Basis of Design

This section applies to the design and installation of building power distribution systems.

Design Criteria

- This section contains the architectural, structural and mechanical provisions for the building electrical systems. The electrical designer shall coordinate these requirements with the other disciplines to insure these requirements are satisfied.

- Use attached drawing, Typical Building Power Distribution Riser, as a guide for building power systems.

- Coordinate with Campus Engineering the distribution concepts, including load calculations, calculated fault duties, protective device coordination methods and grounding practices being utilized on the design.

Architectural Provisions

- Provide separate service entrance electrical rooms for each of the normal and emergency systems in the basement, preferably adjacent to the utility tunnel and on an exterior wall. Equipment access shafts to the outside and walk-in access from the tunnel system shall be provided wherever possible. The design shall take into consideration the possibility of flooding when below grade. Provide emergency power lights with battery back-up to illuminate main service equipment area. Provide at least one phone outlet in main electrical room.

- Distribution within the building shall be via readily accessible electrical rooms and/or closets. These must be independent from all other types of rooms or closets, i.e., communications, telephone, custodial, audiovisual, etc.

- As a general guide, provide one floor electrical distribution room to serve each 15,000 to 20,000 square feet.

- Equipment room and equipment space requirements should exceed minimum NEC requirements and shall be large enough to accommodate the equipment along with space provisions for future equipment. Eventually, panels will become full, requiring the addition of new panels. This is true even for fairly new facilities and is especially prevalent in laboratory and science buildings. These future wall and floor space provisions shall be shown on the design drawings so that space is reserved. Typically, 6-foot hot sticks are used to work on high voltage equipment. Provide adequate working space per NEC, WAC 296-44 and the National Electrical Safety Code.

- Distribution switchboards, panelboards, and dry transformers over 30 kVA shall be in electrical rooms. Rooms shall be stacked for riser efficiency, and be centrally located to keep feeder lengths to a minimum. Several rooms may be necessary to accommodate the building configuration and system design. Refer to attached drawing, Typical Floor Electrical Room.

- Closets should be a minimum 2 feet deep by 6 feet wide and equipped with full width double doors opening into a building corridor.

- Branch panels shall be located in closets located throughout the floor or wing. In laboratories and similar areas, branch panels may be mounted on or in common corridor walls.
Transformer ambient noise and EMF emissions from electrical equipment and risers can negatively impact the equipment and function in neighboring spaces. This includes spaces immediately above and below these rooms, closets and risers. Therefore, the space plan shall be reviewed to determine if modifications are required.

Provide adequately sized access pathways for the repair, maintenance and eventual replacement of the equipment. Equipment access pathways shall be large enough to allow for the removal of transformers, primary switches and other large pieces of equipment. These paths of egress shall be shown on the building drawings. Weights of transformers could exceed floor loading if other than slab-on-grade basement areas are necessary for egress. Make sure that lifting eyes and floor loading are accommodated for in the design.

Padmount transformers and switchgear must be accessible by vehicular crane and have sufficient working space per NEC, WAC 296-44 and the National Electrical Safety Code.

Mechanical Provisions

Coordinate ventilation requirements in electrical rooms and closets containing transformers or other heat generating sources with mechanical engineer. Convection-type ventilation of the electrical rooms via air/access shafts to the outside has been used in the past at the University. Unfortunately, this allows dirt and debris to get into rooms and equipment, resulting in increased maintenance costs. Therefore, the ventilation shall be supplied and filtered by a ventilation system.

Coordinate fire protection requirements in electrical rooms and vaults with the Architect and Mechanical Engineer. The system shall satisfy the code while minimizing the risk of electrocution. Sprinklers in high voltage electrical vaults create extremely hazardous conditions when they discharge, creating an electrocution hazard for workers.

Avoid installation of mechanical piping and ductwork in electrical vaults, rooms or closets except where required for operation of the electrical equipment. Piping and ductwork must never be installed directly over any transformer or switchgear. Sprinklers installed to protect the electrical equipment are the only exception. Drain lines from the floors above shall not be piped through the electrical rooms below. It is not allowed to use drip pans as a mitigating means that would allow for the piping to be installed in these areas.

Structural Provisions

Provide concrete bases and housekeeping pads for all transformers and equipment, seismically designed with structural connections to the floor slab, and channel or angle iron frames for welded equipment fastening.

Provide supports and restraints for Seismic Zone III requirements for all equipment and raceways.

Coordinate conduit penetrations in slabs, floors, shear walls, structural members, and other structural elements.

Laboratory Buildings

Since laboratory buildings will need constant renovation to keep up with changing technology, they are divided up into lab modules. Each lab (one of more modules) will periodically need to be isolated from the rest of the building to facilitate the renovation without impacting the remainder of the building. Provide circuiting isolation for each lab module. All electrical systems shall be down fed to minimize the number of floor penetrations.

If utility corridors can be provided to serve a variety of purposes through laboratory areas, then it would be highly desirable to provide local panelboards, in these utility corridors, dedicated to individual or small groups of laboratories.
Lab areas will be designed with the capacity of at least 1 power outlet per 30 square feet. Dedicated circuits will be supplied for all refrigerators, centrifuge and specialty devices. Provide hospital grade receptacles in all research laboratories and procedure rooms in the Health Sciences and other physical sciences.

Refer to attached drawing, Laboratory Demand Load, to approximate power required for laboratory areas. Laboratory power systems shall be flexible to allow the anticipated increase in laboratory loads. Local distribution shall be provided based on calculated load. However, more generous conduit sizing, sleeving, space allocated in principal electrical cabinets or closets shall be provided to make it convenient to bring in new feeders to supply additional power for load increases.

Dedicated receptacles and isolated ground receptacles are often required for special or sensitive equipment. Extensive use of dedicated receptacles in laboratories can quickly use up all the circuit breakers in the branch circuit panelboard. The Electrical Engineer shall insure that these needs are identified on the room datasheets and that adequate panel space is provided. Define this early in the design process.

Classroom Services
(Information maintained by Classroom Support Services.)

Classroom electrical services should be protected from surges and spikes. There should be no elevator motors, compressor motors, blower motors, or other types of equipment on the side of the power transformer that feeds the classroom circuits.

New construction and major renovation should provide for between 40 and 50 percent future expansion (space only) in electrical service in each classroom.

Each classroom should have a minimum of two dedicated 20A circuits not shared by any other room.

Classrooms seating under 50 persons should have a minimum of FOUR duplex receptacles: one on each side wall and one in each front corner. In addition, each room should have a minimum of two double duplex receptacles: centered on each of the front and rear walls. Locate all receptacles at 18 AFF.

Auditoria should have a minimum of FOUR duplex receptacles (two on each side wall) and a minimum of THREE double duplex receptacles (spaced evenly along the front wall.) Locate all receptacles at 18 AFF.

Provide a duplex electrical outlet in the ceiling for ceiling mounted video projector in Level "C" and "E" rooms. Locate service within 4 feet of ceiling mounting bracket as directed by CSS staff. Ceiling outlet should be on circuit not shared with other outlets.

Auditoria projection rooms should have both 120v and 220v service. 220v service is required for data projectors. The specific type of 220v outlet and its location will be determined with CSS staff during the design/development stage of the project.

Auditoria should have a breaker panel in the projection booth or control room that provides electrical service for all functions specific to that room. Breaker panels inside instructional rooms are otherwise not acceptable. Panels should be located in either corridors or electrical closets.

Electrical service is required at podium floor boxes in Level "C" and "E" rooms.

Floor duplex outlets are required in all classrooms to support overhead projectors and other portable equipment.
- Classrooms may use owner-provided equipment. Provide appropriate wiring and raceways necessary for power and communication systems for owner-provided equipment.
- Refer to Section 18A, Classroom Support Services for additional information.

**Design Evaluation**

The following information is required to evaluate the design:

- **Programming**: Space planning and provisions for power distribution systems. Statement on power distribution system layout and basis of design.
- **Schematic Design Phase**: Design requirements and location of electrical rooms and closets. Design intent for power distribution system including point of connections and modifications to existing systems. Preliminary power one-line diagram and riser diagram. Electrical load estimate. Outline specification.

**Submittals**

- Provide standard industry submittal requirements.
- Refer to requirements specified in related sections.

**Products, Materials and Equipment**

- Refer to requirements specified in related sections

**Installation, Fabrication and Construction**

- Refer to requirements specified in related sections.
NOTES:
- EXCLUDING LIGHTING AND SPECIAL EQUIPMENT.
- EXCLUDING RELATED STORAGE, OFFICE, OR RECEPTION AREA.
- MINIMUM TRANSFORMER AND FEEDER SIZES NOTED. (INCLUDES 40% SPARE CAPACITY)
Typical Building Power Distribution Riser

NOTES:

1. USE CABLE & CONDUIT RISERS, AND FEEDERS NOT TO EXCEED 800A EACH.
2. A SINGLE RISER MAY FEED NO MORE THAN TWO DISTRIBUTION PANELS, OR THREE 480V BRANCH PANELS.
3. FOR SMALLER BUILDINGS OR LOADS, A SINGLE DISTRIBUTION BOARD MAY SERVE UP TO 3 FLOORS WHEN LOCATED ON THE MIDDLE FLOOR.

4. 30% TO 40% SPARE SPACES AND AMPACITY SHALL BE PROVIDED.
NOTE:
ADDITIONAL ROOMS OR CLOSETS MAY BE REQUIRED ON EACH FLOOR. ADDITIONAL SPACE MAY BE REQUIRED FOR LIGHTING CONTROL PANELS, CRITICAL OR EQUIPMENT BRANCH PANELS, FIRE ALARM PANELS, SUPERVISORY CONTROL PANELS, AND SPACE FOR FUTURE PANEL(S).