

## Table of Contents

1. SCOPE .....	2
2. PROJECT ENGINEER .....	2
3. GENERAL DESIGN REQUIREMENTS .....	2
4. DESIGN REVIEW .....	3
5. SITE CONDITIONS.....	3
6. ELECTRICAL DESIGN REQUIREMENTS.....	4
7. STATIONARY STRUCTURE.....	4
8. CIRCUIT BREAKER COMPARTMENT .....	7
9. AUXILIARY COMPARTMENTS.....	8
10. CABLE COMPARTMENT .....	8
11. MAIN BUS AND BUS COMPARTMENT .....	9
12. INSTRUMENT TRANSFORMERS.....	10
13. VACUUM CIRCUIT BREAKERS .....	11
14. SWITCHGEAR CONTROLS, RELAYS, METERS AND CONTROL WIRING .....	14
15. HEATERS .....	20
16. NAMEPLATES.....	20
17. ACCESSORIES.....	21
18. PAINT/ FINISH .....	21
19. HARDWARE .....	22
20. FACTORY TESTS .....	22
21. DRAWINGS.....	23
22. SUBMITTALS .....	26
23. PROJECT RECORD DOCUMENTS .....	28
24. OPERATION AND MAINTENANCE DATA .....	28
25. SHIPPING REQUIREMENTS.....	28
26. FIELD ENGINEERING SERVICES.....	30
27. TRAINING.....	31
28. SPARE PARTS.....	31
29. MANUFACTURER'S WARRANTY.....	31
30. APPENDIX .....	32

## 1. SCOPE

JEA is replacing the metal clad switchgear lineup and switchgear building (as applicable) at various substations located in Jacksonville, FL. The scope of the work shall include furnishing the following materials and services. This also includes the requirements for protective relaying, circuit breakers and all appurtenances as indicated in the specification and drawings. Equipment to be furnished is shown on attached one-line drawings, data sheets and arrangement drawings (see Appendices).

## 2. PROJECT ENGINEER

The Project Engineer(s) and contact person(s) for technical questions and clarifications concerning this specification are:

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## 3. GENERAL DESIGN REQUIREMENTS

- 3.1. The switchgear and switchgear building shall be designed, manufactured, assembled, insulated, and tested in accordance with the latest applicable State and Federal Laws and all applicable codes and regulations in effect at the time of the switchgear and building construction including, but not limited to: ANSI/IEEE, AISC, NEMA, NFPA, NEC, NESC, AWS, OSHA, SDI, and ASTM standards except where specific requirements of these specifications conflict with these standards. In the event of any conflict between Specifications and Codes the more stringent requirements shall apply.
- 3.2. The switchgear and building shall be of the highest commercial quality as to material, workmanship, and design. All components and materials used in the construction of the apparatus shall be selected as the best available for the purpose for which used, considering strength, ductility, insulation, and best engineering practice. Liberal factors of safety shall be used throughout the design.
- 3.3. All materials and equipment shall be completely factory built, assembled, wired, and tested. All equipment and components shall be new and of first quality and shall conform to these specifications, as well as, any codes governing the use of the material.
- 3.4. The Switchgear Manufacturers and Manufacturer plant locations must be pre-approved by JEA.
- 3.5. The Manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five years. When requested by the Project Engineer, an acceptable list of installations for utilities with similar equipment shall be provided demonstrating compliance with this item.
- 3.6. The Manufacturer shall be ISO-9001 Certified.
- 3.7. The Manufacturer shall supply a copy of their Quality Assurance Program and/or Inspection and Test Plan that describes how the quality of the product is maintained throughout the fabrication and test processes.
- 3.8. All equipment furnished under this contract shall be labeled and listed by a nationally recognized testing laboratory.

- 3.9. The switchgear manufacturer shall serve as the single point of responsibility for field service, as well as, warranty for all component systems installed within the assembly. The Manufacturer shall provide all interconnecting wiring between component systems mounted within the assembly and shall furnish functional testing of these systems such as Metal-Clad Switchgear, data acquisition, protective relaying, etc. Provisions shall be made for JEA or consultant to witness these tests. Any additional costs incurred for this service shall be included in the base proposal.

#### 4. DESIGN REVIEW

- 4.1. The Manufacturer shall, upon request, provide JEA with all the switchgear design data.
- 4.2. JEA may have a consulting engineer review the design data provided by the Manufacturer.
- 4.3. At JEA's discretion, JEA may ask the Manufacturer to meet in person at a JEA facility to discuss the design of the switchgear and any other aspect related to these specifications. JEA may ask the Manufacturer to have the design engineer(s) available to discuss the design with JEA and/or JEA's consulting engineer. At JEA's discretion, these meetings may also be held via conference call.
- 4.4. Under no circumstance shall the Manufacturer have any authority to change the design agreed upon without consulting with JEA's Project Engineer.
- 4.5. **The Manufacturer shall not start manufacturing the switchgear until all the design data has been reviewed by JEA and written authorization to proceed is received from JEA's Project Engineer.**
- 4.6. The Manufacturer shall submit a production schedule associated with the equipment being provided. Such schedule shall be updated and submitted by the first of each month until completion and delivery of the switchgear.

#### 5. SITE CONDITIONS

- 5.1. Location: Multiple Substation locations in Jacksonville, Florida (see Appendix)
- 5.2. Applicable Codes: ASCE-7-10 Minimum design loads for Buildings and Other Structures; Florida Building Code
- 5.3. Structural Loads:
- 5.3.1. Dead loads shall include all future structural, electrical, and mechanical components of the switchgear buildings including, but not limited to switchgear, cable tray, control cable, HVAC units, etc.
- 5.3.2. Live loads: Roof Live Load = 40psf; Ceiling Dead Load = 10psf; Floor Live Load = 200psf; Floor Lifting Load = 125psf; Maximum Deflection = L/240
- 5.4. Structure Risk Classification: Category II
- 5.5. Wind: Basic Wind Speed:  $V_{ult} = 135\text{mph}$ ; Wind Importance Factor = 1.15; Exposure Category C; Occupancy Category III
- 5.6. Seismic: Design Category B
- 5.7. Rainfall: 8.75 inches (25 year, 24 hour rainfall)
- 5.8. Temperature: Maximum average = 93°F (July/August), Minimum average = 38°F (January)

## 6. ELECTRICAL DESIGN REQUIREMENTS

The New Replacement Switchgear shall consist of:

- 6.1. The 36" wide breaker compartments shall be provided for Main breakers, Feeder breakers, spare breakers, and bus tie breaker. Breakers shall be single frame vacuum circuit breakers with multi-ratio CTs, associated protective relays, controls, indicating lights and wiring. One set of relaying accuracy, multi-ratio CTs shall be provided and mounted on the Line and Load sides of the removable breakers. The Manufacturer shall furnish all necessary power and control interconnections between cubicles.
- 6.2. 13.4kV (nominal), 15kV (maximum), 3-Phase, 3 Wire, Grounded, 60 Hz system rated for continuous operation and Voltage Range Factor (K) of 1.0.
- 6.3. Indoor Arc Terminating Switchgear tested to the latest IEEE C37.20 requirements for Arc Resistant Switchgear which includes Arc-Terminating equipment.
- 6.4. Arc-Terminating Requirements:
  - 6.4.1. JEA prefers the use of the Arcteq AQ-110P. Any other Arc Terminating device must be approved by JEA prior to installation.
  - 6.4.2. The Manufacturer is required to provide the details of the ANSI/IEEE tested and approved arc-terminating or fault suppression device and the cycles and/or milliseconds in which the arc will be detected and quenched.
  - 6.4.3. The Manufacturer needs to provide details and references of actual installations of this same type of device.
  - 6.4.4. The Manufacturer must provide documentation of factory and field testing.
  - 6.4.5. The Arc Terminating device must be resettable in the field.
  - 6.4.6. The Arc Terminating device must have an operating and clearing time of 2ms or less.
- 6.5. Underground cable connections to Power transformers.
- 6.6. Underground cable connections to distribution feeder circuits.

## 7. STATIONARY STRUCTURE

- 7.1. The switchgear shall be a complete self-supporting structure consisting of one high vertical sections mounted side by side and connected electrically and mechanically to form one metal-enclosed rigid equipment. The switchgear shall be modern in appearance and design. Front covers, instrument doors, interior barriers, end trim, rear covers, interior current and voltage transformer compartments and roofs will be no less than 11 gauge steel. Equipment is to be provided with adequate lifting facilities.
- 7.2. Metal side sheets shall provide grounded barriers between adjacent structures and solid removable metal barriers shall isolate the major primary sections of each circuit.
- 7.3. Each metal-clad vertical section shall be a self-supporting stationary housing consisting of and divided into a secondary and primary enclosure.
  - 7.3.1. The secondary enclosure shall consist of a compartment with a hinged, latched door or panel (11 gauge steel) upon which are mounted the specified protective and control instruments at

dedicated locations. Each door panel shall be equipped with a door stop. Other required surface-mounted devices, fuses and terminal blocks shall be mounted on the vertical side sheets inside the compartment. A wire trough shall be located at the top to provide for inter-unit wiring. Secondary control wires shall be enclosed in grounded steel troughs where they pass through primary compartments.

- 7.3.2. The primary enclosure houses the high voltage equipment (breakers, CTs, VTs) and connections. It shall consist of formed steel frame divided into individual compartments. The compartments shall be arranged to prevent the interchange of gas between compartments. The main primary compartments are the breaker compartment, main bus, power termination and auxiliary compartments.
- 7.4. The switchgear shall be designed for all circuits to enter the vertical sections from below. Openings shall be 24" x 12" unless otherwise indicated.
- 7.5. All bus joints, taps, splices and outgoing connections shall be insulated. Bolt sequencing and torquing instructions shall be provided.
- 7.6. Each cubicle which has high voltage connections shall be effectively isolated from the others and from low voltage sections by metal barriers. All high voltage connections in these compartments shall be accessible through removable cover plates or doors. There shall be no exposed low voltage wiring in high voltage compartments. The voltage and current transformer secondary wiring runs in high voltage compartments shall be in metal conduit or equivalent. Removable cover plates shall be provided for access to buses, voltage and current transformers, low voltage wires, etc. The relay panels shall be isolated from the high voltage connections by grounded metal panels.
- 7.7. All doors shall be hinged with formed edges and provided, as required, with doorstops, louvers with 1/8" mesh aluminum backup vermin screens. Doors shall open a minimum of 105" and be so designed that there will be no interference with devices when the circuit breakers are racked "in" or "out".
- 7.8. Provision shall be made in the appropriate switchgear cubicles for the entrance of conduits containing the low voltage control and auxiliary power cables and necessary connections to interposing relays, auxiliary transformers, voltage regulating equipment and other low voltage wiring. In the cubicles, a removable floor plate shall be provided for the entrance of the cables.
- 7.9. The power cable compartment shall be located at the rear of the structure and shall provide adequate facilities for terminating cables. At least 33" of vertical space shall be provided to accommodate cable bending radius and stress cones. Cable supports shall be included. Terminal connectors for cable connections will use NEMA 4-hole drilling and adapters where required, for multiple cables and be silver-plated copper. Connections made to bus ducts shall have all the necessary bus adapters, bolting, insulating supports and metal flanges provided. Ground sensing current transformers shall be mounted in the respective cable compartments as noted on the drawings provided.
- 7.10. The compartment access doors shall be hinged and latched and shall have provisions for padlocking. Door stops and stop catches shall be furnished.
- 7.11. Bottom entry shall be provided for power cables. Top entry for power cable connections shall be provided as required for manufacturer to connect remote switchgear units. Top and bottom entry shall be provided for control cables.

## Technical Specifications - 15kV Metal-Clad Switchgear with Arc Terminating Technology

- 7.12. Grounded metal cable troughs shall be provided in each unit to segregate cables between the upper and lower breaker units where applicable.
- 7.13. Grounded metal safety shutters will close the entrance to stationary primary disconnecting devices when the breaker is in the test or withdrawn position.
- 7.14. All bus supports and other insulating material subject to line-to-line or line-to-ground voltages shall be of high grade wet process porcelain or cycloaliphatic epoxy, including stationary primary disconnects. This equipment shall be shipped assembled to the maximum possible extent.
- 7.15. The primary disconnecting contacts shall be constructed of silver-plated copper. All moveable contact fingers and springs shall be mounted on the circuit breaker where they may be easily inspected.
- 7.16. All floors shall be under-coated with a flame retardant sealant.
- 7.17. All control cables shall enter as shown on the conduit drawings.
- 7.18. Cable troughs for wiring between the circuit breaker cubicles and the miscellaneous cubicles shall be located internal to the switchgear.
- 7.19. Enclosures shall be designed for indoor locations and fit inside a building with interior clear height of 138" unless otherwise specified. The Manufacturer shall be required to provide ingress and egress requirements for the switchgear including minimum clear height and door opening sizes to accommodate moving the switchgear into and out of the building and provide a description of the means and methods for moving the switchgear.
- 7.20. Switchgear shall be designed in accordance with the testing requirements of ANSI/ IEEE C37.20 for one-high construction.
- 7.21. The Manufacturer shall use fittings and materials that prevent the propagation of damage to the adjacent compartments.
- 7.22. Switchgear units, generally, shall be arranged as shown on the drawings provided.
- 7.23. Energized bare parts mounted on doors shall be guarded where the door must be opened for maintenance of equipment or removal of draw-out equipment.
- 7.24. Each outgoing, rear cable compartment shall be provided with a lockable, hinged door(s) utilizing a 3-point latching system. Cable supports shall be provided for outgoing underground cables. The floor of each cable compartment shall be provided with removable openings for bottom entry power cable connections to the switchgear.
- 7.25. Work to be included:
  - 7.25.1. Design, fabrication, shop testing, documentation, delivery, offloading and installation of 15kV Class Metal-Clad Switchgear and building, as applicable.
  - 7.25.2. Aligning, leveling, and bolting the switchgear to the concrete pad.
  - 7.25.3. Connecting the bus work and cables at shipping splits.
  - 7.25.4. Furnish and install a separate, single cabinet 125VDC UPS System (SENS, Power Cab 120 Model # 4BG8110NTBAC00 or equivalent) to be located inside the switchgear building.

7.25.5. Furnish and install a Fiber Optic Rack inside the Switchgear Building. Provisions shall include providing required conduit and cables for routing Fiber Optic cable interconnections between the switchgear auxiliary compartment RTAC units and the 125VDC source breaker at the UPS unit panel. The 125VDC power circuit shall be routed and terminated on a terminal block mounted on the equipment rack. The 19" communications rack shall be Chatsworth Products Part # 55053-103. The rack shall be grounded to the switchgear ground bus.

7.26. Work not to be included:

7.26.1. The Power Transformer and the Underground Cable Connection between the switchgear and transformer or between the switchgear and distribution feeders.

7.26.2. Attaching external yard equipment AC power and control cables to appropriate terminals.

## 8. CIRCUIT BREAKER COMPARTMENT

8.1. Circuit Breaker Compartments shall be designed to house single frame, removable-element, vacuum circuit breakers.

8.2. Stationary primary disconnect contacts shall be silver-plated copper. Grounded metal safety shutters shall isolate all primary connections in the compartment when the breaker is withdrawn from the connected position and in either the test, disconnected or removed position. The shutter assembly shall be capable of being padlocked in the closed position. Shutters shall be permanently marked to indicate the "BUS" or "FEEDER" side primary stationary disconnects. Phase markings shall also be included.

8.3. Each circuit breaker will be mounted in a steel framework equipped with self-connecting primary disconnects.

8.4. Circuit breaker compartments shall have front and rear steel hinged doors with a single handle multi-point latching system.

8.5. Circuit breaker compartments shall include reinforced hinged front panels suitable for mounting relays and instruments.

8.6. Circuit breakers shall be equipped with secondary disconnecting contacts which shall manually or automatically engage in the connected position.

8.7. Sturdy interlocks to prevent racking breaker into or from connected position with breaker closed shall be provided. A positive stop will prevent over-travel when in the connected position. The design of the mechanism will be such that the removable breaker will be self-aligning and will be held rigidly in the connected position without the necessity of locking bars or bolts. Interlocks shall be described below:

8.7.1. The breaker is automatically tripped when racking in before the primary shutters open.

8.7.2. The breaker is trip-free mechanically and electrically during levering.

8.7.3. The breaker shall be racked with front door open or closed.

8.7.4. The breaker closing spring is automatically discharged as the breaker is withdrawn from the cell.

- 8.7.5. A latch secures the breaker in the connected, disconnected or test position with the door open or closed.
- 8.7.6. The circuit breaker is grounded throughout its travel.
- 8.7.7. Positive indication of the breaker position shall be provided for connected, test and disconnected positions.
- 8.7.8. It shall not be possible to insert or remove a circuit breaker element from the connect position while the interrupters are in the closed position. The stored energy mechanism shall be discharged automatically before the circuit breaker element being withdrawn from the cubicle.
- 8.8. A handle shall be used to manually charge the spring for slow closing of contacts for inspection or adjustment. Two handles shall be provided with each switchgear assembly.
- 8.9. Each breaker compartment shall incorporate a breaker rack out device. Using the rack out device, a breaker will be self-aligning and will be held rigidly in the operating position. In the disconnect position, the breaker shall be easily removable from the compartment. Two racking devices shall be provided with each switchgear assembly.
- 8.10. Breaker racking shall be accomplished with the door closed and latched. Insert handle through a hole in the front door to operate rack out device. An indicating tape shall show breaker position when racking breakers in or out of their connected positions. Three breaker positions shall be indicated with the door closed: CONNECTED, TEST and DISCONNECTED.
- 8.11. The rack out device shall have provisions for padlocking in the disconnected position. When locked in disconnected position, breaker shall be removable from compartment. Padlock shall not interfere with breaker operation.
- 8.12. All breaker auxiliary contacts and other devices will function normally in TEST position; an umbilical cord shall be included, if required.
- 8.13. Automatic shutters shall cover primary disconnect stabs when the breaker is withdrawn to test/disconnect position. Linkages connected to racking mechanism shall positively drive shutters.

## 9. AUXILIARY COMPARTMENTS

- 9.1. Each of the auxiliary compartments (primary enclosure) shall be designed to house the voltage and current transformers.
- 9.2. The rating for the voltage and current transformers shall be as indicated in each switchgear unit specification.

## 10. CABLE COMPARTMENT

- 10.1. The cable termination compartment (primary enclosures) for incoming source and feeder cables shall be located at the rear of the equipment and shall be accessible through a padlockable door.
- 10.2. All cables shall enter the compartment from the bottom.
- 10.3. The incoming source cable compartments shall be designed to house and support at least six (6) single phase terminators and be a minimum of 24" x 12".



- 10.4. A copper ground bus shall extend through this compartment for the full length of the switchgear and shall be easily accessible from the cable entrance. The ground bus shall have a minimum rating equal to the maximum momentary and four second rating of any circuit breaker.

## 11. MAIN BUS AND BUS COMPARTMENT

- 11.1. The main bus compartment shall contain three-phase, three-wire, fully insulated, copper bus, silver plated at connection points and have a continuous rating of 2000A unless otherwise noted in specific project details.
- 11.2. The Short Circuit withstand rating of the switchgear bus bar system shall match that of the maximum interrupting ratings of the Main Circuit Breakers feeding the switchgear.
- 11.3. Bus bars shall have a continuous current rating based on temperature rise and documented by design tests.
- 11.4. All joints will be silver plated with at least two bolts per joint. Bus bars will be braced to withstand magnetic stresses developed by currents equal to the power circuit breaker close, carry and interrupting ratings.
- 11.5. Access to bus bars shall be through removable front panels.
- 11.6. Bus bars shall have fluidized bed epoxy flame retardant and non-hydroscopic insulation.
- 11.7. The rated maximum voltage shall be 15kV.
- 11.8. The bus bar supports shall be polyester glass for the switchgear's rated maximum voltage.
- 11.9. Provide and install an SEL bare-fiber loop Sensor along the length of each complete bus section for connection to the Main Breaker **SEL-751 (Part #751501ACACA70850620 to be used where SEL-751 is mentioned throughout the document)** protective relay mounted in the main breaker compartment. The switchgear Manufacturer shall provide the bare fiber sensor, the jacketed duplex fiber zipcord, splice connectors and dual V-Pin latch terminators. V-Pin Splice Bushings shall be provided as required between compartments. Installation shall be in accordance with recommendations of SEL Application Guide, Volume III (AG2011-01) recommendations.
- 11.10. Bus orientation shall be A-B-C top to bottom, front to back and left to right when viewed from the front of the switchgear.
- 11.11. Tapering of the bus systems is not permitted.
- 11.12. All main bus supports shall be porcelain or epoxy, including inter-unit bus isolation barriers. All bus and live part supports shall be high-strength electrical grade wet process porcelain or cycloaliphatic epoxy (bisphenol epoxy is not acceptable) or polyurethane.
- 11.13. Liquid dipped epoxy shall be used for insulating the bus. Insulating boots over the joints either match the color of the bus sleeving or be of a clear insulating material.
- 11.14. Two control buses consisting of insulated copper cable shall run the entire length of each switchgear assembly. Control buses shall be isolated from the primary devices in separate solid raceways or metal conduit. One two-wire bus with an auxiliary undervoltage alarm relay shall operate at 110 dc voltage and shall supply power to the close and trip circuits of the switchgear and the spring charging motor of the stored-energy mechanism. The second control bus shall

carry cabling as required per station service availability. The load on the ac control power bus shall be arranged such that it is balanced as closely as possible for each switchgear assembly.

#### 11.15. Ground Bus

- 11.15.1. A full length, silver-plated, copper ground bus shall be provided and installed near the bottom of the unit line up. It shall be  $\frac{1}{4}$  x 2 inches minimum in cross-section. In the feeder breaker units, provision shall be made for attachment of a NEMA 2-hole ground lug. The ground bus shall be securely bonded to the frame of each unit and shall have provision for grounding the entire assembly at each end of the lineup. Extension provisions similar to those of the power buses shall be provided.
- 11.15.2. The ground bus shall extend throughout assembly with connections to each breaker grounding contact and cable compartment ground terminal. The ground bus continuous current rating shall be sized to match that of each main bus bars at a 65 degree rise. Station ground connection points shall be located in each end section or as otherwise designated.
- 11.15.3. Ground bus shall be braced to withstand magnetic stresses developed by currents equal to the power circuit breaker close, carry and interrupting ratings.

## 12. INSTRUMENT TRANSFORMERS

- 12.1. Current Transformers: The current transformers shall have ratios, relay accuracies and metering accuracies as indicated in each switchgear unit specifications. The current transformers shall have sufficient thermal and mechanical rating equal to the momentary rating of the circuit breakers and shall be insulated for full BIL rating of the switchgear.
  - 12.1.1. The Current Transformers secondary terminals shall be of the solder-less clamp type. All current transformers shall be properly identified for polarity with standard marking symbols.
  - 12.1.2. Current Transformers having an insulation rating of 600V with fully insulated bus centered in the transformer window opening are acceptable when corona, hypot and impulse tests prove a satisfactory arrangement. Tests shall be performed on a Current Transformer installation in the switchgear Manufacturer's equipment. Certified test reports shall be submitted with the approval drawings.
  - 12.1.3. A minimum acceptable accuracy class for metering and relaying (C400 or better) shall be in accordance with the latest edition of ANSI Standard C37.20.2 and C57.13.
  - 12.1.4. Phase Current Transformers shall be mounted over stationary primary disconnects. Ground fault sensor Current Transformers shall be mounted in cable compartments and sized to accommodate power cables and reliable relay operation.
- 12.2. Voltage Transformers: Voltage Transformers shall be draw-out type, equipped with current-limiting fuses and shall have accuracies and ratios complying with ANSI C57.13 as indicated in each switchgear unit specifications.
  - 12.2.1. Each set of voltage transformers and their primary fuses (current limiting, high interrupting capacity) shall be mounted in separate steel compartments. They shall be equipped with primary and secondary fused disconnecting devices. Withdrawing the Voltage Transformers shall disconnect the primary side of the transformer from the power source.

A grounding device shall contact the fuses as the Voltage Transformers are withdrawn, effectively discharging the transformers of any static charge.

- 12.2.2. Primary connections to the transformers shall be insulated and enter the compartment through porcelain or cycloaliphatic epoxy bushings. Each set of voltage transformers and fuses shall be mounted on the tiltout steel carriage which will be capable of disconnecting the transformer fuses from their voltage source and removing them from the structure. This removing mechanism shall be so arranged that full access to the transformers cannot be accomplished until the fuses are disconnected from the structure and grounded. When moved to a full out position, the transformer fuses and VT windings shall be automatically connected to ground. Primary contacts shall be insulated from the structure by porcelain or cycloaliphatic epoxy supports, shall be self-aligning and shall have silver to silver contact surfaces.
- 12.2.3. The drawout Voltage Transformers shall be designed to deter accidental contact with any live parts when in the drawn position.
- 12.2.4. All Voltage Transformers shall have 8400V to 120V ratio. Voltage Transformers shall be connected in Wye on primary and secondary winding.

### 13. VACUUM CIRCUIT BREAKERS

- 13.1. The specific circuit breaker manufacturer and type must be approved by JEA before furnishing. Approved Circuit Breaker manufacturers are as follows: GE PowerVac, Powell, and Schneider. Breakers by any other manufacturer must be approved by JEA during the switchgear design process.
- 13.2. Circuit breakers shall be three-pole, single-throw, removable, horizontal draw-out roll on floor type rated at 2000A (main and tie), 1200A (feeder) and 60Hz with a symmetrical interrupting rating of 18kA and a symmetrical close and latch rating of 37kA unless otherwise noted in specific project details.
- 13.3. Circuit breakers shall be vacuum-break type and have a rated interrupting time of 3 cycles.
- 13.4. The circuit breaker control voltage shall be 125VDC. The 125VDC power source, for breaker control, shall be provided from a separate UPS system installed in the switchgear enclosure or from a separate 125VDC source provided by JEA. When required, the UPS system shall be provided by the switchgear manufacturer.
- 13.5. Circuit breakers shall be operated by an electrically charged, mechanically and electrically trip-free, stored-energy spring. The stored energy mechanism shall be charged normally by a universal electric motor and in emergency situations by a manual handle. Only a spring-open, spring-close mechanism will be acceptable.
- 13.6. Circuit breakers of same ratings and control voltage shall be completely interchangeable both physically and functionally without having to adjust any wiring. Interchangeability shall be demonstrated during factory testing.
- 13.7. Breakers and compartments shall be manufactured so a breaker of lesser continuous amperage or short circuit capability cannot be installed in a compartment manufactured for a breaker or a higher rating. The installation of the highest rated breaker of the switchgear into all other compartments

shall be demonstrated at the factory with the specific breakers for this project being inserted and tested in each cell.

- 13.8. The circuit breaker's primary disconnecting fingers shall be silverplated. The secondary disconnecting contact shall be a silver-plated, multiple contact plug. The plugs shall manually engage the housing sockets in the breaker operating positions.
- 13.9. The breaker compartment shall be furnished with a mechanism which will move the breaker between the operating and disconnecting positions. The mechanism shall be designed so that the breaker will be self-aligning and will be held rigidly in the operating position without the necessity of locking bars or bolts. In the disconnect position the breaker shall be easily removable from the compartment.
- 13.10. Circuit breakers shall be provided with self-aligning contacts for grounding the removable elements when they are inserted in the housings or in the test position. Circuit breaker removable elements shall have three (3) distinct positions in their housings:
  - 13.10.1. "Connected" – ready for operation.
  - 13.10.2. "Test" – primary contacts separated at a safe distance, switchgear primary contact shutter closed, and secondary contacts connected.
  - 13.10.3. "Disconnected" – primary and secondary contacts separated by a safe distance.
- 13.11. Interlocks shall be designed to deter moving the breaker to or from the operating position unless its contacts are in the open position. As a further precaution, interlocks shall be provided to prevent moving the breaker into the disconnected position while the operating springs are charged.
- 13.12. Protective front covers shall be provided on the circuit breaker element to prevent access to the operating mechanism or live parts when the circuit breaker is in the connected position.
- 13.13. The breaker front panel shall be a grounded steel barrier that effectively isolates the instrument and control compartments. The front panel shall have the following control and indication features:
  - 13.13.1. Breaker open-close indication.
  - 13.13.2. Closing springs charged-discharged indication.
  - 13.13.3. Operations counter.
  - 13.13.4. Manual trip-close push buttons.
- 13.14. Switchgear shutters shall be permanently marked to indicate the "Bus" or "Feeder" side primary stationary disconnects. Phase marking shall also be included.
- 13.15. The circuit breaker shall be mechanically interlocked to coordinate with the requirements outlined in the Circuit Breaker Compartment section of this specification and applicable ANSI standards.
- 13.16. Manual operating devices for racking the circuit breaker elements in and out of their cubicle shall be provided.

- 13.17. The circuit breakers shall be equipped with a polymer metal oxide type surge suppressor devices per Manufacturer standards that is capable of providing protection against overvoltage transients to the load supplied by the breaker.
- 13.18. An extension jumper and test stand shall be provided for each switchgear assembly so that the circuit breaker and the circuit breaker's operation may be checked with the breaker element outside of the circuit breaker cubicle.
- 13.19. Each circuit breaker shall be provided with an auxiliary switch. All breakers shall have a 6-stage switch containing six "a" (normally open) and six "b" (normally closed) contacts rated at 20 amps continuous, 10 amps interrupting at the specified control voltage. Mechanism operated cell switches shall be operated directly by the breaker mechanism when in the connected and test positions and shall be capable of individual adjustment. All wiring to mechanism operated cell switches shall be brought out to the terminal blocks for external secondary connections. All spare contacts shall be wired to terminal blocks.
- 13.20. The Manufacturer shall furnish in each compartment a truck operated cell (TOC) switch with a minimum of three (3) "a" and three (3) "b" breaker cell mounted position contacts rated 20 amps continuous, 10 amps interrupting at the specified control voltage. Truck operated cell switch shall be operated when the breaker is moved into or out of the connected position. All wiring to truck operated cell switches shall be brought out to terminal blocks for external secondary connections.
- 13.21. Each circuit breaker shall be provided with a position switch indicating whether the circuit breaker is in the "Connect" or "Disconnect" position.
- 13.22. Arc Flash Sensor Provisions: (These SEL point and loop fiber sensors are not required to be installed as the Arcteq AQ-110P will perform this function)
- 13.22.1. For each Main breaker, provide SEL fiber point sensors (2) mounted on the rear wall of each breaker cell and connected to the Main SEL-751 protective relay. Sensors shall be located so that the breaker shutters do not obstruct the operation of the point sensors.
- 13.22.2. Provide and install an SEL bare fiber loop sensor at the rear of each feeder breaker cell's outgoing line compartment. This fiber loop shall terminate on the SEL-751 relay located in the associated feeder breaker control panel.
- 13.22.3. For each switchgear section line up, provide and install a bare fiber sensor loop routed from the Main breaker cell through the front sections of all auxiliary and feeder breaker cells and terminated back at the Main breaker SEL-751 protective relay. Placement of the bare fiber in the Feeder breakers shall be along the rear wall of each breaker cell with due care so that the breaker shutters do not obstruct the fiber sensor's operation.
- 13.22.4. For each bus tie breaker, provide SEL fiber point sensors (2) on the rear wall of the breaker cell. One of the two sensors shall be routed through the switchgear and terminated at the Main Breaker 1 SEL-751 relay and the other shall be routed and terminated at the Main Breaker 2 SEL-751 relay.

13.22.5. The switchgear Manufacturer shall provide the SEL bare-fiber loops and point sensors, jacketed duplex fiber zip cord, splice connectors and Dual V-Pin Latch terminators, in lengths as required.

13.22.6. All arc flash sensors shall be provided and installed in accordance with recommendations of SEL Application Guide, Volume III (AG2011-01).

#### 14. SWITCHGEAR CONTROLS, RELAYS, METERS AND CONTROL WIRING

14.1. Meters (Electro Industry Shark), protective relays (SEL-751, SEL-787E), Transformer tap changer relay and monitor (Beckwith M-2001C, INCON 1250B-1-S-120) instruments and controls shall be furnished and installed by the switchgear manufacturer.

14.2. The following are general requirements for the switchgear controls, relays, meters, and control wiring:

14.2.1. Instruments and controls shall be installed and wired on the hinged front panels. Protective relays shall be mounted on the hinged front door of each low voltage compartment. Auxiliary relays shall be mounted inside of the appropriate low voltage compartment.

14.2.2. Energized bare parts mounted on doors shall be guarded where the door must be opened for maintenance of equipment or removal of draw-out equipment.

14.2.3. The Manufacturer shall furnish ABB type switches or approved equal for protective relay and meter inputs/outputs.

14.2.4. Location and arrangement of the all the devices must be approved by JEA.

14.2.5. Control switches: The control switches shall be rotary, multi-position, cam-operated, multi-stage type and silver-to-silver contacts rated 600 volt, 20 amperes. Breaker control switches and selector switches shall have "pistol grip" handles. The control switches for the circuit breaker shall be of the pull-out type. In the operating position they shall provide for local control and indication of the equipment. In the pull-out position they shall provide for supervisory control of the equipment served. In the supervisory position, local indication shall be in operation, but local control shall be disconnected. Circuit breaker control switches shall have a mechanical flag indicator with red and green markers to indicate the last manual operation of the switch. Switches shall be GE Type SB-10.

14.2.6. Lockout relays shall have "oval" handles and shall be Electroschwitch Series 24 Type LOR or approved equal with electric trip and hand reset.

14.2.7. Main contacts of all switching devices shall be silver-plated or equivalent. The contact surfaces of secondary disconnecting devices and relays shall be silver-plated or equivalent.

14.2.8. Each circuit breaker shall be provided with Light Emitting Diode (LED) lights mounted on the breaker panel and wired to provide indication unless the breaker is in the operating test or disconnected position. Indicating lights shall be of the series resistor type with color caps designed for maximum visibility and long service life, GT Type ET-16 or approved equal. The indicating lights shall be as follows:

14.2.8.1. Red to indicate the closed position.

14.2.8.2. Green to indicate open position.

14.2.9. Appropriate test switches shall be provided for voltage, current and trip circuits of all the protection relays and panel metering units.

14.2.10. Each incoming line main circuit breaker, bus tie circuit breaker and feeder circuit breaker unit shall be provided with a Mechanism Operated Contact (MOC) auxiliary switch. The auxiliary switch shall operate when the breaker closes and in either the connected or test positions. A TOC switch having a minimum of two normally open and two normally closed contacts rated at 10 amperes, 125 VDC shall be provided. The MOC auxiliary switch shall have a minimum of five normally open and five normally closed contacts rated 10 amperes. All auxiliary switches shall be wired to terminal blocks located in the breaker compartment.

14.2.11. Control wiring shall be provided per the drawings including all auxiliary relays and device indicated to be furnished with the switchgear. Control buses and wiring for each vertical section shall be enclosed in conduit or in compartments isolated from the primary circuits. The switchgear shall be furnished completely wired. The switchgear shall be wired with type SIS (Vulkene) #14 AWG except where larger is specified. The switchgear shall be provided with terminal blocks near the edge of the cabinet for connection to control cables entering from above or below.

14.2.11.1. Each switchboard gear line up shall be completely assembled, wired, and tested at the factory, including all buses, connections, insulators, cleats, terminals and terminal blocks.

14.2.11.2. Secondary wiring shall be firmly laced, secured, and terminated in approved molded-type terminal blocks conveniently located with respect to shipping splits and control conduit terminals.

14.2.11.3. All secondary wiring shall be 600 volt, type SIS stranded switchboard wire, #14 AWG or larger. It shall be UL Listed, Type VW-1 flame retardant rating, 90 degrees C, tinned copper and provided with a wire marking system at each end of the wire. These designations shall match the wiring diagram.

14.2.11.4. All current transformers and associated circuitry control wiring shall be #12 AWG and shall be terminated with insulated ring-tongue lugs.

14.2.11.5. Control cables, electronic instrument cables (control), fiber optic cables, ethernet, coaxial cable (communication) installed between compartments shall be kept separate.

14.2.11.6. Control cables, electronic instrument cables (control), fiber optic cables, ethernet, coaxial cable (communication) installed between transformer protection panel and switchgear cubicles shall be kept separated routed via the main and communication overhead cable trays.

14.2.11.7. Plastic wire trough may be used in lieu of cable bundles with tie wraps.

14.2.11.8. All single pair electronic instrument wire shall be #16 AWG, 7 strand copper conductor, 90 degree Celsius non-polyvinyl chloride primary insulation, colored black (negative leads) and white (positive leads), twisted, shielded with non-

polyvinyl chloride outer jacket. Conductors shall be identified on each end with sleeve type wire markers.

14.2.11.9. Multiple pair electronic instrument wire shall be #18 AWG, 7 strand copper conductor, 90 degree Celsius non-polyvinyl chloride primary insulation, each pair numbered, twisted, and cabled with an overall shield with non-polyvinyl chloride outer jacket. Conductors shall be identified on each end with sleeve type wire markers.

14.2.11.10. Manufacturer shall supply unit internal connection diagrams and data with identification of devices, terminals and connecting wires. The system used for designation of control wiring shall show device identification with terminals arranged in substantially correct physical relationship. The identification system shall provide sufficient information at each wire termination to locate the other termination without referring to supplementary tabulations or data on function of wire. The Manufacturer is solely responsible for correctness of the internal wiring and for proper functioning of the equipment being furnished.

14.2.11.11. The diagram shall show any connections to be made in the field due to shipping sectionalizing.

14.2.11.12. The Manufacturer's control wiring shall be brought to terminal blocks. Connections made on terminal blocks and on internal devices shall be by means of crimped ring type, insulation-gripping insulated terminals. On internal devices which do not permit ring type, insulation gripping insulated terminals, control wiring shall be held by screw type compression devices. Terminal blocks, wired to outgoing control circuits shall be mounted inside of each compartment.

14.2.11.13. Secondary control wires shall be armored when they pass through primary compartments.

14.2.12. Terminal blocks shall adhere to NEMA ICS 4, have approved covers and shall be mounted such that the wires to them can be grouped and laced together in a neat and workmanlike manner. A sufficient number of terminal connections including 20% spare terminals shall be provided for all control and instrument wiring.

14.2.12.1. Terminal blocks shall be 600 volt class, GE type EB-25 or approved equal, barrier type, minimum rating 20 amps with marker strips identifying internal and external wiring. All auxiliary and unused contracts shall be wired out to terminal blocks. The system shall be designed so that only one outgoing wire per terminal is connected to any terminal. On the unit side of the terminals, a maximum of two wires shall be terminated on any one terminal.

14.2.12.2. All terminals for external customer wiring, for example, breaker auxiliary contacts, MOC contacts, TOC contacts and remote breaker controls shall be located in the low voltage compartment.

14.2.12.3. Terminal blocks with internal wiring and jumpers as required shall be provided for remote close and trip contacts, remote breaker position indicator lights, remote protective relating and a remote block close contact.



14.2.12.4. Two-pole, pull-out disconnecting fuse blocks (with fuses) to be provided for each breaker to protect trip and close circuits.

14.2.12.5. Current Transformer Terminal Blocks

14.2.12.5.1. Shorting terminal blocks in the low voltage compartment shall be provided for all current transformers (CTs) including CTs for relays and other remote devices with connections external to the switchgear including shorting blocks for neutral connections to ground.

14.2.12.5.2. Delta or wye connections for the current transformers shall be made at the terminal block and the ground connections for the CT circuit shall be made at this terminal block only. Do not ground the CTs at the CT.

14.2.12.5.3. The shorting block terminals for the main breaker bus side CTs closest to the bus shall be capable of terminating up to two #4 conductors per terminal.

14.2.12.5.4. The Manufacturer shall provide the SEL bare-fiber loops and points sensors, jacketed duplex fiber zipcord, splice connected and Dual V-Pin Latch terminators, in length as required.

14.2.12.5.5. All arc flash sensors shall be provided and installed in accordance with recommendations of SEL Application Guide, Volume III (AG2011-01).

14.2.12.5.6. Protective relays shall be SEL-751. Relays shall be provided by the Switchgear manufacturer.

14.2.12.5.7. One (1) set of relaying accuracy, multi ratio, C400 or better CTs shall be provided and mounted on the Line and Load sides of removal breakers.

14.2.13. Cell and Door Equipment Details

The following equipment shall be provided by the switchgear manufacturer. Details below do NOT include miscellaneous devices such as terminal blocks, fuse blocks, fuses, wiring, lugs, screws etc. These materials shall also be provided by the switchgear manufacturer as part of this specification.

14.2.13.1. Typical Door for Transformer Breaker Compartment

14.2.13.1.1. GE main breaker control switch type SB-10

14.2.13.1.2. SEL-751 Multifunction Relay P/N 751501ACACA70850620, to be provided by switchgear manufacturer. NOTE: to be supplied with all required mounting hardware. Settings will be prepared by JEA.

14.2.13.1.3. Indicating light Red = 1, Green = 1, White = 1

14.2.13.1.4. ABB test switch for trip isolation with clear case.

14.2.13.1.5. Test switches for SEL-751 relay (Quantity = 1), Test switches for SEL-787 relay (Quantity = 1), Test switches for Beckwith M-2001C

## Technical Specifications - 15kV Metal-Clad Switchgear with Arc Terminating Technology

(Quantity = 1), Shark Meter (Quantity = 1) and ION 7650 meter (Quantity = 1).

14.2.13.1.6. ION 7650 transducer only type meter.

14.2.13.1.7. Electro Industry Shark meter

14.2.13.1.8. Electro Switch type 24 LOR lockout relay with 5 decks.

14.2.13.1.9. Indicating Light, GE ET-16, 70Vac, Incandescent Bulb, Clear Cap

14.2.13.1.10. SEL-787 Multifunction Relay P/N 07871X1ACACAA5850220, to be provided by switchgear manufacturer. NOTE: to be supplied with all required mounting hardware. Settings will be prepared by JEA.

14.2.13.1.11. An INCON Tap Position Monitor, Type 1250B, P/N 1250B-1-S-120, in order to provide transformer tap indication to be provided by switchgear manufacturer. NOTE: to be supplied with all required mounting hardware.

14.2.13.1.12. A Beckwith Digital Tap changer Control, Type M-2001C with MOD467 firmware, fiber optic RS485, and RS232 communication ports, with DNP3 protocol and M-2025B current loop interface to use with M2001C and M2067B panel adapter, P/N M-2001C-6SL, to be provided by switchgear manufacturer. NOTE: to be supplied with all required mounting hardware.

### 14.2.13.2. Typical Door for Feeder Breaker and Spare Breaker Compartment

14.2.13.2.1. GE main breaker control switch type SB-10.

14.2.13.2.2. SEL-751 Multifunction Relay P/N 751501ACACA70850620, to be provided by switchgear manufacturer. NOTE: to be supplied with all required mounting hardware. Settings will be prepared by JEA.

14.2.13.2.3. Indicating light Red = 1, Green = 1, White = 1

14.2.13.2.4. ABB test switch for trip isolation with clear case.

14.2.13.2.5. Test switches for SEL-751 relay (Quantity = 1) and Shark Meter (Quantity = 1)

14.2.13.2.6. Electro Industry Shark meter

14.2.13.2.7. Indicating Light, GEC ET-16, 70Vac, Incandescent Bulb, Clear Cap.

### 14.2.13.3. Typical Door for Bus Tie Breaker Compartments

14.2.13.3.1. Satellite clock, SEL-2407 with receiver antenna and coax, mounted on the exterior of the switchgear enclosure. Switchgear manufacturer to provide complete mounting hardware such as: Surge Suppressor, Surge Suppressor mounting brackets, TNC Coaxial cable between GPS antenna to surge suppressor to

## Technical Specifications - 15kV Metal-Clad Switchgear with Arc Terminating Technology

SEL2407, SEL953 cables routed from SEL2407 to RTAC, SEL-787 and SEL-751 relays using communication wire-way between the enclosure.

14.2.13.3.2. SEL 3350 #IKP4 RTAC to be installed in the Unit 4 Bus Tie. RTAC to be provided and wired by switchgear manufacturer. Settings will be prepared by JEA.

14.2.13.3.3. GE main breaker control switch type SB-10.

14.2.13.3.4. SEL-751 Multifunction Relay P/N 751501ACACA70850620, to be provided by switchgear manufacturer. NOTE: to be supplied with all required mounting hardware. Settings will be prepared by JEA.

14.2.13.3.5. Indicating light Red = 1, Green = 1, White = 1

14.2.13.3.6. ABB test switch for trip isolation with clear case.

14.2.13.3.7. Test switches for SEL-751 relay (Quantity = 1)

14.2.13.4. Misc. Equipment Scope of Supply for the Switchgear manufacturer

14.2.13.4.1. SEL-2814M0; Qty: 6

14.2.13.4.2. SEL-2812MRX0; Qty: 12

14.2.13.4.3. SEL02812MTX0; Qty: 12

14.2.13.4.4. SEL C808 cable; Various lengths; Qty: 12

### 14.2.14. Control Power

14.2.14.1. DC Control Power will be provided by a 125VDC UPS system within the switchgear building. Separate terminals for connection to switchgear DC control bus shall be supplied.

14.2.14.2. All control and PT secondary fuse blocks shall be range type pullout fuse blocks. Fuse blocks shall be accessible from the control side of the switchgear regardless of the position of the circuit breaker.

14.2.14.3. Each breaker's close, lockout and trip circuit shall be fused separately in each low voltage compartment. Any control or protective devices that are common to more than one breaker shall be on separately fused circuits. Minimum trip circuit fuse rating shall be 30 amps.

14.2.14.4. All contacts for control circuit devices shall be heavy-duty type, rated 600 volts, 20 amperes continuous, 10 amperes interrupting.

14.2.14.5. Breaker indicating lights shall be powered from the breaker trip circuit.

14.2.14.6. Each vertical section shall be provided with a breaker spring charging motor circuit "ON-OFF" toggle switch located in the low voltage compartment.

### 14.2.15. Bus Differential Protection

14.2.15.1. For 13kV Bus Differential protection, use relay part number:

0487B1X4X52XC0XE9EEEEEX, to be provided by switchgear manufacturer. NOTE: to be supplied with all required mounting hardware. Settings will be prepared by JEA.

- 14.2.15.2. ABB test switch for trip isolation with clear case. Type FT-19R, 3RU LO 30 Pole, 30 Potential Arranged (P P P P P P P P) (P P P P P P P P) (P P P P P P P P). Part number: FRXG-001-001-001 (Quantity=2).
- 14.2.15.3. Test switches for SEL-487B relay:
- Type FT-19R, Arranged (P P P C-C C-C C-C P) (P P P C-C C-C C-C P) (P P P C-C C-C C-C P). Part number: FRXG-014-014-014. (Quantity = 2)
  - Type FT-19R, Arranged (P P P C-C C-C C-C P) (P P P P P P P P) (P P P P P P P P). Part number: FRXG-014-001-001. (Quantity = 1)
- 14.2.15.4. Electro Switch type 24 LOR lockout relay with 7 decks.
- 14.2.15.5. Indicating Light, GE ET-16, 70Vac, LED Bulb, Clear Cap

## 15. HEATERS

Long life tubular heaters with suitable thermostat shall be supplied for each vertical section. Each heater shall be 500 Watts at 240V to produce 125 Watts at 120V and have low surface temperature. Each heater shall have a protective perforated metal cover. An external source within the switchgear building shall supply power to the heaters.

## 16. NAMEPLATES

- 16.1. Each cubicle for all main and feeder circuits shall be provided with 1/16-inch thick black phenolic engraved nameplates with white lettering. Size of the lettering is to be 1/4" minimum. Nameplates shall give item designation and circuit number, as well as, frame ampere size and the appropriate trip rating.
- 16.2. Each control component mounted within the assembly including fuse blocks, interior devices, etc. shall have an identification plate. Lettering shall be 1/4" minimum.
- 16.3. Test switch nameplates shall be placed directly above each test switch onto the control cabinet swing door and not onto the ABB test switch cover. Nameplates shall be aligned such that the nameplate description corresponds with each test switch pole and associated function.
- 16.4. All nameplates shall be secured with corrosion resistant screws or aluminum rivets.
- 16.5. Two 2 1/2" wide nameplates shall be provided for each vertical section: one to be installed on the breaker compartment door and one to be loose for buyer's use. The following format shall be used:
- 16.5.1. Line 1: 7/16" Letters ... Equipment Tag Number
- 16.5.2. Line 2: 7/16" Letters ... Description
- 16.5.3. Line 3: 7/16" Letters ... Description
- 16.6. One 2 1/2" wide master nameplate giving switchgear designation, voltage ampere rating, short circuit rating, Manufacturer's name, date of manufacture, general order number, and item number. Letters shall be 1/2" high.
- 16.7. A Mimic Bus engraved nameplate showing the entire one line switchgear diagram with all buses, circuit breakers, VTs, CTs, etc. shall be provided on one designated unit.
- 16.8. All doors and hinged bolted panels that allow access to high-voltage components or bus work shall have permanent warning labels mounted on them with the text "DANGER – HIGH VOLTAGE".
- 16.9. JEA shall provide the detailed information for the Annunciator Panel window labels.

- 16.10. Prior to shop fabrication, the Manufacturer shall provide and JEA shall approve complete nameplate information.

## 17. ACCESSORIES

- 17.1. Provide station class arresters for outgoing circuits connected to each feeder breaker. Arresters shall be gapless metal-oxide type with a nominal rating sized to meet the requirements of the project. The arrester shall be enclosed in a polymer housing. Arresters shall be designed and manufactured in accordance with the latest revision of ANSI/IEEE C62.11. Arresters shall be GE Tranquell type or approved equal.
- 17.2. Provide and install one (1) UPS system to be used as the 125VDC source of power for all switchgear relays and equipment where indicated. The UPS system shall be a SENS (Stored Energy Systems) 100AH, 120VAC input, 125 VDC/12ADC output system. This is a Single PowerCab 120 cabinet assembly containing battery, charger and DC distribution panel. Equipment shall be provided with standard input breaker and output filter to include a communications board with Modbus RS485 connection.
- 17.3. Provide and install one 19" communication equipment rack for use in installing fiber optic termination equipment. Installation shall include required conduit and cables for routing F/O cable interconnections between the switchgear auxiliary compartment RTAC units and the 125VDC source breaker at the UPS unit panel. The 125VDC circuit shall be terminated on a terminal block mounted on the equipment rack. The 19" communications rack shall be Chatsworth Products Part Number 55053-103. The rack shall be grounded to the switchgear ground bus.
- 17.4. One complete set of Manufacturer's standard accessories for test, inspection and operation shall be furnished. The following accessories, as a minimum, shall be supplied to facilitate handling, maintenance and operation, unless a particular item is not used with the selected design:
- 17.4.1. Breaker charging handle (2 furnished per lineup).
  - 17.4.2. Manual racking handle (2 furnished per lineup).
  - 17.4.3. Control jumper for checking breakers outside the stationary structure.
  - 17.4.4. Test stand for testing electrically operated breakers outside the stationary structure.
  - 17.4.5. A remote racking device shall be provided including push-button, motor operator and 25 feet of cable.
  - 17.4.6. Transport lifter as required and necessary to transfer the breakers.

## 18. PAINT/ FINISH

- 18.1. All steel structure members shall be cleaned, rinsed and phosphatized prior to painting.
- 18.2. The switchgear shall be painted with an electrostatically applied polyester powder with final baked on average thickness between 1.5 and 2.0 mils and meet ANSI requirements for indoor equipment.
- 18.3. All exterior surfaces of the switchgear assembly shall be ANSI 61 gray for indoor equipment and ANSI 70 gray for outdoor equipment as standard unless otherwise specified.
- 18.4. Finish shall have a minimum pencil hardness of 2H as tested per ASTM D3363 and shall pass the ASTM B117 Salt spray test for a minimum of 1500 hours.

## 19. HARDWARE

All bolting hardware is to be high tensile strength stainless steel where high currents are encountered to prevent excessive joint heat.

## 20. FACTORY TESTS

- 20.1. The Manufacturer shall perform factory tests at not less than standard NEMA, ANSI or IEEE values. Refer to the latest version of ANSI/IEEE C37.20.2, Paragraph 5.3. Additional factory tests as determined are required by the complexity of the assembly shall be performed to ensure that this product will be operationally correct and maximize reliability in operation.
- 20.2. Tests on the switchgear assembly shall be performed using three phase voltage and current and included, but not be limited to:
  - 20.2.1. Low Frequency Dielectric (5.3.1)
  - 20.2.2. Sequence (Control Circuit Continuity) (5.3.4.1/5.3.4.4)
  - 20.2.3. Low Frequency Withstand test on Major Insulation components and Control Wiring
  - 20.2.4. Control Wiring and Device Functional Check (5.3.4.2)
  - 20.2.5. Mechanical Operation (5.3.2)
  - 20.2.6. Polarity Verification (5.3.4.3)
  - 20.2.7. Grounding of Instrument Cases
- 20.3. Tests on the Breakers that shall be performed, but not limited to:
  - 20.3.1. Trip and Close Coil check
  - 20.3.2. Clearance and Mechanical Adjustment
  - 20.3.3. Electrical and Mechanical Operation
  - 20.3.4. Timing
  - 20.3.5. Conductivity of Current Path
  - 20.3.6. Hi-potential.
  - 20.3.7. Vacuum Bottle Integrity
- 20.4. Tests on the Protective Relaying that shall be performed, but not limited to:
  - 20.4.1. Protective relay test - will include the testing of each protective relay under the overload/fault/abnormal conditions simulated with the help of three phase voltage and current injection test set.
  - 20.4.2. Power on test - will apply rated voltages and currents to all continuous rated electrical items (such as aux-relays, indicating lamps meters, transducers, protective relays, communication modules, switches, etc.) mounted in the cell or supplied as loose items, for at least one continuous 24 hour period. In this test the PT and CT circuits will also be energized with equivalent voltages and currents for the same continuous 24 hour period.
  - 20.4.3. Meters test – will include the testing of each meter under 110% loading.
  - 20.4.4. Functional test – will include the functional test of each circuit breaker.

- 20.5. The Manufacturer shall check and align all mechanisms.
- 20.6. Each circuit in the high voltage portion, except the ones containing electronic components, shall be given insulation resistance tests with all the equipment connected.
- 20.7. A simulated operating test shall be conducted on each Controller. This test shall include steps that are necessary to determine that the relays, instrument transformers, interlocks, control systems, etc., are correctly wired and function correctly when energized.
- 20.8. The Manufacturer shall provide to the Project Engineer documents verifying completion of factory production tests prior to shipment.
- 20.9. Test procedures along with certificates of calibrations of test instruments traceable to National Institute of Standards and Technology, shall be submitted and approved prior to test.
- 20.10. The Manufacturer shall notify JEA in writing one month before the intended date for shipment and testing. JEA reserves the right to inspect the equipment during manufacture and prior to shipment. Such visits to the Manufacturer's plant will be at JEA's expense. JEA will not accept any charges for visiting the plant.
- 20.11. Equipment, apparatus, and material furnished shall be subject to factory tests and inspection by JEA's authorized representative. Such tests and inspection may be made during any stage of manufacture and any equipment, apparatus or material found unsatisfactory as to quality of workmanship will be rejected. Tests shall be in accord with applicable standards.
- 20.12. Every medium voltage draw-out circuit breaker element which will be used in the line-up shall be uncrated and inserted into the cubicles of said line-up for the purpose of verifying alignment, interlocks, and proper operation during ANSI production tests. After testing is complete, these breakers shall be packed into appropriate boxes to protect them against shipping damage.
- 20.13. Certified Test Reports of design and/or conformance in accord with the latest applicable standards shall be provided upon request. These tests shall have been made with a circuit breaker of the same Manufacturer specified and connected in the cubicle of the same design as being provided in accord with these specifications. The Manufacturer shall provide the JEA Project Engineer a certified test report covering all factory tests made on the equipment and insulating materials.

## 21. DRAWINGS

- 21.1. JEA will provide "typical" drawings to the switchgear Manufacturer as required to describe the desired protection and control schemes used in meeting the operational requirements for the substation. The intent is to provide the general arrangements/connectivity required. Using these drawings, the Manufacturer shall develop all detailed wiring and final AC and DC schematic drawings required throughout the switchgear. The Manufacturer shall fully develop the equipment drawings and incorporate them into the Final Equipment Submittal package for approval.
- 21.2. The following drawings will be provided for use by the Switchgear Manufacturer during the design of the wiring and installation of all metering, protective relays, and control devices:
  - 21.2.1. Main Breaker Cubicle – door layout showing proposed locations for relays, meters, control switches, lights, etc.
  - 21.2.2. Feeder Breaker Cubicle – door layout showing proposed locations for relays, meters, control switches, lights, etc.

- 21.2.3. Auxiliary Cubicle (where indicated) – door layout showing proposed location of station GPS clock and Communications Processor, when required.
- 21.2.4. AC Schematic – wiring of Protective relays and meters for each Main and Feeder Breaker position.
- 21.2.5. DC Schematic – wiring of Protective relays and meters for each Main and Feeder Breaker position.
- 21.2.6. Communication Processor Interconnection Schematic – interconnection of all switchgear devices and station GPS clock.

21.3. JEA Wiring Standards for Wiring Diagram Development

The following standards and procedures shall be used by the Switchgear Manufacturer for developing wiring diagrams:

21.3.1. Procedures for Device Designation:

21.3.1.1. List termination as shown on Typical Drawings included in Attachment A.

21.3.1.2. Label devices by levels.

Example: Level 1: “AB”, “AC”, “AD” ...

Level 2: “BA”, “BC”, “BD” ... Letters “U” and “R” as first character are reserved for fuses and resistors.

21.3.1.3. Do not use double letters for devices.

Example: Do not use “AA”, “BB”, “CC”, “DD” ...

21.3.1.4. Do not use “I”, “O” or “Z” as a letter to designate the devices.

Example: Do not use “AI”, “AO”, “OA”, “ZA” ...

21.3.1.5. Delete the device label “GB” (it is reserved for Ground Bus).

21.3.1.6. List each termination on a device separately.

Example: AB

1-AC1

1-AC2

1-AC3

And not like ...

AB

1-AC1, AC2, AC3

21.3.1.7. Fuses shall begin with “U” – Delete “UI”, “UO” and “UZ”.

21.3.1.8. Devices on sub-panels shall be labeled with the next available letter and shall be designated with dotted lines.

21.3.1.9. Resistors shall begin with “R” – Delete “RI”, “RO” and “RZ”.

21.3.1.10. Each pot light shall be given a separate device label. All other lights associated with devices shall share the devices’ label and be designated by the light’s color.



- 21.3.1.11. Devices on the sides of the cells shall be labeled in such a way as to continue the sequence of the device labels around the cell, so that no label is repeated.
- 21.3.1.12. The ground bus shall be designated as "GND BUS". Terminal blocks for landing control cable shields shall be identified as "shield wire bus".
- 21.3.1.13. The designation of the terminal blocks should be in the format aaXbb. "aa" is the two digit unit number. "X" is alphabet "A" to "Z" excluding the letters U, I, O, Q and X. "bb" is the terminal numbers of a block and sequential numbers starting from "1". No two terminals shall have the same designation.
- 21.3.1.14. Cell to cell wires shall go from Terminal Blocks only and not directly from devices and shall be listed by destination's Cell Number / Terminal Block Number.
- 21.3.1.15. When a device such as annunciator contains Terminal Blocks, the Terminal Blocks shall be labeled by position starting with "TB1". All Terminal Blocks of this device shall share the same device name.
- 21.3.1.16. List all the jumpers within the same device next to the termination listings.
- 21.3.1.17. List all light-device and light-light connections along with termination listing.
- 21.3.2. Procedure for Assigning Drawing Number
  - All protection and control drawings concerning this project shall be named as per the following standard practices:
    - 21.3.2.1. The drawing numbers will be comprised of three upper case characters followed by two digit numbers written in the following style: AAXNN.
    - 21.3.2.2. The first two characters (AA) designate the substation. The third character (X) will be selected from the following list:
      - A - AC Schematic Diagrams, Three Line Power Diagrams
      - D - DC Schematic Diagrams
      - I - Interconnection Diagrams
      - L - Layout and General Arrangement Diagrams
      - M - Equipment (Excluding control panels) Manufacturer's Diagrams
      - S - Single Line Diagrams
      - SS - Station Single Line Diagrams
      - W - Wiring Diagrams
      - C - Communications Diagrams
    - 21.3.2.3. The Project Engineer will sequentially allot two digit number (NN). The practice of using sheet numbers with the same drawing number will not be adopted under any circumstance.

#### 21.4. JEA Wiring Approval Process

- 21.4.1. Once wiring diagrams have been developed, the switchgear manufacturer will transmit wiring diagrams to JEA's Project Engineer in the latest MicroStation format and updated cable schedule in Microsoft Excel format as a standalone file or a table on the MicroStation drawing.
- 21.4.2. JEA's Project Engineer shall be responsible for providing feedback. After incorporating JEA's comments in the drawings, the Switchgear Manufacturer shall transmit the drawings to JEA for approval.
- 21.4.3. Once approval from JEA's Project Engineer has been received, the Switchgear Manufacturer will commence the wiring of the panels.
- 21.4.4. During wiring of the panel if any changes to previously approved drawing and cable packages are required, the Switchgear Manufacturer shall inform JEA's Project Engineer. JEA's Project Engineer shall be responsible to provide approval for the above changes.
- 21.4.5. Once approval is received from JEA's Project Engineer, the Switchgear Manufacturer shall proceed with the approved changes and provide JEA with updated electronic MicroStation drawings. Therefore, both JEA and the Switchgear Manufacturer will always have the most up to date design drawings.

## 22. SUBMITTALS

The Manufacturer shall provide copies of the following documents to JEA for review and evaluation in accordance with requirements of the General Conditions and this Technical Section. No work shall be done without both the approved drawings and a release for manufacture.

- 22.1. Product Data on a specified product. When requested by the Project Engineer, any descriptive bulletins or product sheets shall be submitted.
- 22.2. Shop Drawings, for approval and final submittal shall include the following at a minimum:

The following drawings shall be provided within Six (6) weeks after award of a PO:

  - 22.2.1. Master Drawing Index complete with dimensioned assembly drawing(s) showing General Plan, Elevation and Section Views of proposed switchgear arrangements showing dimensioned views and a floor plan, foundation details and one-line diagram.
  - 22.2.2. Plan view showing exact location and details of channel sill, anchor bolts and terminations of power bus and control cables.
  - 22.2.3. Dimensioned section cut drawings showing transformer-to-switchgear interconnection requirements.
  - 22.2.4. Elementary and schematic diagram.
  - 22.2.5. Total assembled switchgear and switchgear building weight as required for foundation design.
  - 22.2.6. Shipping split requirements.
  - 22.2.7. Switchgear layout plan drawings showing mounting and anchoring systems required including placement of JEA-provided power transformer relative to the associated switchgear. The Manufacturer shall provide a hoisting plan and instructions. Drawings

## Technical Specifications - 15kV Metal-Clad Switchgear with Arc Terminating Technology

shall show and detail the locations of feeder terminal compartments and openings/conduit entrance locations for outgoing, underground cables and locations of top-mounted 13kV power cable terminal arrangements.

- 22.2.8. Bill of Material listing all the devices and accessories to be furnished. The Bill of Material shall include complete identification and description of all the devices. Items, which are not manufactured by the switchgear Manufacturer, shall have the original Manufacturer's name and catalog number with other descriptive data.
- 22.2.9. After receipt of approval or as required by the project schedule, revised drawings with detailed control schematics and wiring diagrams shall be provided. Equipment shall be shown on the cubicle Wiring Diagram with the same relative position as shown on the Front View Drawing. On the Wiring Diagram, the rear view shall be shown for all equipment mounted on the front of the panel where space is available on the front of the panel. Shipping splits shall be shown on drawings of cubicles affected, clearly showing all connections to be made by JEA when installing switchgear.
- 22.2.10. Terminal block drawings shall show the installing contractor's field wiring connections. These test interconnecting wiring diagrams provided four weeks after receiving the relevant shop drawings from JEA's engineer. The engineer's cable schedule markings shall then be added to the Manufacturer's tracings and "as built" and connection drawings resubmitted.
- 22.2.11. Manufacturer shall assure that drawings are correct at date of switchgear shipment and that "as built" drawings are included as part of the instruction manuals.
- 22.2.12. Spare parts list.
- 22.2.13. Manufacturer shall furnish electronic copies of drawings in MicroStation and PDF format. The following drawings shall be provided within Twelve (12) weeks after award of a PO:
  - 22.2.14. Equipment assembly drawings.
  - 22.2.15. Additional details, as required, including, but not limited to showing the locations of internal/external power receptacles and lighting.
  - 22.2.16. Cubical internal wiring drawings and terminal block arrangements for each cubical. Wiring drawings shall include terminal block provisions required for required external connections to the transformer control cabinet including those for AC control power and protection and control connections.
  - 22.2.17. AC and DC schematics including, but not limited to showing all breaker internal elements, protective relays, control switches, lights and meters for each switchgear cubicle.
  - 22.2.18. Nameplate schedules
- 22.3. All revisions to the drawings shall be identified.
- 22.4. Certified copies of all Type (Design) and Verification Test Reports on the specified equipment.

## 23. PROJECT RECORD DOCUMENTS

- 23.1. Maintain an up-to-date set of Contract documents. Note all revisions and deviations that are made during the course of the project.
- 23.2. Provide three (3) copies of all final approved switchgear components, AC and DC schematics and wiring diagrams including all information listed in the Submittal section.
- 23.3. Provide three (3) copies of operating and maintenance manuals of all provided equipment. One set of operating and maintenance manuals shall be included with the equipment at the time of shipment. The operating and maintenance manuals shall include instruction books, leaflets, a recommended renewal parts list and equipment drawings.
- 23.4. Installation, operating and maintenance instructions shall cover all the equipment furnished including all protective relays, power fuses, auxiliary relays, etc. and shall include characteristic curves for each different current transformer, protective relay and power fuse.
- 23.5. Supply a flash drive with an electronic copy in PDF format of instruction books, operating manuals and "as-built" drawings for all provided equipment.
- 23.6. Supply all "as-built" drawings, schematics and wiring diagrams in MicroStation v8i and PDF format.
- 23.7. Please note that all manuals, drawings, instruction books, etc. shall be in English language only.

## 24. OPERATION AND MAINTENANCE DATA

- 24.1. Provide copies of installation, operation, and maintenance procedures to JEA in accordance with the requirements of the General Conditions and this Technical Section.
- 24.2. Submit operation and maintenance data based on factory and field testing, operation and maintenance of all switchgear equipment being provided.
- 24.3. Provide certified reproducible copies of factory test reports to be included with the manuals.
- 24.4. Provide final factory drawings in hardcopy and electronic format. The electronic copies must be provided using the most recent version of MicroStation and also PDF.

## 25. SHIPPING REQUIREMENTS

- 25.1. The switchgear manufacturer shall be responsible for the on-site delivery and mechanical installation of the sections of medium voltage switchgear, installation and wiring of the SENS DC power cabinet (UPS system) and installation of the 19" Communications panel within the switchgear building.
- 25.2. All equipment shall be shipped F.O.B. jobsite, freight prepaid and allowed to the project address in Jacksonville, FL.
- 25.3. The Manufacturer shall coordinate and schedule delivery of all equipment to the job site for off-loading.
- 25.4. At least six weeks prior to shipping the Manufacturer shall create and transmit to JEA a shipping schedule showing, at a minimum, the following information:
  - 25.4.1. Item Description (Breaker #)
  - 25.4.2. Shipping form (Crate, carton, pallet, etc.)
  - 25.4.3. Shipping Dimensions

## Technical Specifications - 15kV Metal-Clad Switchgear with Arc Terminating Technology

### 25.4.4. Gross Weight

### 25.4.5. Shipping Plan (route of delivery)

### 25.4.6. Date of Arrival

- 25.5. The shipping schedule should be per shipping vessel (truck) to assure that JEA's on-site representative knows exactly what is arriving and when it is to arrive. Any updates to the shipping schedule should be provided at least three business days in advance of delivery.
- 25.6. Equipment and accessories shall be labeled for shipment with a large (minimum 8 x 10) sheet in an obvious location on the outside of each of the shipping containers as follows:
- Owner name: JEA
  - Owner Order Number: (JEA Purchase Order #)
  - Owner Project Name: (To be determined)
  - Owner Contact: (To be determined)
  - Contents: (Vertical section, breaker, etc.)
- 25.7. Each container should be labeled and numbered so that they may be identified before being uncrated. Any items not fully assembled shall be packaged separately.
- 25.8. All equipment openings and entrances to internal wiring and control devices shall be protected against the entrance of dirt, dust, moisture, or any other element. All surfaces that may be subject to corrosion or oxidation should be protected per Manufacturer's recommendations. All connections shall be protected by metal covers to prevent damage during shipment.
- 25.9. All equipment shall be packaged for outdoor storage.
- 25.10. The Manufacturer shall include storage instructions that will minimize damage to the equipment and material. Storage requirements shall be site specific and as stringent as the most sensitive component requires.
- 25.11. Switchgear shall be provided with adequate lifting means. Handle in accordance with the Manufacturer's written instructions to avoid damaging equipment, installed devices and finish. Lift only by installed lifting eyes.
- 25.12. Adequate means for moving the units on rollers shall also be provided.
- 25.13. The equipment shall be ruggedly designed and braced to withstand shipment by truck or rail.
- 25.14. The Manufacturer shall prepare and crate all equipment and materials to protect them against damage in transit. The Manufacturer has the option to ship on a designated truck and not crating cubicles. The factory protection or cover must be maintained with heavy canvas or plastic to protect from dirt, water, construction debris and traffic.
- 25.15. Where equipment sections must be separated for shipment, all materials and equipment required to facilitate reassembly and reconnection of interconnecting bus work in the field shall be furnished. Wiring between equipment sections separated for shipment shall be brought to terminal blocks appropriately identified so only short jumper connections are required. These shall be furnished and identified by the Manufacturer for field assembly.
- 25.16. The Manufacturer shall provide procedures for delivery, storage, handling and preventative maintenance after receipt of the equipment on site.

- 25.17. The Manufacturer shall provide complete written instructions prior to shipping describing the necessary procedures to receive the material and equipment in a safe manner preventing injury to the receiving personnel and minimizing any damage to equipment.
- 25.18. Each group shall be bolted to skids and enclosed in a protective covering and be equipped to be handled by crane or industrial "fork" truck. Each group shall be a maximum of 4000 pounds.
- 25.19. All apparatus or equipment, not bolted to the housing structure and not forming a part thereof in shipment, shall be packed and crated separately. Circuit Breakers, accessories and installation materials shall be packed and crated separately. Detailed packing lists shall be provided.
- 25.20. Circuit breakers may be integrally shipped in their switchgear enclosures. If shipped separately, they shall be appropriately marked, boxed and protected against shipping and handling damage and shall be delivered to a designated point by JEA. They shall be inserted in the appropriate cubicles after each cell has been inspected and/or tested for mechanical performance. They are not to be considered an integral part of the stationary structure, but together they shall perform as outlined in this specification and the appropriate standards.
- 25.21. Deliver the switchgear building and medium voltage metal clad switchgear as one completed assembled unit. Shipping splits, if required, will be enclosed with a protective covering to prevent the entrance of dust and water. Shipping splits are to be limited to two (2) coupled compartments during transit. Temporary bracing to support the roof and wall structure to prevent damage during shipment shall be installed as required.
- 25.22. Provisions for anchoring on a level foundation will be provided.

## 26. FIELD ENGINEERING SERVICES

- 26.1. JEA requires that the Manufacturer's representative visit the site to review site conditions and delivery route prior to switchgear construction and installation. The site visit can be scheduled through the Project Engineer.
- 26.2. The switchgear manufacturer shall supply a field service technician for the complete installation, startup and final testing after equipment has been delivered. The total cost for the field service technician which shall include all travel and living expenses shall be provided in the bid.
- 26.3. The field service technician shall be a qualified technician having a minimum of five (5) years field experience in the installation, operation and maintenance of switchgear and associated equipment.
- 26.4. The field service technician shall be available to answer any installation questions that may arise.
- 26.5. The field service technician shall perform the following functions while on-site:
  - 26.5.1. Examine the installation area to assure there is enough clearance to install the switchgear.
  - 26.5.2. Check concrete pads for flat and level surface.
  - 26.5.3. Check and verify field measurements and locations of required switchgear anchors and feeder conduits are located as per Manufacturer's specific requirements.
  - 26.5.4. Verify that medium voltage metal-clad switchgear is ready to install and oversee the assembly of the equipment.
  - 26.5.5. Verify that any required utilities are available and in the proper location and ready for connection to the equipment.

## Technical Specifications - 15kV Metal-Clad Switchgear with Arc Terminating Technology

- 26.5.6. Inspect installed switchgear for anchoring, alignment, grounding and physical damage.
- 26.5.7. Check the tightness of all accessible electrical connections with a calibrated torque wrench. Refer to minimum acceptable values in the Manufacturer's instructions.
- 26.5.8. Measure and record phase-to-phase and phase-to-ground insulation resistance of each bus section. Megger for one minute for each measurement at the minimum voltage of 1000VDC. Measured insulation resistance shall be at least 500 megaohms.
- 26.5.9. Adjust all circuit breakers, switches, aisle access doors and operating handles for free mechanical and/or electrical operation as described in the Manufacturer's instructions.
- 26.5.10. Clean the interiors of the switchgear, switchboards, and panels to remove construction debris, dirt and shipping materials.
- 26.5.11. Repaint scratched or marred exterior surfaces to match the original finish.
- 26.5.12. Set relays in the field unless they were factory set or are to be set in the field by JEA or JEA's representative.
- 26.5.13. Perform resistance measurements through bolted electrical connections with a low resistance ohmmeter.
- 26.5.14. Perform insulation resistance tests on each pole of each circuit breaker, phase to phase and phase to ground with circuit breaker closed and across each open pole at 1,000 VDC for one minute. Measured insulation resistance shall be at least 500 Megaohms.
- 26.5.15. Perform contact resistance measurement across the closed contacts of each pole of each circuit breaker with a digital low resistance ohmmeter.
- 26.5.16. Perform vacuum bottle integrity test across each vacuum bottle with the circuit breaker in the open position. Follow manufactures recommendations for voltage, duration, and method.

## 27. TRAINING

The Manufacturer shall provide a training session for one (1) normal working day at the jobsite location determined by JEA. A Manufacturer's qualified representative shall conduct the training session. The training program shall include instructions on the assembly, circuit breaker, protective devices, and other major components.

## 28. SPARE PARTS

Provide a list of recommended spare parts for the equipment being purchased, including spare part pricing information. Pricing for optional items is to be covered under commercial terms and conditions.

## 29. MANUFACTURER'S WARRANTY

- 29.1. The Manufacturer shall act as a "single point" of responsibility for all components installed in the switchgear assembly that are not furnished by JEA.
- 29.2. This equipment shall be warrantied for a period of 5 years from startup date.

### 30. APPENDIX

- 30.1. JEA has provided assumptive sizing and clearances for each switchgear project in the Appendices. The Manufacturer will need to specify all required clear opening and clearances required for installation, operation, and maintenance of the switchgear.
- 30.2. JEA has specified the number of compartments required for each switchgear project, if more compartments are required, the manufacturer will need to work with JEA's design team on the proper location and switchgear compartment requirements.
- 30.3. Refer to the Appendices for Switchgear Building Requirements for each specific project. It is intended that the Georgia Street and Kennedy switchgear will be in its own building provided by the Switchgear manufacturer. The College Street switchgear will be housed in an existing JEA control house.
- 30.4. The following typical drawings shall be considered part of the specification:
- |        |                |
|--------|----------------|
| XX4A06 | AC Diagram     |
| XX4D18 | DC Diagram     |
| XX4D19 | DC Diagram     |
| XX4W05 | Wiring Diagram |
| XX4W06 | Wiring Diagram |

#### **Substation Projects Covered by these Specifications:**

JEA College Street Substation, 831 College Street, Jacksonville, FL 32204

JEA Georgia Street Substation, 664 Franklin Street, Jacksonville, FL 32202

JEA Kennedy Substation, 4215 Talleyrand Avenue, Jacksonville, FL 32206

#### **For each Substation Project, the following details will be provided by JEA:**

Substation Site Plan (current and final)

Switchgear Layout (current, progress (if applicable), and final)

Single Line (current, progress, final)

Switchgear Building Specification (if applicable)



