Basis of Design

This section applies to the design and installation relating to load interrupters (switches).

Design Criteria

- 13.8kV equipment shall be 15kV class; 2.4kV and 4.16kV equipment shall be 5kV class.
- Space for metering CT’s and PT’s may be required in the switch enclosures.
- Provide barriers to meet Washington State rules. Air break switches require an insulated barrier between line and load contacts when the switch is open to comply with State Code requirements.
- Equipment switches shall be fused for coordination with the rest of the University’s power distribution system. Refer to the University’s short circuit studies for design fault duties.
- Switches shall be able to be configured and operated according to UW High Voltage Shop operation procedures for closed transition switching. In a primary-select configuration, allow switching operations between two feeders so that one feeder can be isolated, de-energized, and “cleared” for shutdown while the other feeder continuously serves building loads without interruption. Note that in this configuration the load side of both incoming feeder switches is always energized when either switch is “opened”.
- Switch line-ups with the “primary select” configuration shall be bus type construction that can accommodate addition of future switches by extension of existing busses. Switch enclosures shall be equipped with removable plates to allow extension of the busses on both sides ends of the lineup. New switches shall match the manufacturer and type of existing switch line-ups they are being added to. Additional spaces and enclosures may be required to accommodate bending radius requirements of feeder cables.
- When sizing vaults or rooms for primary switch line-ups always design space for the addition of future switches. In addition to future building switches, also allow space for the installation of a switch for construction power. Space for future switches shall be designed and noted in the design documents.
- Where expansion space is available, design switches for future extensions to additional equipment bays on both ends of the lineup.
- Do not use oil and gas insulated switches. (Exception: Pad-mount transformers with integrally equipped switches may be oil filled.)

Design Evaluation

The following information is required to evaluate the design:

- Schematic Design Phase: Proposed service arrangement, i.e. preferred alternate, double ended, or spot network. Proposed switch location & arrangement.
- Construction Document Phase: Switch line-up and enclosure footprint and location, final cable routing plan, cable bending radius details. Cable termination & grounding details, required equipment fault duty. Complete specifications.
Submittals

- Equipment catalog cuts
- Dimensioned installation drawings
- Certified test reports of full load, load interrupt and fault current and close and latch ratings

Products, Materials and Equipment

- Approved manufacturers: S&C Electric, no exceptions.
- Interrupter switches shall have a one-time or two-time duty-cycle fault-closing rating equal to or exceeding the short-circuit rating of the switchgear. These ratings define the ability to close the interrupter switch either alone (unfused) or in combination with the appropriate fuse, once or twice (as applicable), against a three-phase fault with asymmetrical current in at least one phase equal to the rated value, with the switch remaining operable and able to carry and interrupt rated current. Tests substantiating these ratings shall be performed at maximum voltage. Certified test abstracts establishing such ratings shall be furnished upon request.
- Interrupter switches intended for manual operation shall be operated by means of an externally operable, non-removable handle. The handle shall have provisions for padlocking in both the open and closed positions. Interrupter switches intended for power operation shall be operated by means of a switch operator expressly designed to be compatible with the interrupter switch.
- Interrupter switches shall utilize a quick-make quick-break mechanism installed by the switch manufacturer, which shall swiftly and positively open and close the interrupter switch independent of the switch-handle or switch operator operating speed.
- For manually operated interrupter switches, and for interrupter switches operated by direct motor drive switch operators, the quick-make quick-break mechanism shall be integrally mounted to the switch frame.
- Interrupter switches shall be completely assembled and adjusted by the switch manufacturer on a single rigid mounting frame. The frame shall be of welded steel construction such that the frame intercepts the leakage path which parallels the open gap of the interrupter switch, to positively isolate the load circuit when the interrupter switch is in the open position.
- Provide interrupter switches with a single blade per phase for circuit closing including fault closing, continuous current carrying, and circuit interrupting. Spring-loaded auxiliary blades shall not be permitted.
- Interrupter switches shall have a readily visible open gap when in the open position to allow positive verification of switch position.
- Interrupter switches shall be hinged at the bottom of the switch blade to allow insertion and removal of a full isolating barrier in the open gap when the switch is opened with a hotstick.
- Provide reverse cable entrance/exit on all bays.
- Provide copper main and ground bus as well as copper terminals on switches and fuses.
- Provide isolating barrier per switch compartment. The interrupter switch housing shall have provisions guides/tracks/brackets to facilitate installation and hold the barrier in place (when
Load Interrupter Switches

- Barrier shall be of NEMA GPO3-grade fiberglass reinforced polyester. WARNING: REQUIREMENT FOR BARRIER IS A NON-STANDARD COMPONENT.

- Provide grounding stirrups in the line and load compartments such that, with the barrier installed, grounding can be achieved without entering an energized compartment.

- Grounding jumpers are to be provided with clear insulation; Part No. 3611-215 for Salisbury “ball-type” studs and Part No. 3611-479 for S&C standard studs.

- Salisbury “ball-type” ground studs are required on switch terminals of “switch-only” entrance bays. Standard S&C ground studs are required on terminals of “fused-switch” feeder bays.

- All grounding landing pads shall have a “Chance” stud ball.

- Pads for switch line-ups with the “primary select” configuration shall have space for additional switches to be added in the future. Where space is limited and allowing space for future switches is difficult, contact Engineering Services for resolution.

- “Kirk-Key” system is not allowed unless specifically requested by the Engineering Services and UW High Voltage Shop.

- All switches installed in exterior areas, utility tunnels, vaults, and other areas exposed to steam condensation, corrosion, and moisture, shall be NEMA 3R exterior type construction. NEMA 3R switches have larger space requirements and may be mounted on a stand-off frame.

- Approved manufacturer shall be S & C.

- Load side of switch shall be on the bottom.

- If equipped with lightning arresters, they shall be located on the load side of the switch.

- Pad Mount – Manually operated, elbow connected, compartmentalized & fused. May be integral with a transformer.

- Provide two sets of NO and NC contacts for remote monitoring the switch position. Wire the switches out to a terminal strip (typically located near the top of the bay) that is accessible for safe access when the switch is energized.
Typical primary select interrupter switch and isolation barrier configurations:

16K – Figure 1
*Primary Select 3-Bay Switching*

16K – Figure 2
*Isolation Barrier in Storage Position*

16K – Figure 3
*Isolation Barrier Being Inserted*

16K – Figure 4
*Barrier Isolating Switch*
Fuses

- Solid-material power fuses shall be of the solid-material type and shall utilize refill-unit-and-holder or fuse-unit-and-end-fitting construction. The refill unit or fuse unit shall be readily replaceable.

- For switchgear rated up through 270 MVA at 4.16 kV and 600 MVA at 13.8 kV, mountings for solid-material power fuses shall be disconnect style. Non-disconnect style mountings for power fuses shall be used only where higher ratings are required.

- Solid-material power fuses shall be equipped with a blown-fuse indicator that shall provide visible evidence of fuse operation while installed in the fuse mounting.

- Solid-material power fuses in feeder bays shall be equipped with grounding provisions on the load side of each fuse and on the enclosure ground bus.

- SM-5S fuses are required for 13.8kV equipment. SM-5S fuses are required for 2.4kV and 4.16kV equipment.

- Fuse ratings for 13.8kV equipment is to be provided per the table below.

<table>
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<th>Transformer size (KVA)</th>
<th>Fuse Rating (A)</th>
<th>Main Breaker Pick up (A)</th>
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Installation, Fabrication and Construction

- Switches may be installed indoors or outdoors in non-secure areas.
- A category “A” enclosure is to be provided for equipment installed on non-secured locations.
- Provide features and requirements for enclosures similar to medium voltage switchgear requirements.
- Each bay is to be furnished with laminated plastic nameplates.
- Indoor enclosures shall be drip-proof. All enclosures shall be of compact height: 90” for indoor installations and 93” for outdoor installations.
- For outdoor installations, provide features and requirements for enclosure ventilation, lifting eyes, gasketing and sealing, and space heaters similar to medium voltage switchgear requirements. A thermostat and low-voltage circuit breaker is to be provided in the heater circuit on outdoor equipment.
- Load connections may be direct (transformer throat) or via cable. Note: Phase rotation is a concern at transformer terminals and may require transition space.
- Campus phase sequence is C-B-A. Cable termination positions in switches shall be A-B-C left to right, top to bottom, or front to back when viewed from the front of the switch.

END OF DESIGN GUIDE SECTION