



DESIGN REQUIREMENTS

SECONDARY UNIT SUBSTATIONS

GENERAL INFORMATION

- 1.1 This section applies to unit substations.

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- 2.1 Provide a complete system analysis showing device coordination curves and charts indicating that all equipment (e.g. Primary fuses, secondary main breakers and secondary feeder breakers) are selectively coordinated. Set all circuit breakers in accordance with the study. Submit the protection study report along with complete current characteristic curves for each overcurrent protective device as part of the turnover process.
- 2.2 A single full size main bus system shall extend through all frames of the switchgear with interconnection to the circuit breakers in each individual frame. All bolted bus joints shall be silver-plated copper or equivalent protection. The neutral shall be rated for 100% of the phase bus capacity.
- 2.3 Generally, sub-stations shall be double ended with suitable redundancy for critical systems served. For the safe operation of each primary switch provide a Kirk Key interlocking system which will incorporate the following features:
- a. A key interlock system to prevent the operation of any primary switch when the transformer main secondary breaker is in the "closed" position.
 - b. A key or mechanical interlock system to prevent the opening of the primary fuse compartment doors when either associated primary switch is closed and to prevent any primary switch being closed when the fuse compartment door is open.
 - c. For double-ended configurations, each secondary main breaker shall be key interlocked with tie breaker.
- 2.4 Submit scaled drawings showing the coordinating penetrations, dimensioned concrete base, outline of secondary unit substation, conduit entries, and ground rod locations.
- 2.5 Sound level may not exceed 60 dB for air-cooled units through 500 KVA, 67 dB for fan-cooled units through 1500 KVA and 71 dB for larger fan cooled units.

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- 2.6 Provide surge arresters for use in conjunction with substation transformers. Surge arresters shall be intermediate type, rated for voltage serviced and suitable for protection of the associated transformer. One arrester shall be connected to each phase of the bus. Arrester ground terminals shall be directly connected to the switch assembly ground bus. Arrester connections shall be made with a bus bar, braced for the full short circuit rating of the switch.
- 2.7 Specify sizing and operation of electrical strip heaters.
- 2.8 Transformer coils shall be dry type copper or aluminum, in accordance with NEMA Standard TP-1-2002, Table 4-2.

CONSTRUCTION REQUIREMENTS

- 3.1 Shop Drawings: Submit shop drawings for Secondary Unit Substations including detailed equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Include the following:
 - a. Wiring diagrams of power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
 - b. Dimensioned plans and elevations showing major components and features.
 - c. One-line diagram.
 - d. List of materials.
 - e. Nameplate legends.
 - f. Size and number of bus bars and current rating for each bus, including mains and branches of phase, neutral, and ground busses.
 - g. Short-time and short-circuit current ratings of secondary unit substations and components.
 - h. Ratings of individual protective devices.
- 3.2 Product Data: Submit product data for Secondary unit Substations and component devices. Include rated capacities, furnished specialties, and accessories, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

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- 3.3 Submit field test reports with all testing data including inspection procedures and test results. Include start-up inspection findings. Submit copies of factory test reports certified by the manufacturer. It is absolutely imperative that the Engineer of record obtain, review, approve and submit these documents for substation installations.
- 3.4 Barriers shall be installed between switch and fuse compartments, between the switch and incoming cable compartments, between the switch and fuse assembly and the primary bushing transition compartment. Barriers shall be full height between compartments. Insulation barriers shall be provided between the poles of the switches.
- 3.5 Each switch shall be provided with a front mounted up/down operating handle mechanism with provisions for lockout. The operating handle shall be located on the front of the unit and shall be provided with a position indicating plate. The switch operating mechanism shall be of the "quick-make", "quick-break" type in which the speed of the switch on closing and opening is controlled by a "stored energy" device and is independent of the speed of the operating handle.
- 3.6 Spare fuses: Provide three of each type and rating of fuse and fusible device including:
 - a. Spare medium voltage fuses.
 - b. Potential transformer fuses.
 - c. Control power fuses.
- 3.7 Electrical strip heaters shall be provided for each switch, where required by the installed environment, wired to terminal blocks and powered from the unit unless otherwise indicated on the drawings. The Engineer of record will specify the sizing and operation of the heaters.
- 3.8 Transformer high voltage and low voltage windings shall be copper with forced-air rating and fan cooling. Provide a multi-phase electronic based temperature monitoring system with local audible and visual alarm and contacts for remote alarm. Fans shall be capable of being operated in manual or automatic mode. Fans shall have an automatic exerciser.
- 3.9 Secondary section shall be coupled to transformer LV side. The low voltage switchgear shall be metal enclosed draw-out type switchgear consisting of main breaker, feeder breakers, and tie-breakers (for double-ended arrangements). The switchgear shall be of the freestanding, dead-front type. The front of each compartment shall consist of a hinged door providing access to the removable breaker element. The top of the structure shall be enclosed with removable steel sheets. The stationary structure shall be designed to allow future additions.

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- 3.10 All circuit breaker compartments shall have barriers on each side for complete compartmentalization of devices. Each compartment's hinged door shall be interlocked so that the door can only be opened when the circuit breaker is in the "off" position. Provide a defeater type mechanism preventing access by unauthorized personnel.
- 3.11 Circuit breaker devices shall have external handle operators with lockout provisions. Handle operators for all devices shall be of the same design and have the same method of operation.
- 3.12 The frame size, trip rating, short circuit rating and an "open/close" indication shall be readily visible at each circuit breaker position without opening the compartment door.
- 3.13 Isolating barriers shall be provided between the incoming line and main bus systems to prevent fault communications. The vertical buses shall be isolated and insulated from the main buses. The main bus shall be phase isolated and insulated from each other and from device load terminals. Bus joints shall be insulated with removable caps.
- 3.14 All equipment shall be completely wired within the switchgear for control and operation. Wire shall be clearly identified at each terminal or junction point with non-metallic, permanent wire markers. All wiring shall be terminated to terminal boards with crimp type spade terminals.
- 3.15 Provide a rail type traveling circuit breaker lifter on top of secondary switchgear running the entire length.
- 3.16 Multifunction Digital Metering Monitor: Provide a microprocessor-based unit on the transformer secondary suitable for 3- or 4-wire systems and with the ability to measure all standard electrical metric and consumption. The meter will have the ability to export its data to a SCADA system or BMS.

REFERENCE

- 4.1 The applicable CSI Specification Section is 261116.