

SECTION 261116 – SECONDARY UNIT SUBSTATIONS

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. Section Includes:

1. This Section specifies the unit substations for buildings and structures.
2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein for a complete operating system.

Note information to be shown on the drawings.

3. Furnish and install complete double ended unit substation/s, metal enclosed, indoor type, number as shown on the drawing.
4. Each unit shall include the following items at a minimum:
 - a. Medium-voltage incoming line sections
 - b. Medium-voltage transformer sections
 - c. Low-voltage switchgear sections

B. Related Sections:

1. Applicable sections of Division 26 - Electrical

1.3 SUBMITTALS

A. Shop Drawings

1. Medium-voltage incoming line sections
2. Medium-voltage transformer sections
3. Low-voltage switchgear sections

1.4 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70, “National Electrical Code”
- C. The unit substation shall conform to the following:
 - 1. ANSI C37.20
 - 2. IEEE Standard 27
 - 3. NEMA SG-5
 - 4. Transformers shall be in accordance with the latest applicable standards as recommended by A.S.A., N.E.M.A., and I.E.E.E.
- D. Guarantee
 - 1. Furnish full parts and labor warranty to cover the unit substation for one year from date of installation.

1.5 MATERIAL TURNED OVER TO OWNER

- A. Products Supplied But Not Installed Under This Section
 - 1. Provide a metal cabinet in the electrical room to house spare fuses and special tools. Cabinet shall be Tennsco no. 7824MGY or Grainger item no. 1UBT8, 24 x 36 x 78.

1.6 DESIGN REQUIREMENTS

The Designer should perform their own fault and coordination study to ensure that equipment is sized properly and overcurrent protection will coordinate.

- A. The primary fuses, main secondary breakers, and feeder breakers shall be completely coordinated by the manufacturer of the unit substation equipment. Shop drawing submittal shall include complete coordination curves of the exact equipment furnished.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The units shall be arranged according to the drawing. Dimensions of the sections are approximate and shall be varied to suit the equipment furnished and such that the overall dimensions of the complete unit suit the room dimensions and aisle space, subject to the

approval of the Engineer. Complete shop drawings shall be submitted to the Engineer before fabrication.

- B. The entire unit shall be metal enclosed and provided with ventilation and access. Complete unit shall be rustproofed and painted two coats. Units shall be mounted on leveling channels in concrete bases. Leveling channels shall be furnished by the Contractor.
- C. Solderless lugs and ground connections shall be provided at each end of the structure and a copper or aluminum ground bus shall be furnished running the entire length of the structure providing positive ground connections.
- D. Units shall be as manufactured by Westinghouse, General Electric, Siemens, or Square D.

2.2 INCOMING LINE SECTIONS

- A. The incoming line sections shall be full height air terminal chambers suitable for cable and conduit connection to the transformer primary switch. Sufficient space shall be provided for cable termination and cable terminators.

2.3 TRANSFORMER SECTIONS

- A. All transformers shall be liquid filled with ABB BIOTEMP or Cooper Envirottemp and each provided with four 2-1/2% fully rated taps in the high-voltage winding, two above and two below nominal primary voltage, with externally operated no-load tap changer.

Insert here transformer ratings ___ KVA, 13.2 kV delta primary, ___/___ volt wye secondary, 3 phase, 60 Hertz.

- B. The high voltage bushings shall be provided with lugs for 15Kv cable connection to transformer primary switches.
- C. A low-voltage neutral bushing shall be included on each transformer.
- D. The secondary shall be bus connected to the low-voltage switchgear section.
- E. Transformer shall be provided with the following accessories:
 - 1. Drain and sampling valves.
 - 2. Filter-press and filling connections.
 - 3. Top liquid dial-type thermometer.
 - 4. Liquid level gauge.
 - 5. Pressure-vacuum gauge.
 - 6. Pressure relief device.
 - 7. Ground pad.
 - 8. Nameplate.
 - 9. Provisions for padlocking tap changer handle.
 - 10. Provisions for lifting and jacking.

- F. Transformers shall have sealed tanks with welded on cover for preservation of the insulating liquid. The transformer base construction shall be of the fabricated type and suitable for using rollers or skidding in any direction.
- G. Exterior surfaces shall be painted gray to match switchgear.
- H. Tests and characteristics shall be in accordance with latest ANSI standards.
- I. Information supplied by the Manufacturer shall include dimensional sketches, installation requirements, instruction books, guaranteed efficiencies at full, 3/4, 1/2, and 1/4 loads, guaranteed regulation at unity and 80% P.F., and core loss.

2.4 LOW-VOLTAGE SWITCHGEAR SECTIONS - GENERAL

Information to be shown on the drawing.

Low-voltage section should be sized to have at least two spare breakers on each end of the low-voltage section. Any spaces should be bussed to accommodate future breakers.

- A. Furnish and install low-voltage feeder switchgear sections for each unit substation as indicated on the drawing and as follows:

Information to be specified on drawing.

- B. The complete switchgear structure shall be metal enclosed and fabricated from sheet steel with separate bus and circuit breaker compartments. No live parts shall be exposed. Air vents and general design of the housing shall match that of transformer and switch sections.
- C. A full height rear compartment shall be provided for the bare busses, instrument transformers, and outgoing feeder cable connections. All bus bars shall be bare copper or aluminum. Bus supports shall be designed to withstand the stress produced by a fault current of 65,000 amperes.

Increase fault current level based on site fault analysis.

- D. Main, tie, and feeder breakers shall be of quantities, capacities, and ratings as indicated on the drawing and in sub-section E below, Low-voltage sections - circuit breakers. Breaker trip ratings shall be as indicated on the drawing.

Information to be specified on drawing.

- E. Provide spare breakers and compartments for future breakers, completely bussed, as indicated on the drawing.
- F. Provide breaker traveling lifting device (hoist) mounted on top of the low-voltage section of each of the units. Lifting device shall include guide tracks, travel carriage, movable hoist,

pulleys, supports, cable of adequate strength, lifting hook, etc., as required for complete installation.

2.5 LOW-VOLTAGE SWITCHGEAR SECTIONS – CIRCUIT BREAKERS

- A. Air circuit breakers in the low-voltage switchgear shall be drawout type, rated 600 volts and front removable.

Use the following only when main and tie breaker are to be drawout type.

- B. Main and bus tie air circuit breakers in the low-voltage switchgear shall be drawout type, rated 600 volts and front removable.

Drawout breaker types.

- C. Drawout type breakers shall include the following:
1. Solid state trip devices which require no external power connections. Trip devices shall be provided with adjustable long-time delay and pick-up, instantaneous, and short-time delay and pick-up over current/short circuit protection. Adjustable ground fault time delay and pick-up, integral with the solid state trip device, shall be provided when shown on drawings. Trip unit shall have indicators for overload, short circuit, and ground fault.
 2. Ability to move from connected to test and then to disconnect position, or be removed completely for inspection, maintenance, or replacement.
 3. Mechanical interlock which prevent withdrawing or inserting breakers when in the closed position.
 4. Padlocking provisions to receive up to three padlocks when the breaker is open and in the disconnected position to prevent closing of the breaker contacts when padlocks are applied.
 5. Solid block silver inlaid main contacts with arc chutes totally enclosing arcing contacts.
 6. Manual trip button.
 7. External target to indicate breaker position.
 8. Insulated closing handle for manually operated breakers.
 9. Solderless clamp type load side connectors, sized in accordance with feeder sizes as shown on riser diagram.

Information to be specified on drawings.

10. Each drawout circuit breaker shall be enclosed within an individual compartment fashioned from sheet steel. A steel door shall be provided with concealed hinges and ventilating grilles.

Use the following when feeder breakers are to be molded case type.

- D. Feeder breakers in the low-voltage switchgear shall be manually operated quick-make quick-break molded case circuit breakers, rated 600 volts, 3 pole, with trip free operating mechanism, and interrupting rating of 42,000 amperes symmetrical at 240 volts. For molded case circuit breakers of 800 amps or greater, provide arc flash maintenance switch functionality. Breakers shall include the following:
 1. Adjustable, interchangeable thermal magnetic tripping device on each pole.
 2. Plug in mounting by means of mounting blocks and tulip connectors.

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- E. All breakers shall have handles extending through the door so that the breaker can be operated with positive safety.

2.6 LOW-VOLTAGE SWITCHGEAR SECTIONS – TIE BREAKER AND TIE BUS

- A. Each unit substation shall be arranged for secondary selectivity by means of a tie bus and normally open tie breaker, feeding from the main bus of one end to the main bus of the other end.
- B. Tie bus shall be furnished complete with the units, including all accessories, supports, fillings, etc., suitable for easy connection in the field. Bus shall be copper or aluminum with adequate capacity and short circuit rating, totally enclosed, approved type. (Refer to riser diagram.) Tie bus shall be furnished in the switchgear cubicles with the unit substation.
- C. Tie breakers shall be normally open, 3 pole, drawout type equal to that specified for the main breaker, except with capacity as indicated on the drawing. Kirk key interlocks shall be provided on the tie breaker and main secondary breakers of each unit to prevent closing the tie breaker unless one of the main breakers is open, to eliminate the possibility of parallel operation of the units.

2.7 INSTRUMENTS

- A. Refer to Section 262713 Electricity Metering for metering at the substation.
- B. Install a 120 volt, 20 amp, duplex receptacle in a surface mount box in the designated Main Metering Compartment. Circuit from a dedicated 20 amp circuit breaker in the nearest emergency power system panelboard with two #12 AWG THWN with ground in a one-half inch conduit.

- C. Install a 3/4 inch conduit from the designated Main Metering Compartment to the Broadband Utility Room to allow for Ethernet cable connection from the main electrical meter to the Campus network.

2.8 TEST EQUIPMENT

If MSU Physical Plant already has the latest test equipment from the successful manufacturer, purchasing the test equipment may be deleted.

- A. Provide the substation manufacturers supplied circuit breaker tester for setting and calibrating the breakers. Only one tester is needed per project.

2.9 EMERGENCY CIRCUIT AUTOMATIC THROWOVER

The emergency circuit automatic throwover is provided when an emergency generator is not part of the project.

- A. Provide automatic throwover for emergency lights from the 120/208 volt unit substation as follows:
 - 1. Automatic transfer unit shall provide feeder failure protection. When normal source voltage drops below 70% the emergency load shall be automatically transferred to the alternate source and transferred back again when the normal source is 90% of nominal voltage.
 - 2. The unit shall consist of two electrically operated molded case circuit breakers: 3 pole, capacity as indicated on the drawing, adequate interrupting rating, 250 volts, with overload protection, indication lights, key interlocks, test switch, 3 phase sensing, and necessary auxiliary relays and wiring to provide automatic throwover. Normal operation position shall be normal closed and emergency open. It shall be possible to have both breakers open at the same time.
 - 3. Throwover unit shall be mounted in space provided in the secondary switchgear of the 120/208 volt unit substation. Connect same by means of cable connection ahead of the main breakers of each end.

PART 3 - EXECUTION

3.1 RISER DIAGRAMS

- A. Provide an electrical riser diagram for light and power, telephone, fire alarm and smoke detector, and emergency power framed, under glass, and mounted on the wall in the transformer room. Prints shall be of the diffusion transfer process to eliminate fading.

END OF SECTION 261316