PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general conditions, Division 26, and Basic Electrical Materials and Methods (Section 260500) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.

B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

C. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.

D. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the Contractor.

E. Testing Agency Qualifications: Member company of NETA.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.2 SUMMARY

A. Section includes dead-front, SF6 switch

1.3 DEFINITIONS

A. BIL: Basic Impulse Insulation Level.

B. Bushing: An insulating structure including a central conductor, or providing a central passage for a conductor, with provision for mounting on a barrier, conducting or otherwise, for insulating the conductor from the barrier and conducting current from one side of the barrier to the other.

C. Bushing Elbow: An insulated device used to connect insulated conductors to separable insulated connectors on dead-front, pad-mounted switchgear and to provide a fully insulated connection. Also called an "elbow connector."

D. Bushing Insert: That component of a separable insulated connector that is inserted into a bushing well to complete a dead-front, load break or non-load break, separable insulated connector (bushing).

E. Bushing Well: A component of a separable insulated connector, either permanently welded or clamped to an enclosure wall or barrier, having a cavity that receives a replaceable component (bushing insert) to complete the separable insulated connector (bushing).

F. Fault Interrupter: A self-controlled mechanical switching device capable of making, carrying, and automatically interrupting an alternating current. It includes an assembly of control elements to detect overcurrents and control the fault interrupter. A fault interrupter always consists of a switching device, a control unit, and sensors for current and/or voltage sensing.

G. Hotstick: An insulated stick, usually made of fiberglass, that is used to work energized overhead conductors and operate electrical equipment that is overhead, underground, and compartmentalized.

H. NETA ATS: Acceptance Testing Specification.

I. SCADA: Supervisory control and data acquisition.

J. Way: A three-phase or single-phase circuit connection to the bus that may contain combinations of switches and protective devices or may be a solid bus.

1.4 SUBMITTALS

A. Submit shop drawings per Section 260500 for review including the following:
1. Switch detailed drawings
2. Switch ratings and test data
   a. Voltage.
   b. Continuous current.
   c. Short-circuit rating.
   d. BIL.
3. Mounting details
4. Fault current ratings
5. Singleline diagrams
6. Enclosure detailed drawings
7. Design Calculations: Seismic certification restraints.
8. Wiring Diagrams: For each switchgear assembly, include the following:
   a. Power, signal, and control wiring.
   b. Schematic diagrams showing connections to remote devices including SCADA remote terminal unit.
9. ISO 9001-2000 certification
10. Warranty
11. Qualification Data: For testing agency.
12. Seismic Qualification Certificates: For pad-mounted switchgear, from manufacturer.
   a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
13. Field quality-control reports.
14. Operation and Maintenance Data: For switchgear and switchgear components to include in emergency, operation, and maintenance manuals.
   a. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1) Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2) Time-current curves, including selectable ranges for each type of overcurrent protective device.
3) Record as-left set points of adjustable devices.

B. Coordination Drawings:
1. Utilities site plan, drawn to scale, showing heavy equipment or truck access paths for maintenance and replacement.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Switch manufacturer shall be Canada Power, G&W, S&C, or equal.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: The switchgear shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the switchgear will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Component Importance Factor: 1.25.
3. Component Amplification Factor: 2.5.
4. Component Response Modification Factor: 6.0.

B. Service Conditions:
1. Switchgear shall be suitable for operation under service conditions specified as usual service conditions in IEEE C37.20.3.

2.3 ELECTRICAL RATINGS AND STANDARDS

A. Switches are to be designed, tested, and built per applicable sections of ANSI C37.71-1987 and IEC 265-1. Certified test reports shall be provided confirming complete ANSI series test results. The switch assembly itself shall be rated:

1.	Max. design voltage, kV	15.5
2.	Impulse level (BIL), kV	95
3.	Open gap (BIL), kV	200
4.	Contr. & loadbreak, Amps	600
5.	1 min. withstand, AC kV	34
6.	15 min. withstand, DC kV	53
7.	Momentary asym, kA	40
8.	Fault-close asym, kA	40
9.	1 second RMS sym, kA	25
10.	Operating overload interrupting capability, A	3,000
11.	Operations load interrupt endurance at 610A	1,200
12.	Max. gas leak test, cc/sec	10 -7

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

C. Comply with IEEE C2.

D. Comply with IEEE C37.74.

2.4 SWITCH CONFIGURATION

A. Switches shall be designed for front access to cables and switch operators. Each switch shall have 3-phase load switch ways and/or 3-phase vacuum interrupter tapped ways as shown on the drawings.

2.5 SWITCH CONSTRUCTION

A. Weatherproof enclosure with an integral skid mounting frame, designed for mounting on a concrete pad, suitable to allow skidding or rolling of the switchgear in any direction, and with provision for anchoring the frame to the pad.

B. Enclosure Integrity: Comply with IEEE C57.12.28 for compartmentalized enclosures that contain energized electrical equipment in excess of 600 V that may be exposed to the public.

C. Corrosion Protection: Enclosure coating system shall be factory applied, meeting the requirements of IEEE C57.12.29, in manufacturer's standard color green.

D. Dead-front, front access switchgear.

E. Construct switchgear assembly with switched ways that have front-accessible terminations for cables entering from below and with manual operating provisions with a lineman's hotstick.

F. Viewing Windows: For each switch, located adjacent to manual operating devices, and positioned to show switch contact position.

G. Grounding: Provision to make grounding cable and wire connections at each way.

H. All switch components and entrances shall be assembled in a totally welded stainless steel tank comprised of 11 gauge tank walls and a 1/4" thick lid. Entrances shall be internally connected by copper conductors capable of handling momentary and continuous current duty. The switch shall contain no electrically floating metallic parts of components. 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.

2.6 STANDARD COMPONENTS

A. The following shall be included:
1. SF6 fill valve.
2. Two welded lifting eyes.
3. Welded or bolted, gasketed entrance bushings.
4. Gas pressure gauge and fill valve.
5. Grounding provisions for one 1/2"-3/4” ground connection per switch way plus provisions for one 1/2"-3/4” tank ground connection.
6. Stainless steel tank design using stainless steel and brass fasteners with no external aluminum parts.
7. Three-line diagram and stainless steel nameplate, permanently mounted.
8. Compression spring center.

9. 11 gauge stainless steel tank with 1/4" stainless steel lids.
10. Tank coating to be light gray (ASA 70) vinyl paint with primer, three mil thick minimum.
11. Padlockable operating mechanism with position indication.
12. 5" phase spacing.
13. 2" high mild steel mounting channel.
14. Phase designation nameplates.
15. Removable or fixed style operating handle(s).
16. Switch enclosure shall be factory standard finish (color: green) with one-year factory warranty.

2.7 CABLE ENTRANCES

A. Cable entrances shall be tested to ANSI/IEEE 386 and be 600A apparatus bushings.

2.8 SWITCH OPERATION

A. Each switching way shall be equipped with an internally mounted puffer-type 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. The mechanism shall use compression type springs to assure long life and reliability. All switch positions are to be clearly identified and padlockable. The operating mechanism shall be actuated from outside the switch tank by an external operating handle. The operating shaft shall be made of stainless steel for maximum corrosion resistance. A double “O” ring type operating shaft seal shall be used for a leak resistant, long life seal.

2.9 SWITCH CONTACTS

A. Switch contacts shall be puffer-type linear design and made of high-conductivity copper alloy with arcing tips of copper/tungsten alloy to assure permanent low resistance and to avoid sticking during operation. The contacts shall be designed so that:
1. Arcing does not occur in the area of main current interchange.
2. Contact pressure shall increase with increasing current flow.

B. The contact nozzle shall have a converging/diverging geometry which improves the flow of SF6 into the arc zone. Contact travel shall be three inches and have sufficient open contact separation to assure efficient arc extinction and to withstand field DC testing levels and maintain BIL levels. The stationary contacts shall be supported independent of the cable entrance bushings, eliminating possible misalignment resulting from tank deflections. Temperature rise shall not exceed ANSI C37.71 and IEC 265-1 standards for this type of device. Switch contacts shall be clearly visible in the open position with optional viewing windows.

2.10 MOUNTING FRAMES

A. Frames shall be of bolted galvanized steel construction.

2.11 OPTIONS

A. The following options shall be supplied:
   1. Provisions for keylock.
   2. Remote monitoring
   3. Viewing windows per switchway.
   4. Provisions for use identification plate.

2.12 WARNING LABELS AND SIGNS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for labels and signs.
   1. High-Voltage Warning Label: Self-adhesive warning signs on the outside of the high-voltage compartment door(s). Sign legend shall be "DANGER HIGH VOLTAGE" printed in two lines of nominal 2-inch (50 mm) high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background.
   2. Arc-Flash Warning Label: Self-adhesive warning signs on the outside of the high-voltage compartment door(s), warning of potential electrical arc-flash hazards and appropriate personal protective equipment required.

2.13 FACTORY PRODUCTION TESTING

A. Factory Tests: Comply with requirements in IEEE C37.60 and IEEE C37.74 for testing procedures.
   1. Circuit Resistance Test: Verify that switchgear contacts have been properly aligned and current transfer points have been properly assembled.
   2. Power-frequency dry withstand voltage test.
   3. Dielectric withstand test; one-minute dry power-frequency.
   4. Calibrate overcurrent devices for conformance to published time-current characteristic curves.
   5. Sealed Tank Leak Test:
      a. Comply with IEC 62271-1 for test procedure for switchgear using SF6.
      b. The test procedure for vacuum switchgear shall be as follows:
   6. Each vacuum tube shall be identified by its serial number. Its vacuum pressure level shall be tested by the manufacturer of the vacuum interrupter. Document the test results.
   7. After assembly of the switchgear way, test the vacuum pressure level of the vacuum tubes by the routine dielectric test across the open contacts. The test voltage shall be stated by the manufacturer. The dielectric test shall be carried out after the mechanical routine test.
   8. Operating tests shall verify the following:
      a. Switch position indicators and contacts are in the correct position for both the open and closed positions.
      b. Insulating medium quantity indicator (if provided) is functioning properly.
      c. Circuit configuration is shown correctly.
      d. Mechanical interlocks are in place and operative.
      e. Position and polarity of current transformers meets requirements.
      f. Control, secondary wiring, and accessory devices are connected correctly.

g. Devices and relays actually operate as intended. Circuits for which operation is not feasible shall be checked for continuity.

B. Bulk SF6 gas supply for each individual switch shall be tested for moisture content. Each individual switch shall undergo a mechanical operation check, leak test, and a moisture content check. Switch shall be factory filled with SF6 gas and AC Hi-Pot tested one minute phase-to-phase and phase-to-ground and across the open contacts. Circuit resistance shall be checked on all ways.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Upon delivery of switchgear and prior to unloading, inspect equipment for damage.
1. Examine tie rods and chains to verify they are undamaged and tight and that blocking and bracing are tight.
2. Verify that there is no evidence of load shifting in transit and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.
3. Examine switchgear for external damage, including dents or scratches in doors and sill, and termination provisions.
4. Compare switchgear and accessories received with the bill of materials to verify that the shipment is complete. Verify that switchgear and accessories conform to the manufacturer's quotation and Shop Drawings. If the shipment is not complete or does not comply with project requirements, notify the manufacturer in writing immediately.
5. Unload switchgear, observing packing label warnings and handling instructions.
6. Open compartment doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.

B. Handling:
1. Handle switchgear, according to manufacturer's recommendations; avoid damage to the enclosure, termination compartments, base, frame, and internal components. Do not subject switchgear to impact, jolting, jarring, or rough handling.
2. Transport switchgear upright to avoid internal stresses on equipment mounting assemblies. Do not tilt or tip switchgear.
3. Use spreaders or a lifting beam to obtain a vertical lift and to protect switchgear from straps bearing against the enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.
4. Do not damage structure when handling switchgear.

C. Storage:
1. Switchgear may be stored outdoors. If possible, store switchgear at final installation locations on concrete pads. If dry concrete surfaces are not available, use pallets of adequate strength to protect switchgear from direct contact with the ground. Ensure switchgear is level.
2. Protect switchgear from physical damage. Do not store switchgear in the presence of corrosive or explosive gases.
3. Store switchgear with compartment doors closed.

D. Examine roughing-in of conduits and grounding systems to verify the following:
   1. Wiring entries comply with layout requirements.
   2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders have to cross section barriers to reach load or line lugs.

E. Pre-Installation Checks:
   1. Verify removal of any shipping bracing after placement.

F. Verify that ground connections are in place and that requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at switchgear location.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Equipment Mounting:
   1. Install switchgear on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
   2. Comply with requirements for vibration isolation and seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

C. Install level and plumb, tilting less than 1.5 degrees when energized.

D. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and CEC.

E. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and IEEE C2.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
   1. For counterpoise, use tinned bare copper cable not smaller than No. 4/0 AWG, buried not less than 30 inches below grade interconnecting the grounding electrodes. Bond surge arrester and neutrals directly to the switchgear enclosure and then to the grounding electrode system with bare copper conductors, sized as shown. Keep lead lengths as short as practicable with no kinks or sharp bends.
   2. Fence and equipment connections shall not be smaller than No. 4 AWG. Ground fence at each gate post and corner post and at intervals not exceeding 10 ft.. Bond each gate section to the fence post using 1/8 by 1 inch flexible braided copper strap and clamps.
   3. Make joints in grounding conductors and loops by exothermic weld or compression connector.
   4. Terminate all grounding and bonding conductors on a common equipment grounding terminal on the switchgear enclosure.
   5. Complete the switchgear grounding and surge protector connections prior to making any other electrical connections.

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
   1. Maintain air clearances between energized live parts and between live parts and ground for exposed connections in accordance with manufacturer recommendations.
   2. Bundle associated phase, neutral, and equipment grounding conductors together within the switchgear enclosure. Arrange conductors such that there is not excessive strain on the connections that could cause loose connections. Allow adequate slack for expansion and contraction of conductors.

C. Terminate medium-voltage cables in incoming section of switchgear according to Section 260513 "Medium-Voltage Cables."

3.4 SIGNS AND LABELS

A. Comply with the installation requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."

B. Install warning signs as required to comply with OSHA 29 CFR 1910.269.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections as stipulated in Section 260400 “Acceptance Testing”.

END OF SECTION