APPENDIX E

ELECTRICAL CRITERIA

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A. GENERAL REQUIREMENTS

1. Materials

a. All current carrying conductors shall be 95% conductivity copper. This includes primary cable, building wire, signal, communication and control wire, panel buses, switchgear and switchboard buses, and bus duct.

b. Primary cable 5 KV and 15 KV shall be ethylene propylene insulated to 133% voltage level. Systems are to be grounded neutral with the extra thickness as a safety factor. Primary cable shall have copper conductors and copper shielding.

c. The characteristics of the primary power service shall be determined specifically for the campus involved and for the particular location on the campus.

d. In general, each major building shall have two underground primary feeders terminating in a double ended sub-station. This does not apply to all campuses.

2. Transformers

a. Each transformer in a double ended sub-station shall be sized to serve 75% of the maximum demand on the sub-station. In critical loads such as hospitals and research facilities or where determined to be necessary by the University and design team, this may be increased to 100%.

b. Where feeders are arranged in a looped system, full capacity feed-through capability will be required.

c. Generally the first transformation shall be to 277/480 volts, 3 phase, 4 wire. 4160 volts, 3 phase, 3 wire may be required for large motors.

d. Three phase dry type transformers shall be installed at strategic locations to provide 120/208 volt, 3 phase, 4 wire service to incandescent and task lighting, convenience outlets, specific equipment loads and small motors. One of the determining factors of the transformer locations shall be the cost of the increased length of branch circuits versus the addition of transformers/panels.

3. Metering

   a. Minimally, watt hour and demand meters shall be provided to meter all energy usage. Consideration of the use of intelligent metering for power and energy tracking and reporting, power quality monitoring, reporting and alarms shall be made following discussion and coordination with the University and determining compatibility with existing campus metering systems.

   b. Meters shall be equipped with the pulse initiators so they can be monitored remotely. Compatibility with existing campus metering systems shall be considered.

4. Utilization voltages generally shall be as follows, unless determined differently by design team with University approval:

   a. 4160 volts, 3 phase for motors 300 HP and larger.

   b. 480 volts, 3 phase for motors 5 HP and larger.

   c. 208 volts or 480 volts, 3 phase for motors 1 ½ - 5 HP.

   d. 208 volts, 1 phase, for motors 1 ½ HP and smaller.

   e. 120 volts for motors ½ HP and smaller.

   f. 277 volts, 1 phase, for fluorescent lighting.

   g. 120 volts, 1 phase, for incandescent and individual task lighting, convenience outlets and specific equipment loads.

   h. 277 or 480 volts, 1 phase for high intensity discharge lighting, smaller space heating applications, and as required for special purpose outlets.

5. Services Outages – the following requirements shall be included in construction drawings and/or specifications:

   a. Any total or partial building service outage required to complete the installation shall be coordinated with and shall not proceed without written permission from the University.

   b. A written request for service outage shall be forwarded to the Construction Inspector a minimum of 10 business days prior to desired outage. The Contractor shall include in his letter a schedule of work and an estimate of the time to accomplish the work.

c. The University reserves the right to require the Contractor to perform this work during non-normally occupied hours at no increase in contract price.

6. Protection of Apparatus

a. Contractor shall arrange not to bring electrical apparatus on job site, or place within the building until construction has progressed to the point where full protection from damage by weather, submersion by flooding, or other potentially destructive causes is assured.

b. Extreme care shall be exercised at all times to keep the ends of primary service conductors sealed, air and water tight, until connections are made.

7. Energization of Primary Conductors

a. When the primary service conductors have been initially energized, they shall not be de-energized except for emergency reasons, equipment failures, and like causes. Reasons for unscheduled de-energizations shall be immediately reported verbally and subsequently in writing to the Construction Manager.

b. Should de-energization be required for cause, such de-energization shall not continue for a period exceeding three hours. The necessity and reason for one or more operations of scheduled de-energization shall be submitted to the Construction Manager, and subsequently confirmed and approved in writing prior to proceeding.

8. Adequate Space

a. Provide adequate space for all electrical apparatus allowing ample room for access and servicing, removal and replacement of parts, etc., as required.

b. Provide adequate space for telecommunication system equipment on a per floor basis as required. Allow ample wall space for termination of equipment and multi-conductor cables from all telecommunication locations on floors. Terminal boards and cabinets must not be installed in janitor closets or storerooms.

c. A clear statement shall be made concerning construction power: where, and at what voltage and phase, who makes the installation, and who is responsible for the cost.

9. Material Quality

   a. Electrical materials shall comply with the standards of the Underwriters Laboratories, Inc., where that body has established test procedures for a class of material. Evidence of such compliance shall be the U. L. label, or "listing" under Re-examination Service.

      (1) In general, specify top-of-the-line products of proven reliability. Although we are required to encourage competition, in the exceptional case where there is no equal to a product which it would be to our advantage to use, justification must be documented.

10. Lighting

   a. The lighting level required and the type of luminary to be used in each area, interior and exterior, shall be submitted. The calculated lighting level based upon the lighting system designed shall also be submitted by the DD stage or early CD to prevent redesign. Floor or site plans with lighting software generated photometrics are strongly encouraged and may be required by the University depending on the application, for normal lighting and separately for emergency lighting. Catalog cut sheets on each lighting fixture shall be submitted for review.

11. Lightning Protection

   a. In general, all buildings shall have an Underwriters Laboratories, Inc. approved, Master Label lightning protection system. Where such a system is not provided, complete justification for its elimination shall be made a part of the record.

12. Provision for the Handicapped

   a. New buildings shall be constructed to comply with current Texas Accessibility Standards. Remodeled buildings shall be brought into compliance as required. This shall include, but not necessarily be limited to:

      (1) Height of wall mounted devices, receptacles, light switches, card readers, etc., above finished floor.

      (2) Type and location of audible and visible fire alarms and other distress signals.

B. DESIGN REVIEW SUBMITTAL REQUIREMENTS

1. The A/E will be required to present the plans and specifications for review to OFPC at the intervals outlined in the A/E Agreement. Intermediate reviews may be required if the scope of the project has been changed or if an earlier review found the plans and specifications unacceptable either as a whole or in part.

2. The Electrical Engineering consultant(s) will participate in all reviews, work sessions and presentations where this discipline is involved. Items outlined below are to be included for review at each phase or stage of completion.

3. OFPC Project Name and Number, north arrows, and graphic scales on drawings.

4. Engineered drawings are required to include the engineering firm's Texas Registration number and the engineer of record's Texas PE number.

5. Schematic Design – Refer to Appendix L

6. Design Development – Refer to Appendix L

7. Construction Documents:

   a. Interim - 50% CD stage presentation:
      (1) Review of specifications using tracked changes for any modifications made to OFPC base specifications.

      (2) Overall progress made to DD documents prior to those listed for 75% CD.

   b. Interim - 75% CD stage presentation:

      (1) All electrical distribution equipment located.

      (2) Complete lighting and light switching layouts.

      (3) Lights, receptacles and equipment requiring electric power circuited, but circuit numbering may not be complete.

      (4) Fixture schedule complete.

      (5) Electrical symbols schedule complete.

      (6) Site plan, all services detailed.

      (7) Panel schedules nearly complete.

(8) Separate grounding system design complete.

(9) Electrical details nearly complete.

(10) One-line or riser diagram complete, except final sizing of protection, transformers and feeders depending upon final mechanical equipment selections.

(11) Updated load analysis accurate to 75% CDs.

(12) Reflected ceiling plans to match architecture's.

(13) Specifications complete.

c. Final - 100% Submittal:

(1) Design complete. Corrections required from Final Review Comments to be included on either another final submittal or as addenda, depending upon the extent and severity of comments.

(2) Engineer of Record's seal shall be on all drawings.

C. ENERGY CONSERVATION

1. Electrical systems design shall comply with The Energy Conservation Design Standard for State Buildings except Low-Rise Residential Buildings, based on ASHRAE Standard 90.1 for Nonresidential Buildings. See Appendix C for current edition.

2. Consideration shall be given to efficiency, lamp life, and ease of maintenance of light source:

a. In general, use fluorescent, HID or LED sources in lieu of incandescent or quartz lamps.

b. Use incandescent or quartz only where aesthetics or the specific function requirement outweighs economic considerations.

c. Where incandescent or quartz sources are used, consider methods for increasing lamp life and reducing energy consumption, such as limit the use and quantity, use dimmer control, etc.

d. Coordinate with each University campus for preferred lamp and fixture types.

e. Design illumination levels shall be as set forth in IESNA Lighting Handbook, latest edition.

f. Consider maximum flexibility for switching and circuiting for lighting control as natural illumination levels, and/or task change:

(1) Automatic occupancy sensing may be used in areas where this may be applicable to save energy, even where not required by ASHRAE 90.1.

g. Switch rows of fixtures nearest natural illumination (windows) separate from other fixtures where applicable.

h. Provide multiple circuits for outside lighting, such that lighting can be reduced, yet uniform coverage retained, in times of critical energy shortage or as applicable for scheduling.

i. Control outside lighting with photo-electric cells in conjunction with a time-of-year adjustable time switch capable of one "off" and one "on" operation during the hours of darkness.

j. Designate security fixtures that are to remain on all night as controlled with photocell only.

3. Use task lighting techniques with lower room ambient lighting levels where applicable and where task areas can be defined to achieve energy conservation.

D. COORDINATION OF DESIGN

1. The A/E shall prepare Reflected Ceiling Plans that coordinate and accurately locate ceiling panels, lighting fixtures, A/C supply and return grilles, sound system speakers, automatic sprinkler heads, fire and smoke detectors, access doors, and any other ceiling located items.

2. The A/E shall make every effort to coordinate the design between disciplines. The final drawings shall as a minimum be checked for the following:

a. Physical space above ceiling for duct work, lighting fixtures, piping, etc.

b. Compatibility of lighting fixtures to ceiling types and the environment in which they are installed.

c. Compatibility of all equipment to the environment in which they are installed.

Revision Log
Appendix E

Rev. Date	Remarks
10/1/10	Various technical clarifications throughout document and deliverable requirements