ELECTRIC DISTRIBUTION SYSTEMS

ENERGY SERVICES DEPARTMENT

TECHNICAL DESIGN AND CONSTRUCTION

GUIDELINES AND STANDARDS

JULY 2009

Notes:

1. References for Electric Distribution Systems standards and guidelines would normally be contained in Section 16 of the OSC Construction Guidelines, and are contained herein with that same reference section. Section 16 has not been included in its entirety, which includes electrical facilities other than medium voltage and site lighting.
2. Specifications for switchgear, transformers, cable, meters, sight lighting and other equipment are available from Electric Distribution Systems, on request and when appropriate to the project considered.
3. Please direct questions or concerns regarding design and materials to the Manager of Electric Distribution Systems, telephone 919-962-5244.
4. Listed standards and guidelines are provided under the authority and direction of the Manager, EDS.

DIVISION 16 – ELECTRICAL

16050 General

Description

Refer to Chapter III, Paragraph 18, Building Systems for Mechanical, Plumbing, and Electrical Building Spaces for Schematic and Design Development design considerations.

This division provides information on basic materials and methods for providing and installing electrical service, distribution, lighting, special systems, communications and controls for new construction and renovation projects at The University of North Carolina, Chapel Hill.

Applicable Codes, Regulations, and Standards

- The following codes (latest edition) shall apply:
  - National Electrical Code
  - National Electrical Safety Code
  - The State Building Code
  - North Carolina State Construction Office 2005 Electrical Guidelines
  - Occupational Safety and Health Act of North Carolina (OSHANC)
  - Code of Federal Regulations (DFR) 1910.269
  - Code of Federal Regulations (CFR) 1946
  - Illuminating Engineering Society (IES)
- The following standards shall apply:
  - Underwriters Laboratory (UL)
  - Electric Testing Laboratory (ETL)
  - National Fire Protection Association (NFPA)
  - National Electrical Manufacturers Association (NEMA)
  - American National Standards Institute (ANSI)
  - Requirements for Fire Detection and Alarm Systems/Smoke Detectors Meeting State Requirements, Department of Insurance, State of North Carolina, Latest Edition.
  - Institute of Electrical and Electronic Engineers (IEEE)

Local utility regulations governing connections and metering require an electrical inspection certificate from the State Electrical Inspector, Department of Insurance prior to approval for final payment and before energizing any new transformers and electrical service.

Where above guidelines conflict with this specification, the more stringent of the two shall prevail.

Any and all work in streets or sidewalks will require proper permits and traffic control plans should be submitted to NCDOT, Town Engineer and UCD DPS for approval.

Premises Wiring System Tests

Upon completing the installation, the electrical contractor shall conduct an electrical load balance test, a system and equipment ground resistance test (maximum of 5 ohms), and system continuity tests and shall submit reports documenting such tests. Panel phases shall be balanced within 10%.

Equipment Identification
All equipment shall be properly identified with equipment identification, equipment controlled, electrical ratings and date of installation.

The following are recommended general notes to include in the specifications.

Performance Tests
Should the Designer have any reasonable doubt as to the proper functioning of any equipment installed under this Contract, at any time during the guarantee period; the Owner and/or Designer has the right to perform any test deemed practical to determine whether such equipment is functioning properly and performing at required capacity. If such tests show proper functioning, the cost of the test will be paid by the Owner. If the test indicates a deficiency in equipment capacity or performance, the Contractor shall pay the cost of the test and also make good any deficiencies shown by the test to the full satisfaction of the Owner and the Designer.

Electrical Systems Training
The instruction time periods shall be approved by the Owner and conducted during normal working hours, Monday through Friday, at the job site. Owner's facilities staff will be trained in proper maintenance and how to operate and make adjustments on all equipment. Training on specialized equipment shall be by manufacturer's authorized representative.

The Owner reserves the right to request replacement of any instructor who, in their opinion, does not demonstrate sufficient qualifications as an instructor. Final acceptance of the project will not be given until all specified training is completed.

Acceptance Criteria
After completion of specified training, the Contractor shall conduct the specified operation acceptance test, witnessed by the Owner's representative.

16111 Conduits-Primary Service (15 kV)

Approved Contractors
UNC-Chapel Hill Electric Distribution Systems has special requirements for any contractor or subcontractor installing duct-banks, transformer pads, switch pads, and similar facilities that will ultimately be part of its joint electric/telecommunications distribution system.

Any such contractor or subcontractor must have a North Carolina General Contractor's License with a Public Utility - Electrical - Ahead of the Point of Delivery - Unlimited Classification per the North Carolina Licensing Board for General Contractors, Rules and Regulations, North Carolina Administrative Code, Title 21; Chapter 12.

All such contractors must also be able to demonstrate to the satisfaction of the Manager - UNC-CH Electric Distribution Systems and/or his or her appointees, through references or prior project work at UNC-CH, that they have adequate, directly related experience to properly perform the ductbank work requested.

The contractor possessing the required license and meeting the experience test described must perform the work themselves.

Applicable Codes, Regulations, and Standards:

The following codes (latest edition) shall apply:

- National Electrical Code
- National Electrical Safety Code
- The State Building Code
- North Carolina Construction Manual, Division of State Construction, Department of Administration, Section 112.4 Electrical.
- Occupational Safety and Health Act of North Carolina (OSHANC)
- Code of Federal Regulations (CFR) 1946
- Code of Federal Regulations (CFR) 1910.269

The following standards (latest edition) shall apply:

- Underwriters Laboratory (UL)
- Electric Testing Laboratory (ETL)
- National Fire Protection Association (NFPA)
- National Electrical Manufacturers Association (NEMA)
- American National Standards Institute (ANSI)
- UNC-CH Electric Distribution Systems Material, Design, and Construction Specifications

Detailed Ductbank Specifications:

Trenching and Excavations

- Excavation and backfill shall conform to NC State Construction Office Guidelines except that heavy-duty, hydraulic-operated compaction equipment shall not be used.
- A tree protection plan shall be approved by the UNC Grounds Department prior to excavation. (Add Link to standard.)
- Trenches should be cut neatly, uniformly and as straight as field conditions permit, sloping uniformly to required pitch with smooth walls.
- Bottom of trenches to be smooth; uniform and free of loose dirt, rocks or other debris. Mud shall be mucked out and replaced with dry dirt or stone as needed. The bottom of the trench shall be properly compacted.
- Trench walls that have collapsed or where large rocks have been removed shall be formed with plywood to maintain a uniform side of the concrete encasement and to reduce concrete overflow.

Back Filling

- All back fill material shall be clean, dry, and free of rock, concrete, and other construction debris.
- Backfill shall be tamped in layers per NC State Construction Office Guidelines.
- When a ductbank is installed through cut rock; at least 3 inches of clean backfill such as sand, fine gravel or crush and run shall be placed in the bottom of the trench and properly compacted before conduits are installed.
- Any ductbank through existing or proposed asphalt or concrete must be completely back filled with flowable fill to avoid future settling.

Rock Removal

Rock excavation includes removal of rocks or boulders larger than ½ cu. yard in volume and that occurs in beds, ledges, stratified or unstratified masses or in singular deposits. Qualifying rock or boulders are those which cannot be removed by heavy-duty rock excavating machinery or equipment without the use of a ram hoe, symmetrical drilling, blasting or ripping.

Removal costs for rock shall be on the basis of unit prices included in the Contract Documents. A specific rock allowance may be requested on a project by project basis.

Conduits

All conduit runs used for primary voltage (15 kV) cables shall be PVC Schedule 40 or rigid galvanized steel as specified in project documents. Typical conduit shall have a nominal (minimum inside) diameter of six (6) inches. Other size conduits may be required depending on the project needs. All conduits shall have one belled end per length.

Terminate all conduit end points in switching cabinets and at transformer pads no less then 2 inches and no more than 4 inches above grade or a finished slab. Use of steel conduit when required coverage is unattainable shall be approved by the UNC Project Manager and UNC-CH Electric Distribution Systems Engineering.

Terminate all PVC conduit end points in utility holes, switching cabinets, transformers, hand holes and buildings with end bells. The bell end of the conduits that enter manhole and handhole walls shall be flush with the wall. Seal conduit entrances into utility holes, hand holes and buildings on the end bell side of the entry. Plug all conduit entry end points with expandable reusable conduit plugs capable of withstanding 15 PSI minimum hydrostatic pressure. As an example, UNC Electric Distribution Systems uses blank plugs made by Jackmoon USA Inc. a division of Tyco Electronics.

Bends and Sweeps

All conduit field bends and factory elbows must be equivalent in strength to the attached conduit. All factory elbows shall have a minimum “standard” radius by size, as prescribed by NEMA. All field bends shall be made only with approved equipment identified for that purpose and have a minimum standard radius by size, as prescribed by NEC Articles 346 and 347.

Use of special radius bends and elbows is encouraged. Special radius bends and elbows are those which have a larger (more gentle) radius than the standard radius. Schedule 40 PVC shall be used for field bends.

The inside of conduits shall be beveled slightly when conduits are cut or when joining two different schedules of PVC conduit to prevent conductors from snagging on the inside edge.

Dimensions

Ducts should be pitched to drain toward manholes and hand holes and away from buildings and equipment. Minimum slope shall be 4 inches in 100 feet. Where necessary to achieve this between manholes, ducts should be sloped from a high point in the run to drain in both directions.

Design depth for the top surface of all duct banks is 36 inches (minimum) below finished grade or concrete.

Encase all PVC conduit in concrete, with a minimum 3 inch spacing between the outside of adjacent conduits, a minimum of 3 inches to the outside of the concrete ductbank on the sides and top, and a minimum of 3½ inches of concrete on the bottom of the ductbank . This is accomplished using only approved duct bank conduit spacers. Do not use other means, material or devices to achieve the required spacing. The UNC-CH Electric Distribution System approved duct bank spacer is the Underground Devices, Inc. "WUNPEECE" spacer, web site www. Udevices.com. No other spacer is acceptable.

Apply duct bank conduit spacers along each level of conduits no more than 5 feet apart. To provide required support in a manner which will minimize the creation of sheer joints, spacers at any given conduit level shall be staggered 1 foot relative to spacers at conduit levels above and below. Sheer joints are created when the spacers per each conduit level are applied all at the same point along the duct bank run. This creates a weak "joint" (wall of spacers) in the duct bank, due to the lack of concrete. Conduit spacers to the earth and to ducts should be secured or anchored to prevent floating during placement of concrete. Steel or tie wires shall not be used as they may form conductive or magnetic loops around ducts or duct groups.

Electric automation and control conduits shall be placed within the open space of the conduit spacers and secured with plastic tie wraps.

All duct bank runs where the cumulative effect of field bends and factory bends or elbows exceeds 180 degrees must be approved by the UNC Project Manager and UNC-CH Electric Distribution Systems Engineering. Under no circumstances should the cumulative effect of field bends and factory elbows between termination points exceed 270 degrees.

Concrete

All concrete shall be 3000 PSI or greater, 28-day compressive strength, with a slump at point of placement of 4 inches maximum and 3 inches minimum.

The top surface of the concrete ductbank envelope shall be raked smooth and level.

At the end of each day's pour, stop concrete at a 45 degree angle and install reinforcing bars (minimum of six) to strengthen the transition to future duct extensions.

Marking, Testing and Inspecting

Mark all duct bank runs with a warning tape, installed no less than 6 inches and no more than 12 inches above the top of the duct bank concrete. Place warning tape along the approximate center line of the duct bank run. Warning tape shall be permanent, bright-colored, continuous printed, plastic tape compounded for direct burial not less than 6 inches wide and 4 mils thick. Printed legend shall be indicative of general type of underground line below.

Waterproof marking cord shall be installed using ½ inch wide 1250 -pound tensile test cord (marked at least every foot), equivalent to NEPTCO Inc. MuleTap Part # WP1250P, in all ducts, including spares, after thoroughly rodding, clearing and swabbing all lines free of any and all obstructions. DO NOT splice, tie or otherwise join shorter lengths together. Only a whole, unbroken length of tape to be installed in each duct.

As part of acceptance testing, all conduits, including spares, shall be mandrelled using an appropriately sized steel mandrel approved and witnessed by UNC-CH Electric Distribution Systems.

In addition to the State Electrical Inspector, UNC Electric Distribution Systems shall inspect all 15 kV primary conduit installations prior to concrete encasement or backfill. Failure to receive this inspection could result in demolition and rebuild of the duct bank.

Telecommunications Duct Systems

All specifications noted above in Detailed Ductbank Specifications apply to telecommunications duct systems.

Telecommunications conduit needs vary. Telecommunications utilizes multiple conduit bundles designed to fit standard size conduit spacers. These bundles are to be secured together utilizing plastic tie wraps to prevent conduit sagging, bending, and movement.

All duct banks installed for the sole use of telecommunications cables shall include a suitable locating wire.

Refer to Section16130 – Conduits Telecommunications for details associated with use of multi-cell conduits in telecommunication duct systems used as service laterals to buildings, etc. Multi-cell conduits will typically not be used between manholes and in joint electric/ telecommunication duct banks.

Manholes

Telecommunication, electric distribution and electric transmission manholes shall consist of preformed concrete top and bottom elements with knockouts for ductbank installations. Each manhole shall be consistent with the specifications provided by UNC-CH Electric Distribution Systems for each new installation.

Minimum cover over manholes shall be 36 inches from finished grade.

Manholes shall be left clean of debris, water, mud and soil, with all ductbank entrances sealed as per specifications.

16120 Wire and Cable

The minimum size wire conductor is #12 AWG for premises wiring. Exception: #16 and #14 is acceptable for control and/or signal circuitry as allowed by the National Electrical Code and the Department of Insurance. Branch circuit wiring shall be sized for a maximum of 3 % voltage drop. Fully loaded multi-outlet receptacle circuits shall be assumed in sizing wiring for receptacle outlets.

- Insulation for premises wiring is THHN for dry locations; THWN for wet.
- All conductors, without exception, shall be copper. Aluminum is strictly prohibited.
- Size all neutral wires for 3 phase systems equal to or larger wire size than the phase conductors. 120/208 volt branch circuits in all labs and offices shall have a separate neutral conductor for each circuit
- No more than one conductor for each phase plus individual neutrals and an equipment grounding conductor is allowed in a conduit.
- All wireways shall contain code sized equipment grounding conductor. All power wiring shall be in conduit. Conduit shall not be run in slab except where specifically approved and indicated in plans.
- **MC, AC or "BX" cable is not allowed, .**

Electric Distribution Systems' will specify, furnish, install, terminate, splice and test all high voltage (15 KV) cable. Cable will be single conductor, copper shielded, ethylene propylene rubber (EPR) insulated power cable rated 15 KV. Installation will include separate 600 volt neutral.

Although not prohibited by the National Electrical Code, do not mix conductors serving two separate power systems (i.e., 208/120 volt and 480/277 volt) in the same raceway, pull box or junction box. Exception: Where control wiring is a different voltage from power for the same system.

- Color code system wiring for standard clockwise rotation is shown below:
  - 208/120 volt systems 408/277 volt system

o Phase A -- Black	Phase A -- Brown
o Phase B -- Red	Phase B -- Orange
o Phase C -- Blue	Phase C -- Yellow
o Neutral -- White	Neutral -- Gray
o Ground -- Green	Ground -- Green

16130 Conduits

Minimum conduit (including flexible) size is 3/4" (interior) and 1" (exterior) for premises wiring (system). Exception: 1/2" flexible metal conduit not exceeding six feet may be used for fixture and small equipment drops.

Telecommunications Conduits must comply with the following:

All specifications noted in 16111 Conduits-Primary Service (15 KV) apply, except as altered by the characteristics of the Carlon Multi-Guard product line. Conduit systems for Telecommunications include at least one Multi-duct conduit for each three empty conduits installed.

In addition to standard PVC and galvanized steel conduits, Telecommunications utilizes Carlon Multi-Guard MXSS4S. This is a multi-cell conduit system inclusive of flexible bends, factory bends and accessories such as spacers, standard coupling kits, slip coupling kits, and terminator kits.

Install as per the manufacturer's instructions. All installation requirements as stated in 16111, for handling, supporting, terminating, testing and sealing procedures, apply.

16271 Transformers - Pad Mounted

Transformers shall be dead front, loop feed, pad mounted design. UNC Electric Distribution Systems shall provide transformers for connection between the UNC 15 kV primary cable system and the building service. Transformers shall be located no closer to any building surface than 4.0' and more than 10' from any window. These transformers will be in accordance with the latest version of UNC Electric Distribution Systems General Specification No. E0006.

- UNC Electric Distribution Systems shall provide and install connectors to terminate contractor installed service conductors on the transformer secondary spade terminals.
- UNC Electric Distribution Systems shall make the final service conductor connections to the transformer secondary spade terminals.

The costs of service transformers are included as part of the project cost. Electric Distribution Systems will provide the cost for the installation to the project designer for inclusion in the project. Electric Distribution Systems will make the size determination for all transformers installed on the campus for all service connections.

The contractor is responsible for:

- Proper installation of the secondary/ service conductors which shall include accurate cable phasing and marking, cutting conductors to the proper length, and megohmeter testing for any insulation problems, short circuits, or cross phasing connections.
- For contractor installed direct buried ground loop, grid, or counterpoise requiring buried connections, these connections shall be exothermic weld type connections. This applies to both transformers and primary voltage switchgear grounding.

16341 Primary Voltage Switchgear

Normally, new connections to the electric distribution system are made at switches. Locate these switches in utility manholes or surface mounted on a concrete pad sized for the switch that will be installed. Information regarding the switch type and location will be provided to the project designer at or near Schematic Design review time.

Since these switches are part of the electric distribution system, the design associated with switch installations is the responsibility of Electric Distribution Systems. Coordinate any proposed connection to the system with Electric Distribution Systems. The costs of system connections, including additional switches needed for the connection, are included as part of the project cost. Electric Distribution Systems will provide and install system switches and will provide the cost for the installation to the project designer for inclusion in the project.

16441 Service and Distribution

Equip main distribution panel with digital metering to measure the following:

- Voltage: Phase to neutral and phase to phase.
- Amperage: (True RMS) - each phase and neutral. Fundamental and harmonics through 19th.
- Kilowatt Demand
- Power Factor

Mount one copy of the electrical riser diagram near the main switchgear in the M.E. Room under clear protective material. For partial renovations an updated copy of the complete electrical riser shall be provided in plans and mounted in main switchgear room by contractor.

Temporary Services

Standard temporary service is provided for the sole purpose of providing construction power for only the duration of the construction project. All such services shall comply with NESC, Section 1 and NEC Article 230. Such service does not alter service entrance code and safety requirements and shall not be used as a replacement for permanent service.

Standard Temporary Services are typically overhead, but may be underground, depending upon the construction site location. UNC Electric Distribution Systems' preferred temporary service is 120/240 single phase, furnished from an overhead transformer. Overhead three phase 120/208, 120/240 and 480 volt service can be made available. In addition, underground three phase 120/208 and 277/480 volt service can be made available. Although underground 120/240 volt single phase service can be made available, it is highly discouraged due to the associated cost.

Temporary service costs, payable in advance, are based upon all non-reusable materials, labor to install and remove and appropriate overheads. This cost is a fixed cost, i.e., it is a lump sum cost and must be paid prior to UNC Electric Distribution Systems providing the temporary service.

Temporary services 200 amperes and under are metered with self contained meters. Therefore they only require a standard meter base, which is furnished by UNC Electric Distribution Systems. Temporary Services over 200 amperes require current transformers for metering. This will require a CT cabinet, furnished by the contractor.

The contractor should contact UNC Electric Distribution Systems for the location of temporary service equipment, the appropriate size of any CT cabinets, and associated costs for this service. Temporary service is provided at a location just inside the construction site fence at an agreed point of delivery as approved by UNC Electric Distribution Systems. Any damage to or relocation of the temporary service required by the contractor is at the contractor's expense.

Electric Distribution Systems will provide one temporary service per site, unless the site qualifies for more than one as described in NEC Article 230. If more than one temporary service is required, the cost for the second service is payable in advance.

The contractor is responsible for coordinating and acquiring all local inspections and filing an application for service with the Energy Services Business Office. This filing date must allow adequate time for Electric Distribution Systems to provide the desired service. The contractor who applied for each temporary service will be solely responsible for paying all monthly billing associated with that service. No allowance for such billing will be assumed in the overall electrical bid for any project.

The contractor shall provide a structure of sufficient strength and height to accept the appropriate overhead or underground supply conductors and to comply with appropriate local and NEC codes for height, voltage, clearances and utilization of power.

Utility Metering

All electrical installations are typically metered for KWH/KWD for utilities billing purposes at the transformer. Electric Distribution Systems will furnish and install all pad mounted transformer metering equipment including meter, meter base, current transformers, potential transformers and wiring. Cost of this installation will be included in the project cost.

Submit all electrical installations requiring special metering, to Electric Distribution Systems for approval.

16521 Site Lighting

Exterior lighting constitutes the first line of defense in the overall security and safety plan of the campus. It provides the needed visibility for vehicles and more importantly, pedestrians to safely travel around the campus. At the same time, lighting that illuminates perimeter neighborhoods or the night sky is actively avoided.

Exterior lighting typically falls into the following categories:

- Streets
- Parking lots
- Walkways
- Athletic
- Common areas surrounding buildings.

It is the goal of the University to preserve the ambiance of the campus while ensuring well-lit areas of travel about the campus. This requires the consistency, as is feasible, of fixture types and luminaries. The availability of several voltages requires special attention in design. There may be multiple voltages within any one particular area. Typical voltages are 120, 208 and 277.

All street and large surface parking lot lighting is high-pressure sodium (HPS) unless otherwise approved by UNC Campus Lighting Master Plan Committee (CLMPC). New and or replacement fixtures shall confirm to existing fixtures in and around the general area under consideration and shall be of equal or better quality. As a minimum, lighting levels should conform to those put forth by the Illuminating Engineering Society of North America. Temporary lighting may be required during the construction phase to ensure a safe area at night. Temporary lighting will be the responsibility of the project. All such lighting shall be of a cutoff design to reduce any light distribution above a plane equal to the plane of the fixture lens.

All pedestrian pole lighting is ceramic metal halide with “Old Standard” style in accordance with EDS specifications ES 12-01 and ES 12-02 and as approved by CLMPC. All such lighting shall be of a cutoff design to reduce any

light distribution above a plane equal to the plane of the fixture lens. Further, consideration may be given to the use of LED light fixtures, in consultation with the EDS Manager.

Athletic field lighting shall be designed for use with ceramic metal halide lamps. The poles, fixtures, operating voltage, and power sources or feeds shall be specifically designed for each particular installation.

All outdoor fixtures shall be photocell relay operated. Multiple lighting fixtures should be on a contactor that controls all lights within an area.

Lighting Fixture Types

Lighting in relationship to a new or remodeled facility may typically involve:

- Removal and replacement of existing fixtures
- Addition of new self standing fixtures
- Addition of new wall mounted fixtures
- Use of new technology LED type fixtures (subject to specific EDS conditions and specifications)

Removal of Existing Fixtures

It may be necessary to remove some existing fixtures to facilitate the transition between a new fixture and the existing fixtures or to improve the illumination level. UNC Electric Systems personnel accomplish removal of all existing fixtures. Associated cost for this work is to be included within the project budget.

There are many fixtures on campus that are very old and almost impossible to replicate. Great care needs to be exercised when handling these fixtures.

Fixtures may or may not be all on one circuit. Use appropriate breakers and contactors in conjunction with rated photocells.

Addition of New Free Standing Fixtures

When the need arises for adding new freestanding fixtures, care must be given to ensure uniformity in fixtures and lighting levels with surrounding fixtures and lighting levels. Detail should be given to all obstructions that result in a "cutoff" of the required light pattern. All new freestanding fixtures to be approved by CLMPC. All new site lighting systems, other than individual lights, shall be served from an electrical source that is connected to the exterior electric system typically near or at the nearest transformer, not the building system , and be metered at the separate source.

Addition of New Wall Mounted Fixtures

When the need arises for mounting fixtures on an outside wall of a building, design the lighting system to ensure adequate lighting levels without creating glare or nuisance lighting into residential rooms or other areas. Mount these lights for ease of maintenance and connect to a source in the building load center. Coordinate with UNC Facilities Planning and UNC Electric Distribution, prior to preliminary design, regarding the following:

- Available voltages and sources.
- Fixture styles and types.
- Pole placement and heights.

The UNC Campus Lighting Master Plan Committee (CLMPC) approves all selections for site lighting. UNC Electric Distribution Systems provides standards, approves selections and ultimately maintains all outside, pole mounted area, walkway, parking lot, street, and athletic lighting on the UNC campus properties. For projects which involve typically less than five lights, UNC Electric Distribution Systems may elect to provide materials and installation using project funding. Projects involving larger numbers of lights should be included in the requirements for the electric contractor and are subject to Electric Distribution Systems approval and inspection. For more details on lighting, see relevant section of the University's Development Plan at http://www.fpc.unc.edu/planning/MainCampusDevelopmentPlan.aspx

Consideration shall be given to specifying exterior lighting such that exterior luminaries with more than 1,000 initial lamp lumens are shielded and all luminaries with more than 3500 initial lamp lumens meet the Full Cutoff IESNA Classification. In addition, consideration shall be to specifying luminaries within a distance of 2.5 times its mounting height from the property boundary to have shielding such that no light from those luminaries crosses the property boundary. (IESNA RP-33-99).

Furthermore, lighting should be designed to reduce light pollution to the night sky. For more details on light pollution and light trespass, see the Illumination Engineering Society of North America's Recommended Practices for outdoor lighting (IESNA RP-33-99). All outside lighting, except athletic lighting, shall be as noted above.

Operating voltage for pole mounted lighting shall be 120 volts. Voltages up to but no more than 277 volts may be used with special approval by the Manager of UNC Electric Distribution Systems.

The electric source or feed for outside lighting shall be a minimum of one 60 amp, 240 volts, two pole circuit wired from the nearest service transformer (preferred) or possibly a breaker in the building to a weather proof enclosure mounted on or near the transformer or on the exterior of the building. Within the enclosure shall be an electrical contactor that is controlled by a photocell. With special approval from the Manager of UNC Electric Distribution Systems, the electrical contactor(s) may be located inside an easily accessible electrical/mechanical room. No other building or landscaping lights shall be served from this system.

16740 Photovoltaic Solar Power Generation

Photovoltaic solar cell power generation panels may be considered for installation on campus buildings or facilities. The design of such installations shall be in accordance with the ENERGY SERVICES SOLAR ELECTRIC GENERATION POLICY.