PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. This Section includes indoor and outdoor secondary unit substations, each consisting of the following:
   1. Primary incoming section.
   2. Transformer.

B. Related Sections include the following:
   1. Division 16 Section "Overcurrent Protective Device Coordination" for short-circuit rating of devices and for setting of overcurrent protective devices.
   2. Division 16 Section "Medium-Voltage Cables" for requirements of terminating cables in incoming section of substation.
   3. Division 16 Section "Electrical Power Monitoring and Control" for communication features of power distribution system devices.
   4. Division 16 Section "Transient Voltage Suppression" for transient voltage surge suppressors for low-voltage power, control, and communication equipment that may be located in secondary section.
   5. Division 16 Section "Medium-Voltage Switchgear" for metering and instrument transformers.
   6. Division 16 Section "Transfer Switches" for transfer switches that may be located in secondary distribution section.
   7. Division 16 Section "Enclosed Bus Assemblies" for busway connections between transformers and secondary distribution equipment.

1.3 DEFINITIONS


1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Dimensioned plans and elevations showing major components and features.
3. One-line diagram.
4. List of materials.
5. Nameplate legends.
6. Size and number of bus bars and current rating for each bus, including mains and branches of phase, neutral, and ground buses.
7. Short-time and short-circuit current ratings of secondary unit substations and components.
8. Ratings of individual protective devices.

C. Time-Current Characteristic Curves: For overcurrent protective devices.

D. Primary Fuses: Submit recommendations and size calculations.

E. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Dimensioned concrete base, outline of secondary unit substation, conduit entries, and ground rod locations.
   2. Location of structural supports for structure-supported raceways, busways, and seismic bracing.
   3. Location of lighting fixtures, sprinkler piping and heads, ducts, and diffusers.

F. Product Certificates: For secondary unit substations, signed by product manufacturer.

G. Material Test Reports: For secondary unit substations.

H. Factory test reports.

I. Field quality-control test reports.

J. Operation and Maintenance Data: For secondary unit substations and accessories to include in emergency, operation, and maintenance manuals.

1.5 QUALITY CONTROL

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 secondary unit substation through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of secondary unit substations and are based on the specific system indicated.

D. 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.

E. Comply with IEEE C2.

F. Comply with IEEE C37.121.

G. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver in shipping splits in sizes that can be moved past obstructions in delivery path.

B. Coordinate delivery of secondary unit substations to allow movement into designated space.

C. Store secondary unit substation components protected from weather and so condensation will not form on or in units. Provide temporary heating according to manufacturer's written instructions.

D. Handle secondary unit substation components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner at least 14 days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner’s written permission.

3. Field Measurements: Verify dimensions by field measurements.
B. Environmental Limitations: Rate equipment for continuous operation at indicated ampere ratings for the following conditions:

1. Ambient temperature not exceeding 140 deg F (60 deg C).
2. Altitude of 2500 feet above sea level.

1.8 COORDINATION

A. Coordinate layout and installation of secondary unit substations with other construction that penetrates floors and ceilings, or is supported by them, including light fixtures, HVAC equipment, and fire-suppression-system components.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spare fuses: Six of each type and rating of fuse and fusible device used, except for medium-voltage fuses and fuses associated with network protector. Include spares for the following:
   a. Primary disconnect fuses.
   b. Potential transformer fuses.
   c. Control power fuses.
   d. Fuses and fusible devices for fused circuit breakers.
   e. Fuses for secondary fusible devices.

2. Spare Indicating Lights: Six of each type installed.

3. Primary Switch Contact Lubricant: One container(s).

4. One set(s) of spare mounting gaskets for bushings, handholes, and the gasket between relief cover and flange of pressure relief device.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. GE Electrical Distribution & Control.
5. Square D; Schneider Electric.
6. S & C

2.2 MANUFACTURED UNITS

A. Indoor Unit Arrangement: Single assembly.

B. Outdoor Unit Arrangement: Single assembly
   1. Weatherproof, listed for installation outdoors, complying with IEEE C37.20.1.

C. Enclosure Finish: Factory-applied finish in manufacturer's standard color, including under surfaces treated with corrosion-resistant undercoating.

2.3 INCOMING SECTION

A. Primary Incoming Section: Enclosed, air-interrupter, primary switch.
   1. Three pole, single throw, dead front, metal enclosed, with manual stored energy operator, with fuses mounted on a single frame, complying with IEEE C37.20.3.
   2. Key interlocking system to prevent fuse access door from being opened unless switch is open. Additionally, interlock air-interrupter switch with transformer secondary main circuit breaker, preventing switch from being opened or closed unless secondary main circuit breaker is open.
   3. Phase Barriers: Located between blades and fuses of each phase, designed for easy removal, allows visual inspection of switch components when barrier is in place.
   4. Window: Permits viewing switch-blade positions when door is closed.
   5. Accessory Set: Tools and miscellaneous items required for interrupter switchgear test, inspection, maintenance, and operation. Include fuse-handling tool as recommended by switchgear manufacturer.
   6. Continuous-Current Rating: 600 A.
   7. Short-Circuit Rating:
      a. Short-time momentary asymmetrical fault rating of 40 kA.
      b. 3-second symmetrical rating of 25-kA RMS.
      c. Fault close asymmetrical rating of 40 kA.
B. Surge Arresters: Comply with IEEE C62.11, Distribution class; metal-oxide-varistor type, with ratings as indicated, connected in each phase of incoming circuit and ahead of any disconnecting device.

2.4 DRY-TYPE TRANSFORMER SECTION

A. Description: IEEE C57.12.01, IEEE C57.12.50, NEMA ST 20, and dry-type, 2-winding, secondary unit substation transformer.

B. Enclosure: Indoor, ventilated, cast coil/encapsulated coil, with primary and secondary windings individually cast in epoxy; with insulation system rated at 185 deg C with an 80 deg C average winding temperature rise above a maximum ambient temperature of 40 deg C.

C. Enclosure: Outdoor, ventilated, vacuum-pressure, impregnated type and with insulation system rated at 220 deg C with an 80 deg C average winding temperature rise above a maximum ambient temperature of 40 deg C.

D. Cooling System: Class AA, air cooled or A, air cooled with forced-air rating as indicated on the drawings complying with IEEE C57.12.01.

   1. Automatic forced-air cooling system controls, including thermal sensors, fans, control wiring, temperature controller with test switch, power panel with current-limiting fuses, indicating lights, alarm, and alarm silencing relay.

   2. Include mounting provision for fans.

E. Insulation Materials: IEEE C57.12.01, rated 220 deg C.

F. Insulation Temperature Rise: 80 deg C, maximum rise above 40 deg C.

G. Basic Impulse Level: 95 kV.

H. Full-Capacity Voltage Taps: 4 nominal 2.5 percent taps, 2 above and 2 below rated primary voltage; with externally operable tap changer for de-energized use and with position indicator and padlock hasp.

I. Sound level may not exceed 30db without fans operating.

J. Impedance: 5.75 percent maximum.

K. High-Temperature Alarm: Sensor at transformer with local audible and visual alarm and contacts for remote alarm.

L. Windings: Copper.

2.5 SECONDARY DISTRIBUTION SECTION

A. Secondary Terminal Compartment: Bus bars mounted on standoff insulators.

B. Secondary Distribution: Low-voltage switchgear as specified in Division 16 Section
"Switchgear."

2.6 IDENTIFICATION DEVICES

A. Compartment Nameplates: Engraved, laminated-plastic or metal nameplate for each compartment, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 16 Section "Electrical Identification."

2.7 SOURCE QUALITY CONTROL

A. Factory Tests: Perform design and routine tests according to standards specified for components. Conduct transformer tests according to IEEE C57.12.90. Conduct switchgear and switchboard tests according to ANSI C37.51. Submit documented results.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and space conditions for compliance with requirements for secondary unit substations and other conditions affecting performance of work.

B. 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 will have to cross section barriers to reach load or line lugs.

C. Examine walls, floors, roofs, and concrete bases for suitable conditions for secondary unit substation installation.

D. Verify that ground connections are in place and that requirements in Division 16 Section "Grounding and Bonding" have been met. Maximum ground resistance shall be 5 ohms at secondary unit substation location.

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

3.2 INSTALLATION

A. Install secondary unit substations on concrete bases.
   1. Anchor secondary unit substations to concrete bases according to manufacturer's written instructions.
   2. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit and 4 inches (100 mm) high.
   3. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3.
4. Install dowel rods to connect concrete bases to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.

5. Install epoxy-coated anchor bolts for anchoring equipment to the concrete base.

6. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Bolt transformers to channel-iron sills embedded in concrete bases. Install sills level and grout flush with floor or base.

B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

3.3 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Operating Instructions: Frame printed operating instructions for secondary unit substations, including key interlocking, control sequences, elementary single-line diagram, and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on wall of secondary unit substation electrical room.

3.4 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

3.5 CLEANING

A. After completing equipment installation and before energizing, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Vacuum interiors of secondary unit substation sections.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Testing: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

1. Perform each visual and mechanical inspection and electrical test according to NETA ATS. Certify compliance with test parameters.
2. After installing secondary unit substation but before primary is energized, verify that grounding system at the substation tested at the specified value or less.

3. After installing secondary unit substation and after electrical circuitry has been energized, test for compliance with requirements.

4. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
   a. Remove and replace malfunctioning units and retest as specified above.

3.7 FOLLOW-UP SERVICE

A. Voltage Monitoring and Adjusting: After Substantial Completion, but not more than six months after Final Acceptance, perform the following voltage monitoring:

   1. During a period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at the outgoing section of each secondary unit substation. Use voltmeters with calibration traceable to the National Institute of Science and Technology standards and with a chart speed of not less than 1 inch (25 mm) per hour. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from the nominal value by more than plus or minus 5 percent during the test period, is unacceptable.

   2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:
      a. Adjust transformer taps.
      b. Rebalance loads.
      c. Prepare written request for voltage adjustment by electric utility.

   3. Retests: Repeat monitoring, after corrective action has been performed, until satisfactory results are obtained.

   4. Report: Prepare a written report covering monitoring performed and corrective action taken. Deliver the report directly to the Facilities Division, Attention: Electrical Engineer.

B. Infrared Scanning: Perform as specified in Division 16 Section "Medium-Voltage Switchgear."

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain systems.

B. Train Owner’s maintenance personnel on procedures and schedules for energizing and de-energizing, troubleshooting, servicing, and maintaining equipment and schedules.

C. Review data in maintenance manuals.

D. Schedule training with Owner with at least seven days advance notice.
SECTION 16361
SECONDARY UNIT SUBSTATIONS

END OF SECTION