

City of St. Charles

**34.5 kV Padmounted
Switchgear Specification**

City of St. Charles
Two East Main Street
St. Charles, IL 60174-1984

May, 2016

City of St. Charles

**34.5kV Outdoor Padmounted
Switchgear Specification**

1.0 INSTRUCTIONS TO BIDDERS:

Request for Proposal:

Sealed proposals for 34.5kV, outdoor, padmounted, switchgear, as described in the accompanying technical specification, shall be received **before 11:00a.m, Thursday, May 26th**, 2016 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 5:00 PM, Tuesday May 18th, 2016

Upon receipt of questions prior to May 18th, 2016, 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 5:00 PM, May 18th, 2016 shall not be acknowledged or answered. Bidder shall take all necessary steps to propose questions prior to May 18th.

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.

Phone: _____

Fax: _____

email: _____

Exceptions and Clarifications to Specifications

Bidder proposes to furnish the 34kV switchgear in accordance with the Purchasers specifications, unless exceptions and clarifications are noted below on this proposal document, as follows, provide attachments if necessary:

2.0 PROJECT DESCRIPTION AND SCOPE

2.1 Location

New substation equipment is needed by the City of St. Charles, IL (hereinafter called the "City").

2.2 Owner

For the purposes of these specifications, the terms "Owner," "Buyer," "Purchaser," and "City" may be regarded as interchangeable and they refer to the City of St. Charles, the Project's owner.

2.3 Bidder

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

2.4 Scope

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

A. Providing three (3) comprehensive sets of approval drawings to the City Engineers for approval prior to manufacture.

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

B. Manufacture of (1) new 34.5-kV padmounted, outdoor switchgear, with all appurtenances as described in the accompanying technical specifications. Equipment shall comply with all current industry standards.

C. Performing all of the specified factory tests on the equipment, as described in the accompanying technical specifications, or as defined by current industry standards and practices.

D. Shipping all equipment included in the accompanying technical specifications to the City by the most reliable and economic method. All equipment provided shall be clearly identified with the equipment tag number, the purchase order number, and an item list.

E. Delivering the equipment to the site with all appurtenances onto a foundation poured by City or contactor working for City or at another prepared site within the City of St. Charles, Illinois municipal limits. This shall be included in the price of the gear.

The Vendor shall coordinate the date and time of the unit with the City.

The Vendor shall provide or contract for the necessary equipment and manpower to unload the gear at the site. Note – Vendor responsible for compliance with the Illinois Prevailing Wage Act.

F. Performing all of the specified acceptance tests on the gear after it is in-place and fully configured by crews under contract to the Vendor, if necessary.

G. Providing one (1) fully trained manufacturer's field service technician, if required, to supervise the unloading and site acceptance testing. If required, this shall be included in the cost of the gear.

Vendor is to provide the City with written credentials of the field service technician for the City's approval of the service technician. Note – Vendor responsible for compliance with the Illinois Prevailing Wage Act.

H. Providing two (2) comprehensive set of final "as-built" drawings and other documents, as required by the accompanying technical specifications, at the time of delivery of the gear on site. In addition, one complete set of drawings, including all control wiring, drawings and documents shall be provided in an agreed computer file format. CAD drawings shall be in AutoCAD Version 14 files, or other agreed or Microstation format. Supplier shall also supply a maintenance manual for each gear with all recommended maintenance procedures and recommended schedule of each maintenance task. Where necessary, step-by-step maintenance procedures shall be provided.

2.5 Proposal Documentation

In addition to the information required elsewhere in the Request for Proposal, and Specifications, (hereinafter referred to as Contract Documents) the Bidder shall submit with its proposal complete and accurate data and information regarding the following:

A. Certified design test reports on each type of switchgear assembly to be furnished of the same rating and design being proposed by the Bidder shall be furnished as part of this proposal (Section 5.0).

B. Preliminary switchgear arrangement drawing showing the general arrangement of the switchgear and its footprint showing cable entrances.

C. Preliminary switchgear lifting requirements including, but not limited to, sling and spreader bar requirements, approximate lifting weight, and rigging connection details.

D. Manufacturer's estimate of the man-hours required to unload the switchgear at the Purchaser's site.

2.6 Schedule:

The Bidder shall complete the following schedule and submit same with its proposal.

<u>Event or Task</u>	<u>Weeks From Date Of Order</u>
Approval Drawings Submitted	_____
One-line Diagrams	_____
Bill of Material	_____
Control Panel Elevations	_____
Three Line Diagrams	_____
Control Schematics	_____
Switchgear Footprint	_____
Start of Switchgear Fabrication	_____
Start of Switchgear Assembly	_____
Production Testing	_____
Witness Testing (if required)	_____
Shipment	_____
Delivery	_____

2.7 Freight Terms

The switchgear shall be delivered to the designated location F.O.B. destination.

The switchgear shall be delivered to the designated location, and the Bidder shall provide supervision of the unloading, placement, and reassembly of the switchgear onto the pad or final location.

2.8 Terms of Payment

Purchaser will pay ninety percent (90%) of the proposal and invoiced amount(s) for items shipped, within thirty (30) days of delivery.

The remaining ten percent (10%) will be paid within thirty (30) days of the **final** shipment of the equipment and material purchased, with all required drawings and manuals, in accordance with this specification, if there are no deficiencies and defects. During this thirty (30) day period, the Purchaser will fully inspect and report all deficiencies and defects to the Manufacturer, if any. In the event that deficiencies and defects exist, the final ten percent (10%) payment will be due within ten (10) days of the deficiencies and defects being corrected by the Manufacturer.

2.9 Approved Manufacturers

The Purchaser's approved manufacturers are as follows:

1. S&C
2. G&W
3. Eaton-Cooper

2.10 Proposal Validity

The Bidder's proposal shall remain valid for not less than ninety (90) days from the date the proposals are due. The Purchaser may request an extension of the proposal validity when required for evaluation purposes.

2.11 Evaluation of Proposals

The Purchaser shall evaluate the proposals and award the contract to the Bidder that, in its sole determination, has made the best proposal. In evaluating the proposals, the Purchaser may take into consideration the following factors, in addition to cost, in no particular order of importance:

1. Manufacturer of high voltage components
2. Resource requirements for the unloading, placement and assembly of the equipment
3. Exceptions to the specifications
4. Experience of the Manufacturer
5. Design Tests
6. Project schedule
7. Purchaser's previous experience with the Manufacturer
8. Operations, Physical Size, and Safety differences

The Purchaser will also take into consideration the production schedule and the impact of the equipment delivery on the Purchaser's overall project schedule and resource requirements for the total project. A Manufacturer's delivery schedule which results in the Purchaser's crews working overtime to meet the overall project schedule will have the cost of the overtime added to the Manufacturer's quoted price for purposes of the evaluation.

Pricing:

One Switchgear per below specification. FOB Purchaser's site.

<u>Item</u>	<u>Quantity</u>	<u>Description</u>	
	1.	34.5 kV padmount switchgear assembly for Legacy Substation site as specified in the Purchaser's specifications consisting of (2) Switched Bays, (2) Interrupted Bays one of which houses the Potential transformers. Also, a separate relaying compartment (Semi-custom)	Price \$ _____
2.	Lot	Freight - FOB Purchaser's Site	Included

PART 3- GENERAL SPECIFICATIONS

A. General

These specifications cover the requirements for the design and manufacture of 34.5 KV AC, 3 phase, 60 Hz, Outdoor, Padmounted Switchgear. The switchgear ratings shall be as detailed in Part 4 of these specifications.

The Manufacturer shall furnish the equipment and material specified herein complete and operable. All standard accessories which are required to safely operate and maintain the equipment shall be provided as part of the material supplied. Accessories that enhance the operation and maintenance of the equipment shall be provided as specified.

All work shall be performed and completed in a thorough workmanlike manner and in accordance with the best modern practices in fabrication and manufacturing.

All materials used in the construction of the apparatus shall be selected as the best available for the intended purpose, considering strength, durability, insulation, and best engineering practice. Conservative safety factors shall be employed throughout the design.

The switches shall consist of manually operated load interrupting, SF6 insulated, 600A rotary puffer switches and manually operated vacuum interrupter fault interrupting tap switches, electronically controlled. The switches shall incorporate internal ground switching for both the load break and vacuum interrupter switch ways.

B. Scope

The Manufacturer shall furnish new, outdoor, padmounted, switchgear as detailed in these specifications. Drawings, material lists, arrangement drawings, and other data attached to these specifications shall be considered part of this specification. Where conflicts exist between the written specifications and the drawings or other data provided, the written specification shall govern.

Complete production tests and inspections as detailed in the below specifications shall be included.

The completed equipment shall be prepared and loaded for shipment as detailed in these specifications.

Field Service, if required, shall be provided by the Manufacturer.

Equipment drawings and documentation shall be provided in accordance with Section 4.H of these specifications.

C. Codes and Standards & Quality Assurance

The Applicable codes and standards listed below should be considered part of this specification. The latest revision in effect at the time of this inquiry shall apply for all standards referenced.

National Electrical Manufacturers Association (NEMA)

Institute of Electrical and Electronics Engineers (IEEE)

National Electric Code (NEC)

American National Standards Institute, Inc. (ANSI)

ANSI C37.07 Interrupting Factors - Reclosing Service

ANSI C37.010 Application Guide for Power Circuit Breaker Control Guide
Specifications

ANSI C37.1 Relays Associated with Electric Power Apparatus

ANSI C37.2 Automatic Station Control, Supervisory and Associated Telemetering
Equipment (Includes Device Function Description)

ANSI C57.13 Standard Requirements for Instrument Transformers

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

American Society of Mechanical Engineers (ASME)

American Welding Society

It is the Manufacturer's responsibility to be knowledgeable and employ designs and manufacturing practices that incorporate the latest revisions of these standards where and when applicable.

D. Quality Assurance Program

The Manufacturer shall have a formal Quality Assurance Program (Program). The Program, fully defined in a Quality Assurance Manual (Manual), shall consist of systematic procedures that provide confidence that the work is in accordance with the manufacturer's standard design, codes and standards referenced above, and these specifications. Formal training of individuals performing the work shall be an element of the Program. Inspections and audits shall be conducted to insure that the Program is being followed.

An electronic copy of the manual shall be furnished with the manufacture's proposal and shall include descriptive information and details of the program, including program organization, documentation requirements, and quality control procedures.

The quality assurance personnel shall be experienced in identifying quality problems. They shall have the authority to enforce requirements and to recommend and initiate solutions.

The Program shall include testing procedures, acceptance criteria, repair methods and the quality control requirements of these specifications.

Manufacturer Qualifications: The chosen manufacturer shall have at least 20 years experience in manufacturing SF6 insulated electric equipment. The manufacturer of the switches shall be completely and solely responsible for the performance of the load break switch and fault interrupter as well as the complete integrated assembly as rated.

The manufacturer shall furnish certification of ratings of the load break switch, fault interrupter and the integrated switch assembly upon request.

The switch shall fully comply with requirements of the latest revisions of applicable industry standards, including: IEEE C37.72, IEEE C37.74, IEEE C37.60, ANSI/IEEE 386, IEC 60265-1

The switch manufacturer shall be ISO 9001:2000 and ISO 14001:2004 certified.

Load break switches and fault interrupters shall be shipped preassembled at the factory. No field assembly shall be required.

PART 4- PRODUCTS

A. SWITCH CONFIGURATION

1. Configuration shall be semi-custom with the following: The switch shall be a 4 way switch. Ways 1 and 2 are 3 position (closed/open/ground) loadbreak switches. Ways 3 and 4 are 3 phase Vacuum interrupters with integral ground switch. Ways 1 and 2 are 600 amp switch ways for incoming or outgoing feeders. Way 3 will protect and feed the transformer load. Way 4 will protect and feed auxiliary PT's. See attached diagram.

Diagram at issue date of Bid is named "SWGR1_R1"

B. SWITCH CONSTRUCTION

1. General

Switch contacts and cable entrance terminations shall be contained in a single welded mild steel tank with entrances internally connected by copper conductors. Construction shall be a deadfront design. Switches shall be shipped factory filled with SF6 gas conforming to ASTM D-2472. Switch tanks shall be painted ASA70 light gray using a corrosion-resistant epoxy paint.

2. Load Break Puffer Switch

Each switching way is to be equipped with an internally mounted, spring assisted, operating mechanism capable of providing quick-make, quick-break operation in either switching direction. The mechanism must be capable of delivering sufficient torque and shall be provided with latches for each position to assure load interrupting, fault closing and momentary ratings. All switch positions are to be clearly identified inside and outside the tank. The operating mechanism shall be actuated from outside the switch tank with an operating handle.

3. Vacuum Interrupters

The vacuum interrupter shall consist of vacuum bottles and a spring-assisted operating mechanism. The mechanism shall be designed for three phase operation. Maximum interrupting time shall be three cycles (50 msec). The movable contact shaft shall be flagged to indicate the contact position, open or closed. This contact position indicator shall be fully visible through viewing windows supplied in the switch tank. Each tap phase is to be equipped with an individual 600A vacuum interrupter fully enclosed in an SF6 insulated switch tank. Electrical opening shall be by a solenoid that is activated from sources external to the switch tank. Reset or closing of the vacuum interrupter shall be mechanical with the use of an external operating handle. The mechanical linkage assembly shall provide for a "trip-free" operation which allows the vacuum interrupter to interrupt independent of the operating handle.

C. DESIGN RATINGS

1. Load Break Switches

The switches shall be rated:

SELECTION OF RATINGS	IEEE/IEC	
Maximum Design Voltage, kV		38
Impulse Level (BIL) Voltage, kV		150
Continuous Current, Amperes		630
Load break Current, Amperes		630
One Minute Withstand (dry), AC kV		70
Production Test Rating		50
15 Minute Withstand, DC kV		103
Momentary Current, kA, ASYM		32
Fault-Close Current, kA, ASYM		32
One Second Current, kA, SYM		20
Mechanical Endurance, Operations		2000

2. Vacuum Interrupters

The vacuum interrupter assembly shall be rated:

SELECTION OF RATINGS	IEEE/IEC	
Maximum Design Voltage, kV		35
Impulse Level (BIL) Voltage, kV		150
Continuous Current, Amperes		630
Load break Current, Amperes		630
One Minute Withstand (dry), AC kV		70
Production Test Rating		50
Symmetrical Interrupting Rating, kA		20
Asymmetrical Interrupting Rating, kA		32

ANSI C37.60 Fault Interrupting Duty

Percent of Maximum: Interrupting Rating	Approx. Interrupting: Current Amps	No. of Fault: Interruptions
15-20%	2000	44
45-55%	6000	56
90-100%	12000	16
Total Number of Fault Interruptions: 116		

D. CABLE ENTRANCES

1. Load Break Puffer Switches

Cable entrances shall be tested to IEEE 386 and be 600 amp Apparatus bushings for all switch ways.

2. Vacuum Interrupters

Cable entrances shall be tested to IEEE 386 and be 600 amp Apparatus bushings for all interrupter ways.

E. VACUUM INTERRUPTER TRIP MODULE – GENERAL SPECIFICATIONS

SEL Relays shall be provided to sense load and fault current on each phase of the load tap circuits. The trip modules shall be powered from the City's AC emergency power panels inside the Substation building. Relays shall be powered from the 130V DC station battery. The relays shall monitor the current on the individual phases of the load tap circuits using input from the current transformers. The CT's in Bay 3 which feed the transformer are to have a ratio of 600:5 and an accuracy class of C400. The PT protection CT's may be chosen by the manufacturer to work with the 751A relay to protect the PT compartment.

Way 3, which feeds the transformer load, shall have an SEL 787 protection relay to provide overcurrent protection and differential protection.

Way 4, which feeds the PTs, shall have an SEL 751A protection relay to provide overcurrent protection. SEL 751A part #: 751A61A1A0X73850220. Note: this part number assumes CT secondary to be 5A. If manufacturer chooses CT with 1A secondary, the 751A part number ordered has to be adjusted accordingly.

Additional details will be provided below.

F. ENCLOSURE

Enclosures shall be made of 12 gauge galvanized steel and manufactured to ANSI C37.72 and C57.12.28 standards. The enclosure shall be mounted independent of the switch allowing removal for ease of cable installation or future replacement if required. Enclosures shall be tamper-resistant incorporating hinged access doors with pentahead locking bolts and provisions for padlocking. The enclosure shall be provided with lifting provisions and painted with a Munsell 7.0GY3.29/1.5 green finish.

The switchgear design shall provide for reasonable access to all parts for inspection, maintenance, and adjustments. The switchgear structure shall be sufficiently rigid to prevent warping of doors and to insure the proper operation of all doors and latches. Doors shall be made from suitable gauge galvanized steel with stiffeners where necessary.

The switchgear shall be constructed so that all buses, bus supports, and connections shall withstand the electromechanical forces which would be produced by currents equal to the momentary ratings of the equipment.

All doors shall be weather tight. The Relay section of the gear shall be constructed to NEMA 3R standards.

Footprint and configuration must match existing unit such that it is interchangeable with our existing spare. A drawing with the dimensions of our present switchgear is in the drawing SWGR DIM.pdf and the dimensions of the pad are in PAD DIM.pdf

G SF6 FACTORY PRODUCTION TESTS

The bulk SF6 gas supply and each individual switch shall be tested for moisture content. Each individual switch shall undergo a mechanical operation check and a leak test. The switch shall be factory filled with SF6 and AC hi-pot tested one minute phase-to-phase, phase-to-ground and across the open contacts. Circuit resistance shall be checked on all ways. Switches will be shipped factory filled with SF6 gas. Tank shall be designed to

withstand 15 psig internal pressure and an external pressure of 14 psig without affecting the performance of the switch.

H DRAWINGS

In accordance with the project schedule submitted with the proposal, the following drawings shall be submitted by the Manufacturer for approval by the Purchaser.

- 1 One-line diagram(s).
- 2 Front Panel Elevation(s).
- 3 Switchgear footprint, including mounting (channel sill and anchor bolt locations) details, cable entrances, power bus entrances, weights, and door swing requirements.
- 4 Cross section of each different switchgear section showing equipment arrangements.
- 5 Bill of material, including quantity, item description, Manufacturer, and catalog or reference numbers.
- 6 Three line diagram(s).
- 7 Control schematic diagram for each different unit.
- 8 Plan view drawing of switchgear showing door swing clearances and all other required clearances.

Purchaser will review and return all approval drawings within 14 days of receipt to the Manufacturer.

Changes made to previously approved drawings shall be submitted to the Purchaser for record. All revisions shall be identified on the drawings.

Following the approval of the above drawings, the Manufacturer shall prepare wiring diagrams that indicate the relative physical location and the rear view of all terminals of all secondary control components and the appropriate wiring connections. Each control wire shall be labeled with its wiring designation from the wiring diagram. These drawings shall be submitted to the Purchaser for record following their completion.

Wiring diagrams shall allow for adequate space (30% of terminal block space) for the Purchaser to add their external connections.

Following the completion and testing of the switchgear assembly, the Manufacturer shall submit (2) - two complete set(s) of "as-built" drawings to the Purchaser. The "as-built" drawings shall include all of the approval drawings listed above, wiring diagrams, and section view and detailed dimensioned drawings.

Each drawing provided to the Purchaser shall include at a minimum, the name, jobsite location, purchase order or contract number, and such additional information as required by the Manufacturer.

One copy of all "as-built" drawings shall be provided to the Purchaser in AutoCAD or Microstation format on CD ROM. The drawing will be utilized to add references to City control wiring and to add City references to the manufacturer drawing.

I INSTRUCTURAL MATERIAL

1. Within (2) weeks before the switchgear shipment, the Manufacturer shall provide (3) copies of the operating and instructional manuals for all major components contained in the switchgear assembly to the Purchaser. The manuals shall include a table of contents and detailed instructions on any recommended maintenance.
2. Unloading Instructions

Approximately two (2) weeks prior to shipment, the Manufacturer shall provide a complete set of unloading information for the switchgear to the Purchaser.

5.0 TESTING

A Design Testing

The Manufacturer shall have completed, prior to the award of the contract, design tests as required by the applicable standards for each type of switchgear assembly to be furnished. These tests shall have been conducted at a recognized independent testing facility under the direct supervision of the facility's personnel.

B Production Testing

The Manufacturer shall perform all production tests required by the applicable standards and these specifications. Additionally, the Manufacturer shall perform all tests required by

its Quality Assurance Program to insure that this product will maintain its high quality standard of materials and reliability in operation.

Tests on each switchgear assembly shall include, but not be limited to, the following:

1. Mechanical Operation Tests
2. Instrument Transformer Case Grounding
3. Dielectric (AC Hi-Pot)
4. Control Wiring Insulation Test
5. Current, Potential, and Control Powers Transformers
6. Instrument Transformer Polarity Verification
7. Functional and Sequence Tests (Control Wiring Continuity)
8. Power factor/Doble testing as applicable
9. SF6 Testing Requirements:

Calibration certificates for all test equipment shall be available for inspection and copies shall be furnished to the Purchaser when requested.

C Inspection & Witness Testing

The Purchaser reserves the right to inspect the equipment during manufacture and prior to shipment. The Manufacturer shall notify the Purchaser, in writing, not less than two (2) weeks prior to the intended production testing and shipment dates.

Equipment, apparatus, and material furnished shall be subject to factory tests and inspections by the Purchaser's authorized representative. Such tests and inspections may be made during any stage of the manufacturing process and any equipment, apparatus or material found unsatisfactory as to quality of workmanship will be rejected. Tests shall be in accordance with applicable standards and Quality Assurance Program as noted above.

Acceptance of tests, or the waiving of witness tests, shall not relieve the Manufacturer from the responsibility of furnishing equipment and material in accordance with these specifications.

The Purchaser shall bear all costs associated with their inspections. The Manufacturer shall make reasonable accommodation within the facility to allow the inspection to proceed smoothly without impeding the manufacturing and assembly process.

D Production Tests

The Manufacturer shall provide one (1) copy of certified production test reports for the completed assembly in each instruction manual. Test results shall also be electronically provided on CD in PDF format. Double tests shall be provided in electronic format for import into the City DTA Web Database.

6.0 WARRANTY

All equipment and material furnished in accordance with this specification shall be warranted against material and manufacturing defects for a period of eighteen (18) months from date of shipment or twelve (12) months from the date the equipment is initially energized, whichever occurs first.

The switchgear Manufacturer shall be responsible for the warranty of all equipment regardless of who the Manufacturer of component material or equipment may be.

Damage which occurs as a result of misuse or improper operation shall not be covered under the warranty. Damage as a result of an act of God shall not be covered under the warranty.

Exterior paint finish shall carry a five year warranty for any rusting or bubbling not associated with vandalism or scratches made after installation.

7.0 STANDARD COMPONENTS & DETAILS

A. General

Note to Bidders – this specification was developed based on a previous specification for indoor metal clad gear. There is a possibility that a portion of that specification, which does not apply to this bid, has remained in the specifications. Please identify any inconsistencies or questionable requirements as soon as possible for clarification. Please advise if there are multiple references to the same requirement, especially if they conflict.

The following shall be included as standard on each gear:

- Welded steel tank painted light gray with stainless steel and brass fasteners.
- Lifting provisions.
- Gas pressure gauge and fill valve.
- Grounding provisions designed in accordance with ANSI C57.12.10 of latest issue in each bay shall be provided. 4/0 Brass Lugs. Grounding provisions for switch tank and all cable entrances.
- Stainless steel three line diagram and corrosion-resistant nameplates.
- Switch operating handle(s) with padlock provision and end stop.
- 12 gauge galvanized steel padmount enclosure painted Munsell green with stainless steel hinges and pentahead locking mechanisms with integral padlock. Padlock will need to be removed to obtain access to the pentahead bolt.
- 5 year warranty for rust or bubbles in paint finish
- Switchgear shall have a suitable SF6 pressure monitoring relay that will provide an alarm output contact. SF6 alarm shall be wired to a terminal block and onto the relay if applicable.
- All switchgears shall be delivered with a 12 port SEL Radio Ranger Wireless Interface SEL8300A with antenna. Mounted in the Relay Hub area. The gear shall have adequate cable training room to feed the magnetic probe from the Radio Ranger fault indicators through to the Interface from other bays and enough room for all of the cables between the bays.
- SF6 Density Switch, Gas pressure gauge, and fill valve.

Cable Terminations/Surge Arresters:

The goal is to have all components required, minus inbound 35kV cables to the gear, to be provided by the Bidder as part of the gear, even though some pieces (T-Op elbows and arresters) will not be physically installed at the factory. It will be the responsibility of the vendor to insure compatibility of all components.

35kV T-Op terminations for 1000MCM Cu 420mil cable shall be Cooper part #TP635U27TCS3 and provided with the gear for all applicable sections. Each shall have the test point option and the capability of attaching/piggy-backing elbow

arresters Cooper part # 3238020C30M if required or for grounding and phasing of cables. Although not physically installed, the terminations shall be included and shipped with the gear:

- o Bay 1 – 1000MCM Cu, 420mil cable
- o Bay 2 – 1000MCM Cu, 420mil cable
- o Bay 3 – 1000MCM Cu, 420mil cable
- o Bay 4 – PT's in gas, no cable or terms needed

Supplier shall be responsible for insuring that all components fit/integrate with each other.

Power Cable Compartment:

- Enclosures shall be tamper-resistant incorporating hinged access doors with pentahead locking bolts and provisions for padlocking. The enclosure shall be provided with lifting provisions and painted with a Munsell 7.0GY3.29/1.5 green finish.
- Access to the power cables shall generally be on one side.
- Each incoming section cable compartment shall accommodate the termination of 1 set of conductors on 600A non-loadbreak, bolted, apparatus bushings.
- Each power cable compartment shall include a 1-5/8" unistrut, cable support system which is field adjustable in the vertical plane.

Wiring:

All instrument, control, indication, relaying, and instrument transformer secondary wiring shall be stranded tinned copper conductor, type SIS, cross-linked polyethylene insulation, rated 600 volt. The wire size and number of strands per conductor shall be in accordance with Table 1. The minimum wire size shall be #14 AWG, 41 strand, except for current transformer secondary wiring which shall be #12 AWG, 65 strand, or larger. Signal wiring (transducer outputs, etc.) shall be #16 twisted shielded pair. RTU indication point connections shall be #16 AWG, 26 strand, type SIS. Splicing and tapping of wiring shall not be permitted.

Table 1
Type SIS
Conductor Sizes &
Number of Strands

<u># AWG</u>	<u>Strands</u>
18	18
16	26
14	41
12	65
10	105

All wiring shall be fitted with solderless, non-insulated, ring-type compression terminal connectors. All wire terminals shall be attached using a positive ratchet locking crimping tool. More than two terminations per pole of terminal blocks and devices will not be permitted.

All devices shall be permanently labeled and in agreement with the wiring diagrams.

A conductor identification sleeve shall be provided on each end of each conductor. Each sleeve shall be marked with the opposite end destination identification as indicated on the wiring diagrams. Identification sleeves shall be not less than 1.5 inch long. Adhesive labels are not acceptable.

Terminal blocks shall have washer head binding screws and shall have bases and barriers molded integrally with brass inserts rated for not less than 600 volts. The terminal blocks shall accommodate up to #8 AWG ring tongue type terminals and shall include a marking strip for terminal identification. Terminal block covers shall be provided when specified.

Terminal blocks for current transformer secondaries shall be equipped with a shorting device to permit the removing and testing of secondary wiring without opening the current transformer secondary. Removal of the outgoing wiring shall not affect the short-circuiting device.

Unused differential relay terminals will be wired to the terminal blocks for later use by the city.

All terminal blocks shall be mounted such that they provide adequate space and are easily accessible for field wiring and servicing. A minimum of 30% spare terminals shall be provided for the Purchaser's use.

All unused contacts from breaker auxiliary switches and lockout relays shall be wired to terminal blocks.

Two pole, disconnecting protective devices shall be provided for each breaker to protect the trip, close, and motor circuits. Protective devices required for the circuits shall be pullout cartridge type fuses or thermal-magnetic circuit breakers with ambient temperature compensation and a two-pole knife blade switch.

All wiring shall be installed in suitable wiring gutters or troughs and protected against arcing in the switchgear and exposure to high voltage. Gutters and troughs shall not be more than 70% filled. All inter-unit wiring shall terminate at terminal blocks at both ends.

Wiring between hinged and stationary panels shall be supported and fastened in such a manner to prevent undue stress and to protect the wiring bundle from contact with sharp edges.

All wiring shall be firmly bundled and secured to ensure that it will remain in its intended location and not interfere with the operation of any device or the operation of the breakers, including their removal from the cubicle. Plastic wire troughs may be used in lieu of cable bundles with tie wraps. Wire bundles shall be secured to the structure. Adhesive type wire bundle hold down clamps are not acceptable. All hold downs shall be bolted or welded to the structure.

Test switches shall be: ABB FT-1 129A501G01 or ABB FT-1 670B197G18 or ABB FT-1 716B562G25 as appropriate.

Switch Position:

An auxiliary 52A contact, indicating switch position, normally open when the switch is open, shall be provided for use by the Purchaser and wired to a terminal board for all switches. These contacts shall be wired to a terminal block and then on to the 787 relay as aux inputs.

Interrupter Position:

For both interrupter bays, an auxiliary 52A contact, indicating interrupter position, normally open when the interrupter is open, shall be provided for use by the Purchaser and wired to a terminal board and then on to the appropriate relay as an aux input.

Nameplates:

Nameplates shall be provided for all the equipment to be furnished. Engraved nameplates shall be located and positioned such that they will be easily accessible

and visible, and the information thereon shall be clearly legible to the naked eye. Nameplates will be secured with stainless steel screws.

A Manufacturer's label shall be installed inside the front door of each bay and shall contain the following information:

1. Manufacture's name, address
2. Serial Number
3. Three line diagram

In addition, each bay shall contain a label which contains the following information:

1. Loadbreak Switch Ampacity
2. Interrupter Ampacity

Heaters:

Heaters to prevent condensation shall be provided which are long life resistance type with protective covers to prevent accidental contact by personnel. All heaters shall be rated 500 watts, 240 volt AC, and connected to 120 volt AC to increase their life expectancy.

Heaters shall not be thermostatically controlled.

A dedicated power source, with proper overcurrent protection, shall be provided to power the heaters.

B. Switchgear Specifics:

- Bay 1 – 600A minimum continuous, Load Break Switch
- Bay 2 – 600A minimum continuous, Load Break Switch

- Bay 3 – 600A minimum continuous, Vacuum Interrupter – Power Transformer feed
- Bay 4 – 600A minimum continuous, Vacuum Interrupter and PT's – (2) – 34.5kV to 120V PT's (open delta wired) fed from Bay 4 interrupter.
- Extra compartment for Relays.

The interrupter in Bay 3 for the downstream power transformer shall be protected with a transformer differential relay scheme utilizing an SEL787 relay - 0787EX1A1A3A75850220. Multimode fiber input.

- The 787 shall be wired to trip and close Bay 3 through a LO relay – part# Electros witch 7805D.
- The 787 shall have the three 35kV potential and three 35kV current control input wires terminated on a terminal block and wired through test switches. Three additional current wires from the low side of the transformer shall be reserved positions on the terminal block, and wiring between the 787 and terminal block shall be completed at the factory.
- Trip and close for Bay 3 and trip for Bay 4 shall be wired through test switches.
- Auxiliary, control, and alarm wiring – The switchgear shall be furnished complete with all conduits and wiring for auxiliary power, alarms, and control. Test switches shall be: ABB FT-1 129A501G01 or ABB FT-1 670B197G18 or ABB FT-1 716B562G25 as appropriate.
- Aux Binary Inputs to the 787:
 - 52A, 52B and GND status contact from Bay 1- IN401, IN402, IN403
 - 52A, 52B and GND status contact from Bay 2-IN404, IN405, IN406
 - 52A,52B contact from Bay 3-IN102, IN101
 - SF6 Alarm-IN303
 - Transformer trips-IN201, IN202, IN203 (city wired)
 - 12kV main open/close status-IN408
 - Way 3 motor open status-IN301
 - Way 3 motor closed status-IN302
- Aux Analog Inputs to the 787:
 - Three voltages from PT's in Bay 4
 - Three primary currents from interrupter CT's in Bay 3

- Three secondary currents from transformer low side bushings.
- Aux Binary Outputs from the 787:
 - Trip Bay 3
 - Close Bay 3
 - Trip Low side recloser
- Aux Binary Inputs to the 751A:
 - 52A, 52B contact from Bay 4
- Aux Analog Inputs to the 751A:
 - Three voltages from from PT's in Bay 4
 - Three currents from interrupter CT's in Bay 4
- Aux Binary Outputs from 751A:
 - Trip Way 4

The interrupter in Bay 4 for the PT's shall be capable of adjustable settings for the purpose of protecting the circuit in the event of a PT failure or cable failure between the interrupter and the PT's. A 751A overcurrent relay with optional voltage inputs shall be provided. The potential leads shall be wired to the 751 through terminal boards and test switches. Details of the wiring to be provided in approval drawings.

All secondary taps of the PT shall be wired to terminal blocks located in an accessible area. Secondary fuses shall be provided to protect the potential transformers.

The potential transformers shall have an ANSI metering accuracy class of 0.3 at a W burden, or better. The Impulse Insulation Level for the voltage transformers shall be equal to or greater than the Impulse Insulation Level of the switchgear. Supplier shall provide the PT manufacturer and part number in approval drawings. Wiring diagrams for both the 35kV cable and the 120V output shall also be provided in the approval drawings.

Instruments, meters, relays, and control devices for mounting on the switchgear panels shall be installed inside the switchgear, or in separate weatherproof compartment. Where condensation control is necessary, the appropriate heating device shall be provided and powered from aux 120V AC. Details on relay locations, terminal block location, and aux and control wiring paths shall be provided in approval drawings.

Relay Hub Area:

Isolated compartment, with a separate door, to allow access to the relays and control devices without being exposed to 35kV. The 787 differential relay and the 751A relay are to be housed in the relay compartment. Unused terminals from the 787 relay are to be wired to the terminal blocks. Unused terminals on the 751A relay may remain unwired as this relay is used only to protect the PT's. The terminal boards, fault indicator interface, and test switches can be mounted in the Relay Hub area. Supplier is to provide wiring, layout, and dimensional drawings as part of the approval drawings. The plan view of the Relay Hub area shall provide for the cable entrances shown in PAD DIM.pdf. These pipes should not come in directly below equipment to allow for cable pulling and training.

Wiring for the 787 and 751A is preferred to be routed above grade within the switchgear. Should that become impossible or impractical, the ability to run the cabling up and under the slab into the Relay Hub area would be considered, with proper allowances for additional pipes.

Approval drawings shall consider and show cable training/routing.