections or revisions.

B. Manufacture of a <u>new</u> 16.8/22.4/28.0 MVA 34.5 kV to 12.47 kV step-down transformer, with load tap changing capabilities, as described in the accompanying technical specifications and shown on Exhibit IV –Substation 3 34.5-12.47 kV Transformer 2.

C. Performing all of the specified factory tests on the new transformer, as described in the accompanying technical specifications.

D. Shipping the newly manufactured transformer to the CITY by the most reliable and economic method, including furnishing and installing impact recorders, as included in the accompanying technical specifications.

E. Delivering with all appurtenances, the new transformer on the transformer pad prepared by the CITY at the substation site.

The Vendor shall coordinate the date and time of delivery with the CITY.

The Vendor shall provide or contract for the necessary equipment and manpower to unload and transfer the transformer and accessories to the transformer pad.

F. Performing all of the specified acceptance tests on the new transformer, once the transformer is fully in-place and fully configured by crews under contract to the Vendor.

SPECIAL CONDITIONS

G. Providing one (1) fully trained manufacturer's field service technician for two (2) consecutive days to supervise the unloading, and to perform the acceptance testing of the new transformer, as included in the accompanying technical specifications.

Vendor is to provide the CITY with written credentials of the field service technician for the CITY's approval of the service technician.

H. Providing one (1) fully trained manufacturer's field service technician for one (1) day to inspect the complete transformer installation, to provide a written report on any part of the installation not meeting the manufacturer's recommended methods or practices of installation, and to witness the initial energization of the new transformer.

Vendor is to provide the CITY with credentials of the field service technician for the CITY's approval of the service technician.

I. Providing three (3) comprehensive set of final "as-built" drawings and other documents, as included in the accompanying technical specifications, at the time of delivery of the transformer on site. In addition, one complete set of transformer drawings and documents shall be provided in an agreed computer file format. CAD drawings shall be in AutoCAD, or other agreed format.

SECTION III

PART II

CITY OF ST. CHARLES, IL
CITY HALL SUBSTATION
TRANSFORMER 2
34.5 - 12.47 kV TRANSFORMER
TECHNICAL SPECIFICATIONS

1.0 SCOPE

This specification covers the minimum requirements for the design, rating, manufacture, and factory testing of one (1) high efficiency, step-down power transformer with ratings of 15/20/25 MVA OA/FA/FA @ 55°C and 16.8/22.4/28.0 MVA OA/FA/FA @ 65°C. The transformer shall be furnished complete with all associated appurtenances, features, accessories, oil, special tools and maintenance equipment, and spare parts, as described herein. All materials shall be new and free of defects. Transformer shall be of the outdoor, oil-immersed, dual-winding, three-phase type. The transformer shall be used to step-down 34.5 kV transmission voltage to 12.47 kV distribution voltage. The high voltage and low voltage bushings of the transformer shall be cover mounted with terminal connections for terminating the CITY's overhead conductors connecting to the substation's 34.5 kV and 12.47 kV buses. The primary and secondary bushings are to be as specified on the Transformer Data Sheets (Attached as Exhibit I).

The transformer shall be furnished, and delivered on the transformer's pad at the CITY's Dunham Rd Substation Site. All equipment provided with the transformers shall be clearly identified with the equipment tag number, the purchase order number, and an item list.

2.0 CODES, STANDARDS, AND REFERENCE DOCUMENTS

2.1 GENERAL REQUIREMENT

The transformer and its components and accessories shall be constructed, wired, and tested in accordance with all applicable sections of the latest edition of all applicable standards published by the following organizations:

ANSI	-	American National Standards Institute, Inc.
ASTM	-	American Society for Testing and Materials
NBS	-	National Bureau of Standards
NEMA	-	National Electric Manufacturers Association
IEEE	-	Institute of Electrical and Electronic Engineers
UL	-	Underwriters Laboratories
FM	-	Factory Mutual
ISA	-	Instrument Society of America

All codes and standards shall be those in effect at the time of Purchase Order award. Deviations from this specification or the referenced codes and standards shall be obtained in writing from City. In the event of conflicting requirements, the order of precedence shall be this specification, the standards, and the purchase order.

2.2 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C1 National Electrical Code NFPA 70

ANSI C2 National Electrical Safety Code

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

ANSI C57.12.10 Requirements for Transformers 230,000 Volts and Below, 833/958 through 8,333/10,417 kVA, Single-Phase, and 750/862 through 60,000/80,000/100,000 kVA, Three Phase

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

ANSI C57.12.80 Terminology for Power and Distribution Transformers

ANSI C57.12.90 Test Code for Liquid Immersed Distribution, Power and Regulation Transformers and Guide for Short Circuit Testing of Distribution and Power Transformers

ANSI C57.12.98 Impulse Test Guide for Transformers (Appendix to ANSI C57.12.90)

ANSI C57.13 Requirements for Instrument Transformers

ANSI C57.92 Guide for Loading Mineral-Oil Immersed Power Transformers up to and Including 100 MVA with 55^{o} C or 65^{o} C Winding Rise

ANSI C62.22 Standard for Metal-Oxide Surge Arresters for Alternating-Current Systems

ANSI C84.1 Electric Power Systems and Equipment - Voltage Ratings (60 Hz)

ANSI Z55.1 Gray Finishes for Industrial Apparatus and Equipment

2.3 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 877 Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using …

ASTM D 3487 Standard Specifications for Mineral Insulation Oil Used in Electrical Apparatus

2.4 INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 21 General Requirements and Test Procedure for Outdoor Apparatus Bushings

IEEE 315 Graphic Symbols for Electrical and Electronics Diagrams

2.5 NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 Motors and Generators

NEMA TR1 Transformers, Regulators and Reactors

2.6 INSTRUMENT SOCIETY OF AMERICA (ISA)

S1.4 Specification for Sound Level Meters

S5.1 Instrument Symbols and Identification

2.7 It shall be the Seller's responsibility to be, or to become, knowledgeable of the requirements of these Codes and Standards. Any required changes or alterations to the equipment to meet the Codes and Standards requirements shall be at the expense of the Seller.

2.8 Equipment proposed by the Seller that cannot fully meet the requirements of this specification shall have all exceptions clearly stated in the proposal. No exception shall be allowed, unless approved by the City in writing.

3.0 TECHNICAL REQUIREMENTS

3.1 GENERAL REQUIREMENTS AND ENVIRONMENTAL CONDITIONS

3.1.1 The transformer shall be designed and built in accordance with proven industry practices and techniques using all new parts and components.

3.1.2 The transformer shall be assembled in the United States with over 50% of the components manufactured in the United Sates by a manufacturer currently engaged in the production of such equipment.

3.1.3 The transformer shall include a UL listing and shall be constructed in conformance with all applicable ANSI Standards.

3.1.4 The transformer and accessories shall be installed in an outdoor environment and must comply with the environmental service conditions of the site in accordance with ANSI C57.12.00 and as specified in the Transformer Data Sheets, Exhibit I.

3.1.5 The transformer shall be certified as non-PCB.

3.1.6 The transformer and auxiliary cooling equipment shall be designed and constructed to minimize the audible noise generated with the transformer energized at rated voltage and with all auxiliary cooling equipment in operation. The transformer shall be in accordance with NEMA TR 1 except as specified herein.

3.1.7 CITY will not accept asbestos or asbestos compounds. Failure to comply will obligate Seller for all cost of removal, including proper disposal and replacement.

3.2 RATINGS AND CHARACTERISTICS

3.2.1 General

The transformer ratings and characteristics shall be in accordance with ANSI C84.1, ANSI C57.12.00 and as shown on the Transformer Data Sheets, Exhibit I.

3.2.2 Temperature Rise

The observable temperature rise of the transformer or parts thereof, as determined by resistance of the windings, shall not exceed 65°C at rated MVA on the tap connections that give the highest winding temperature rise, and the winding hottest spot temperature shall not exceed 80°C at rated load.

The maximum hottest spot temperature of the windings shall not exceed 130°C when operating under the condition of nameplate rating output, maximum ambient temperature, and elevation specified on the transformer data sheets.

3.2.3 Short Circuit Capability

The transformer shall be designed and constructed to be completely self protected by its own ability to withstand the external short-circuits, as defined by ANSI C57.12.00, and tested in accordance with C57.12.90. The transformer shall successfully withstand, without failure or injury, the mechanical and thermal stresses caused by the worst case short circuit current. The worst case short circuit current is that maximum current produced by any type phase or ground faults, occurring on the transformer high voltage or low voltage terminals, and persisting for the time period (as a minimum value) specified by ANSI C57.12.00, Section 7. The worst case short circuit current shall be calculated assuming that the electric system's impedance is equal to zero; i.e., infinite short circuit currents are available on all other high voltage and low voltage terminals. No windings shall be below the mechanical and thermal requirements defined by Section 7 of ANSI C57.12.00.

3.2.4 Loading Cycle

The power transformer is intended to have a cycling duty consistent with municipal electric utility system electrical demands. This loading cycle shall be factored into the design of the transformer.

3.2.5 Audible Noise

The average noise level of the transformer and auxiliary cooling equipment shall be no greater than 73 dB(A) when energized at rated voltage with all fans in operation. The measurement procedure shall be as specified in ANSI C57.12.90.

3.3 CONSTRUCTION

3.3.1 Tank

3.3.1.1 The tank shall be in accordance with ANSI C57.12.10 and other applicable standards. The tank shall be of oil-tight welded steel construction and as specified on the transformer data sheets, with an inert gas seal over the oil with automatic pressure control, including gas bottles, regulator, valves, piping, alarm contacts, and all other accessories required for a complete and automatic operating system.

3.3.1.2 The joints between the case and cover shall be such that the cover and top section of the case are integral. Gasket or shield shall be provided to prevent entrance of weld spatter into the case when the cover is welded. This material shall not deteriorate under any service conditions. All gaskets shall be made of Viton without glued joints and shall be spot-glued in place.

3.3.1.3 The transformer case shall be provided with handholes or manholes of size to afford easy access to the inside ends of bushings, terminals, and the upper portions of the coils.

3.3.1.4 **The core ground strap shall be terminated near the handhole cover labeled "Core Ground" for easy access.** Core ground access design shall be such that the core ground shall be available outside of the main tank, in a gasketed compartment, for testing and inspection.

3.3.1.5 Guides shall be provided inside the case for guiding the cores and windings as they are being removed from or lowered into the case.

3.3.1.6 The transformer case shall be capable of withstanding, without leakage or distortion, a full vacuum and an internal gas pressure 25% greater than the maximum operating pressure resulting from the system of oil preservation used. All valves, fittings, and piping affected by this requirement shall be of correct design and construction for full vacuum filling.

3.3.1.7 Lifting, Moving, and Jacking Facilities

3.3.1.7.1 The transformer shall be provided with eyebolts and/or lugs for lifting the essential parts and for lifting the completely assembled transformer filled with oil. Lifting, moving, and jacking facilities shall be furnished in accordance with ANSI C57.12.10, as specified below.

3.3.1.7.2 Lifting lugs shall be provided at each corner of the tank. The lifting lugs shall be designed to provide a minimum safety factor of 5.

3.3.1.7.3 The transformer shall be provided with a steel skid base, without wheels. The base shall be designed to equally distribute the load to the floor and permit moving the transformer in the direction of either major axis. The transformer shall be designed to be pushed or pulled in any direction. The design of the base will be subject to review. Anchor bolts shall be provided.

3.3.1.7.4 Jacking lugs or pads shall be provided for raising the completely assembled, oil-filled transformer when the transformer is to be moved. The lugs and case shall be of ample strength to avoid over stress or distortion resulting from possible unequal division of weight among the jacks.

3.3.1.7.5 Pulling eyes shall be provided for moving the transformer horizontally.

3.3.1.8 The transformer shall be provided with approved valves as required for:

1. Draining the case (flanged-gate valve). Valve to be provided with locking provisions by use of CITY-provided padlock,
2. Sampling oil from the extreme bottom of the case,
3. Lower filter press connection and complete drain,
4. Upper filter press connection,
5. Isolating each radiator,
6. Air relief or venting from each radiator,
7. Draining oil from each radiator,
8. Nitrogen and automatic nitrogen make-up system,
9. Vacuum line connection, and
10. Gas analysis sampling.

3.3.1.9 Oil valves shall be stainless steel and specially designed for use with insulating oil and shall hold hot oil without leaking. All radiator valves shall withstand a vacuum applied to either side of the valve. An air vent shall be provided on the transformer at the top of the case and piped to a valve within reach from the floor for releasing air when the case is being filled with oil and/or nitrogen gas.

3.3.2 Core, Windings and Bushings

3.3.2.1 Core

The core of the transformer shall be constructed of high grade, non-aging, high-permeability silicon steel suitable for the purpose. The steel shall be cut in thin, grain oriented laminations, properly annealed after cutting to suitable size and rolled to ensure smooth surfaces at the edges. Both sides of each sheet shall be insulated with a durable, heat-resistant enamel or varnish, baked on. The core shall be carefully assembled and the construction shall include step-lap, mitered joints to keep core losses, excitation current and noise level to a minimum. The magnetic flux density is to be kept well below the saturation point. The core shall be rigidly clamped to ensure adequate mechanical strength, to support the windings, to prevent shifting of the lamination during shipment, and to minimize vibration under operating conditions. The core grounding strap connection to the tank shall be available through one of the handhole covers.

3.3.2.2 Windings

a) Primary and Secondary windings are to be of a circular winding design. (Disk or Helical winding only).

b) The transformer windings shall be in accordance with ANSI C57.12.00, as specified on the transformer data sheets. Both the high voltage and low voltage windings, and internal connections in the transformer shall be made of **copper** and assembled in such a manner as are best suited for the particular application. Proper consideration shall be given to all factors of service such as high dielectric and mechanical strength of insulation, coil characteristics, and minimum restrictions to free circulation of oil.

c) Coils shall be made up, shaped, and braced to provide for expansion and contraction due to temperature changes in order to avoid abrasion of insulation and to provide rigidity to resist movement and distortion caused by abnormal operating conditions. Adequate barriers shall be provided between windings and core and between the high voltage and low voltage windings. End coils shall have additional protection against abnormal line disturbances. The entire design, construction, and treatment of the windings and their assembly on the core shall embody the latest improvements in the art and conform to best modern practice.

d) The transformer windings shall be designed to withstand impulse, induced, and dielectric test voltages in accordance with ANSI C57.12.90.

e) The transformer shall be capable of withstanding without injury the mechanical and thermal stresses caused by short circuits on the external terminals of any winding, or windings, with rated voltages maintained across the terminals of all other windings intended for connection to sources of energy in accordance with ANSI C57.12.00.

f) Impedance 6.5% @ 15 MVA BASE

Seller shall state the guaranteed impedance in the quotation. Transformer design and construction shall ensure that a short circuit test of the transformer will not result in an impedance change exceeding 2% of the impedance value measured prior to short circuit testing.

3.3.2.3 Bushings/Terminals

a) The transformer shall have each high voltage and each low voltage winding lead brought out from the tank through a bushing. The bushings shall be field removable with gaskets, and shall not be welded to the tank. All bushings shall be porcelain or polymer type with a metal flange mounting provision. The bushings shall be in accordance with IEEE 21 and as specified on the transformer data sheets.

b) All porcelain used in the bushing shall be manufactured by the wet process; shall be homogenous, free from lamination, cavities, and other flaws affecting its mechanical strength or dielectric quality; and shall be well vitrified, tough, and impervious to moisture. The glazing of the porcelain parts shall be free from imperfections, such as blisters and burns. Bushing porcelain shall be light gray, No. 70, in accordance with ANSI Z55.1.

c) All bushings shall be so designed that there will be no undue stress imposed on any parts due to temperature changes, and adequate means shall be provided to accommodate conductor expansion. Bushings of the oil-filled type shall be free from oil leakage and shall be provided with suitable indicators to show oil levels and with convenient means for sampling oil and draining the bushings from the bottom.

d) The high voltage bushings shall be standard light gray, 34.5 kV voltage class, 200 kV BIL. High voltage bushings shall be top cover mounted and provided with standard, threaded, stud-type connector fitted with a four hole NEMA drilled pad connector. A mating four hole NEMA drilled, pad type, straight compression connector, and all hardware shall be supplied for each terminal for the Purchaser's 477 ACSR conductor. Each high voltage bushing shall be equipped with capacitance tap for use with a bushing potential device.

e) The low voltage bushings, including the neutral bushing, shall be standard light gray, 25 kV voltage class, 150 kV BIL, and provided with standard, threaded, stud-type terminals. Low voltage bushings shall be top cover mounted and spaced a minimum of 24" apart.

f) The neutral bushing shall be provided with bolted terminal connectors for a 2-1/2 in. x 1/8 in. copper bar which shall extend to the bottom of the transformer tank. The copper bar shall be insulated from the tank with 15-kV rated insulators and shall be terminated with a bolted clamp type ground connector for three(3) 4/0-bare copper cable using NEMA 2-hole compression connectors. This connector shall be located at the transformer base away from arrester ground bus.

g) All contact surfaces of external terminals shall be silver plated, using pure silver free from copper, and the thickness of the silver coating shall be not less than 1-mil.

h) If bushings are shipped separately, the bushing wells shall have bolted dust covers in place for shipment.

i) Bushings manufactured by Trench and Passoni will not be accepted.

3.3.3 High Voltage, No-Load, Tap Changer

3.3.3.1 The transformer's high voltage winding shall be equipped with two 2 -½ % full capacity taps above and below nominal.

3.3.3.2 The manual operated, no-load tap changer shall be rated for the maximum FA output of the transformer, and shall be suitable for changing the connections to the taps in the windings only when the transformer is de-energized. The complete tap changing mechanism shall be built with high electrical, mechanical, and thermal safety factors. The tap changer contacts and all taps shall be capable of withstanding the full short-circuit current of the transformer without injury.

3.3.3.3 The operating handwheel shall be mounted on the side of the case at a convenient height for operation from the foundation on which the transformers are mounted. A positive indicating tap pointer and dial shall be provided including a means for locking the tap changer in any desired position.

3.3.3.4 Tap changing contacts and mechanism shall be accessible through manholes in the transformer cover without requiring untanking or other major disassembly of transformer. The tap changer shall be removable from the transformer for replacement without untanking the core and coil assembly.

3.3.4 Load Tap Changer (LTC)

3.3.4.1 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.

3.3.4.2 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 regulate and shall be connected to the low voltage winding.

3.3.4.3 The LTC equipment shall be supplied by Reinhausen Manufacturing, reactance type using vacuum switches (Type RMV-II) housed in a compartment separate from the main transformer. A contact life curve for the load tap changer being provided shall be supplied with the bid documents.

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

3.3.4.5 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:

3.3.4.5.1 Liquid level gauge with alarm and trip contacts.

3.3.4.5.2 Oil temperature gage with alarm and trip contacts.

3.3.4.5.3 Pressure relief device (PRD) with alarm contacts.

3.3.4.5.4 Drain valve with sampling device.

3.3.4.5.5 Tap selector with 33 operating positions.

3.3.4.5.6 Filling plug located at the top of the compartment.

3.3.4.5.7 LTC tank bottom shall be sloped to drain oil away from the door.

3.3.4.5.8 Equalization line between main tank and LTC to be used during vacuum filling of transformer.

3.3.4.5.9 LTC compartment shall include a lip to prevent oil spills after draining compartment and opening the door.

3.3.4.5.10 The cover on the oil filled compartment, regardless of weight of the cover, shall be hinged to support itself when open.

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

3.3.4.6.1 Operating mechanism with motor drive. The drive motor shall be easily accessible and not immersed in oil.

3.3.4.6.2 Local position indicator.

3.3.4.6.3 Operation counter.

3.3.4.6.4 Thermostatically controlled strip heater.

3.3.4.6.5 Electrically resettable drag hands.

3.3.4.7 The seller shall include (in the main transformer tank) a current transformer for input to the line drop compensator. The CITY will provide a 120 volt ac potential source for the operation the voltage-regulating relay.

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

3.3.4.8.1 Static voltage regulating relay.

3.3.4.8.2 Line drop compensator with resistance and reactance adjustments.

3.3.4.8.3 Reactance reversing switch.

3.3.4.8.4 Provision for manual operation.

If the load tap changer operation sequence is susceptible to interruption and consequently can be stopped in the "off-tap" position, the preventive autotransformer shall be designed to carry the maximum current available in the "off-tap" position indefinitely. The transformer shall also be equipped with an alarm to be activated if the "off tap" position occurs.

3.3.4.8.5 Automatic-manual selector switch, with extra contacts wired into the tap changer for remote indication.

3.3.4.8.6 Raise and lower switches for manual operation.

3.3.4.8.7 Motor and controls protected by circuit breakers.

3.3.4.8.8 Voltage testing terminals.

3.3.4.8.9 Space for mounting equipment for parallel operation by the circulating current method.

3.3.4.8.10 Control compartment heater with thermostat.

3.3.4.8.11 Terminal board in control compartment for termination of control and wiring.

3.3.4.8.12 Drill plate in bottom of cabinet for attachment of CITY’s conduit.

3.3.4.8.13 Light with door-operated switch.

3.3.4.8.14 GFIC protected convenience outlet.

3.3.4.9 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.

3.3.4.10 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.

3.3.4.11 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.

3.3.4.12 Maintenance-free dehydrating breather, eliminating the need for periodic desiccant replacement, shall be located at operator level for ease of viewing.

3.3.4.13 LTC performance shall be based on entire range of operations (+/-16) and maximum nameplate rating unless otherwise specified by the CITY.

3.3.4.14 Load tap changer controls to include provisions for remote indication and for remote raise and lower of the load tap changer mechanism. For the purposes of this bid, it is expected that, as a minimum, the bidders will quote a digital tap changer control package (Beckwith Electric Co. M-2001C or equivalent), current loop interface module (Beckwith Electric Co. M-2025 or equivalent), and communications software package (Beckwith Electric Co. M-2029 “Tap Talk”). The circuit is to have feedback that measures the tap position and provides that to the controller. The tap changer chosen is to communicate DNP3 over Ethernet or DNP3 over serial. In either case the communication is to be over multimode fiber.

3.3.4.15 An LTC Backup control is to be wired into the circuit to prevent the Voltage from running outside of the upper and lower limits in case of primary LTC failure

3.3.5 Auxiliary Equipment Location, Wiring and Termination

3.3.5.1 Auxiliary equipment, such as relays, contactors, terminal boards, etc., shall be readily accessible for wiring, testing, and maintenance. All spare auxiliary contacts shall be wired to terminal boards for the CITY’s future connections. Wiring shall be continuous between terminal points.

3.3.5.2 Each auxiliary relay, contactor, breaker, fuse block, terminal block, control switch, auxiliary switch, instrument transformer, or other auxiliary device shall be permanently labeled to coincide with the identification shown on the drawings.

3.3.5.3 Grouped terminal blocks for all external connections shall have a volt and ampere minimum rating as specified on the transformer data sheets. The screw-type terminals shall have barrier-type separators for proper isolation of the terminals. The barrier spacing and the terminal size shall permit the ready installation of pre-insulated, long-shank, metal-reinforced, compression-type wire terminals for field wire connections as specified on the transformer's data sheets. All wiring terminating on the terminal blocks shall be identified on the marking strips. All other low voltage wiring terminations shall be identified by legible markings on or at the device terminals. Twenty- percent minimum additional terminals shall be provided on the terminals boards designated as "spares."

3.3.5.4 Control wiring shall be properly rated for the load and terminal box internal ambient temperatures. Conductors shall be identified by heat shrinkable, permanently marked sleeves.

3.3.5.5 All control, cooling system, current transformer, protective device, and signal wiring shall be run in rigid aluminum conduit to terminal blocks in a centrally located terminal cabinet mounted on the transformer.

3.3.5.6 All DC signals, including wiring and terminals, shall be isolated by metal barriers from AC signals.

3.3.5.7 All wiring insulation shall be rated 600V, 90°C, with flame retardant, moisture and heat-resistant thermoplastic insulation, conforming to applicable NEC Standards. Control wiring shall be minimum #12 AWG, stranded copper. Signal wiring shall be marked to agree with drawings.

3.3.5.8 Control wiring terminal boards shall be barrier type rated 600V, 30 amp, with washer head binding screws, General Electric Company Type EB-5 or equal. Wiring and terminals shall be marked to agree with drawings.

3.3.6 Cooling System

3.3.6.1 The cooling system shall conform to the cooling class in accordance with ANSI C57.12.00, as specified on the transformer data sheets and shall consist of fans, power supplies, and controls. The transformer shall be provided with two (2) step forced-air cooling. The cooling fans shall be suitable for the transformer continuous capacities without exceeding the temperature rise specified. All cooling equipment shall include supports, mountings, conduit, and wiring.

3.3.6.2 The automatic control and alarm features shall be obtained by the use of a hot-spot relay similar to Westinghouse type "TRO". The cooling system shall be furnished complete with all necessary temperature and flow indicators, automatic controls, alarm devices, and piping.

3.3.6.3 Control and alarm circuits shall be designed for operation specified on the transformer data sheets.

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3.3.6.4 A 125-V DC source will be supplied from the station battery furnished by CITY for DC control power. All equipment and devices utilizing this supply shall operate satisfactorily over a range of 90 to 140 Volts DC.

3.3.6.5 The CITY will supply a single phase, 3-wire, 60 Hz, 120/240-V power source for operation of the cooling equipment, heaters, voltage regulators, and controls.

3.3.6.6 All necessary circuit breakers, control supply transformers, motor running overcurrent protectors, motor starters, selector and control switches, temperature control devices, alarm actuating devices, and associated equipment needed to provide a complete control system shall be furnished. The control equipment shall be mounted either in the transformer control cabinet or in a separate weatherproof aluminum enclosure with gasketed door suitable for locking. If a separate cooling equipment control enclosure is provided, it shall be complete with terminal blocks, space heater, light, convenience outlet, and other provisions same as specified for the transformer control cabinet. All power and control wiring for each fan motor shall be individually connected to the terminal blocks in the enclosure. OSHA-approved fan guards shall be supplied.

3.3.6.7 The control scheme shall be the seller's standard provided that it meets the following requirements:

1. Main breakers shall be provided.

2. The radiator fans shall be in at least two groups.

3. Suitable control devices for automatic control of the cooling system based on hot-spot simulated winding temperature shall be provided.

4. Local manual start/test switches shall be provided for fans from the transformer control cabinet.

5. Provision shall be provided for remote manual starting of cooling fans.

3.3.6.8 The cooling system controls shall include a cooling system "failure" auxiliary relay with two (2) Form C contacts to indicate when the temperature sensing device has been initiated but the cooling system has failed to be activated.

3.3.7 Control Cabinet

3.3.7.1 Weatherproof NEMA 4 control cabinets shall be furnished with grouped terminal blocks containing all wiring requiring external connections. The cabinet shall be accessible and located at a convenient height for servicing. Field conduit shall enter as specified on the transformer data sheets. The devices mounted inside the cabinet shall be located such that they shall not obstruct cables pulled in cabinets.

3.3.7.2 A space heater rated at 240-Volt, 60 Hz AC single-phase and operated at 120 Volts shall be provided with a thermostat control to prevent condensation, as specified on the transformer data sheets.

3.3.7.3 A pocket shall be provided inside the cabinet door for the instruction manual and drawings.

3.3.8 Insulating Oil

3.3.8.1 Insulating oil shall be furnished in sufficient quantity to fill the transformer to the normal oil level. Oil shall meet Doble Transformer Oil Testing Specifications described in ASTM D 3487.

3.3.8.2 The oil shall be pure mineral oil refined by a proven process from high quality, napthenic base crude. The oil shall be neither overrefined nor underrefined; shall be low in alkali, sulfur, and other corrosive compounds and shall contain a minimum of 0.15% of DBPC inhibitor.

3.3.8.3 The oil utilized for transformer cooling shall have a polychlorinated biphenyl (PCB) level less than 1 ppm. The CITY will obtain an oil sample direct from the transformer, as delivered to the site. Half of the sample will be made available to the Seller and the CITY will test half for PCB content. If the level of PCB content tests to be 1 ppm or above, the Seller shall pay the total cost of reducing PCB content to below the 1 ppm level.

3.3.8.4 Certified copies of test reports showing the physical and chemical characteristics of the insulating oil to be furnished shall be provided to the CITY.

3.3.9 Electric Motors

3.3.9.1 All transformer auxiliary motors shall be rated as specified on the transformer data sheets.

3.3.9.2 The motors furnished shall be designed, manufactured, and routine tested and shall operate in accordance with the latest applicable NEMA, EEMAC, IEEE, and ANSI standards.

3.3.9.3 All motors shall operate successfully at their specified rating at the ambient temperature and altitude specified in the environmental and service conditions specified on the transformer data sheets.

3.3.9.4 The continuous horsepower nameplate rating shall be greater than the maximum brake horsepower required by the driven equipment when the drive equipment is operating at the maximum load conditions. Service factor ratings shall not be used to meet this requirement.

3.3.9.5 Fan motors shall have Class B or higher insulation.

3.3.9.6 All motors shall be capable of starting and accelerating their driven equipment to full speed with 80 percent of rated terminal voltage without exceeding the temperature limits. The motors shall be capable of stable operation and maintaining rated output during short duration terminal voltage dips to 70 percent of rated voltage.

3.3.9.7 All exterior motors shall have totally enclosed fan-cooled or non-ventilated enclosures.

3.3.9.8 All totally enclosed integral horsepower motors shall have at least one drain outlet equipped with an automatic breathe-drain plug.

3.3.9.9 Integral horsepower motors shall have a NEMA design B torque characteristic unless otherwise required by the driven equipment.

3.3.9.10 Motor starting current shall not exceed 6.5 times full load current.

3.3.10 Auxiliary Potential Transformer - External

3.3.10.1 An outdoor-type, two bushing potential transformer shall be mounted on the top of the transformer tank and connected, through a removable fuse element and holder, to the transformer's X_1 bushing.

3.3.10.2 Potential transformer shall monitor the voltage between X_1 and Neutral.

3.3.10.3 Accuracy class shall be 0.3 metering.

3.3.10.4 Secondary leads of auxiliary potential transformer shall terminate on marked terminal blocks located within the transformer control cabinet described in Section 3.3.7 of these specifications.

3.4 ACCESSORIES

All standard accessories per ANSI C57.12.10 and all accessories indicated on the Transformer Data Sheets, Exhibit I shall be provided, including but not limited to the following:

3.4.1 Surge Arresters

3.4.1.1 General

Surge arresters shall be provided for the high and low voltage bushings complete with all accessories, line and ground terminals and connectors as specified herein. The arresters shall meet the applicable requirements of ANSI C62.22, C62.11 and applicable standards. The surge arresters shall be mounted on the transformer and shall not extend above the bushings.

3.4.1.2 Type and Rating

The surge arresters shall be single-pole, outdoor, station class, metal-oxide-type, suitable for operation under standard service conditions as defined in ANSI C62.11. Surge arresters shall be General Electric Tranquil Type, Ohio Brass, or equal. The required surge arrester ratings shall be 29 kV MCOV on the high-side of the transformer and 7.65 kV MCOV on the low-side of the transformer.

3.4.1.3 Construction

a) General

The construction of the arresters shall be as such to ensure permanent and continuous performance free of the influence of moisture and weather conditions. The arresters shall not cause radio interference except during discharge. No chemical action shall take place, nor shall the arresters show deterioration as a result of ordinary operation of the arrester. No maintenance, upkeep, or attendance shall be necessary due to operation other than routine inspection. The arrester units shall be interchangeable with like rated units of the same construction.

b) Housing

The arrester units shall be composed of a suitable process porcelain housing with metal end fittings enclosing the metal-oxide elements. Porcelain color shall be light gray, No. 70, in accordance with ANSI Z55.1. Seals shall be provided between the porcelain housing and metal end fittings, and any materials used therefor shall be such as to maintain their effectiveness over long periods. The metal fittings shall be attached to the housing either by solder or cement as appropriate for the construction used. Each unit shall have a pressure relief diaphragm which will prevent excessive internal pressure.

c) Mounting

Each single-pole arrester assembly shall be provided with suitable brackets, mounting bolts, washers, nuts, and locknuts for mounting the arrester on the transformer.

d) Line Terminal Cap

Each single-pole arrester shall be equipped with a non-ferrous metal line terminal cap bolted to the top of the line end arrester unit. The line terminal cap shall have the line conductor clamp terminal as an integral part of it or shall provide for attaching a separate clamp type terminal using a minimum of two attachment bolts. When a separate terminal clamp is used, necessary attachment bolts shall be included.

e) Line Terminals

The arresters shall be provided with four-hole NEMA flat terminal pads for the line conductors.

f) Ground Terminals

The ground terminals shall be provided with bolted terminal connectors for 2-1/2-in. by 1/8-in. copper bar which shall connect the three arresters and extend to the bottom of the transformer tank. The copper bar shall be fastened to the tank with clamps and shall be terminated with a bolted clamp-type ground connector for 4/0 bare copper cable. This connector shall be located at the transformer base away from the high-voltage neutral ground bus.

g) Nameplates

Each single pole arrester shall be furnished with a nameplate. The nameplate shall give the manufacturer's name, name of device, style number, voltage rating of complete arrester, and the position and rating of each unit used in the complete arrester assembly. The unit nameplate shall be located on each unit in the assembly and shall give the line-to-ground voltage rating and the style number of the unit. Nameplates shall be of corrosion resistant metal. Nameplate markings shall be in English.

3.4.2 Current Transformers

3.4.2.1 General

Bushing-type current transformers shall be provided on the transformer bushings as specified below, and on the Transformer Data Sheets, Exhibit I and one-line diagram. Current transformers shall be a minimum of C400 relay accuracy class in accordance with ANSI C57.13, and IEEE 21 and suitable for the burdens imposed by the protective relay scheme.

3.4.2.2 Type and Ratings

Current transformers shall be bushing-type and designed for continuous operation at the full rated voltage and current. The secondary windings shall be rated 5A with ratios as specified on the transformer data sheet. Current transformers shall be designed to withstand, without damage, thermal, electrical, and mechanical stresses set up under short-circuit conditions within the limits of the transformer winding in which they are located.

3.4.2.3 Construction Details

Current transformers shall have the secondary leads brought to short-circuiting type terminals blocks arranged inside the transformer terminal box. All secondary leads shall be run in conduits. The necessary conduit, conduit fittings, and wiring to extend all current transformer secondary leads to the terminal boxes shall be furnished. The polarity of each current transformer terminal shall be plainly marked at its terminal and at the terminal blocks.

3.4.3 Pressure Relief Device

Mechanical pressure relief device shall be furnished to protect the transformer case against a primary explosion due to arcing below the surface of the oil. The device shall operate automatically at a preset pressure and reset automatically when the pressure returns to normal. The device shall be designed so as to minimize discharging of oil and to exclude air and water after it opens. The device shall be equipped with a visual alarm indicator and with alarm contacts.

3.4.4 Fault Pressure Relay or Sudden Pressure Relay

A fault pressure relay shall be furnished for operation on rate-of-rise of internal pressure for protection against internal faults in the transformer. The relay shall be rated and shall function properly if its 125 V DC supply voltage varies from 90 –140 V DC. Sufficient contacts shall be provided for tripping two power circuit breakers and two electrically separate alarm systems. Full provision shall be made for local test and reset of the fault pressure relay.

3.4.5 Pressure Vacuum Gauge

A pressure vacuum gauge shall be furnished in accordance with ANSI C57.12.10. Hi pressure/low pressure alarm contacts to be provided as per the transformer data sheets.

3.4.6 Winding Temperature Gauge

Dial-type "hot-spot" thermometer shall be furnished with alarm contacts in accordance with ANSI C57.12.10, as specified on the transformer data sheets.

3.4.7 Liquid Level Indicator

Magnetic liquid level gauge shall be furnished with two sets of contacts for alarm and trip functions in accordance with ANSI C57.12.10. The first set of contacts shall indicate a low-level alarm condition. The second set of contacts shall indicate an oil level 12" below the first level.

3.4.8 Top Oil Temperature Gauge

Dial-type liquid thermometer with a remote bulb sensing located in the region of the hottest oil shall be furnished with two sets of contacts for alarm and trip functions in accordance with ANSI C57.12.10. The dial shall be mounted on the transformer case approximately 5 ft. above the base of the transformer. The thermometer shall be provided with a red peak-temperature pointer. The first set of contacts shall indicate a high-oil-temperature alarm condition. The second set of contacts shall indicate an extreme high oil temperature to be used for unit tripping.

3.4.9 Resistance Temperature Devices (RTD) and Thermal Relays

3.4.9.1 Temperature Detectors

a) The transformer shall be provided with three standard IEEE 100 Ohm at 0°C., platinum resistance temperature detectors (RTD), one per phase, for reading the equivalent hot-spot temperature of the transformer windings, mounted in the wells extending into the top or side of the transformer. The wells shall be independent of the wells utilized for the thermal relay. A heater coil, supplied with current proportional to the transformer load current, shall be mounted inside the RTD well and shall be of such a rating that the RTD will be subjected to a temperature equivalent to that of the hottest part of the transformer windings.

b) One 100-Ohm 0°C. platinum RTD shall be mounted in a well extending into a region of the hottest oil to provide for remote monitoring of the oil temperature.

c) Each RTD shall be provided with a converter to supply a 0 to 1 milliamp analog output signal for the Purchaser's SCADA system

3.4.9.2 Thermal Relays

Replica-type thermal relay or relays to simulate the winding hot spot temperature, shall be furnished and mounted externally on the case with adjustable temperature settings and auxiliary relays as required. It shall be have 4 or more sets of electrically independent, self-resetting contact circuits; for starting the second and successive stages of cooling equipment, for annunciation when the maximum safe continuous winding temperature has been reached, and for unit tripping when the maximum safe operating temperature has been exceeded. The relay shall be responsive to the combined effects of transformer load current and oil temperature in such a way that its thermal characteristics correspond to those of transformer windings.

3.4.10 Ground Bus

One copper-bar ground bus, a minimum of 2 in. x 1/8 in., shall be furnished on stand-off, insulating supports from high voltage neutral bushing to connector as specified under Section 3.3.2.3.

3.4.11 Alarm and Trip Contacts

3.4.11.1 Devices with alarm contacts shall be as defined by ANSI C57.12.10 and applicable standards, and suitable for interrupting a load as specified on the transformer data sheets.

3.4.11.2 Two electrically separate, normally open contacts as specified on the transformer data sheets, shall be furnished for each alarm and trip points.

3.4.11.3 All signaling, alarm and trip contacts shall be wired out separately to terminal blocks to make possible any grouping for remote use.

3.4.12 Grounding Pads

Two copper-faced steel grounding pads shall be furnished on opposite sides of transformer tank near the base, in accordance with ANSI C57.12.10 with pressure-type connectors for stranded copper cable termination as specified on the transformer data sheets.

3.4.13 Nameplate

The transformer shall be provided with two satin-finish, stainless steel nameplates with etched lettering and designations filled with a black enamel paint. All nameplate markings shall be in English. One nameplate shall be mounted on the inside of the terminal cabinet door, and the second nameplate shall be mounted on the transformer tank adjacent to the tap charger. The nameplate shall be in accordance with ANSI C57.12.00 and shall include a non-PCB label.

3.4.14 Miscellaneous Accessories

All standard accessories and fittings for transformer oil installation or removal shall be furnished, including oil sampling connections, top and bottom oil filtering connection, oil drain connection for draining extreme bottom of tank, and valves for isolation of heat exchangers. The Seller without additional cost to the CITY shall furnish any equipment necessary for satisfactory operation in accordance with ANSI C57.12.10 or any equipment normally furnished by the Seller for transformers of this size.

3.4.15 Oil Preservation and Nitrogen Supply System

3.4.15.1 The transformer shall be equipped with an inert-gas oil preservation system.

3.4.15.2 The nitrogen supply system shall be furnished in accordance with ANSI C57.12.00. Accessories shall include two (2) nitrogen cylinders (one as spare), reducing valve, regulator, relief valve, purging and gas sampling valves, pressure gauges for transformer tank and nitrogen supply, and alarm contacts for transformer tank pressure and low nitrogen supply. Both nitrogen gas cylinders shall be housed within the same enclosure.

3.4.15.3 The inert-gas equipment shall be automatic in operation and shall maintain an adequate supply of oil-pumped dry nitrogen gas under a positive internal pressure by means of the pressure regulator that limits this pressure to not more than 7.5 psi for normal operating conditions. This pressure regulator shall be of a make and type which has been in successful operation with transformers for a period of not less than five (5) years and shall be subject to approval. The alarm contacts for the CITY's use shall indicate pressure below 0.5 psi. The relief valve shall automatically relieve any internal pressure that may develop in excess of 15 psi.

3.4.15.4 A weatherproof steel cabinet containing the gas cylinders and regulating equipment shall be mounted on the low voltage bushing side of the transformer. The bottom of the cabinet shall not be more than four inches above the transformer base. Two (2) cylinders (one and a spare) of nitrogen gas shall be furnished with the transformer for use with the regulating equipment and shall remain the property of the CITY. Such additional cylinders of nitrogen gas are necessary for satisfactory flushing out the transformer upon installation and for charging it ready for operation shall also be furnished.

3.5 FINISH PAINT

3.5.1 Transformer tank and all auxiliary equipment shall be painted with a rust-inhibiting primer topcoat to provide a minimum 3-mil dry film thickness. External paint color shall be Sky Gray, ANSI 70.

3.5.2 Inside of main tank, LTC compartment and control equipment cabinet shall be painted white. Accelerated aging test must be performed on the paint to be used inside the tank. A plate steel sample coated with the white paint shall be submerged in transformer insulating oil and heated to 130 degrees C. After 1,000 hours, there may not be any change in the painted surface, or in the power factor of the oil used for the test.

3.5.3 The top of the main tank and LTC compartment shall be a non-skid coating.

3.5.4 Electrostatic application of the paint is required on the radiators.

3.6 FACTORY ASSEMBLY AND TESTS

3.6.1 General

All measurements, computations, and tests shall be made in accordance with ANSI C57.12.90 except as otherwise specified. Each transformer shall be subject to the tests shown on the Transformer Data Sheets, Exhibit I and specified herein. The test to determine the excitation losses and exciting current shall be the first test in the testing sequence.

3.6.2 Bushings

Each bushing, including spares, shall be given a dry, low frequency withstanding test, power factor test, and production tests in accordance with ANSI C761. One bushing of each type shall be given the standard, wet, 10-second, low frequency dielectric withstanding test. Bushing current transformers shall be tested in accordance with ANSI C57.13.

3.6.3 Transformer Case and Radiators

The transformer case and radiators shall be tested as an assembly at not less than 10 psi for oil and air leaks when filled with hot oil for 24 hours and at 0.05 in. mercury absolute pressure to verify capability for vacuum oil filling in field.

3.6.4 Ratios

The turn ratios for all positions of the tap charger shall be measured.

3.6.5 Polarity and Phase Relation

The polarity and phase relation shall be tested on the rated voltage connection and the lead marking checked.

3.6.6 Resistance

The cold resistance of the high voltage and the low voltage windings shall be measured. The hot resistance of the windings shall be measured immediately after the temperature test.

3.6.7 Impedance and Losses

The impedance and no-load and load losses shall be determined at full rated load current for each high voltage tap position for the transformer. A test for transformer zero sequence impedance shall also be performed.

3.6.8 Temperature Rise

The temperature rise shall be determined for the connection that will produce the highest winding temperature at rated load. An infrared scan of the tank, braces, etc., shall be made during the temperature rise test.

3.6.9 Losses and Efficiencies

Losses shall be measured, and efficiencies at unity power factor shall be computed at 50%, 75%, and 100% of rated output.

3.6.10 Exciting Current and Excitation Losses

The exciting current and excitation losses at 90%, 100%, and 110% voltage shall be measured.

3.6.11 Regulation

The regulation shall be determined for rated MVA at unity power factor and at 90% lagging power factor.

3.6.12 Insulation

3.6.12.1 The transformer complete with bushings shall be given standard insulation tests to be applied in succession as listed herein.

3.6.12.2 ANSI standard impulse tests on each low-voltage and high-voltage winding terminal as follows:

a. Reduced full wave (1.2 x 50 s),

b. Chopped wave, and

c. Full wave (1.2 x 50 s).

3.6.12.3 ANSI standard applied potential test on each high voltage and low voltage winding with full BIL as listed in ANSI C57.12.00, Table 5. Neutral shall be disconnected if necessary for high voltage applied potential tests.

3.6.12.4 ANSI standard induced-potential test on all windings.

3.6.12.5 Tests on transformer neutral consisting of 1 reduced full wave and 2 full wave tests.

3.6.12.6 The high voltage tap changer shall be set on the minimum tap during all dielectric tests.

3.6.13 Noise

The transformer shall be completely assembled and energized at rated voltage and frequency at no load and tested for audio sound levels. The average noise level shall not exceed 73 dB with all fans running, as measured in accordance with NEMA TR 1 and EEMAC standards.

3.6.14 Insulation Power Factor

Each winding of the transformer shall be given a power factor test, and the data shall be entered on the test records and corrected to 20^{o}C. The purpose of these records is for reference in future maintenance tests. The power factor of the windings, individually or combined, when corrected to 20^{o}C shall not exceed 0.5%. If tests indicate power factors in excess of 0.5%, sufficient evidence shall be provided before the transformer is shipped to satisfy the Engineer that the high power factor is not due to excessive moisture.

3.6.15 SFRA tests

The factory is to perform SFRA tests with the transformer in the final configuration, i.e., final bushings and full of oil.

3.6.16 Partial Discharge

Partial discharge tests shall be made on the transformer. These tests shall be made at the low frequency, insulation-test voltage, and the RIV (Radio Influence Voltage) shall not exceed 100 V at full-induced test voltage. Equipment and general method used shall be in accordance with ANSI C57.12.90 and ANSI C57.113.

3.6.17 Instrument Transformers

Instrument transformers shall be subjected to tests in accordance with ANSI C57.13. Tests shall include:

a. Routine accuracy tests and polarity test for each instrument transformer furnished;

b. Dielectric withstand test of 2500 V to ground for one minute on each secondary winding for each instrument transformer furnished;

c. Special ratio and phase angle test at secondary currents of 0.5, 1, 2, 3, and 5 A and with ANSI standard 60Hz burdens of B-0.1, B-0.5, and B-2 for one current transformer of each type furnished.

3.6.18 Witnessed Tests

The CITY reserves the right to witness all tests per Section 3.6 of this Specification or to have his authorized representative present for such tests. The Engineer shall be notified at least 5 working days prior to performing such tests. In each case, notification shall include purchase order number, item involved, the location of the equipment to be tested, and the test scheduled to be performed at the time. The Seller shall be informed promptly if CITY elects not to witness the tests.

As part of the bid price, Bidder shall add the cost of hotel stay for two- (2) and two- (2) coach fare, round trip tickets for the CITY's Engineers to witness the factory tests.

3.6.19 Three (3) certified copies of the results of the factory tests, including oscillograms, and copies of curves showing the characteristics of the transformers as determined by these tests, shall be furnished to the Engineer ten (10) days after completion of all factory tests.

3.7 PROPOSAL DATA

3.7.1 The Seller submitting proposals shall include all vendor and guaranteed data on the forms provided; i.e., Proposal Data Forms, Exhibit II and Guaranteed Data Forms, Exhibit III. The following data will be used in evaluating the quotations:

1. Guaranteed no-load core losses.

2. Guaranteed full-load winding losses.

3. Auxiliary equipment power requirements.

4. Impedance values.

5. Outline drawings including overall dimensions, low voltage flange height, and approximate weights of tank, wound core and oil.

6. List of tests included in base bid.

7. List of accessories included in base bid.

8. List of any deviations from CITY's specifications.

4.0 SHIPPING REQUIREMENTS

4.1 The Seller shall be responsible for all costs associated with shipment and delivery of the transformer F.O.B. to the CITY's transformer pad at the substation.

4.2 The method of packaging shall adequately protect the case, radiators, core and coils, bushings, and all other auxiliary devices or accessories against corrosion, dampness, breakage, and vibration injury that might reasonably be encountered in transporting and handling. All removable auxiliary equipment shall be shipped in weatherproof protection suitable for storage in an outdoor area for a period of 1 year. All conduits and auxiliary equipment mounted in position shall be sealed and/or covered to prevent water damage during storage. All valves, shipping covers, etc., shall be sealed and effectively crated to prevent tampering or removal while in transit.

4.3 The Seller shall furnish a two-way (horizontal and vertical) impact recorder for the transformer. The recorder shall be attached to the carrier, on which the transformer is shipped, throughout all legs and transfers of the journey. Upon arrival at the jobsite and before unloading the transformer, the impact recorder shall be removed by Seller's representative or the carrier, witnessed by the Engineer, and returned to the Seller. The Engineer, the carrier's agent, and the Seller's representative will inspect the recorded chart. The recorder shall have sufficient paper to record the total journey time.

5.0 SELLER DATA REQUIREMENTS

The Seller shall complete and comply with all information on the attached Proposal Data Forms, Exhibit II and Guaranteed Data Forms, Exhibit III.

6.0 MAINTENANCE EQUIPMENT

A complete set of any special tools, wrenches, or equipment that may be necessary or convenient for assembling or disassembling the transformer shall be furnished. Any accessories and/or appliance that are regularly furnished with this class of apparatus or that are necessary for satisfactory operation thereof and not specified herein shall also be furnished.

7.0 SPECIFIED SPARE PARTS

The following spare parts shall be furnished and priced separately.

a. One (1) high voltage bushing of each type complete with gaskets.

b. One (1) low voltage bushing of each type complete with gaskets.

c. One (1) surge arrester of each type

d. One (1) set of gaskets as required for covers, cases, manholes, and handholes.

e. One (1) cylinder of compressed nitrogen.

f. One (1) set of contacts and coils of each type of contactor or relay used; and

g. Two (2) complete motor and fan assemblies.

8.0 FIELD SERVICE ENGINEER

Services of a qualified Field Engineer shall be required to supervise installation, testing, and start-up of the transformer. Seller's proposal shall include a total of three (3) days of Field Engineer and two (2) trips provided at no cost and rates for subsequent periods including travel. Bidder will incur all costs associated with complete startup/operation of transformer, however much time or number of trips are requied.

9.0 TRANSFORMER LOSS EVALUATION

The guaranteed no-load, load losses and auxiliary losses shall be stated on the Guaranteed Data Forms, Exhibit III.

a. No-Load Losses $ 3,990/kW

b. Load Losses $ 1,300/kW at 15 MVA

c. Auxiliary Losses $ 1,300/kW at 15 MVA

d. Test system accuracy must be verified for conformance with the requirements of C57.12.00-1993, Section 9.4. The documentation provided with the quotation shall include sufficient identification of the test system to enable the CITY to confirm that it is the same system used to test the transformer.

e. Reported losses shall use ANSI reference temperatures of 20 °C for No Load Losses and 75 °C for Full Load Losses.

d. If certified test result losses exceed quoted losses, seller/bidder will reimburse the City of St. Charles the difference in operating costs. No additional payment to the seller/bidder will be made if certified test result losses are less then quoted.

SECTION IV

PROPOSAL FORM

I propose to furnish the City of St. Charles 1 - 34.5/12.47kV Substation Step-Down Power Transformer

TOTAL COST: $_____

ALL PRICES ARE FIRM WITH NO ESCALATOR.

By submission of this bid I certify that the bid has been arrived at independently and has been submitted without collusion with any vendor of materials, supplies, or equipment of the type described in the preceding section.

Shipment can be made F.O.B. City of St. Charles _____ weeks after receipt of Purchase Order.

MANUFACTURER/MODEL #:_____

_____
COMPANY

_____
ADDRESS

_____
CITY, STATE, ZIP

_____
TELEPHONE

_____
SIGNATURE OF AUTHORIZED AGENT

_____
PRINTED NAME OF AUTHORIZED AGENT

EXHIBIT I

IDENTIFICATION

PROJECT: **Substation No. 3**
PROJECT NO: _____
LOCATION: **St. Charles, IL**
ITEM NO: **TR #2**
SERVICE: **Step-down**
NO. REQUIRED**:** **ONE (1)**

ENVIRONMENTAL CONDITIONS

ELEVATION

_____ METERS ABOVE SEA LEVEL

AMBIENT TEMPERATURE

40 °C MAXIMUM -30 °C MINIMUM
_____ °C AVERAGE ANY 24 HR PERIOD
_____ °C AVERAGE ANNUAL

SOLAR RADIATION

SUN SHIELDS: ___YES _X_NO
____ MEAN DAILY SOLAR RADIATION ENERGY LEVEL
____ HIGHEST DAILY RADIATION INTENSITY
____ °C HIGHEST TEMPERATURE OF METAL SURFACE EXPOSED TO DIRECT SOLAR RADIATION

HUMIDITY

100% MAXIMUM RELATIVE HUMIDITY
50% MINIMUM RELATIVE HUMIDITY

WEATHER

WIND: 1.0 kPa MINIMUM DESIGN LOAD
ICE: 32 mm MAXIMUM ACCUMULATION
SNOW: 1.0 kPa MAXIMUM ACCULATION
RAIN: 849 mm ANNUAL AVERAGE

EXHIBIT I

ADDITONAL ENVIRONMENTAL CONDITIONS

SEISMIC DATA:

Za = 0; Zv –0
Zonal Velocity, V=0.00

CORROSIVE AREA

____YES _X_ NO
_____CHEMICALS:
_____
_____
_____

HAZARDOUS AREA

____YES __X_NO
AREA CLASSIFICATION: CLASS _____DIVISION _____GROUP

TRANSFORMER RATINGS

15/20/25___ MVA, OA/FA/FA@ 55°C
16.8/22.4/28 MVA, OA/FA/FA@ 65°C
_3__ PHASE
_60_ HZ FREQUENCY
TEMPERATURE RISE: ____ 55 °C _X_ 55°C/65°C ____ 65°C ____150° C OTHER:_____ C °
TEMPERATURE RISE: _80_ C ° HOTTEST SPOT
_6.5__ % IMPEDANCE AT _15_ MVA BASE
NEMA TRI SOUND LEVEL _73_dB(A) OTHER:_____ C °

OIL PRESERVATION SYSTEM

_X_ INERT GAS SEAL OVER OIL
_____ CONSTANT PRESSURE OIL SEAL
OTHER:_____
_____
_____

EXHIBIT I

WINDINGS

HIGH-VOLTAGE WINDINGS

MATERIAL: _X_ COPPER _____ ALUMINUM
CONNECTION: _X_ DELTA _____ WYE
_200_ kV BIL LINE END
none kV BIL NEUTRAL END

LOW VOLTAGE WINDING

MATERIAL: _X_ COPPER _____ ALUMINUM
CONNECTION: ____ DELTA _X_ WYE
_30°_ lagging ANGULAR DISPLACEMENT OF LV TO HV
_110_ kV BIL LINE END
_15_ kV BIL NEUTRAL END

BUSHINGS

HIGH VOLTAGE BUSHING

_34,5_ kV INSULATION CLASS
_200_ kV EXTERNAL BIL
_____ kV INTERNAL BIL
_____ AMPERE RATED CONTINUOUS CURRENT
_____ INCHES CREEPAGE
_____ WET SWITCHING SURGE
_____ TEST TAPS
_____BUSHING COLOR

HV NEUTRAL BUSHING

none kV INSULATION CLASS
_____ kV EXTERNAL BIL
_____ kV INTERNAL BIL
_____ AMPERE RATED CONTINUOUS CURRENT
_____ INCHES CREEPAGE
_____ WET SWITCHING SURGE
_____BUSHING COLOR

EXHIBIT I

LOW VOLTAGE BUSHINGS

__25__ kV INSULATION CLASS
__150__ kV EXTERNAL BIL
_____ kV INTERNAL BIL
AMPERE RATED CONTINUOUS CURRENT
_____ INCHES CREEPAGE
_____ WET SWITCHING SURGE
_____ TEST TAPS
_____BUSHING COLOR

LV NEUTRAL BUSHINGS

__25__ kV INSULATION CLASS
__150__ kV EXTERNAL BIL
_____ kV INTERNAL BIL
AMPERE RATED CONTINUOUS CURRENT
_____ INCHES CREEPAGE
_____ WET SWITCHING SURGE
_____BUSHING COLOR

BUSHING SPACING:
_____ HV _____ LV CENTERLINE TO CENTERLINE OF BUSHINGS MAXIMUM
_____ HV ___24___ LV CENTERLINE TO CENTERLINE OF BUSHINGS MINIMUM
_____ HV _____ LV CENTERLINE TO EDGE OF OPENING MAXIMUM
_____ HV _____ LV CENTERLINE TO EDGE OF OPENING MINIMUM
_____ OTHER: _____

TAP CHANGERS

NO LOAD TAP CHANGER

__X__ YES ____ NO 2 TAPS ABOVE @ 2-1/2% 2 TAPS BELOW @ 2-1/2%

LOAD TAP CHANGER

__X__ YES ____ NO LOAD TAP CHANGER EQUIPMENT TO REGULATE THE LOW-VOLTAGE WINDING LOAD TO PROVIDE PLUS OR MINUS 10% IN PHASE REGULATION IN 16 APPROXIMATELY 5/8 PERCENT STEPS BELOW RATED LOW VOLTAGE AT A CURRENT EQUAL TO THE CURRENT AT RATED kVA AND RATED LOW VOLTAGE
__X__ AUTOMATED OPERATION __X__ SCADA CONTROL
____ DEVICES FOR PARALLELLED OPERAITON OF TWO OR MORE LTC UNITS IN THE SAME SUBSTATION BY THE CIRCULATING CURRENT METHOD.
__X__ DEVICE FOR REMOTE POSITON INDICATION OF LTC THROUGH SUPERVISING CIRCUIT.
__X__ OTHER: SPACE FOR FUTURE INSTALLATION OF EQUIPMENT FOR PARALLEL OPERATION BY THE CIRCULATING CURRENT METHOD.

EXHIBIT I

ACCESSORIES

SURGE ARRESTERS:

HV LINE-TO-GROUND VOLTAGE RATING: OB – 29-kV MCOV
LV LINE-TO-GROUND VOLTAGE RATING: OB - 7.65-kV MCOV
BUSHING CURRENT TRANSFORMER:

HV BCT'S:	600/5	RATIO:	X	Multi-Ratio	TYPE: C-400
HV BCT'S:	600/5	RATIO:	X	Multi-Ratio	TYPE: C-400
LV BCT'S:	2000/5	RATIO:	X	Multi-Ratio	TYPE: C-800
LV BCT'S:	2000/5	RATIO:	X	Multi-Ratio	TYPE: C-800
NEUTRAL BCT'S:	600/5	RATIO:	X	Multi-Ratio	TYPE C-400
NEUTRAL BCT'S:	____	RATIO:	_____	Multi-Ratio	TYPE:_____
		RATIO:	_____	OTHER CT's:	

PROTECTIVE DEVICES:

X PRESSURE RELIEF DEVICE: X ALARM CONTACTS
X FAULT PRESSURE RELAY RANGE: 125 VOLTS DC
X TR. & ALARM CONTACTS
X GAS DETECTOR RELAY:
____ OIL FLOW INDICATOR: _____ALARM CONTACTS
X WINDING TEMPERATURE GAUGE: X ALARM CONTACTS
X LIQUID LEVEL INDICATOR: X ALARM CONTACTS
X TOP OIL TEMPERATURE GAUGE: X ALARM CONTACTS
X WINDING RESISTANCE TEMPERATURE DEVICES (RTD): 3 REQUIRED (100 OHM AT 0°C)
X OTHER: One (1) 100 ohm @ 0°C RTD shall be mounted into the region of hottest oil

ALARM CONTACTS:

QUANTITY: 2 ea. Prot. Dev.	RATINGS:
	0.02 AMPERE DC INDUCTIVE LOAD
TYPE:	0.20 AMPERE DC NONINDUCTIVE LOAD
2 N.O.	2.50 AMPERE AC NON-INDUCTIVE OR INDUCTIVE LOAD
____ N.C.	250 VOLTS MAXIMUM IN ALL CASES

HIGH VOLTAGE BUSHING TERMINALS:

____ MCM ALUMINUM
____ INCH ALUMINUM TUBE
____ COPPER TO ALUMINUM LINER
X OTHER: STUD TO 4 HOLE NEMA PAD

GROUNDING

X GROUNDING PADS:	2 REQUIRED	4 HOLE NEMA DRILLING	
X CABLE LUGS:	4* REQUIRED	2 HOLE NEMA DRILLING	
OTHER:	* Compression connectors for 4/0 cable		

EXHIBIT I

CONTROL EQUIPMENT

__X___ TERMINAL BLOCKS 600 VOLT 30 AMP RATING FOR #12 AWG SIZE FIELD WIRE
__X___ CONTROL CIRCUITS: 120 VOLT AC 60 HZ AND 125 VOLT DC
__X___ ALARM CIRCUITS: 125 VOLTS DC
__X___ AUXILIARY MOTORS: 220 VOLTS AC 1 PHASE 60 HZ
CONTROL CABINET TOP MOUNTING HEIGHT: ____6___FT ____6___IN.
CONTROL CABINET CONDUIT ENTRY: ____ TOP __X_ BOTTOM ____SIDE
CONTROL CABINET HEATER: __X_ YES ____NO _____WATTS
_____ OTHER: _____
_____
_____

ANNUNICATION

LOCAL ANNUNCIATION REQD: YES _____ NO __X___
ADDITIONAL ANNUNCIATION DESCRIPTION**:**_____
_____
_____

FINISH

_____ ANSI 61 - GRAY
____ ANSI 24 - DARK GRAY
__X__ OTHER: ANSI 70 LIGHT GRAY COLOR_____
_____ SPECIAL PREPARATIONS:_____
_____
_____
_____

QUALITY ASSURANCE

__X__ NO ADDITIONAL REQUIREMENTS ____ ATTACHED SPECIFICAITON:
_____
_____

EXHIBIT I

FACTORY TESTING (See Section 3.6)

__X__	TANK PRESS/VAC	__X__	DIELECTRIC
__X__	RATIO, POLARITY & PHASE	__X__	APPLIED POTENTIAL
__X__	RESISTANCE, IMPEDANCE, LOSSES	__X__	INDUCED POTENTIAL
__X__	EXCITATION CURRENT & LOSSES	__X__	SWITCHING SURGE
__X__	REGULATION & EFFICIENCY	__X__	IMPULSE-PH-REDUCED, CHOPPED, FULL
__X__	DOBLE	__X__	IMPULSE-N-1-REDUCED, 2-FULL
__X__	INSULATION POWER FACTOR	__X__	WITHSTAND (WET & DRY
__X__	INSULATION RESISTANCE	____	CORONA
__X__	PARTIAL DISCHARGE	____	CREEPAGE
__X__	TEMP RISE MAX RATING	__X__	AUDIBLE NOISE
__X__	SFRA IN FINAL CONFIGURATION	____	SEISMIC

OTHER:_____
_____
_____
_____

LOSS EVALUATION (See BidForm)

__X__ NO LOAD LOSS AT __$3990__ PER kW
__X__ LOAD LOSS AT ___$1300__PER kW*
__X__ AUXILIARY EQUIPMENT kW REQUIREMENTS AT ___$1300__PER kW*
____ CALCULATION_____
_____
_____
_____

* - At 15MVA

PACKAGING

__X__ DOMESTIC ____ EXPORT
____ MONTHS LONG TERM STORAGE

SHIPPING

ADDITIONAL REQUIREMENTS: The Seller shall furnish a two-way (horizontal and vertical) impact recorder for the transformer. _____
_____
_____
_____
_____
_____

PROPOSAL DATA FORMS

EXHIBIT II

IDENTIFICATION

PROJECT: Substation No. 3
PROJECT NO: _____
LOCATION: St. Charles, IL
ITEM NO: TR #2
SERVICE: Step-down
NO. REQUIRED: ONE (1)

MANUFACTURER: _____
MODEL NO: _____
SIZE: _____
SERIAL NO: _____
INQUIRY NO: _____
P.O. NO: _____

TRANSFORMER TYPE

_____ HV WINDING _____ LV WINDING _____ TERTIARY WINDING
_____ TYPE CORE _____ CLASS CORE
COOLING CLASS: _____ OA _____ OA/FA __X__ OA/FA/FA _____ FOA
_____ FOA/FOA _____ OTHER
OTHER COOLANT: ____
ADDITIONAL REQUIREMENTS: _____
_____
_____

NET WEIGHT AND CAPACITIES

_____ LB CORE AND COILS
_____ LB TANK AND ACCESSORIES
_____ LB INSULATING OIL
_____ TOTAL WEIGHT
_____ LB UNTANKING WT
_____ GAL INSULATING OIL
_____ WT OF HEAVIEST HANDLED PIECE

OVERALL DIMENSIONS

____ HEIGHT OVER SURGE ARRESTERS
____ HEIGHT OVER HIGH VOLTAGE
____ HEIGHT OVER LOW-VOLTAGE BUSHING
____ OVERALL WIDTH (INCLUDE HEAT EXCHANGER)
____ OVERALL DEPTH
____ HEIGHT ABOVE BASE REQUIRED TO REMOVE HIGHEST BUSHING
____ SHIPPING HEIGHT
____ MINIMUM RADIUS CURVE
____ SPECIAL RAILROAD CAR

NOTE: ALL INFORMATION TO BE COMPLETED BY SELLER

PROPOSAL DATA FORMS

EXHIBIT II

CENTER OF GRAVITY

____ PARALLEL MAJOR CENERLINE ____ PARALLEL MINOR CENTERLINE
____ PARALLEL VERTICAL CENTERLINE

LIST OF ITEMS SHIPPED SEPARATELY FROM TRANSFORMER TANK REQUIRING FIELD ASSEMBLY:_____
_____
_____

SHORT CIRCUIT CAPABILITY

_____ A SHORT CIRCUIT ON H-WINDING RMS SYMMETRICAL
_____ A SHORT CIRCUIT CURRENT ON X-WINDING RMS SYMMETRICAL
_____ A SHORT CIRCUIT CURRENT ON H-WINDING MAXIMUM DURATION
_____ A SHORT CIRCUIT CURRENT ON X-WINDING MAXIMUM DURATION
_____ A SHORT CIRCUIT CURRENT ON H-WINDING MAXIMUM CREST VALUE
_____ A SHORT CIRCUIT CURRENT ON X-WINDING MAXIMUM CREST VALUE

INRUSH RMS MAGNETIZING IN TIMES FULL LOAD CURRENT

_____ BASED ON NO RESIDUAL MAGNETISM IN TIMES FULL LOAD CURRENT AT 55°C
_____
_____
_____

OVERVOLTAGE AND UNDER FREQUENCY

_____ MIN TRANSFORMER OPERATED AT 130% VOLTS PER HERTZ
_____ MIN TRANSFORMER OPERATED AT 125% VOLTS PER HERTZ
_____ MIN TRANSFORMER OPERATED AT 120% VOLTS PER HERTZ
_____ MIN TRANSFORMER OPERATED AT 115% VOLTS PER HERTZ
_____ MIN TRANSFORMER OPERATED AT 110% VOLTS PER HERTZ

TOTAL CAPACITANCE

_____ MICROFARAD LOW-VOLTAGE WINDING TO GROUND

NOTE: ALL INFORMATION TO BE COMPLETED BY SELLER

EXHIBIT II

APPROXIMATE RESISTANCE AT 75° C

_____ OHMS HIGH-VOLTAGE WINDINGS _____ OHMS LOW-VOLTAGE WINDING

AVERAGE SOUND LEVEL

_____ dBA AT RATED LOAD WITH ALL FANS & PUMPS RUNNING SCALE "A" AT 5'-0"

HIGH-VOLTAGE BUSHING

_____ MANUFACTURER	_____ TYPE
_____ CATALOG NUMBER	_____ INSULATION CLASS
_____ RATED CONTINUOUS CURENT	_____ MAX DES VOLT TO GROUND
_____ BIL INTERNAL	_____ BIL EXTERNAL
_____ TEST TAPS	_____ BUSHING COLOR

HIGH –VOLTAGE NEUTRAL BUSHING

_____ MANUFACTURER	_____ TYPE
_____ CATALOG NUMBER	_____ INSULATION CLASS
_____ RATED CONTINUOUS CURENT	_____ MAX DES VOLT TO GROUND
_____ BIL INTERNAL	_____ BIL EXTERNAL
_____ TEST TAPS	_____ BUSHING COLOR

LOW-VOLTAGE BUSHING

_____ MANUFACTURER	_____ TYPE
_____ CATALOG NUMBER	_____ INSULATION CLASS
_____ RATED CONTINUOUS CURENT	_____ MAX DES VOLT TO GROUND
_____ BIL INTERNAL	_____ BIL EXTERNAL
_____ TEST TAPS	_____ BUSHING COLOR

LOW –VOLTAGE NEUTRAL BUSHING

_____ MANUFACTURER	_____ TYPE
_____ CATALOG NUMBER	_____ INSULATION CLASS
_____ RATED CONTINUOUS CURENT	_____ MAX DES VOLT TO GROUND
_____ BIL INTERNAL	_____ BIL EXTERNAL
_____ TEST TAPS	_____ BUSHING COLOR

NOTE: ALL INFORMATION TO BE COMPLETED BY SELLER

EXHIBIT II

SURGE ARESTERS (HIGH VOLTAGE)

_____ MANUFACTURER _____ CATALOG NUMBER
_____ TYPE _____ kV VOLTAGE RATING
_____ COLOR _____ ANTICONTAMINANT FEATURES
_____ LB CANTILEVER STRENGTH AT TOP OF ARESTER

SURGE ARESTERS (LOW VOLTAGE)

_____ MANUFACTURER _____ CATALOG NUMBER
_____ TYPE _____ kV VOLTAGE RATING
_____ COLOR _____ ANTICONTAMINAANT FEATURES
_____ LB CANTILEVER STRENGTH AT TOP OF ARESTER

TRANSFORMER OIL PRESERVATION SYSTEM

_____ MANUFACTURER OF OIL
_____ NAME OF OIL
_____ TYPE OF OIL PRESERVATION
_____ TYPE OF OIL DRAIN VALVE
_____ IN. SIZE OF OIL DRAIN VALVE
_____ IN. SIZE OF OIL SAMPLING VALUE
_____ IN. SIZE OF GAS SAMPLING VALVE
_____ MANUFACTURER OF COMBUSTIBEL GAS DEVICE
_____ TYPE OF COMBUSTIBEL GAS DEVICE
_____ MANUFACTURER OF FAULT GAS PRESSURE DEVICE
_____ TYPE OF FAULT GAS PRESSURE DEVICE

TRANSFORMER TANK

_____ IN. VACUUM (ABSOLUTE PRESURE) INCHES OF

TRANFORMER COOLING EQUIPMENT

_____ NUMBER OF SEPARATE RADIATORS
_____ NUMBER OF HEAT EXCHANGER COOLERS
_____ % CAPACITY REDUCTION W/ONE RADIATOR OR HEAT EXCHANGER OUT OF SERVICE
_____ HRS FULL LOAD AT 55°C WITH FANS & PUMPS OUT OF SERVICE COLD START
_____ HRS CONTINUED FULL LOAD AT 55°C WITH FANS & PUMPS OUT OF SERVICE
_____ HRS EXC. ONLY AT 55°C WITH FANS & PUMPS OUT OF SERVICE COLD START
_____ HRS EXCITATION CONTINUED AT 55°C WITH FANS & PUMPS OUT OF SERVICE

NOTE: ALL INFORMATION TO BE COMPLETED BY SELLER

PROPOSAL DATA FORMS

EXHIBIT II

FANS

_____ TOTAL NUMBER
_____ VOLT
_____ FREQUENCY
_____ HORSEPOWER EACH
_____ PHASE
_____ LOCKED ROTOR CURRENT EA.

PUMPS (N/A)

_____ TOTAL NUMBER
_____ VOLT
_____ FREQUENCY
_____ HORSEPOWER EACH
_____ PHASE
_____ LOCKED ROTOR CURRENT EA.

TRANSFER SWITCH (N/A)

_____ MANUFACTURER _____ CATALOG NUMBER
_____ CONTINUOUS CURENT RATING
_____ A WITHSTAND RATING (3-CYCLE) RMS SYMMETRICAL

MOLDED CASE CIRCUIT BREAKERS

_____ MANUFACTURER _____ CATALOG NUMBER
_____ CONTINUOUS CURENT RATING
_____ A INTERRUPTING RATING RMS SYMMETRICAL
_____ CYCLES INTERRUPTING TIME
_____
_____

DEVICE WIRING

_____ **°C** INTERNAL AMBIENT TEMPERATRUE
_____ YES – USED WIRE SPECIFIED
_____ NO – DID NOT USE WIRE SPECIFIED
DESCRIPTION OF WIRE:_____
_____
_____
_____

NOTE: ALL INFORMATION TO BE COMPLETED BY SELLER

CITY OF ST. CHARLES, IL **34.5-12.47-kV TRANSFORMER**
CITY HALL SUBSTATION **TRANSFORMER 2**

GUARANTEED DATA FORM

EXHIBIT III

LOSSES GUARANTEED

_____ kW LOSS AT 100% RATED VOLTAGE AND NO LOAD (EXCITATION ONLY)
_____ kW TOTAL LOSS AT THE 55°C RISE OA RATING AT UNITY POWER FACTOR (NO LOAD LOSS PLUS LOAD LOSS)
_____ kW TOTAL LOSS AT THE 65°C RISE OA RATING AT UNITY POWER FACTOR (NO LOAD LOSS PLUS LOAD LOSS)
_____ kW AUXILIARY POWER LOSS WITH ALL FANS OPERATING

EFFICIENCY AT 100% POWER FACTOR GUARANTEED

_____ % AT FULL RATED LOAD _____ % AT 75% FULL LOAD
_____ % AT 50% FULL LOAD _____ % AT 25% FULL LOAD

TEMPERATURE UNDER CONTINUOUS OPERATION GUARANTEED

_____ °C WINDING TEMPERATURE RISE BY RESISTNACE AT 55°C
_____ °C HOTTEST SPOT WINDING TEMPERATURE RISE BY RESISTANCE AT 55°C
_____ °C OIL TEMPERATURE RISE AT 55°C
_____ °C WINDING TERMPERATURE RISE BY RESISTANCE AT 65°C
_____ °C HOTTEST SPOT WINDING TEMPERATURE RISE BY RESISTANCE AT 65°C
_____ °C OIL TEMPERATURE RISE AT 65°C
_____ °C PERFORMANCE REF TEMP (EFFICIENCY, LOSSES, IMPEDANCE COORECTED)
_____ °C MAX AMBIENT TEMPERATURE FOR EQUIPMENT HEAT TO DISSIPATE

EXCITING CURRENT GUARANTEED

_____ % AT 100% VOLTAGE
_____ % AT 110% VOLTAGE

IMPEDANCE GUARANTEED

_____ % IMPEDANCE BASED ON _____MVA AND RATED VOLTAGE TAP H-X WINDING
_____ % MANUFACTURER'S TOLERANCE _____ PLUS _____ MINUS

REGULATION H-WINDING TO X-WINDING GUARANTEED

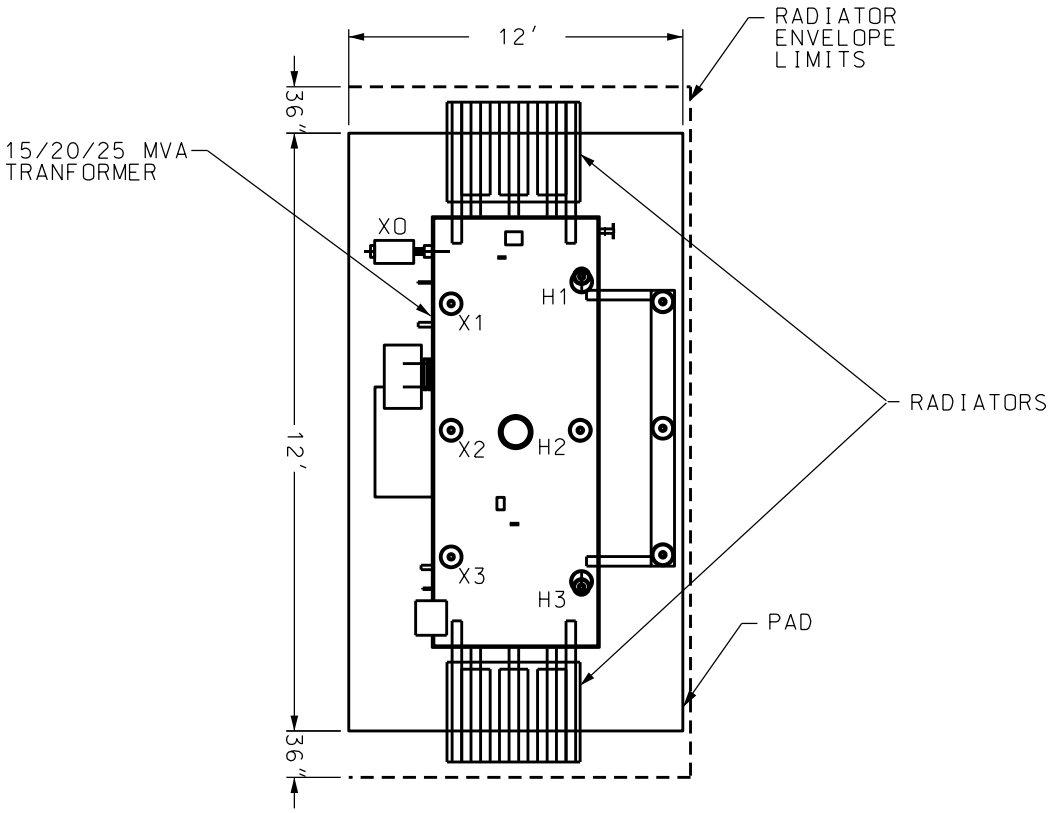
_____ % BASED ON _____ MVA WITH 55°C RISE AT UNITY POWER FACTOR
_____ % BASED ON _____ MVA WITH 65°C RISE AT 0.8 LAGGING POWER FACTOR

TRANSFORMER RADIO INFLUENCE VOLTAGE GUARANTEED

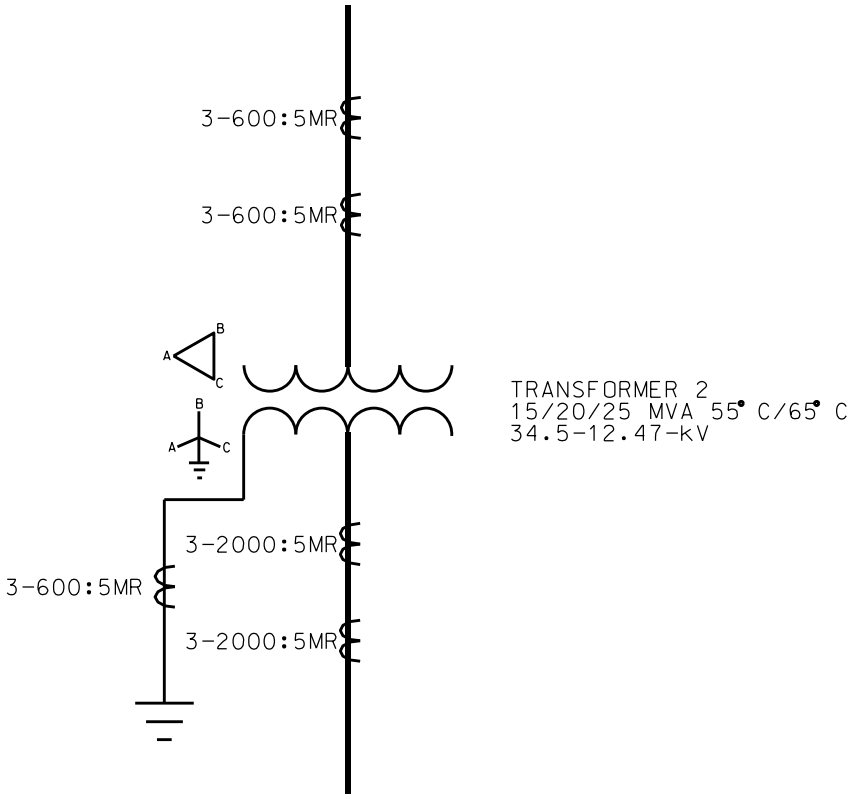
_____ AT 120% NORMAL OPERATING VOLTAGE (MICROVOLT)
_____ AT 100% INDUCED TEST VOLTAGE (MICROVOLT)

_____
_____

NOTE: ALL INFORMATION TO BE COMPLETED BY SELLER



TRANSFORMER PLAN VIEW



TRANSFORMER ONE LINE

EXHIBIT IV

SHEET 1 OF 1	ST. CHARLES MUNICIPAL ELECTRIC UTILITY ESTABLISHED IN 1892	SUBSTATION NO.3 34.5-12.47 KV TRANSFORMER 2	ST. CHARLES MUNICIPAL ELECTRIC UTILITY Glynn Amburgey APPROVED:	REVISIONS ISSUE NO. / DESCRIPTION / DATE

PROJECT No.: EXHIBIT IV
DWG.: AUG. 29, 2002
SCALE: NO SCALE
FILE: TRAN EXH 4.dgn

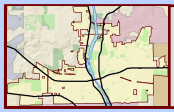
EXHIBIT V

TABLE OF ATTACHMENTS

City of St. Charles, Illinois
Two East Main Street St. Charles, IL 60174-1984
Phone: 630-377-4400 Fax: 630-377-4440 - www.stcharlesil.gov

Precision GIS

RAYMOND ROGINA *Mayor*
MARK KOENEN *City Administrator*

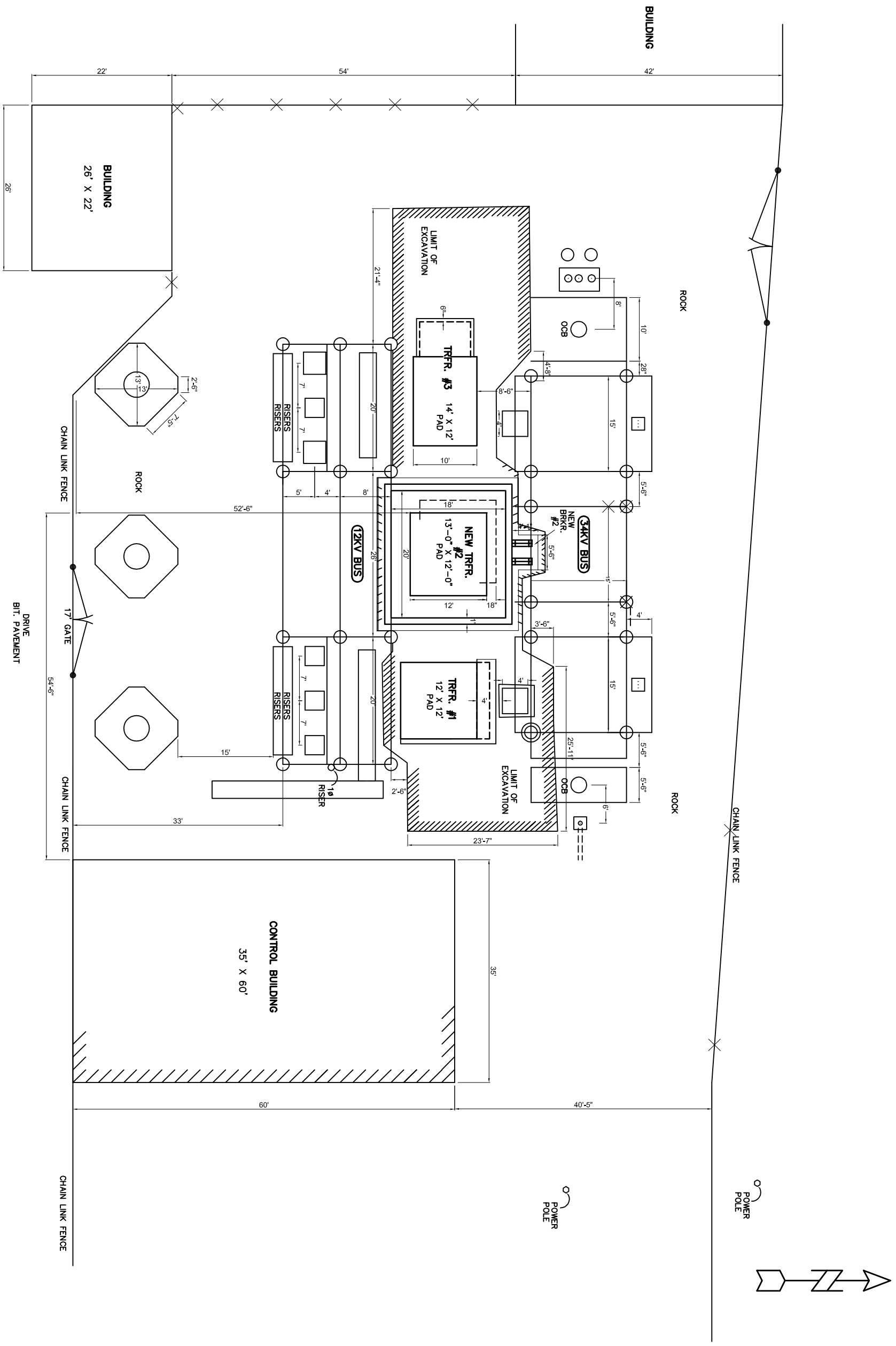


Data Source:
City of St. Charles, Illinois
Kane County, Illinois
DuPage County, Illinois

Projection: Transverse Mercator
Coordinate System: Illinois State Plane East
North American Datum 1983

Printed on: April 11, 2014 10:00 AM

Substation 3 - 12kV yard map

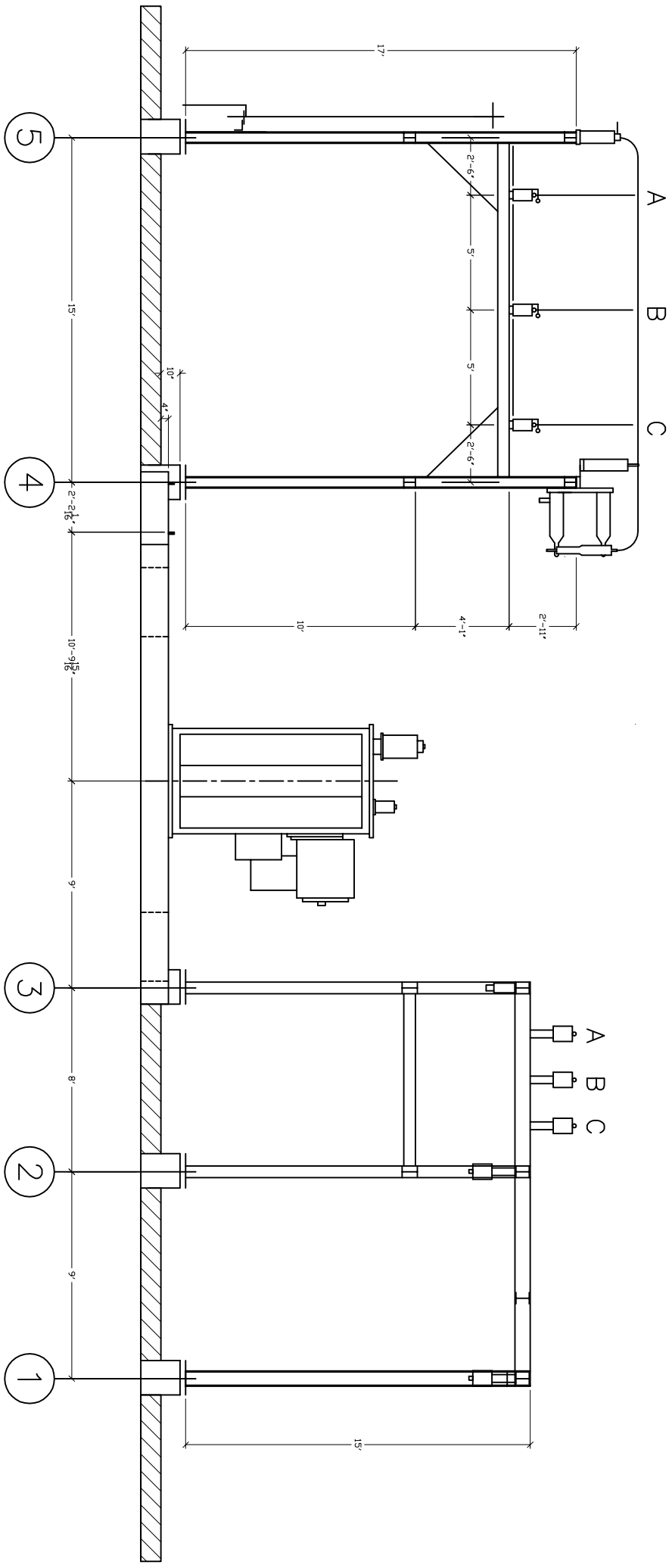


ST. CHARLES
MUNICIPAL ELECTRIC UTILITY
ESTABLISHED IN 1892

SUBSTATION NO. 3
SITE PLAN

REVISIONS		
ISSUE NO.	DESCRIPTION	DATE
01	ISSUE FOR CONSTRUCTION	11/04/2003

PROJECT ENGINEER: NAITIK PATEL
DATE: 11/04/03
SCALE: 1"=10'
DRAWN BY: ADRIANO URGENA
DRAWING NO. 3C-11



SECTION "E-E"

3E-13

CITY OF ST. CHARLES
ELECTRIC
DEPARTMENT
ESTABLISHED IN 1892

SUBSTATION No. 3
34.5/12.47 kV SUBSTATION
ELECTRICAL SECTION ELEVATION

PROJECT ENGINEER: CL
DATE: 05/11/04
SCALE: NO SCALE
DRAWN BY: PWS
DRAWING NO.: C-01

REVISIONS

ISSUE NO.	DESCRIPTION	DATE