

## SECTION 26 11 16 - SECONDARY UNIT SUBSTATIONS

### PART I - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. *Section 26 09 13 - Power Monitor*
- B. *Section 26 27 13 – Electrical Metering*

### PART 2 - PRODUCTS

#### 2.1 INTERIOR TRANSFORMER ROOMS

- A. **Equipment Included:** Buildings shall be equipped with interior transformer rooms. The rooms shall contain the primary disconnect switch, building transformer, main fusible switch and secondary switchgear/ or switchboard, signal cable terminal box, and McCulloh Loop fire alarm cable terminal. Space and access are required for removal of switchgear/or switchboard or transformers should they fail in the future.
- B. **Equipment Not Permitted:** There shall be no fire protection sprinkler, steam, gas, water, sewer or air pipes in the transformer room, or any other equipment requiring attention by anyone except authorized electrical personnel.
- C. **Lighting:** Fluorescent or LED lighting fixtures shall be provided, illuminating both the front and back of the unit sub-station. Provide a switched duplex outlet located near the door. Connect the lights to an emergency circuit.
- D. **Heat:** All transformer rooms shall be heated.
- E. **Clearance and Ventilation Requirements:** The room shall be sized to allow code conforming safety clearances, ventilated per requirements in this Section, and arranged to conform to manufacturer's recommendations for clearances from walls.
- F. **Ventilation:** Transformer rooms shall be ventilated with a minimum of 4 CFM per KVA of transformer capacity and heated. The exact configuration of the ventilation shall be determined during the formal review process.
- G. **Primary Switch:** Primary switch shall be furnished with S & C Electric, type SM-4 (200A) or SM-5 (600A) fuse holders and have sufficient interrupting capacity to accommodate fault current available to the system. Fault closing rating and fuses shall have the same current interrupting capacity.
- H. **Floor-Mounted Versus Cabinet-Mounted:** If the transformer in the room is 150 KVA capacity or more, the secondary distribution shall be part of a floor-mounted switch group or against the wall, if back access is not required. This switch group shall contain the current transformers, the kilowatt hour meter, the demand meter, and all necessary overcurrent protection devices. Buildings with room capacity smaller than 150 KVA may have the secondary distribution in cabinets mounted in the transformer compartment.
- I. **Framed One-Line Diagram:** Provide a one-line diagram of the building distribution system from the incoming high voltage feeder to the last low voltage distribution panel. This drawing is to be framed under glass and securely mounted to the wall in the transformer room. The following information shall be shown on the drawing: all conduit sizes, wire sizes and types, maximum amperage of devices, voltage of devices, fuse or circuit breaker rating, Short-Circuit Current Rating, Available Fault Current, main lugs or size of the main breaker for panels, the number of circuits for panels and panel locations.
- J. **Redundancy:** A building with expected maximum demand of over 750 KVA generally should have 2 separate transformer rooms of equal capacities in different parts of the

building or in a double-ended arrangement in one transformer room. This is recommended for reasons of safety, reliability, and equipment handling. Buildings with large auditoriums and other structures that may be occupied by large numbers of people shall have 2 separate transformers to ensure reliability of the lighting.

- K. Buss Taps: Unit substation bus taps are not allowed without the written permission from F & S Engineering Department. However, should a written permission be granted, then taps shall comply with the following:
  - 1. Taps will have to be done using U.L. Listed materials.
  - 2. Taps will have to be done per substation manufacturer instructions to maintain the U.L. Listing of the electrical equipment.

## 2.2 DISTRIBUTION VOLTAGE

- A. Low Voltage Distribution: The low voltage distribution in new buildings shall generally be 3-phase, 4-wire, 480Y/277V system, supplying electrical energy for both lighting circuits and 3-phase, 480-volt building power. 208Y/120 volt system shall be utilized to support the building receptacle system. *[Note to PSC: Building power voltage of 208Y/120V, 3-phase, 4-wire for building power and light can be considered only with approval from the Facilities and Services Engineering Services, this power type will be considered for existing buildings upgrade in some instances.]*
- B. Verify Primary Voltage: *[Note to PSC: The Owner shall be consulted to verify what primary voltage is available.]*

## 2.3 TRANSFORMERS

- A. Transformer: See Section 26 22 13.

## 2.4 EQUIPMENT

- A. Unit Substation: Equipment, where the maximum demand is approximately 150 KVA or more, shall be all in one factory assembled unit-substation. The unit shall be made of a primary switch (preferred to be attached but not necessary if there is saving of space in the electrical room), transformer and the secondary main, the rest of the unit-substation can be a switchboard type placed adjacent or against the wall in the same room, if no back access is required.
- B. Metering: Switchboard or switchgear equipment shall include a solid state utility meter. The meter shall be a standard round face transformer rated utility grade meter socket with 10-pole test switch installed inside the cover. *[Note to PSC: Meter shall comply with the Owner's requirements.]*
- C. Metering Arrangements: *[Note to PSC: The Owner shall be consulted if there are questions on metering arrangements and the multiplier.]*
- D. Fuses: Potential fuses for watt-hour meter shall be provided inside the switchboard and be readily accessible from the exterior.
- E. Secondary Buses: The secondary buses in large units shall be located and sectionalized for quick disconnecting so as to facilitate moving the transformer and load break switch portion of the unit sub-station in and out of the room separately from the secondary switchgear portion of the unit.
- F. Conductors: All sub-station bus conductors shall be silver plated copper.
- G. Digital Temperature Controller: Unit substations 500 kVA and larger shall be equipped with cooling fans that are controlled by a digital temperature controller. The temperature controller shall monitor each coil of the transformer. The temperature controller shall have a local audible alarm and shall be capable of initiating a remote alarm.
- H. TVSS: Every unit substation shall have a TVSS included in the unit. The TVSS shall be capable of withstanding a minimum of 240KA.

- I. Tapping of an existing Unit-Substation bus to add feeder circuit breaker/ fusible switches is not permitted without a written permission from F & S Engineering department.

J. *[Note to PSC: Unit Substation preference is to have an all fused overcurrent protection devices instead of circuit breakers].*

- K. Manufacturers: Eaton, GE or Square D

## 2.5 SHORT CIRCUIT CALCULATIONS *[Note to PSC: Provide the following to the Owner:]*

- A. Short Circuit Current Calculations: The short circuit current calculations shall be required and shall form the basis for the following:
  - 1. All secondary overcurrent protective devices to be utilized within the building unit substations, distribution panels, branch circuit panels, motor control centers, and devices on plug-in bus-duct circuit current to the proper value for the protection of connected downstream components.
  - 2. All protective devices shall be coordinated for a purely selective system and fusible switch type equipment shall be used where required.
  - 3. The main secondary overcurrent protective devices shall be selected for protection of the transformer and shall provide a selective system between the primary fuse and each feeder protection device.
  - 4. Each feeder protection device shall be selected for protection of the feeder conductors and coordination between the primary fuse, secondary main and other load side components fed by the feeder device.

## 2.6 AVAILABLE FAULT CURRENT LABEL

- A. Provide a label on Substations indicating the Available Fault Current. Label shall include the installation date, and be suitably durable for the environment involved.
- B. When modifications occur that change the amount of Available Fault Current, the Label shall be adjusted to reflect the new level of maximum available current.

## 2.7 ARC-FLASH LABELING

- A. All substations shall have arc flash warning labels on the electrical equipment with a specific incident energy value in calories/cm<sup>2</sup>.
  - 1. Perform incident energy calculations (arc flash analysis) by a qualified engineer using methods similar to those described in IEEE Standard 1584-2002 "Standard Method for Determining Incident Energy" - Nov 2002
  - 2. Incident Energy calculations take into account bolted fault current, clearing time, equipment type, grounding and construction over a range of voltages
  - 3. Information required to perform an Arc-Flash Analysis shall include:
    - a. Up to date system one-line diagram (NFPA 70E)
    - b. Conductor size, types, and lengths
    - c. Electric utility source information
    - d. Current short-circuit/coordination study (*per 2.5*)
    - e. Validated protective device types and settings
- B. Arc-Flash labels shall meet the requirements of NFPA 70E.
  - 1. Labels shall include the following information for Appropriate PPE Required:
    - a. Flash Hazard Boundary Distance
    - b. Flash Hazard at 18 inches

- c. Arc-Flash Hazard Risk/PPE Category
- d. Shock Hazard when cover is removed
- e. Class of glove
- f. Limited Approach Distance
- g. Restricted Approach Distance
- h. Prohibited Approach Distance
- i. Name & Address of Company preparing the Label
- j. Date of Label Preparation

### PART 3 - EXECUTION

#### 3.1

END OF SECTION **26** 11 16

This section of the *U of I Facilities Standards* establishes minimum requirements only.  
It should not be used as a complete specification.