

Notice to Bidders
ECSU Equipment Purchase: Pad Mounted Switches

Equipment Description

ECSU is seeking bids on the purchase of electrical distribution equipment. The following equipment bid includes only Pad Mounted Switches.

List of Pad Mounted Solid Dielectric Switches (6 in total):

Switch Name	Switch Type
SW-105	6-Way
SW-135	6-Way
SW-205A	6-Way
SW-215	6-Way
SW-220	6-Way
SW-225	6-Way

List of Pad Mounted Air Insulated Switches (10 in total):

Switch Name	Switch Type
SW-100	4-Way
SW-110	4-Way
SW-115	4-Way
SW-120	4-Way
SW-125	4-Way
SW-130	4-Way
SW-140	4-Way
SW-145	4-Way
SW-200	4-Way
SW-210	4-Way

The Pad Mounted Switches are supporting an overall Infrastructure upgrade project occurring on campus at ECSU. The owner reserves the right to add or subtract to this total based on the active design and available budget.

Project Site

The project is located on the main campus of Elizabeth City State University at 1704 Weeksville Rd, Elizabeth City, NC 27909.

Equipment Specifications

The equipment specifications are outlined in Appendix A, Air Insulated and Appendix B Solid Dielectric. This Specification can be found on the ECSU website, ([Design and Construction \(ecsu.edu\)](https://www.ecsu.edu/design-and-construction)) under the Business Opportunities tab. Please contact Ryan Strickland, restrickland@ecsu.edu for any issues.

Due Date

Bids are due by **2:00 pm on December 19, 2023**. **Proposals may be submitted electronically to DesignandConstruction@ecsu.edu and restrickland@ecsu.edu.**

Once bids have been received, a certified bid tab will be issued to all companies submitting.

Appendix A

ELIZABETH CITY STATE UNIVERSITY
INFRASTRUCTURE UPGRADES, PH1 AND PH2 –
SWITCH EQUIPMENT PRE-PURCHASE PACKAGE

MEDIUM-VOLTAGE PAD MOUNTED SWITCHES -
AIR INSULATED

SECTION 261329.1 - MEDIUM-VOLTAGE PAD MOUNTED SWITCHES – AIR INSULATED

***NOTE: THIS SPECIFICATION IS FOR THE PURCHASE OF THE PAD-MOUNTED SWITCHES. OFFLOADING, STORAGE, TESTING, AND INSTALLATION REQUIREMENTS AT THE PROJECT SITE ARE THE RESPONSIBILITY OF THE CONTRACTOR AND INCLUDED FOR REFERENCE ONLY.**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The pad-mounted gear shall consist of a single self-supporting enclosure, containing interrupter switches and power fuses with the necessary components, all completely factory-assembled and operationally checked. Switch terminals shall be equipped with bushings rated 600 amperes continuous, and fuse terminals shall be equipped with bushing wells rated 200 amperes continuous to provide for elbow connection. Bushings and bushing wells shall be mounted on the walls of the inner compartment and shall extend into termination compartments. Termination compartments shall be provided as follows: one for each three-phase switch and one for each three-phase set of fuses.

- B. **Quantity of 4-way pad-mounted switches: 10**

1.3 SUBMITTALS

- A. Product Data: For each type of switchgear and related equipment.
 - 1. Features, accessories, characteristics, and ratings for switches.
- B. Shop Drawings: For each type of switchgear and related equipment. Provide approval drawings for review by the owner and engineer. Release the equipment for production only once the drawings are approved by the owner and engineer. Provide final factory as-built drawings after the switches after shipment from the factory.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show method of field assembly and location and size of each field connection. Include the following:
 - a. Tabulation of installed devices with features and ratings.
 - b. Outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.
 - c. Drawing of cable termination compartments showing preferred locations for conduits and indicating space available for cable terminations.
 - d. Current ratings of buses.

- e. Short-time and short-circuit ratings of switchgear assembly.
- f. Nameplate legends.

2. Wiring Diagrams: For each type of switchgear and related equipment.

- a. Power, signal, and control wiring.
- b. Three-line diagrams of current and future secondary circuits showing device terminal numbers and internal diagrams.
- c. Diagrams showing connections of component devices and equipment.
- d. Schematic diagrams showing connections to remote devices.

C. Field quality-control test reports.

D. Material Test Reports: For each type of switchgear and related equipment

E. Operation and Maintenance Data: For switchgear and switchgear components to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

- 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain switchgear and switchgear components through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with IEEE C2.

1.5 DELIVERY, STORAGE, AND HANDLING

A. The switch manufacturer shall warehouse switches and only ship the switches to site when a minimum of 4 switches are available. This is to limit the number of times the contractor must mobilize to offload the switches at the site. **The pallets provided by the switch manufacturer for shipping are to have pressure treated plywood tops to prevent dirt contamination and animal entry during storage exposed to weather.**

B. Freight terms are to be FOB Destination, Freight Prepaid.

- C. Store switchgear indoors where possible in clean dry space with uniform temperature to prevent condensation. Protect switchgear from exposure to dirt, fumes, water corrosive substances, and physical damage. If stored in areas subjected to weather, cover switchgear to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchgear.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation at indicated ampere ratings for the following conditions:
 - 1. Ambient Temperature: Not exceeding 0-40 deg C.
 - 2. Altitude: Not exceeding 6600 feet.
- B. Interruption of Existing Utility Service: Do not interrupt utility service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility service according to requirements indicated:
 - 1. Notify Engineer and Owner no fewer than 30 days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner and Engineer's written permission.

1.7 COORDINATION

- A. Coordinate layout and installation of switchgear and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.8 WARRANTY

- A. The switch manufacturer shall warrant to the owner that each switch and all internal components and wiring is free from defects in material, design and workmanship and will provide reliable performance for a period of two years from the date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products by the following:
 - 1. S&C Electric Company

2. Eaton (Cooper Power Series)
3. Federal Pacific

2.2 MANUFACTURED UNITS

- A. Description: Factory assembled and tested, complying with IEEE C37.20.1.
- B. Ratings: Suitable for application in 3-phase, 60-Hz, multi-point grounded-neutral system.

2.3 LOAD BREAK PAD MOUNTED SECTIONALIZING SWITCHES

- A. The pad-mounted gear shall be in accordance with the one-line diagram and shall conform to the following specification.
- B. Padmount switches are rated at 600A, they will contain a combination of load break switches and fused tap ways. See description below.

1. Voltage Class: 12.47 kV (nominal), 17 kV (max), 95 kV BIL
2. Type: Padmount, Front and Rear Access
3. Number of ways (configuration): 4 way – 2 load break mainline ways /2 fused tap ways

a. Fuse size and speed to be provided by engineer prior to shipment of switches.

4. Continuous and load break rating: 600 Amp
5. Peak, peak withstand rating: 65,000 A
6. RMS Sym, one-sec, short-time withstand: 25,000 A
7. Bushings:

a. Provided by Contractor:

- 1) Line (ways 1 & 2) – 600 Amp dead break elbow connector, bushing adapter, 200 amp load break elbow tap plug (rated for 15kV), 200 amp insulated cap with ground (rated for 15kV).
- 2) Load (ways 3 & 4) – 200 amp load break bushing well inserts, 200 amp load break elbow connector, insulated parking bushings, 200 amp insulated cap with ground (rated for 15kV).

b. Provided by Switch Manufacturer.

- 1) Line (ways 1 & 2) – 600 Amp dead break bushing.
- 2) Load (ways 3 & 4) – 200 Amp bushing well.

8. Minimum Bushing Height: 24"
9. Enclosure: 14-gauge mild steel enclosure with 30" cable compartment, painted **Munsell Green – Munsell 7GY3.29/1.5**.
10. Faulted Circuit Indication will be provided on Way 1 and Way 2. FCI using three Power Delivery Products (PDP) FCI (296215-00), or similar, one PDP Automation Relay (496020-

003), and one PDP DA Lead per supervised way. (The Automation Relay will be mounted and wired at the factory. The FCI and the DA leads will be supplied as loose components for installation in the field by others.)

C. Compliance with Standards and Codes

1. The pad-mounted gear shall conform to or exceed the applicable requirements of the following standards and codes:
 - a. IEEE C37.74, IEEE C37.60, ANSI/IEEE 386, IEC60529, IEEE 592, ANSI/ IEEE C37.60.2 or equivalent, C37.60.1 or equivalent, IEC 60255-22, IEC 60255-21-1 or equivalent, IEC 60255-21-2 or equivalent. All portions of ANSI C57.12.28, covering enclosure integrity for pad-mounted equipment.
 - b. Article 710-21(e) in the National Electrical Code, which specifies that the interrupter switches in combination with power fuses shall safely withstand the effects of closing, carrying, and interrupting all possible currents up to the assigned maximum short-circuit rating.
 - c. All portions of ANSI, IEEE, and NEMA standards applicable to the basic switch and fuse components.

D. Enclosure Design

1. To ensure a completely coordinated design, the pad-mounted gear shall be constructed in accordance with the minimum construction specifications of the fuse and/or switch manufacturer to provide adequate electrical clearances and adequate space for fuse handling.
2. In establishing the requirements for the enclosure design, consideration shall be given to all relevant factors such as controlled access, tamper resistance, and corrosion resistance.

E. The fuse-mounting insulators shall be of an epoxy resin system with characteristics and restrictions as follows:

1. Adequate leakage distance established by test per IEC Publication 507, First Edition, 1975.
2. Adequate strength for short-circuit stress established by test.
3. Conformance with applicable ANSI standards.
4. Homogeneity of the epoxy resin throughout each insulator to provide maximum resistance to power arcs. Ablation due to high temperatures from power arcs shall continuously expose more material of the same composition and properties so that no change in mechanical or electrical characteristics takes place because of arc-induced ablation. Furthermore, any surface damage to insulators during installation or maintenance of the pad-mounted gear shall expose material of the same composition and properties so that insulators with minor surface damage need not be replaced.

F. High-Voltage Bus

1. Bus and interconnections shall withstand the stresses associated with short-circuit currents up through the maximum rating of the pad-mounted gear.

G. Ground-Connection Pads

1. A ground-connection pad shall be provided in each compartment of the pad-mounted gear.
2. The ground-connection pad shall be constructed of 3/8" thick steel, which shall be nickel plated and welded to the enclosure and shall have a short-circuit rating equal to that of the pad-mounted gear.
3. Ground-connection pads shall be coated with a uniform coating of an oxide inhibitor and sealant prior to shipment.
4. A 3/8" diameter copper rod connected to the ground-connection pad shall be provided in each termination compartment for switches and each termination compartment for bus. The rod shall extend across the full width of each compartment to allow convenient grounding of cable concentric neutrals and accessories and shall have a short-circuit rating equal to that of the pad-mounted gear. Continuous copper ground bus shall be provided across the full width of each termination compartment for fuses. For each fuse mounting, there shall be a ground ring made of 3/8" diameter copper rod bolted to the ground bus and placed to allow convenient grounding of cable concentric neutrals and accessories. Ground rings and bus shall have a short-circuit rating equal to that of the pad-mounted gear.

H. Bushing and Bushing Wells

1. Bushing and bushing wells shall conform to ANSI/IEEE Standard 386 (ANSI Standard C119.2).
2. Bushing and bushing wells shall be of a cycloaliphatic epoxy resin system with characteristics and restrictions as follows:
 - a. Operating experience of at least 10 years under similar conditions.
 - b. Adequate leakage distance for in-air application established by test per IEC Publication 507, First Edition 1975.
 - c. Adequate strength of short-circuit stress established by test.
 - d. Conformance with applicable ANSI standards
 - e. Homogeneity of the cycloaliphatic epoxy resin throughout each bushing or bushing well to provide maximum resistance to power arcs. Ablation due to high temperatures from power arcs shall continuously expose more material of the same composition and properties so that no change in mechanical or electrical characteristics takes place because of arc-induced ablation.
3. Bushing and bushing wells shall be mounted in such a way that the semiconductive coating is solidly grounded to the enclosure.
4. Bushing rated 600 amperes continuous shall have a removable threaded stud so that the bushings are compatible with all 600-ampere elbow systems-those requiring a threaded stud as well as those that do not.

I. Enclosure

1. The pad-mounted gear enclosure shall be of unitized monocoque (not structural-frame-and-bolted-sheet) construction to maximize strength, minimize weight, and inhibit corrosion.
2. The basic material shall be 11-gauge hot-rolled, pickled and oiled steel sheet.
3. All structural joints and butt joints shall be welded, and the external seams shall be ground flush and smooth. The gas-metal-arc welding process shall be employed to eliminate alkaline residues and to minimize distortion and spatter.
4. To guard against unauthorized or inadvertent entry, enclosure construction shall not utilize any externally accessible hardware.
5. The base shall consist of continuous 90-degree flanges, turned inward and welded at the corners, for bolting to the concrete pad.
6. The door openings shall have 90-degree flanges, facing outward, that shall provide strength and rigidity as well as deep overlapping between doors and door openings to guard against water entry.
7. Enclosure top side edges shall overlap with roof side edges to create a mechanical maze which shall allow ventilation to help keep the enclosure interior dry while discouraging tampering or insertion of foreign objects.
8. A heavy coat of insulating "no-drip" compound shall be applied to the inside surface of the roof to minimize condensation of moisture thereon.
9. Insulating interphase and end barriers of NEMA GPO3-grade fiberglass-reinforced polyester shall be provided for each interrupter switch and each set of fuses where required to achieve BIL ratings. Additional insulating barriers of the same material shall separate the front compartments from the rear compartments and isolate the tie bus (where furnished).
10. Full-length steel barriers shall separate side-by-side compartments.
11. Lifting tabs shall be removable. Sockets for the lifting-tab bolts shall be blind-tapped. A resilient material shall be placed between the lifting tabs and the enclosure to help prevent corrosion by protecting the finish against scratching by the tabs. To further preclude corrosion, this material shall be closed-cell to prevent moisture from being absorbed and held between the tabs and the enclosure in the event that lifting tabs are not removed.
12. A steel-compartmented, base spacer shall be provided to increase the elevation of live parts in the pad-mounted gear above the mounting pad by 24 inches.

J. Door

1. Doors shall be constructed of 11-gauge hot-rolled, pickled and oiled steel sheet.
2. Door-edge flanges shall overlap with door-opening flanges and shall be formed to create a mechanical maze that shall guard against water entry and discourage tampering or insertion of foreign objects but shall allow ventilation to help keep the enclosure interior dry.
3. Doors shall have a minimum of two extruded-aluminum hinges with stainless-steel hinge pins and interlocking extruded-aluminum hinge supports for the full length of the door to provide strength, security, and corrosion resistance. Mounting hardware shall be stainless steel or zinc-nickel-plated steel and shall not be externally accessible to guard against tampering.

4. In consideration of controlled access and tamper resistance, each door (or set of double doors) shall be equipped with an automatic three-point latching mechanism.
5. The latching mechanism shall be spring loaded and shall latch automatically when the door is closed. All latch points shall latch at the same time to preclude partial latching.
6. A pentahead socket wrench or tool shall be required to actuate the mechanism to unlatch the door and, in the same motion, recharge the spring for the next closing operation.
7. The latching mechanism shall have provisions for padlocking that incorporate a means to protect the padlock shackle from tampering and that shall be coordinated with the latches such that:
 - a. It shall not be possible to unlatch the mechanism until the padlock is removed, and
 - b. It shall not be possible to insert the padlock until the mechanism is completely latched closed.
8. Doors providing access to solid-material power fuses shall have provisions to store spare fuse units or refill units.
9. Each door shall be provided with a zinc-nickel-plated steel door holder located above the door opening. The holder shall be hidden from view when the door is closed, and it shall not be possible for the holder to swing inside the enclosure.

K. Finish

1. Full coverage at joints and blind areas shall be achieved by processing enclosures independently of components such as doors and roofs before assembly into the unitized structures.
2. All exterior seams shall be filled and sanded smooth for neat appearance.
3. To remove oils and dirt, to form a chemically and anodically neutral conversion coating to improve the finish-to-metal bond, and to retard underfilm propagation of corrosion, all surfaces shall undergo a thorough pretreatment process comprised of a fully automated system of cleaning, rinsing, phosphatizing, sealing, drying, and cooling before any protective coatings are applied. By utilizing an automated pretreatment process, the enclosure shall receive a highly consistent thorough treatment, eliminating fluctuations in reaction time, reaction temperature, and chemical concentrations.
4. After pretreatment, protective coatings shall be applied that shall help resist corrosion and protect the steel enclosure. To establish the capability to resist corrosion and protect the enclosure, representative test specimens coated by the enclosure manufacturer's finishing system shall satisfactorily pass the following tests:
 - a. 4000 hours of exposure to salt-spray testing per ASTM B 117 with:
 - b. Underfilm corrosion not to extend more than 1/32" from the scribe as evaluated per ASTM D 1645, Procedure A, Method 2 (scraping); and
 - c. Loss of adhesion from bare metal not to extend more than 1/8" from the scribe.
 - d. 1000 hours of humidity testing per ASTM D 4585 with no blistering as evaluated per ASTM D 714.
 - e. 500 hours of accelerated weathering testing per ASTM G 53 using lamp UVB-313 with no chalking as evaluated per ASTM D 659, and no more than 10% reduction of gloss as evaluated per ASTM D 523.

- f. Crosshatch adhesion testing per ASTM D 3359 Method B with no loss of finish.
 - g. 160-inch-pound impact adhesion testing per ASTM D 2794 with no chipping or cracking.
 - h. Oil resistance testing consisting of a 72-hour immersion bath in mineral oil with no shift in color, no streaking, no blistering, and no loss of hardness.
 - i. 3000 cycles of abrasion testing per ASTM 4060 with no penetration to the substrate.
5. Certified test abstracts substantiating the above capabilities shall be furnished upon request.
 6. After the finishing system has been properly applied and cured, welds along the enclosure bottom flange shall be coated with a wax-based anticorrosion moisture barrier to give these areas added corrosion resistance.
 7. A resilient closed-cell material, such as PVC gasket, shall be applied to the entire underside of the enclosure bottom flange to protect the finish on this surface from scratching during handling and installation. This material shall isolate the bottom flange from the alkalinity of a concrete foundation to help protect against corrosive attack.
 8. After the enclosure is completely assembled and the components (switches, fuses, bus, etc.) are installed, the finish shall be inspected for scuffs and scratches. Blemishes shall be touched up by hand to restore the protective integrity of the finish.
 9. To guard against corrosion, all hardware (including door fittings, fasteners, etc.), all operating-mechanism parts, and other parts subject to abrasive action from mechanical motion shall be of either nonferrous materials, or galvanized or zinc-nickel-plated ferrous materials. Cadmium-plated ferrous parts shall not be used.
- L. The switch shall have parking stands for all bushings.
 - M. Provide adequate depth for bushings rated 600 A continuous to accommodate two 600 A elbows mounted piggyback, encapsulated surge arresters or grounding elbows mounted on 600 A elbows having 200 A interfaces.
 - N. The padmount enclosure shall be 11 gauge galvanized steel with 27" cable compartment. It shall meet ANSI C37.72 & C57.12.28 standards.
 - O. The enclosure shall include ½" 13 NC grounding provisions.
 - P. The switch shall have windows to verify OPEN/CLOSED indicator position with green/OPEN and red/CLOSED.

2.4 LABELING

- A. Hazard Alerting Signs
 1. The exterior of the pad mount enclosure (if furnished) shall be provided with "Warning--Keep Out--Hazardous Voltage Inside--Can Shock, Burn, or Cause Death" signs. Each unit of switchgear shall be provided with a "Danger--Hazardous Voltage--Failure to Follow These Instructions Will Likely Cause Shock, Burn, or Death" sign. The text shall further indicate that operating personnel must know and obey the employer's work rules, know the

hazards involved, and use proper protective equipment and tools to work on this equipment. Each unit of switchgear shall be provided with a “Danger--Keep Away--Hazardous Voltage--Will Shock, Burn, or Cause Death” sign.

B. Nameplates Ratings Labels, and Connections Diagrams

1. Each unit of switchgear shall be provided with a nameplate indicating the manufacturer’s name, catalog number, model number, date of manufacture, and serial number. Provide two nameplates with one installed on the interior of the switch and one on the exterior. Each unit of switchgear shall be provided with a ratings label indicating the following: voltage rating; main bus continuous rating; short-circuit rating.

2.5 SOURCE QUALITY CONTROL

A. Before shipment of equipment, perform the following tests and prepare test reports:

1. Production tests on completed switchgear assembly according to IEEE C37.20.2, Section 5.3.

B. Prepare equipment for shipment.

1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.

PART 3 - EXECUTION

3.1 Contractor to coordinate with construction manager on delivery of switch from local storage yard to project site. Contractor shall pick up, transport switch to site, and off load onto concrete pad.

3.2 EXAMINATION

- A. Examine elements and surfaces to receive switchgear for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchgear units and components.

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification of Electrical Systems."

3.5 CONNECTIONS

- A. Cable terminations at switchgear are specified in Division 26 Section "Medium-Voltage Cables."
- B. Install equipment grounding conductors for switchgear with ground continuity to main electrical ground bus.
- C. Tighten bus joints, electrical connectors, and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified 3rd part testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
 - 1. Perform each related electrical test and visual and mechanical inspection stated in NETA ATS-2017 7.5.1.2. Certify compliance with test parameters. Optional tests are not required to be performed.
 - 2. Perform all tests recommended by manufacturer instructions.
 - 3. Perform the following:
 - a. Test grounding connections at each connection to the equipment ground bus with a low resistance ohmmeter with test leads connected to the bare ground conductors and the switch ground bus.
 - 4. Submit certified written report of results to Engineer and Owner.
- B. Site Acceptance Testing: Support site acceptance testing as described in spec section 019113.
- C. Remove and replace malfunctioning units and retest as specified above.

3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of switchgear. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair damaged finishes.

END OF SECTION 261329.1

Appendix B

ELIZABETH CITY STATE UNIVERSITY
INFRASTRUCTURE UPGRADES, PH1 AND PH2 –
SWITCH EQUIPMENT PRE-PURCHASE PACKAGE

MEDIUM-VOLTAGE PAD MOUNTED SWITCHES – SOLID DIELECTRIC

SECTION 261329.2 - MEDIUM-VOLTAGE PAD MOUNTED SWITCHES – SOLID DIELECTRIC

***NOTE: THIS SPECIFICATION IS FOR THE PURCHASE OF THE PAD-MOUNTED SWITCHES AND THE ASSOCIATED FACTORY TESTING. OFFLOADING, STORAGE, TESTING, AND INSTALLATION REQUIREMENTS AT THE PROJECT SITE ARE THE RESPONSIBILITY OF THE CONTRACTOR AND INCLUDED FOR REFERENCE ONLY.**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The pad- mounted gear shall be in accordance with the one-line diagram and shall conform to the following specification.
- B. The switchgear shall consist of freestanding, self-supporting, pad mounted switchgear, complete with solid dielectric insulated remote operated load break switches and resettable vacuum fault interrupter electronically controlled, bushings and bus terminals. No SF6 gas shall be allowed.
- C. **Quantity of 6-way pad-mounted switches: 6**

1.3 SUBMITTALS

- A. Product Data: For each type of switchgear and related equipment.
 - 1. Features, accessories, characteristics, and ratings for individual interrupter switches.
- B. Shop Drawings: For each type of switchgear and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show method of field assembly and location and size of each field connection. Include the following:
 - a. Tabulation of installed devices with features and ratings.
 - b. Outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.
 - c. Drawing of cable termination compartments showing preferred locations for conduits and indicating space available for cable terminations.
 - d. Current ratings of buses.
 - e. Short-time and short-circuit ratings of switchgear assembly.

- f. Nameplate legends.
2. Wiring Diagrams: For each type of switchgear and related equipment.
 - a. Power, signal, and control wiring.
 - b. Three-line diagrams of current and future secondary circuits showing device terminal numbers and internal diagrams.
 - c. Diagrams showing connections of component devices and equipment.
 - d. Schematic diagrams showing connections to remote devices.
- C. Field quality-control test reports.
- D. Material Test Reports: For each type of switchgear and related equipment.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For switchgear and switchgear components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures," 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.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain switchgear and switchgear components through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C2.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. The switch manufacturer shall warehouse switches and only ship the switches to site when a minimum of 2 switches are available. This is to limit the number of times the contractor must mobilize to offload the switches at the site. **The pallets provided by the switch manufacturer for shipping are to have pressure treated plywood tops to prevent dirt contamination and animal entry during storage exposed to weather.**
- B. Freight terms are to be FOB Destination, Freight Prepaid.
- C. Store switchgear indoors where possible in clean dry space with uniform temperature to prevent condensation. Protect switchgear from exposure to dirt, fumes, water corrosive substances, and physical damage. If stored in areas subjected to weather, cover switchgear to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchgear.
 - 1. Switch Manufacturer shall provide factory punched holes 1” in diameter into the bottom of the external LVE cabinet to allow for installation of temporary power to battery charger. Factory to provide weathertight plugs to re-seal holes after temporary power has been removed.
 - 2. Contractor to install 120VAC connections to battery chargers in the two switch operator cabinets as well as the electric space heater located in the low voltage control cabinet. ECSU to provide source for 120V circuit(s) and the contractor shall make the final connections at the switches.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation at indicated ampere ratings for the following conditions:
 - 1. Ambient Temperature: Not exceeding 0-40 deg C.
 - 2. Altitude: Not exceeding 6600 feet.
- B. Interruption of Existing Utility Service: Do not interrupt utility service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility service according to requirements indicated:
 - 1. Notify Engineer and Owner no fewer than 30 days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner and Engineer's written permission.

1.7 COORDINATION

- A. Coordinate layout and installation of switchgear and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Provide products by the following:
 - 1. Solid dielectric insulated load break switches and resettable, electronically controlled vacuum fault interrupter ways:
 - a. S&C Electric Company
 - b. G&W Electric, Inc.
 - c. Eaton

2.2 MANUFACTURED UNITS

- A. Description: Factory assembled and tested, and complying with IEEE C37.20.1.
- B. Ratings: Suitable for application in 3-phase, 60-Hz, and grounded-neutral system.
- C. System Voltage: 12.47 kV (nominal), 17 kV (max), 95 kV BIL

2.3 15KV PAD MOUNTED SECTIONALIZING SWITCHES

- A. The pad-mounted gear shall be in accordance with the one-line diagram and shall conform to the following specification.
- B. 15kV rated padmount switches rated for 600A, they will contain vacuum fault interrupters.
 - 1. Voltage Class: 12.47 kV (nominal), 17 kV (max), 95 kV BIL
 - 2. Type: Padmount, Front Access
 - 3. Number of ways (configuration): 6
 - 4. Main Bus:
 - a. Continuous Current, Amperes – 600
 - b. Short-Circuit Current, Amperes, RMS, Symmetrical – 16,000
 - 5. Three-Pole Load-Interrupter Switches (Ways 1 & 2)

- a. Continuous Current, Amperes – 600
 - b. Live Switching: Load Splitting and Load Dropping Current, Amperes – 600
 - c. Momentary and Three-Second, Short-Time Withstand Current, Amperes, RMS, Symmetrical – 16,000
 - d. Three-Time Duty Cycle Fault Making Current, Amperes, RMS, Symmetrical –16,000
6. Fault Interrupters (Ways 3, 4, 5, 6)
- a. Continuous Current, Amperes - 200
 - b. Live Switching: Load Splitting and Load Dropping Current, Amperes – 200
 - c. Short-Circuit Interrupting Current, Amperes, RMS, Symmetrical – 12,500
7. The momentary and two-time duty-cycle fault-closing ratings of switches, momentary rating of bus, interrupting ratings of fuses, and one-time duty-cycle fault-closing capabilities of fuses with integral load interrupters shall equal or exceed the short-circuit ratings of the pad-mounted gear.
8. Bushings:
- a. Three-Pole Load-Interrupter Switches (Ways 1 & 2): 600-ampere bushing adapters with threaded studs.
 - b. Fault Interrupters (Ways 3, 4, 5, 6): Provide 200-ampere bushing-well adapters.
 - c. All bushings and bushing-well adapters shall be replaceable in the field.
 - d. Bushing and bushing-well adapters shall have a semi-conductive coating.
 - e. Bushing and bushing-well adapters shall have a separate drain wire or other equivalent means to ensure they are solidly grounded to the switchgear assembly.
9. Minimum Bushing Height: 24"
10. Enclosure: 11-gauge mild steel enclosure with 30" cable compartment, painted Munsell Green – Munsell 7GY3.29/1.5.
11. Motor operators shall be provided for all ways.
12. Test switches for CT's and Voltage Sensors for ways 1 and 2.
13. Outdoor rated mild steel control cabinet(s) housing:
- a. One (1) SEL 451 Protection, Control and Automation System relay, or similar, and (1) SEL 2725 Ethernet switch, or similar, with single mode fiber- optic ports.
 - 1) 04515215XB1X1H641412X
 - 2) 2725D03X1
 - b. Provide two fiber optic termination patch panel similar to Corning "SPH-CS12-A9-P00RE" mounted to backplane of low voltage controls cabinet. Include duplex LC adapters.
 - c. Provide single mode fiber optic jumpers from patch panel to fiber ports of ethernet switch.
 - d. Battery backup and 120 VAC input power supply.
14. Low voltage enclosure(s) on side of switch to house control cabinet(s).
15. Underground Fault Circuit Indicators and Distribution Automation Relay

- a. Faulted Circuit Indication will be provided on fault interrupter ways (Ways 3, 4, 5 & 6). FCI using three Power Delivery Products (PDP) FCI (296215-00), or similar, one PDP Automation Relay (496020-003), and one PDP DA Lead per supervised way. (The Automation Relay will be mounted and wired at the factory. The FCI and the DA leads will be supplied as loose components for installation in the field by others.)
16. Remote open and close capability for all ways.
 17. Switch position indication for all ways.
 18. Voltage Sensors shall be provided on Way 1 and Way 2.
 19. Overcurrent Control
 - a. Provide microprocessor-based overcurrent control to initiate fault interruption for ways 3, 4, 5, 6.
 - b. Mount control in watertight enclosure. Control removable in field without taking gear out of service.
 - c. Provide field-programmable control settings using a personal computer connected via data port to control. Locate data port accessible from exterior of enclosure.
 - d. Provide integral current transformers for power and sensing for control.
 - e. Minimum total clearing time (from initiation of fault to total clearing) for fault interruption shall be 40 milliseconds (2.4 cycles) at 60 Hz or 44 milliseconds (2.2 cycles) at 50 Hz.
 - f. Control shall feature time-current characteristic (TCC) curves including standard E-speed, K-speed, coordinating-speed tap, coordinating-speed main curves, and relay curves per IEEE C37.112-1996. Coordinating-speed tap curves shall optimize coordination with load-side weak-link/backup current-limiting fuse combinations, and coordinating-speed main curves to optimize coordination with tap-interrupter curves.
 - g. Provide standard E-speed curve phase-overcurrent settings ranging from 25E through 400E. Standard K-speed curve phase-overcurrent settings ranging from 25K through 200K. Coordinating-speed tap curve phase-overcurrent and independent ground-overcurrent settings ranging from 50 A through 400 A. Coordinating-speed main curve phase-overcurrent and independent ground-overcurrent settings ranging from 100 A through 800 A
- C. Certification of Ratings
1. The manufacturer of the pad-mounted gear shall be completely and solely responsible for the performance of the basic switch as well as the complete integrated assembly as rated.
 2. The manufacturer shall furnish certification of ratings of the basic switch and/or the integrated pad-mounted gear assembly consisting of the switch in combination with the enclosure.
- D. Compliance with Standards and Codes
1. The manufacturer of the pad-mounted gear shall be completely and solely responsible for the performance of the basic switch as well as the complete integrated assembly as rated.

2. The manufacturer shall furnish certification of ratings of the basic switch and/or the integrated pad-mounted gear assembly consisting of the switch in combination with the enclosure.
- E. Compliance with Standards and Codes
1. The pad-mounted gear shall conform to or exceed the applicable requirements of the following standards and codes:
 - a. IEEE C37.74, IEEE C37.60, ANSI/IEEE 386, IEC60529, IEEE 592, ANSI/ IEEE C37.60.2 or equivalent, C37.60.1 or equivalent, IEC 60255-22, IEC 60255-21-1 or equivalent, IEC 60255-21-2 or equivalent. All portions of ANSI C57.12.28, covering enclosure integrity for pad-mounted equipment.
 - b. All portions of ANSI, IEEE, and NEMA standards applicable to the basic switch components.
- F. The switch shall be a dead-front design. The operating mechanism housing shall be stainless steel with a viewing window for verification of vacuum interrupter contact position. The mechanism housing shall be painted light grey. Operating handles shall be padlockable and adaptable to keylock schemes. The operating shaft shall be stainless steel providing maximum corrosion resistance.
- G. The solid dielectric modules must be coated with a semi-conductive layer of epoxy, providing a completely dead front device. The semi-conductive layer must be tested to IEEE 592 to ensure it can carry fault current to ground so as to ensure operator safety.
- H. All ways of the switch shall be equipped with an integral blade type disconnect switch incorporated within the solid dielectric module to provide a true visible break. The visible break switch shall be in series with the vacuum interrupter and provide a clear three-phase visible break of the circuit. The visible break must be easily seen through a viewing window molded as an integral part of each solid dielectric module.
- I. The switch shall interrupt all load and fault currents within the vacuum bottle. The switch shall include two mechanical interlocks, one external and one internal, for safe operation.
- J. Each switch mechanism shall consist of three individual vacuum bottle assemblies mechanically linked to an operating mechanism.
- K. Load Interrupter Ways
1. Load-interrupter ways shall use a vacuum interrupter in series with a manually operated two-position isolating disconnect for three-pole live switching of 600-ampere three-phase circuits.
- L. Fault Interrupter Ways
1. Fault interrupter ways shall use a vacuum interrupter in series with a manually operated two-position isolating disconnect for three-pole load switching of 200-ampere circuits and fault interrupting through 16 kA symmetrical at 17.5 kV.

2. Fault interrupters shall be trip-free (the opening spring is charged when the closing spring is charged) and will open the fault interrupter automatically based on the TCC curve in the overcurrent control.
- M. All ways shall be equipped with one auxiliary form C contact on the visible break mechanism wired to the control cabinet for use by the control.
- N. The switch shall have two form C contacts for remote monitoring of the position of the vacuum bottle contacts on each way for use by the control.
- O. The switch shall be designed for front access to cables and operators.
- P. The switch shall have parking stands for all bushings.
- Q. Provide adequate depth for bushings rated 600 A continuous to accommodate two 600 A elbows mounted piggyback, encapsulated surge arresters or grounding elbows mounted on 600 A elbows having 200 A interfaces.
- R. The padmount enclosure shall be 11 gauge galvanized steel with 27" cable compartment. It shall meet ANSI C37.72 & C57.12.28 standards.
- S. The enclosure shall include ½" 13 NC grounding provisions.
- T. The switch shall have a 3" diameter circular viewing windows to verify OPEN/CLOSED indicator position with green/OPEN and red/CLOSED.
- U. Motor Operators
1. Provide motor operators for local or remote operation on all ways.
 2. Auxiliary contacts wired to the motor operators to track the position of the isolating disconnect.
 3. Operating times to open or close a load-interrupter switch or fault interrupter shall be no longer than 3 seconds.
 4. It shall be possible to easily decouple motor operators, by hand or using a shotgun clamp stick, from load-interrupter switches and fault interrupters to allow testing of the motor operator, the control scheme, or both.
 5. It shall not be possible to recouple a motor operator to a load-interrupter switch or fault interrupter when the two devices are not in the same position (open or closed).
 6. Control power for motor operators shall be provided from internal source.

2.4 VACUUM INTERRUPTER CONTROL

- A. Batteries
1. Battery

- a. Battery shall be Valve Regulated Lead Acid (VRLA) type, rated for -40 deg C to 50 deg C
 - b. Battery system shall be sized by switchgear manufacturer to operate motor operators and control power.
 - c. Battery system shall be 2 x 12VDC batteries in series – 24VDC.
2. Battery Charger
- a. Alarm Contacts wired to SEL-451 relay.
 - b. Powered internally. Minimum 20VA input to charge and battery packs.
3. Battery system shall be housed in low voltage compartment, attached to pad mounted switchgear.
4. Provide local disconnect within low voltage compartment for input source to battery system.

2.5 POINTS LIST

RELAY I/O (HARDWIRED)	
IN101	WAY 1 CLOSED INDICATION (MOTOR OPERATOR POSITION)
IN102	WAY 1 OPEN INDICATION (MOTOR OPERATOR POSITION)
IN103	WAY 1 VACUUM LOAD INTERRUPTER CLOSED INDICATION
IN104	WAY 1 VACUUM LOAD INTERRUPTER OPEN INDICATION
IN105	WAY 1 ISOLATING DISCONNECT CLOSED INDICATION
IN106	WAY 1 ISOLATING DISCONNECT OPEN INDICATION
IN107	WAY 1 LOCAL/REMOTE INDICATION
IN201	WAY 2 CLOSED INDICATION (MOTOR OPERATOR POSITION)
IN202	WAY 2 OPEN INDICATION (MOTOR OPERATOR POSITION)
IN203	WAY 2 VACUUM LOAD INTERRUPTER CLOSED INDICATION
IN204	WAY 2 VACUUM LOAD INTERRUPTER OPEN INDICATION
IN205	WAY 2 ISOLATING DISCONNECT CLOSED INDICATION
IN206	WAY 2 ISOLATING DISCONNECT OPEN INDICATION
IN207	WAY 2 F.I. INDICATION
IN208	WAY 3 CLOSED INDICATION (MOTOR OPERATOR POSITION)
IN209	WAY 3 OPEN INDICATION (MOTOR OPERATOR POSITION)
IN210	WAY 3 VACUUM FAULT INTERRUPTER CLOSED INDICATION
IN211	WAY 3 VACUUM FAULT INTERRUPTER OPEN INDICATION
IN212	WAY 3 ISOLATING DISCONNECT CLOSED INDICATION
IN213	WAY 3 ISOLATING DISCONNECT OPEN INDICATION
IN214	WAY 3 F.I. INDICATION
IN215	WAY 4 CLOSED INDICATION (MOTOR OPERATOR POSITION)
IN216	WAY 4 OPEN INDICATION (MOTOR OPERATOR POSITION)

IN217	WAY 4 VACUUM FAULT INTERRUPTER CLOSED INDICATION
IN218	WAY 4 VACUUM FAULT INTERRUPTER OPEN INDICATION
IN219	WAY 4 ISOLATING DISCONNECT CLOSED INDICATION
IN220	WAY 4 ISOLATING DISCONNECT OPEN INDICATION
IN221	WAY 4 F.I. INDICATION
IN301	WAY 5 CLOSED INDICATION (MOTOR OPERATOR POSITION)
IN302	WAY 5 OPEN INDICATION (MOTOR OPERATOR POSITION)
IN303	WAY 5 VACUUM FAULT INTERRUPTER CLOSED INDICATION
IN304	WAY 5 VACUUM FAULT INTERRUPTER OPEN INDICATION
IN305	WAY 5 ISOLATING DISCONNECT CLOSED INDICATION
IN306	WAY 5 ISOLATING DISCONNECT OPEN INDICATION
IN307	WAY 5 F.I. INDICATION
IN308	WAY 6 CLOSED INDICATION (MOTOR OPERATOR POSITION)
IN309	WAY 6 OPEN INDICATION (MOTOR OPERATOR POSITION)
IN310	WAY 6 VACUUM FAULT INTERRUPTER CLOSED INDICATION
IN311	WAY 6 VACUUM FAULT INTERRUPTER OPEN INDICATION
IN312	WAY 6 ISOLATING DISCONNECT CLOSED INDICATION
IN313	WAY 6 ISOLATING DISCONNECT OPEN INDICATION
IN314	WAY 6 LOCAL/REMOTE INDICATION
IN315	WAY 1 BATTERY LOW INDICATION
IN316	BATTERY ALARM
IN317	OVER VOLTAGE INDICATION
IN319	AC LOSSED (WAY 1 AND 2)
OUT101	WAY 1 REMOTE OPEN
OUT102	WAY 1 REMOTE CLOSE
OUT103	WAY 2 REMOTE OPEN
OUT104	WAY 2 REMOTE CLOSE
OUT105	WAY 3 REMOTE OPEN
OUT106	WAY 3 REMOTE CLOSE
OUT107	WAY 4 REMOTE OPEN
OUT108	WAY 4 REMOTE CLOSE
OUT201	WAY 5 REMOTE OPEN
OUT202	WAY 5 REMOTE CLOSE
OUT203	WAY 6 REMOTE OPEN
OUT204	WAY 6 REMOTE CLOSE
OUT205	BATTERY TEST START
OUT206	BATTERY ALARM RESET

2.6 LABELING

A. Hazard Alerting Signs

1. The exterior of the pad mount enclosure (if furnished) shall be provided with “Warning--Keep Out--Hazardous Voltage Inside--Can Shock, Burn, or Cause Death” signs. Each unit of switchgear shall be provided with a “Danger--Hazardous Voltage--Failure to Follow These Instructions Will Likely Cause Shock, Burn, or Death” sign. The text shall further indicate that operating personnel must know and obey the employer’s work rules, know the hazards involved, and use proper protective equipment and tools to work on this equipment. Each unit of switchgear shall be provided with a “Danger--Keep Away--Hazardous Voltage--Will Shock, Burn, or Cause Death” sign.

B. Nameplates, Ratings Labels and Connections Diagrams

1. Each unit of switchgear shall be provided with a nameplate indicating the manufacturer’s name, catalog number, model number, date of manufacture, and serial number. Each unit of switchgear shall be provided with a ratings label indicating the following: voltage rating; main bus continuous rating; short-circuit rating; fault interrupter ratings including interrupting and duty-cycle fault-closing; and fault interrupter switch ratings including duty-cycle fault-closing and short-time.

2.7 SOURCE QUALITY CONTROL

A. Before shipment of equipment, perform the following tests and prepare test reports:

1. Production tests on circuit breakers according to ANSI C37.09, Section 5.
2. Production tests on completed switchgear assembly according to IEEE C37.20.2, Section 5.3.

B. Before shipment of equipment, perform the following tests and prepare test reports:

1. Production tests on circuit breakers according to ANSI C37.09, Section 5.
2. Production tests on completed switchgear assembly according to IEEE C37.20.2, Section 5.3.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive switchgear for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchgear units and components.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification of Electrical Systems."

3.4 CONNECTIONS

- A. Cable terminations at switchgear are specified in Division 26 Section "Medium-Voltage Cables."
- B. Install equipment grounding conductors for switchgear with ground continuity to main electrical ground bus.
- C. Tighten bus joints, electrical connectors, and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Factory Acceptance Testing: Switch manufacturer to provide factory testing for the first padmount switches produced. Switch manufacturer shall be prepared to accommodate testing for up to one or two consecutive business days (Monday-Friday). The following provisions shall be made by this Contract for the witnessed factory tests:
 - 1. Allow for up to five (5) people representing the Owner to witness the factory tests.
 - 2. Allow a minimum of 4 weeks for notification of Owner prior to witness tests.
 - 3. Allow time for the Owner's representatives to visually inspect the equipment and review reports of completed tests.
 - 4. Provide for round trip air transportation, rental car, and lodging as required.
 - 5. Tests to be observed (at a minimum):
 - a. Insulation resistance test.
 - b. Contact resistance test.
 - c. Switch position indicators and contacts are in the correct position for both the open and closed positions.
 - d. Circuit configuration is shown correctly.
 - e. Mechanical interlocks are in place and operative.
 - f. Position and polarity of current transformers meets requirements.
 - g. Control, secondary wiring, and accessory devices are connected correctly.
 - h. Devices and relays actually operate as intended. Circuits for which operation is not feasible must be checked for continuity.
 - i. Operate loops ways both manually and automatically using motor operators.

- j. IED control status and analog indications:
 - 1) Alarm statuses
 - 2) Input/output statuses
 - 3) Secondary current and voltage injection testing
 - 4) Full functional operation of the switchgear with the IED
- B. Testing Agency: Engage a qualified 3rd part testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
 - 1. Perform each related electrical test and visual and mechanical inspection stated in NETA ATS-2017 7.5.3. Certify compliance with test parameters. Optional tests are not required to be performed.
 - 2. Perform all tests recommended by manufacturer instructions.
 - 3. Perform the following:
 - a. Test motor operators by connecting temporary 120 VAC at the external interconnection fuse blocks and operating in both local and remote modes. Actuate the open/close pushbuttons on the motor operator unit for local operation. Jumper the remote open/close terminal block connections to simulate operation through the SEL-451.
 - b. Test grounding connections at each connection to the equipment ground bus with a low resistance ohmmeter with test leads connected to the bare ground conductors and the switch ground bus.
 - 4. Submit certified written report of results to Engineer and Owner.
- C. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

- A. Set field-adjustable protective-relay trip characteristics per settings provided by Engineer.

3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of switchgear. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair damaged finishes.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain medium-voltage switchgear. Refer to Division 01 Section "Closeout Procedures."

END OF SECTION 261329.2