

# 1 General

## **.1 System Requirements**

- .a Energy efficient fixtures shall be utilized. LED lighting shall be strongly considered on new construction projects and evaluated for use on renovation projects.
- .b Lighting controls shall tie into the Building Management System so that lights may be scheduled and turned on or off for each lighting zone independently and for the entire building.
- .c Where future expansion is planned in the initial design of a facility the Engineer shall provide adequate additional capacity and connection points in the electrical design. The additional capacity shall be clearly noted in the equipment schedules.
- .d All points for future connections shall be clearly shown and labeled on the drawings with the capacity ( Kw, etc.) that is available at each connection point.
- .e Provide ten (10) ¾" spare conduits for all recessed panel boards to stub out above lay-in ceiling. Label spares and note where spare terminates.
- .f Provide lightning and surge suppression on all security, intercom, Building Automation System (BAS), MATV, and fire alarm systems. Coordinate data drops with BMS contractor.
- .g Provide phase loss protection at electrical panels serving HVAC motors and compressors.
- .h Provide conduit and pull string from demand meters (electrical, gas, and water) to main Mechanical Room and Electrical Room or closest point of access to BAS network.
- .i Provide dedicated and protected 120V power to all HVAC control panels and damper operators.
- .j A network jack shall be located at each DDC panel, UPS system, and Electrical Room.
- .k Label each outlet showing panel, and circuit number.
- .l Label each switch showing panel, and circuit number.
- .m Junction boxes and conduit shall be color coded as indicated in the Wake County Conduit and Box Color Chart supplement in Division 26. Raceways shall be provided with factory applied surface as required.
- .n Provide separate sub-metering for lighting, plug, and mechanical loads, or as required by the owner.
- .o Raceways shall be UL listed and provided for all conductors, including but not limited to lighting, power, grounding, control, fire alarm, communications, and telephones.
- .p Where applicable (Fire stations, EMS, etc.) provide "Supervisory Control and Data Acquisition Systems" (SCADA) at remote equipment sites for supervision and control, alarm management, energy management, and data collection. SCADA shall be IP based and fully compatible and fully integrated with the existing Wake County owned 800 MHz system.
- .q All public safety facilities, detention, and other 24/7 operational facilities shall be equipped with emergency generators to serve 100% of building load.
- .r Occupancy switches are allowed in individual offices, conference rooms, lounges and toilets, or as required by code.
- .s Lighting serving mechanical and electrical rooms shall be un-switched and remain on 24/7

## **.2 Codes & Standards**

- .a Comply with applicable provisions of the most recent "North Carolina Building Code: Electrical Code".
- .b Comply with NFPA Codes and Standards.
- .c Comply with all applicable NEIS standards.
- .d Comply with OSHA electrical standards and workmanship.
- .e Comply with applicable requirements of NEMA Standards.
- .f Comply with Wake County "Guidelines for Design and Construction of Energy-Efficient County Government Facilities and Schools."

- .g Comply with Illuminating Engineering Society (IES) for exterior lighting.
- .h All products specified and installed shall bear the label of UL or other North Carolina recognized third party testing agency.
- .i Reference "Illuminating Engineering Society Handbook" for space lighting illumination levels.
- .j Design and installation shall be compliant with the requirements of the "local authority having jurisdiction."
- .k Reference Division 25 Building Automation, Division 27 Communication/Data/Public Address, and Division 28 Electronic Security.

## 2 Products

### .1 Equipment Selection

- .a The selection of all Electrical systems shall be approved by Wake County at the schematic design phase.
- .b **Conduit:**
  1. Minimum conduit size shall be 3/4", 1" for data.
  2. Conduit types shall be rigid steel, IMC, or EMT.
  3. Exposed raceways or conduits are unacceptable in finished spaces.
  4. Exterior conduits serving lights, equipment, signs, etc. shall be galvanized rigid.
  5. The use of wire mold shall not be permitted.
  6. Bushings or insulated throat connectors shall be used on all conduit terminations
  7. Fittings shall be all steel. EMT couplings shall be compression or threaded type. Set-screw and crimp type fittings shall not be permitted.
  8. Equipment whips to be sealtight.
  9. LB fittings shall be utilized at main service entrance. Elbows should not be used.
  10. Roof penetrations shall use waterheads.
  11. The use of MC Cable shall not be permitted. Exceptions may be granted where MC cable is factory provided, i.e. light fixtures, etc. and is limited to 6'-0.
  12. Conduit and raceways shall be neatly installed parallel to or at right angles to beams, walls, and floors of the building.
  13. PVC may be used under slab or on site if encased in concrete, with metal 90 degree rigid metal elbows. Rigid conduits are preferred.
- .c **Panel boards:**
  1. All panel boards shall have factory furnished copper bus with bolt-in breakers.
  2. Provide main breakers in all panel boards including sub panels that are served from another panel board.
  3. Circuit breakers shall be molded case (MCCB), bolt-on type thermal magnetic trip, with common trip handle for all poles.
  4. Lighting panel boards shall only contain lighting circuits. All other loads such as receptacles, equipment, etc. shall be served from separate panel boards.
  5. All panel boards shall be selected for 25% minimum spare electrical and physical capacity above the anticipated demand load.
  6. Typed directories shall be provided in all panel boards indicating room names and number to match final signage used at the site.
  7. Provide phenolic labels on each panel board, transformer, and main distribution panel identifying the electrical equipment and indicated the panel, transformer, main distribution panel that serves each piece of equipment.
  8. Provide "Do Not Work on Hot Panels" signage on panel.
- .d **Lighting:**

1. Discuss light ideas and control strategies with Wake County prior to design of lighting systems.
2. Site Parking Lighting shall be designed and provided by local utility and shown on the site plan at the Design Development Submittal.
3. Provide additional exterior building lighting as needed to insure all exterior entrances and first floor windows are illuminated. Coordinate with Security Designers.
4. LED Fixtures - Interior:
  - a. 2 x 4 3500 Kelvin, 4800 lumen direct/6000 lumen indirect LED.
  - b. 2 x 2 3500 Kelvin, 3000 lumen direct/4000 lumen indirect LED.
  - c. Five (5) year warranty.
5. Fluorescent Fixtures as approved by Wake County and IES Standard - Interior:
  - a. 2 x 4 four (4) lamps parabolic with T8 fluorescent lamps, electronics ballast.
  - b. 2 x 2 three (3) lamps parabolic with T8 fluorescent lamps, electronic ballast.
  - c. Lamps shall have a color temperature of 3500K, minimum color rendering index of 75, 2800 initial lumens, average life of 20,000 hours.
  - d. Compact fluorescents may be used.
6. Site, flag pole and sign lighting to be reviewed by Wake County of a project basis.
7. Limit the total number of various types of lamps.
8. Two by two troffers with U-shaped lamps are prohibited.
9. Lamps and ballasts shall be eco-friendly, selected to be recycled or landfilled without hazardous material issues, I.E., no mercury containing lamps, etc.
10. Exterior Lighting shall be LED.
11. Exterior lighting enclosures shall be diecast aluminum or stainless steel. Painted aluminum or steel is not permitted.
12. Use wall mounted light fixtures to light stairwells.
13. Engineer to furnish a copy of lighting calculations to the owner to review prior to 100% CD submittal. Provide cut sheets and photometrics of site lighting design.
14. Vandal-resistant materials or metal guards shall be used for fixtures within reach of floors and all outdoor locations.
15. Photocell and BAS control shall be provided for exterior lighting control.
16. Light selections and cut sheets to be submitted to Wake County at DD submittal phase.

**.e Building Distribution Wire and Cable**

1. Conductors for general power wiring shall be single conductor insulated wire, conductor: copper: insulated voltage rating: 600 volts, insulation type: THHN/THWN or other where code mandates.
2. Aluminum wiring is prohibited.
3. Minimum wire #12 gauge, strained wire only. Solid wire is not to be used.

**.f Junction Boxes**

1. Minimum outlet box size: 4" square x 1-1/2" deep.
2. Inaccessible Ceiling Areas: Install outlets and junction boxes no more than 6 inches from ceiling access panel.
3. Metal junction boxes only. Steel interior, stainless steel exterior. Exceptions only as approved by owner.

**.g Wiring Devices**

1. Heavy-duty general use devices.
2. Device body: Gray plastic unless otherwise permitted by owner.
3. Cover Plate: Smooth brushed stainless steel unless otherwise noted.
4. Devices supported by generator shall be red unless it is a fully generated building.

**.h Engine Generators**

1. When generator back-up will be provided, an above ground double-wall belly tank will be specified.
2. All tanks shall have a minimum of 48 hours of fuel capacity.
3. Generators shall be dual fuel (oil and natural gas) unless approved otherwise.
4. Generator Status shall be monitored by SCADA system.
5. Transfer switch to be automatic.

**.i Supervisory Control and Data Acquisition (SCADA)**

1. Designer should request the latest version of the Wake County SCADA specification section and details for adaptation and incorporation into the project manual. See Supervisory Control and Data Acquisition Systems Supplement in Division 26.
2. Automatic transfer switch shall be utilized.

**.j Grounding**

1. Bond the metal underground water pipe, metal frame of the building, and rod electrode with an un-spliced insulated copper grounding electrode conductor.
2. Provide separate, insulated copper within each feeder and branch circuit raceway. Terminate each end on suitable lugs, bus, or bushing.
3. Bond metal coping of building exterior to grounding system.
4. Provide ground bar for data to building ground.

**.k Enclosed Disconnects**

1. Fusible heavy duty load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position except by operating a permissive release device. Handle lockable in OFF position.
2. Interior and dry locations: NEMA type 1 enclosures 1, exterior locations: NEMA type 4X enclosures.
3. Exterior locations shall be stainless steel.

**.l Dry Type Transformers**

1. Use of energy saving or K-rated isolation type transformers shall be evaluated based on specific application and loading.
2. Factory-assembled and tested, air cooled units for 60 Hz service.
3. Surpasses NEMA TP-1, Class I efficiency by 25 percent.
4. Wall mounted units shall have brackets fabricated by the manufacture.
5. Floor mounted units shall have concrete bases and be anchored. Add spacer so conduit stubs into bottom.
6. Provide copper coils.
7. Transformers 100 KVA and over shall be isolated in an individual room and have a separate cooling/ventilation system.

**.m Lighting Relay Panels**

1. Low cost automated central uniform control of multiple branch lighting circuit shall be utilized. Typical usage is corridors and building mounted exterior lights. Motorized breakers are not acceptable.

**.n Lighting Control System:**

1. Minimum requirement of the system is to allow the BMS to sweep entire building with the ability to turn on or off lighting. This includes all lighting with the exception of emergency lighting.
2. Provide lighting control panels consisting of modular construction, flush mounted in all finished locations.
3. Enclosure shall be NEMA 1, NEMA 3R, or NEMA 4.
4. The panel interior to feature one or two optional control and automation cards, removable, plug-in terminal blocks, override push button, LED status light for each relay, switch inputs,

automatic support for occupancy sensor sequence of operation, and automatic sequenced operation of relays.

5. The control panel shall have provision for an individual BACnet device ID for connection to building automation systems.
  6. Browser-based programming and control shall be capable of hosting the schedule, photocell, and group relay control functions for a network of up to 96 LILM lighting control panels.
  7. Digital switching shall be provided.
  8. Motorized breakers are not allowed.
- .o **800 MHz Towers:**
1. Comply with "Understanding TIA-222 – Revision G" supplement in **Division 26**.
- .p **Transient Voltage Surge Suppression (TVSS)**
1. Provide TVSS for main electrical switchgear and branch panel boards serving computers and electronic loads.

## 3 Execution

### .1 Design Requirements

- .a The electrical contractor shall provide all power wiring to each piece of mechanical equipment. The mechanical contractor shall furnish all starters and disconnects to turn over to the electrical contractor. Mechanical contractor is to make final connection to each piece of mechanical equipment.
- .b Engraved laminated labels shall be provided on **all** electrical equipment, panels, main distribution panels, and transformers.
- .c Equipment name plates (metal preferred) with raised or depressed images for permanent attachment shall list the following:
1. Manufacturer, product name, model number, and serial number.
  2. Capacity, operating and power characteristics, and essential data
  3. Labels of tested compliances.

### .2 Testing

- .a Contractor to submit the following to the Designer and County:
1. A copy of all electrical exit and emergency battery testing
  2. Generator capacity load tests. Test at 50, 75, and 100 percent.
  3. Fire alarm certification.
  4. SCADA Testing
  5. Generator load test as required (tested at 100% of generator capacity load).
- .b A copy of all certification tests shall be available for the Fire Marshall at final inspection for issuing the Certificate of Occupancy.
- .c A copy of a letter certifying that an operating test of the complete electrical system has been completed. Minimum tests include the control and distribution equipment, phase rotation, circuit breakers, and wiring.