These guidelines are updated periodically. Users of the guidelines are encouraged to check this site as needed to be sure of having the most current edition. Comments and suggestions concerning improvements to this section of the guidelines may be submitted to jrwatter@uncg.edu.

16000. GENERAL PROVISIONS – ELECTRICAL

Updated: December 18, 2014

UNCG uses the latest edition of the North Carolina State Construction Office document, *Electrical Guidelines and Policies*, as its basic electrical design standard. A copy of this document is available on the State Construction Office web site. UNCG's electrical guidelines provide special, campus specific requirements.

The UNCG facilities groups are especially concerned with maintenance and long term sustainability of the systems on campus. All designs should incorporate materials and designs that will help us use and operate campus systems for many years into the future. The designer should pay attention to those areas on campus where corrosion of metals, deterioration of materials (especially plastics due to ultraviolet light), and corrosive chemicals are present, and design systems using materials that will withstand these harsh environments. Harsh environments as discussed here include all areas that are external to buildings. All fasteners and mounting struts installed in these areas shall be made of either hot-dipped galvanized steel or 300 series stainless steel. If steel materials are used, the designer shall specify that any cut material shall be cold galvanized. Equipment such as electrical outlet boxes, cabinets, conduits, support systems, etc. shall be discussed with the University's Design Project Manager for specific information on campus corrosion requirements.

Designers shall identify and evaluate all opportunities for using energy-efficient systems or products (EPA Energy Star certified or equivalent) in buildings.

During design, consult with the Design Project Manager on appropriate locations for occupancy sensors to control lighting and energy usage based on current ASHRAE/IES Standards. Appropriate areas include, but are not limited to, offices, classrooms, copy rooms, restrooms, storage areas, conference rooms, break rooms, corridors, filing areas, and other spaces.

Light-emitting diode (LED) fixtures are recognized for their contributions towards lowering energy consumption, reducing maintenance, increased durability, and efficient distribution of light. The use of these fixtures is encouraged after careful evaluation of the economic feasibility and the desired light quality.

16110. RACEWAYS

1. There shall be a minimum of one spare conduit for each wiring system in a ductbank. Conduits for primary service shall be concrete-encased schedule 40 PVC. Conduits shall be

installed with as few bends as possible and all bends shall be long-radius type. Bell ends shall be installed at manholes. All conduits shall slope toward manholes. Conduit in the ductbank shall be supported on spacers to provide three inches of concrete on all sides of each conduit. All spare conduits shall be left clean with a suitable nylon pull string in place and plugged or capped to prevent rodent entry.

2. Minimum conduit size shall be 3/4" for interior and 1 1/4" for exterior wiring. This requirement includes flexible conduit. Exception: 1/2" flex may be used for motor make-up and finished lighting connections with a maximum length of 6 feet.

3. 1 1/4" schedule 40 PVC may be used for underground exterior lighting circuits not less than 24" deep with 3" sand under and 6" sand over.

4. All underground conduit shall be installed with warning tape above it and approximately 12" below grade.

16120. CONDUCTORS

1. Conductors serving two separate power systems (i.e., 208Y/120 volt and 480Y/277 volt) shall not be mixed in the same raceway, pull box or junction box. Exception: Where control wiring is a different voltage than power for the same system.

2. One set of the electrical riser diagrams shall be mounted near the main switchgear under clear protective material.

16134. PANELBOARDS

1. All panelboards shall be for bolt-in type breakers. Only copper bus bars shall be used.

2. No single phase panels shall be installed in a three phase system.

3. In general, panels shall have 25% spare capacity, consisting of spare breakers and/or spare spaces. Spare spaces shall be provided with hardware installed from the manufacturer.

4. No information relative to the overcurrent devices provided with switchboards or panels shall be considered proprietary by the manufacturer. All overcurrent devices containing solid-state trip units shall be set by the manufacturer, and the University shall be provided with the technical information, test equipment and training necessary to test and adjust each unit.

16150. MOTORS

Updated: December 18, 2014

1. Energy efficient motors shall be specified unless shown to be economically undesirable. Energy Star rated motors are preferred.

2. New motors 20 HP and above shall include start-up and adjustment by the supplier and training for the Owner's personnel.

16300. POWER TRANSMISSION

1. The Duke Energy transformers at the University substation receive power at 24,000 volts. The secondary side of the Duke Energy transformers provides 12,470Y/7,200 volt Wye connected 3 phase, 4 wire power to the university's point-of-delivery metal clad switchgear. UNCG distributes this power throughout the campus in five underground 12.47 KV loops in a 3 phase, 4 wire configuration to individual building transformers.

2. All electrical service and distribution shall be installed underground in PVC conduit encased in concrete ductbanks. Ductbank routing shall be located in consultation with the Facilities Design and Construction and Facilities Operations departments. Compare all ductbank routes with UNCG Master Plan and review with Design Project Manager.

3. For system reliability and to meet various load requirements, the buildings are served by a looped cable system. New facilities shall be designed so as to permit inclusion in one of the existing loops. The loop to be used, and manhole in which connections are to be made, shall be designated in project meetings.

4. Typical equipment to accommodate the looped feeder cable concept includes air-break switches, fused switch combinations, and radial fed pad mounted transformers.

5. All operations of primary voltage switches on the existing electrical distribution system will be performed by the Facilities Operations department or a qualified firm under the direction of Facilities Operations. The University will schedule all service interruptions to make utility connections. All interruptions shall be during non-class periods where at all practical. Any overtime costs shall be at the Contractor's expense.

16350. MANHOLES

1. Manholes shall be located and sized to allow workable pulling tension on cables. Minimum size shall be 7' x 9' x 6' 6" high for telephone and 8' x 14' x 8' high for power systems. Manholes shall be installed with entrances slightly above finished grade level to prevent the entry of surface water.

2. Manholes shall be precast concrete or poured-in-place, reinforced to withstand H-20 loading as per AASHO Standard Specifications for Highway Bridges. Ladder rungs shall be on 12"

centers and the top rung not more than 12" below the entrance. Manholes shall be supplied with knockouts, inserts, pulling irons and risers suitable for the service intended. Joints in manhole walls, risers and duct entrances shall be grouted with cement, or a gasket seal applied between precast sections, to provide a waterproof structure.

3. Covers shall be round, 30" diameter, heavy duty with the word "ELECTRIC", "TELEPHONE", etc. cast in the cover as applicable.

4. A driven copper clad steel ground rod shall be installed in each manhole for bonding all hardware and cable sheaths.

5. Manholes shall have gravity drains whenever possible. When this is not possible, sump pumps and 18" diameter sump holes shall be provided. Pumps shall be submersible, 1/3 HP, single phase, 120 volt, 60 Hertz, and shall have a minimum capacity of 46 gpm at 20 foot head, through a 1 1/4" discharge and shall be complete with check valve and union. Pumps shall be actuated by an attached 1/2 HP rated float switch equipped with a waterproof, oil resistant cord of proper length and a bronze operator rod.

16405. ARC FLASH

UNCG is committed to providing a safe and healthy work environment. As part of a comprehensive electrical safety program, UNCG has implemented an Arc Flash Hazard Analysis program for all equipment.

For equipment whose voltage is less than 600 volts, the design team is not required to perform any calculations. UNCG's Facilities Operations department will determine the Personal Protective Equipment needed and install signage displaying approach distances and PPE requirements. Auxiliary Services and the Housing and Residence Life departments will coordinate with Facilities Operations to install signage on equipment below 600 volts.

For equipment whose voltage is greater than 600 volts, a Flash Hazard Analysis by the Electrical Engineer or their Representative is required on each project. Flash Protection Boundary calculations will also be included in the Flash Hazard Analysis. The design team will send the required calculations to the University Design Project Manager, who will then send the information to the Facility Operations Department. Facilities Operations will then determine the Personal Protective Equipment needed, and will install signage that indicates approach distances and PPE requirements.

16440. METERING

Updated: 6/11/2013

The purpose of electrical metering is to allow the University to accurately measure and verify electrical energy consumption and demand (both monthly peak and instantaneous) for the project

facility. This information will be monitored and retained in the campus energy management system, via the campus network, at a central location in the Facilities Operations Department. Each design team should discuss their project needs with the Facilities Design and Construction Project Manager to make sure appropriate meters are specified, and also to obtain any campus updates concerning metering. The electrical designer should also coordinate with the person creating the Form of Proposal and have a Preferred Alternate added for the Nexus and Shark Meters.

The electrical design specifications should include the following requirements:

1. Specify an Electro-Industries Nexus 1262 meter as the main building meter. Locate the meter in an enclosure adjacent to the main switchboard or main distribution panel.

    1.1 The meter socket shall be for a Form 9S meter, 13T (13JAW) socket, rated 20 amperes 600 volts, prewired, ringless, with one piece cover, painted gray, UL Listed, provided with bridge for mounting test switches, suitable for copper conductors. Mount the meter socket (meter base) beside the main distribution panel and extend wires from the current transformer compartment to the meter socket. In the meter socket, provide a 10 pole test switch, 4 handles tied to voltage, 6 handles for current, nickel plated, with cover for test switches. Test switches must meet ANSI C12.9.

    1.2 Specify 0.3% accuracy current transformers in the switchboard or panelboard, connected through shorting blocks to terminal strips. Also specify fuses and fuse blocks for the meter's voltage connections.

    1.3 For each Nexus 1262 meter, provide one data outlet immediately adjacent to the meter socket. The Nexus 1262 meter has a 10 inch pigtail that will plug directly into this outlet once installed.

2. For submeters, specify an Electro-Industries Shark 200 series meter, with an INP100S option (100 base T Ethernet card). Also specify a hinged enclosure for this meter, current transformers, test switches, circuit breakers for voltage connections, and a 120 volt power supply connection. Input voltage wires must be protected with 0.1 ampere fuses, and the 120 volt power supply wires must be protected with a 3 ampere slow blow fuse. For each Shark 200 meter, provide a data cable with a male RJ-45 connector that will be plugged into the meter's female Ethernet port.

3. Specify that the electrical contractor shall turn over all meter(s) to the UNCG Construction Project Manager a minimum of four (4) weeks prior to the provision of permanent power. UNCG will return the meters within a two (2) week period once IP addressing has been completed. Also include in the specifications that permanent power will not be turned on to any facility until the main building meter is installed and is operational. This is critical to the University so all electrical consumption will be properly recorded.

4. Specify that the electrical contractor shall be responsible for programming the Nexus meters with UNCG's standard display template, and that the contractor will also be responsible for programming all the needed electrical parameters into both the Nexus and Shark meters. The contractor will also install and complete the installation, leaving the meters ready for operation. Note: The actual programming of the meters could be performed by the manufacturer.

5. Coordinate with the mechanical engineer and specify that the HVAC controls contractor shall provide the necessary software, programming, graphics, points, etc. to input the data from the electric meters to the campus Tridium/Vykon Energy Management System for graphing, charting, and trending the data. The data to be monitored and displayed is energy usage (kW-hr), instantaneous demand (kW), and month-to-date peak demand (kW). All energy management metering issues must be resolved prior to final inspection.

6. Specify that an independent 3rd party test and verify the meter installation for proper operation, and provide a test report for each meter to the electrical contractor, UNCG's Construction Project Manager, and if applicable to the project's commissioning agent.

7. Utilize Appendix A to these guidelines, the "Facilities Operations Utility Meter Setup Guide", in specifying, connecting, and reporting details for all utility meters.

16480. BRANCH CIRCUITS

1. A 120 volt, 20 amp electrical receptacle shall be provided every 50' in corridors, on each stairway landing and close to exterior doors for use with maintenance equipment. These shall be connected to a dedicated circuit.

2. Provide circuit(s) in mechanical equipment rooms for wall outlets every 20' that are fed from the standby generator circuit (if a generator is installed in the facility).

16510. INTERIOR LIGHTING FIXTURES

1. Lighting levels shall correspond to the following standards unless greater illumination levels are needed to meet safety and security requirements, or it is determined that specific visual tasks require either more or less illumination:

    1.1. Offices and classrooms, general use: 50 foot-candles.
    1.2. Laboratories, drafting rooms and similar close-task areas: 75 to 100 foot-candles.
    1.3. Corridors and stairs: 10 foot-candles.
    1.4. Lobbies, lounges, waiting rooms, storage and service areas: 20 foot-candles.
    1.5. Shop areas: 30 foot-candles, with task lighting as required.

1.6. Lecture halls and auditoriums: In accordance with the latest I.E.S. Handbook.
1.7. Parking ramp interior: 5 to 10 foot-candles in traffic lanes, 3 to 5 foot-candles in parking areas and 20 to 30 foot-candles at the entrance and exit.
1.8. Temporary site lighting for construction areas: Sufficient such that University Police may observe the entire area with a minimum of 3 foot-candles.

2. Lighting shall be accessible for relamping, cleaning and other maintenance. The location of fixtures over hazardous substances, mechanical equipment and laboratory benches shall be avoided and the lighting placed on the circumference of such equipment but properly directed. Special provisions shall be made for lamps located in high-ceiling areas or over auditorium seating for lowering or otherwise accessing for maintenance.

3. Stairwell lights shall be wall mounted fixtures which can be reached by hand from the landing floor or located over the landing to permit the safe use of ladders. The maximum height shall be 10 feet if stairwell lights must be ceiling mounted.

4. Fluorescent fixtures and low mercury lamp bulbs not requiring disposal as hazardous waste are generally required. Use of the more efficient high intensity discharge (HID) fixture is encouraged where practical. Incandescent lamps, because of their poor efficiency, shall be used only where more efficient lamps are unsuitable (e.g., spot-lights). The use of chandeliers shall be avoided except in renovation projects where such fixtures are existing.

16520. EXTERIOR LIGHTING FIXTURES

1. Site lighting shall be wired on a separate circuit, contactor, photocell. Site lighting shall not be connected to a circuit for stairway, porch, etc. lights. The photocell for site lighting shall be on the outside of the building not higher than 10 feet and easily accessible for maintenance.

2. Each light pole shall have a handhole for access to wiring connections and an engraved aluminum tag riveted to the pole denoting the pole number. The number schedule will be provided by Facilities Operations to coordinate with existing circuit designations. All pole bases shall be poured in place with the top of the concrete approximately six inches above grade with chamfered edges. Wire entrances to bases shall be made using 90^{o} PVC elbows. Pole base shall be anchor bolt type and include ground rod poured integral to base. Connections in each handhole shall be made using a connector similar to the Ilsco PED multi-tap bar series of connectors, and shall be insulated with the appropriate Ilsco bar covers. Individual weatherproof in-line fuse-holders shall be used to provide power to each fixture, so that each fixture may be isolated in the event of a fault from the other fixtures in the circuit.

3. Fixtures shall be high-pressure sodium of appropriate wattage, high power factor with ballasts or standard design. Fixtures shall be designed to suit standard ballasts of several manufacturers without modifications for installation.

4. Fixtures and poles approximately 12 to 30 feet high for pedestrian and street areas (not parking lots) shall be:

   4.1 Fixtures: high pressure sodium, painted black, without finial, with multitap ballast for applications up to 277 volts, and without fuses. A NEMA Type V horizontal beam pattern (circular) is to be used except where special conditions warrant otherwise. House- side shields will be used where appropriate. Fixtures up to 150 watts shall be Holophane Fluted GranVille (#GVU-100HP-MT-B-5-N-N-U-S/LU100; Holophane Dwg. US-2590) and fixtures from 250 to 400 watts shall be Holophane Washington (#WA-250HP-MT-B-4-B-WHS120 (if needed); Holophane Dwg. US-1452).

   4.2 Poles: fluted, painted black, with weatherproof fuses inside the bases. Poles up to 16 feet high shall be Holophane Wadsworth extruded aluminum shaft and cast aluminum base (12' pole model #: W12F4/17-CA/BK). Poles higher than 16 feet shall be Holophane Columbia tapered steel shaft with cast iron base (20' pole model #: C20FT16AZ/24CSB-CIS/PP-BC(1.0X10.5)-T(3.0X3.0)-2BA30B/1/B0-CA/BK-(1)PGK; Holophane Dwg. US-2627). Banner arms will be provided only on poles higher than 16 feet, only when specifically requested, and will be factory installed. Pole factory primed and field painted to match the light fixture color.

16670. LIGHTNING PROTECTION

1. Each building shall be considered individually to determine the necessity for lightning protection. When required, a complete lightning protection system shall be installed in accordance with UL and NFPA codes, and a UL Listed Lightning Protection system shall be installed.

2. Steel frame buildings shall be grounded through a low resistance ground system whether or not a lightning protection system is installed.

16700. TELECOMMUNICATIONS SYSTEMS

1. TELECOMMUNICATIONS SYSTEM

Updated: February 1, 2017

UNCG telecommunications wiring conforms to current ANSI/TIA/EIA standards, and the latest Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual. Using these standards during the design and installation of telecommunications systems will generally provide a system that will be acceptable for smaller installations. However, the University will generally require new buildings and renovation projects to be designed and have construction administration observations performed by a Registered Communications Distribution Designer (RCDD). The entire telecommunications cabling system shall be designed and stamped by an RCDD. The installation by the contractor shall be a turnkey installation, except for electronic components, which will be furnished and installed by the University.

All University systems are based on a cabling system that is not vendor proprietary and that conforms to ANSI/TIA/EIA telecommunications cabling standards, National Electrical Code, and BICSI guidelines. UNCG follows the general cabling industry practice of using a structured cabling system that will wire a building for information needs without knowing specifically what equipment will be utilized. This type of installation is geared for long-term stability and flexibility, and is based on the idea of wiring the building once for the communications system, and not having to add additional cabling later.

In general telephone, data, and fiber shall occupy the same entrance facility room and telecommunication rooms. Design to BICSI/TDMM, latest edition, and compliance.

The latest edition of the following standards and codes shall be used in all aspects of the telecommunications system: (Reference BICSI/TDMM, ANSI/TIA/EIA latest edition)

ANSI/NFPA-70	National Electrical Code
ANSI/TIA/EIA-568B	Commercial Building Telecommunications Cabling Standards for buildings, 100 Ohm Balanced Twisted-Pair cabling, and Optical Fiber Cabling
ANSI/TIA/EIA-569	Standard for Pathways and Spaces
ANSI/TIA/EIA-526	Measurement of Optical Power Loss of Fiber cable
ANSI/TIA/EIA-607	Commercial Building Grounding and Bonding Requirements for Telecommunications
ANSI/TIA/EIA-606A	Administration Standard for the Telecommunication Infrastructure of Commercial Buildings
ANSI/TIA/EIA-758	Outside Plant Telecommunications Cabling
ADA of 1990 “Title IV”	Americans with Disabilities Act

BICSI/TDMM, latest edition Building Industry Consulting Service International
Telecommunication Distribution Methods Manual

The size and numbers listed in this document for the various aspects of the telecommunications system are minimums, and where the ANSI/TIA/EIA standards or the BICSI manuals require larger quantities, the larger quantity shall be provided.

2. MAIN DISTRIBUTION FRAME (MDF)

Updated: February 1, 2017

Entrance conduits will be extended from the University manhole or pull box into the main communications equipment room, usually on the lower level of the building. Provide a minimum of four 4" conduits stubbed no higher than 4" AFF with bushings, for all buildings. One of the conduits shall be filled with three inner-ducts (two 1.5" and one 1") equipped with pull strings. Another conduit is dedicated for Telephone Company cabling equipped with pull-strings. The remaining conduit(s) shall be empty except for a footage delineated pull tape.

A dedicated telecommunication room (MDF) shall be large enough to house equipment, controllers, LAN racks, fiber optic equipment and telephone lines.

The contractor shall provide racks with adequate space for all rack mounted components and the installation of active components, which are provided by UNCG. Rack count and exact location to be determined by UNCG. Provide 7' floor mounted open equipment racks with 19" mounting space. Each equipment rack shall be equipped with two vertical cable managers (CPI-30095-501) or equivalent. In general, the floor mounted open equipment rack requires a foot print of 31" wide by 24" deep with minimum working clearances of 36". Provide 16" ladder type cable runways from wall-to-wall across each floor rack and on the wall perimeter. Each rack shall have an individual bonding connection to the telecommunication grounding bus bar (# 6 insulated minimum).

Provide dedicated 20 amp electrical circuits to a quad outlet receptacles (NEMA 5-20) 120 volt one mounted on the ladder type cable tray every other rack and the other two spaced at 6' intervals on perimeter walls. (Do not use surface mounted conduit on walls). Provide a minimum of two NEMA L14-30 receptacles mounted on the ladder rack above the racks.

Telephone: The local telephone company provides UNCG with cabling into buildings, entrance protection blocks, and demarcation connecting blocks. The contractor shall provide all other connecting blocks, wiring, wire management, terminations, testing, identification, etc. for a complete installation. Terminate building riser voice cabling on M66-1-50 connecting blocks mounted on appropriate colored backboards in the main telecommunications closet (MDF) located adjacent to the telephone company blocks provided by the contractor and in the IDF (telecom riser rooms). UNCG will mark the backboard prior to the Contractor installing anything as to where they should mount their backboards and associated equipment.

Data: The University, in existing buildings, will generally reuse existing Fiber optic cabling to the building however each Building should be reevaluated prior to installation. The contractor shall provide fiber optic cabling for new construction and in certain other instances. Verify

outside backbone fiber through Facilities Design and Construction. Electronic active components and associated patch cabling is provided by UNCG. Any necessary optical fiber cabling and all other internal building components shall be designed by the engineer (RCDD) and provided by the contractor.

Flooring: All flooring in all Telecommunications rooms shall be Vinyl Composition Tile (VCT).

Install adequate lighting and cover three of the perimeter walls with ¾" AC grade plywood, painted on both sides with two coats of white intumescent paint. Alternatively, ¾" fire retardant plywood may be used and painted with regular white paint, as long as the fire retardant stamping on each sheet of plywood is left unpainted and is clearly visible. The designer shall indicate on project drawings that the plywood shall be completely painted prior to mounting anything on the walls. The grade "C" surface shall be installed against the wall. All screws must be flush mounted.

3. INTERMEDIATE DISTRIBUTION FRAME (IDF)

The dedicated telecommunication room (IDF) shall be large enough to house equipment, controllers, LAN racks, fiber optic equipment and telephone lines. For larger buildings, it is desirable to have a room on each floor and in alignment (stacked) for multiple floors.

Provide three 4" riser conduits to connect the IDF- to the MDF, along with all necessary fiber, copper, and grounding riser cables. Electronic active components and data patch cables for data wiring shall be provided by UNCG. Racks for voice cabling and equipment shall be provided by the contractor in the IDF rooms. From the IDF cables will run from racks via cable pathways, to wall outlets, in a star topology. Provide racks as described in the MDF section of this guideline. Minimum slack required in the MDF/IDF is 10' in a figure eight position.

Provide a minimum of two 120 volt NEMA 5-20R wall receptacles and two quad NEMA 5- 20R electrical outlets in each IDF mounted above the racks on the ladder type cable tray.

Install adequate lighting and cover three of the perimeter walls with ¾" AC grade plywood, painted on both sides with two coats of white intumescent paint. Alternatively, ¾" fire retardant plywood may be used and painted with regular white paint, as long as the fire retardant stamping on each sheet of plywood is left unpainted and is clearly visible. The designer shall indicate on project drawings that the plywood shall be completely painted prior to mounting anything on the walls. The grade "C" surface shall be installed against the wall. All screws must be flush mounted.

NOTE: No tie wraps will be accepted in the MDF or IDF's, Velcro only.

4. BUILDING BACKBONE

Updated: February 1, 2017

Provide an un-spliced cable containing 12 strands 50-micron multi-mode and 12 strands single-mode

fibers (minimum), and a 50 or more pair category 3 cable from the MDF to each IDF (in a star topology). Run the fiber in inner-duct. Provide a minimum of three 4" conduit risers between telecommunication rooms stubbed 4" above finished floor with bushings. Fill two of the 4" conduit with two 1.5" inner-duct, one 1" inner-duct, and a footage delineated pull tape. Locate backbone cabling in cable trays, and where runs go through equipment rooms or inaccessible areas, provide a minimum of three 4" conduits. Provide a Telecommunications Bonding Backbone (TBB) # 6 insulated minimum.

4.1 Backbone Terminations

4.1.1 Fiber

The fiber shall be terminated using LC type anaerobic cure connectors or fusion splice pigtails. Uni-cam terminations are not allowed.

4.1.2 Copper

The copper backbone cable shall be terminated on 66-style blocks on the backboard. Use full 66 boards for all applications. Provide adequate spool boards and mount them above or below the 66 fields.

5. HORIZONTAL CABLING

Updated January 2017

Horizontal cabling shall be configured so that each outlet is directly connected to a telecommunication room. Category 6 cable length limit is 90 meters from the IDF patch panel to outlet jack. All terminations shall be made with a nonimpact termination tool. Center-hung aluminum cable trays with dual-width rungs are preferred over conduit for pathways to distribute, support, and provide cabling access. Walls shall have a 4" square box with a 1" (minimum) conduit run to above the ceiling. Cables shall be run un-spliced from the wall outlet to the patch panel in the IDF. Where cables are not installed in raceway, support the cables with proper hangers at an interval of 5', 3', 4' that does not create a pattern. For those cables that run in conduit back to a closet, 1" shall be the minimum size. Plenum-rated cable shall be used in all applications. All penetrations must be properly fire stopped.

5.1 Cables

Cables used shall be Category 6 (tested and characterized to 600 MHz) white in color for voice and blue in color for data. All cables shall be plenum rated.

5.2 Outlets

All outlet cables shall be terminated in a RJ45 type jack, Category 6 rated with 568B configuration (white jacks for voice and black jacks for data).

5.3 Closet Terminations

All cables shall be terminated on rack mounted Category 6 angled patch panels.

5.4 Racks

A rack shall generally have a fiber optic enclosure at the top (or allocate two units of space), a 48 port Category 6 angled patch panel beneath the fiber enclosure (voice). The voice cables will terminate in rack one, data starting in rack two. A typical rack shall have no more than four angled patch panels to allow adequate space for switching equipment (provided and installed by owner). The contractor will provide floor racks in each MDF/IDF (each Telecommunications rack will have a foot-print of 32" (wide) x 24" deep with 3'0" clearance front and back. This allows 32" for the width (including (2) 6" vertical wire-management), 24" depth for equipment, and 36" clearance for workspace. Provide each rack with pre-specified number of 48-port angled patch panels, Provide mounting space at the top of each rack in MDF/IDF for a future fiber optic patch panel. (Position patch-panels beginning at the third slot from the top). Terminate horizontal voice cabling (originating at the face-plates) on these rack- mounted patch panels.

For specified voice jacks, provide a four pair solid conductor patch cable with a RJ45 mod plug at the patch panel, the other end shall be terminated on a 66-style block on the backboard. All four pairs shall be terminated.

Provide a minimum 6" vertical wire manager on each side of every rack. Chatsworth Evolution vertical 72 x 6 x 24 part # 35521-701 and horizontal part # 35441-702 or equivalent.
Note: when using angled patch panels horizontal management is not required.

6. WORK SPACE CONFIGURATION
Updated: February 1, 2017

A typical outlet is defined as consisting of three category 6 cables, (1) white (voice) and (2) blue (data) in a four port faceplate with Category 6 jacks (white for voice and black for data). All horizontal cabling requires 1' of slack above ceiling.

6.1 Offices

Each office space shall be provided with one typical outlet. Large offices may be required to have two or more typical outlets. Provide one typical outlet for 100 sq. ft. of office space.

6.2 Classrooms, Lecture Halls, Auditoriums, and Conference Rooms

Each room will be provided with a minimum of one quad outlet (one voice, three data). The outlet shall be located in a convenient location near the front of the room. For Conference rooms (1) typical outlet shall be located in a floor box and (1) outlet located on the front wall.

6.3 Computer Laboratories

There should be an adequate number of data cables to support the number of computers.

6.4 Study Areas

Study carrels and other private, single person study areas will be provided with one data connection per location.

6.5 Residence Hall Rooms

Note: Because all Internet access is provided to residents via UNCG wireless network, data outlets within residence hall rooms will be provided only for support of wireless access points. Owner shall approve design/placement of all wireless access points.

Traditional Rooms: (1) cat. 6 and (1) one-inch conduit shall extend from the corridor into the sleeping room and shall have a four-inch rough in box mounted in the ceiling no less than six feet and no more than 10 feet within the room.

Suite Style Facilities: (1) cat. 6 and (1) one-inch conduit shall extend from the corridor into the common living room and shall have a four-inch rough in box mounted in the ceiling no less than six feet and no more than 10 feet within the common living room of the suite.

Apartment Style Facilities: (1) cat.6 and (1) one-inch conduit shall extend from the corridor into the common living room and shall have a four-inch rough in box mounted in the ceiling no less than six feet and no more than 10 feet within the common living room of the apartment.

6.6 Point-of-Sale

Each location shall be provided with one outlet consisting of one typical outlet.

6.7 Vending Machines

Each vending machine shall be provided with an individual data connection.

6.8 Common Areas

Areas where students can reasonably be expected to stay for a period of time between classes, at night, etc. (such as general sitting lobbies) shall be provided with a typical outlet, located adjacent to a 120 volt receptacle.

6.9 Spaces Not Listed

Other spaces shall be evaluated by the University and may be required to have University telephone, data, or CATV outlets.

6.10 ATM Machines

Each location for ATM machines shall have one typical outlet.

6.11 Wireless Access Points

Provide one category 6 cable mounted at a height to be determined for wireless access points in common areas.

7. TESTING

All testing shall be performed after all terminations are completed at both ends of cables. Fiber optic cables shall be tested with an OTDR, appropriate power meter and each fiber tested at both operating frequency ranges for continuity, polarity, and level of attenuation. Copper riser cables (voice) shall be tested with a digital multi-meter and/or automated

continuity tester and shall verify that no conductor is shorted to another conductor or raceway, and that the loop resistance does not exceed 30 ohms. The contractor shall perform validation testing on all Category 6 cables. An approved tester that can measure for Category 6 characteristics shall validate to the latest ANSI/TIA/EIA specifications for 100-ohm structured cable testing parameters. Each cable-run from each closet to every jack in every room shall be tested for Category 6 performance compliance. All cable certification reports shall bear the room number and cable identifier for each cable tested. Test results/reports by closet and building shall be delivered to the owner according to the project submittal procedures.

7.1 Test Equipment

Prior to any testing being performed, the Engineer shall be supplied with a list of test equipment to be used, for review and approval. The submittal shall include documentation indicating that the proposed equipment is capable of performing all tests as required by this specification and has been factory calibrated within the past year.

8. MISCELLANEOUS

Updated: February 1, 2017

8.1 Fire Alarm Systems

Alarm systems requiring the use of a telephone shall be provided with two RJ31X jacks adjacent to the digital alarm communicator.

Two Category 6 cables (Yellow), shall be run from each jack to the closest telecommunications room (IDF / MDF). Cables shall be terminated in the communicator with RJ31X jacks and on a 66block located on a red backboard in the IDF/MDF. Also, provide one Category 6 data cable adjacent to the fire alarm panel for a WEBS device. See fire alarm section 16720A.11

8.2 Lighting

The lighting fixtures shall be placed within the room to provide optimum and uniform illumination of the room after racks and hardware are installed. Consider perimeter placement of light fixtures. Provide a minimum equivalent of 500 lux (50 foot-candles) when measured 3’0” above the finished floor level.

8.3 Electrical

Provide two dedicated L14-30 amp and three 120-volt L5-20 amp receptacles in the building MDF (one dedicated).

8.4 Elevators

Each elevator shall be provided with a telephone connection in the elevator equipment room. Cables shall be category 6 (Yellow) terminated in the elevator controller, run in conduit to the MDF, and terminated on 66 blocks located on a Red Back Board. Each elevator shall also be provided with an emergency phone in the cab. See the Facilities Design and Construction Project Manager for the current telephone used by the University. Ensure compliance with ADA guidelines and specifications.

8.5 Campus Emergency Telephones

Emergency telephones are located both in buildings and as freestanding towers located throughout campus. These telephones provide a voice connection to the University Police Department for immediate assistance to a user. Free standing towers are made of vandal resistant steel with a blue light that is always illuminated. An emergency phone is included in the tower, and when the emergency phone button is pushed; a high-powered strobe automatically pulses. Contact the University Project Manager for direction in whether emergency telephones should be included in the scope of a project, as well as the current vendor of the telephones and installation specifications. Installation requires three 1" conduits, one for cabling, one for electrical 120 volt receptacle, and one for future. Ensure compliance with ADA guidelines & specifications.

8.5.1 Emergency Phone Cabling

For outdoor emergency telephones, provide two outdoor rated, shielded Cat6 gel filled cables. Terminate the cables and lightning protectors on both ends. Ground the pedestal side of the cable to the electrical ground coming in and ground the telecom closet end to the grounding bus bar. Indoor emergency telephones shall have a Yellow Category 6 cable terminated on 66-style blocks mounted on a red backboard.

8.5.2 ADA Requirements

Compliance with The Americans with Disabilities Act (ADA) (36CFR Part 1191) shall be maintained at all times.

8.6 Control Systems

Provide a typical outlet beside the building's HVAC direct digital control system main controller.

8.7 Identification

The University and various subcontractors maintain and provide additions, moves, and changes for the overall campus telecommunications systems. Because of the dependence of the University upon its telecommunications systems, it is critical that labeling be clear and informative. Prior to labeling any portion of the system, the contractor shall coordinate with the Owner for approval of proposed labeling systems. Owner shall approve all labeling schemes, and the labels used, prior to their installation.

The UNCG telecommunication infrastructure cabling administration and identification is based on ANSI/TIA/EIA-606B standard. Cables shall, in general, be identified at each termination point by telecommunication room number and a numerical suffix. The documentation and testing results shall be submitted in an acceptable electronic format as well as one hard copy approved Owner.
Refer to UNCG Wiring Guidelines Figure 1 for current UNCG labeling scheme and Figure 2 for Closet layout.

8.8 Grounding

TIA / EIA 607 covers requirements for telecommunications grounding and bonding as a system. The major guidelines are as follows:

- A permanent infrastructure for telecommunications grounding and bonding is specified to be independent of telecommunications cabling.
- Telecommunications bonding connections are always implemented in accessible locations with approved components.
- Minimum #6 AWG insulated copper bonding conductors.
- Telecommunications Bonding Backbone (TBB) are installed through every major telecommunications pathway (backbone pathway) and directly bonded to a telecommunications grounding busbar (TGB) in each telecommunications equipment location.
- A Telecommunications Main Grounding Bus bar (TMGB) is directly bonded to the electrical service ground. All TBBs end on this bus bar.
- Generally, each TBB should be a continuous conductor from the TMGB to the farthest TGB. Intermediate TGBs should be bond connected to the TBB with a short bonding conductor.

9. WARRANTY

Updated: February 1, 2017

The engineer shall specify a minimum of a 25 year, Category 6 certified, cabling system performance warranty from the cable and equipment manufacture. Their warranty shall guarantee end-to-end system performance, shall cover both components and cabling, and shall cover materials and labor. This type of warranty, available from various system manufacturers, requires that installers be approved by, and registered with the system manufacturer. The engineer shall also include in the specifications that telecommunications submissions shall include proof of registration with a qualified manufacturer and the ability to provide a valid manufacturer's warranty. Failure to provide this proof during submittals will automatically disqualify the installer. The engineer shall provide, as a preferred alternate to the base bid, a specification for a 25 year cabling system Performance Warranty from CommScope Connectivity AMP Net-Connect, using CommScope Connectivity AMP Net-Connect products and installed by an CommScope Connectivity PartnerPro AMP authorized Net-Connect Design & Installation contractor.

10. OTHER REQUIREMENTS

10.1 Heating, Ventilating, and Air Conditioning (HVAC) Operation

Provide an HVAC unit with independent local controls for the MDF and IDF's.

The HVAC system that serves the MDF and IDF's should be tuned to maintain a positive air pressure differential with respect to surrounding areas. If environmental conditions warrant, provide equipment to control humidity and air quality.

In renovations, consider that the following equipment may be located inside the MDF and IDF and could affect HVAC sizing requirements.

1. Environmental control equipment
2. Power distribution/conditioners
3. UPS systems with a rating of 5 kilovolt ampere (kVA) or higher

10.1.1 Environmental Control Requirements

The designer must consider the HVAC requirements of each piece of equipment that will be placed in the MDF and IDF's. The final design must accommodate any special or specific requirements. However, typical equipment requirements can be used as general guidelines until specific requirements are known.

10.2 Sprinkler Systems

Provide cages over sprinkler heads located in the MDF and IDFs.

10.3 Duct Bank Systems

Where duct banks are required, install a minimum of four 6 inch conduits between manholes/hand holes encased in concrete, and a minimum of four 4 inch conduits from the manhole/hand hole into the building encased in concrete. One of the ducts in the duct bank shall be populated with Maxcell fabric inner duct. Discuss the exact quantity and size with UNCG.

10.4 Physical Security

For Security purposes, to ensure that only authorized personnel have access to the Telecommunications Rooms (MDF & IDF'S), all doors shall be equipped with an auditable electronic lock system. Coordinate with the University Project Manager for details of locking requirements. No foreign equipment such as fire alarm panels, HVAC panels, door lock equipment, electrical panels and/or housekeeping supplies shall be installed or placed within these rooms.

16720. ALARM AND DETECTION EQUIPMENT

Fire alarm systems shall be designed and installed in accordance with the North Carolina Department of Insurance Document *Requirements for Fire Detection and Alarm Systems.*

1. Fire alarm system design and construction will be coordinated through the University's Project Manager who will in turn coordinate with the UNCG Office of Safety, UNCG Telephone Services, and end users.

2. Voice systems shall be provided and shall include one-way Public Access emergency communications.

3. Contact ID communicators are used to transmit signals to the University Police Station. The communicator shall be connected through central office telephone lines and shall not be connected through key systems, voice over internet protocol, or other intermediary device.

4. The designer will perform a 100% test on all fire alarm devices during the prefinal inspection, and a representative from the UNCG Office of Safety will accompany the designer during this test. Additionally, other UNCG representatives may also be present at this test, including the Project Manager and a representative from UNCG Facilities Operations. A sensitivity report shall be submitted to the designer three days prior to the inspection, and no device shall be more than 2% dirty.

5. After the designer approves submittals and shop drawings, three copies will be sent to UNCG. One set is for Facility Design and Construction records, one set is for Facilities Operations or Residence Life, and one set is for the Office of Safety.

6. Project specifications shall include the following:

    a. User defined control switches (or buttons) shall be located on the user interface of the FACP. Separate switches are not allowed. Separate switches shall be provided for HVAC bypass, A/V bypass, elevator bypass, fire door bypass, and city disconnects. These switches shall report a supervisory signal to the FACP upon activation.

    b. SNAC panels shall have built in synchronization for strobes. No external devices shall be used.

    c. Two sets of glass-framed floor plans indicating all fire alarm devices and device numbers shall be provided. One plan shall be mounted adjacent to the FACP and the other shall be mounted beside the remote annunciator. These plans shall be secured to the wall with screws.

    d. Two separate days of training will be provided, divided over two days.

    e. The site-specific program for the fire alarm system shall be stored on electronic media and archived by the fire alarm system manufacturer or authorized distributor. A CD copy shall be submitted to the engineer for transmission to the owner.

    f. Provide a horn silence function with an adjustable delay of 2 to 15 minutes. Delay shall prevent the silence function from engaging. This silence function shall be manually activated and shall not prevent visual devices from flashing.

7. Provide adjacent to the fire alarm control panel:

   a. A telecommunications outlet consisting of 2 voice and 1 data port shall be installed adjacent to the fire alarm control panel. The 2 voice lines will be used by the digital alarm communicator, and the 1 data line will be used for mass notification.

   b. A 12"x12"x4" deep box with a hinged cover, with a 120 volt receptacle inside. This box will be used by UNCG's Telephone Services group for the mass communication interface.

   c. Printer stand with paper storage.

16720A. MASS NOTIFICATION REQUIREMENTS FOR FIRE ALARM SYSTEMS

All fire alarm systems designed and installed at UNCG shall be designed with mass notification features, with systems capable of being integrated into an overall campus mass notification system in the future.

> (Note: Because mass notification technology and systems are currently in development by manufacturers and standards-making bodies, there is currently no nationally recognized standard for the installation of these systems. Also, at this time, manufacturers of fire alarm systems also do not have a complete line of products available for purchase, nor do they have guidelines on how to design and install these systems.)

The National Fire Protection Association created Annex E in the 2007 edition of NFPA 72, the National Fire Alarm Code, as a way to begin the process of creating a consensus national standard, and when the 2010 edition of this standard is published it will incorporate mass notification requirements and a national consensus standard will be available for the first time.

Because the University will be installing fire alarm systems before standards-making bodies and manufacturers have completed their work, and because the preliminary standards that will be available are still being modified, each system's design will require close coordination with the campus to help insure the systems are compatible with future developments in this field. Designers are encouraged to keep current with the proposed standards and new hardware, and also to keep University personnel apprised of the most current ideas in this field. Designers should also use the Department of Defense's Unified Facilities Criteria document "Design and O&M: Mass Notification Systems" (UFC 4-021-01) and American's with Disabilities Act Accessibility Guidelines (ADAAG) when designing systems.

It is the University's intent to install a central control station at the UNCG Police Department and at other selected locations in the future that will be able to transmit information to building fire alarm systems. The central station will be able to call to buildings, then the building fire alarm systems will transmit both a public address (voice) message as well as a visual signal (using an amber strobe) to publically indicate an event.

Fire alarm systems should be designed and installed with the following:

1. Systems shall be designed in accordance with NFPA 72, Annex E, Mass Notification Systems.

2. All fire alarm systems shall be voice systems. Coordinate locations of the main fire alarm control panel and remote panels with University personnel so that local mass notification announcements are possible.

3. Fire alarm control panels shall have an external audio input, capable of accepting an external audio signal sent from a central control system.

4. Speakers shall be zoned according to the floor plan of the building and coordinated with the University.

5. A speaker shall be installed in stairwells, located on a landing that is centered vertically in the enclosure. (Note: Some of the taller campus buildings may require more than one speaker per stairwell. Discuss the number and locations with the University Project Manager during design.)

6. Exterior exit locations and appropriate congregation areas (i.e., balconies, patios, walkways) will have a fire alarm (white) strobe and a standard speaker.

7. A combination speaker/fire strobe (white)/mass notification strobe (amber) will be installed at all fire alarm strobe locations in egress corridors, in areas of common congregation, and in all rooms designated by the university to receive notification provisions for the hearing impaired.

8. Toilets, conference rooms, study rooms, and similar locations will have a combination speaker/fire alarm strobe (white)/mass notification strobe (amber).

9. Residence halls will have a speaker installed in each residence room, but not an amber strobe. This is in addition to the combination smoke detector/sounder base that will also be installed.

10. Mass notification strobe units will be initiated by a switch at the FACP, and used in conjunction with the voice communication system for mass notification purposes. It is not envisioned that both visual device systems will be used concurrently.

11. The UNCG Telephone Services group will furnish and install a Voice Over Internet Protocol interface between the campus network and the fire alarm control panel auxiliary audio input.

16722. ELECTRONIC DOOR ACCESS & MONITORING

Updated: 7/31/2013

1. GENERAL
   a. The University uses the Blackboard Transact Access Control System to provide and monitor access into buildings from the exterior and to certain interior spaces such as IT Secure Areas. The Designer should include a discussion of this scope of work in the meeting(s) with the University Locksmith and FDC Design Project Manager early in the Design Development phase of the project. This system should be included in the project as a Preferred Brand Alternate and as one of the three manufacturers in the base bid. These guidelines apply to all installations of the Blackboard Transact Access Control System on campus.
   b. As a general rule, all exterior doors will have one of three configurations:
      - Monitor only
      - Monitor and Unlock
      - Monitor, Unlock, and Card Access
   c. Interior doors that may require access control are:
      - Rooms where audit trails are required by law or regulation (designated IT Secure Areas, HIPPA, etc.)
      - Rooms that serve a large, broad group of the University community (computer labs, library)
      - Rooms with sensitive equipment and/or access, where unauthorized access may hamper educational goals or pose a significant liability risk (scientific labs)
   d. Refer to Hardware Guidelines (section 08000 Doors/Windows and section 16700 Telecommunications Systems) for additional requirements.

2. DESIGNER REQUIREMENTS
   a. The designer shall specify that the door access system must be a turn-key operation and complete installation.
   b. Include separate floor plans to show all access control openings. This should include all devices relevant to life safety and necessary to provide a comprehensive plan for access control. All openings should be clearly defined and labeled as they will exist at completion.
   c. A listing of symbols should be clear and reflect the hardware that will be installed at the opening.
   d. Each opening should have a diagram on the Riser page detailing conduit runs/paths/sizes and labeled clearly to correspond with floor plans.
   e. Label legends shall be listed on riser on page as well as front page of section to detail devices and notes as needed.
   f. Notes should be used to convey work scope and responsibility.
   g. Access control equipment should be placed in secure room with network connectivity and on standby power. Requests to place wiring or equipment in IT Secure Areas must have written approval from the Vice Chancellor for Information Technology Services (UNCG Physical Access to Information Technology Resources Policy).

h. Equipment should be mounted on ¾" non-combustible plywood. If painted ensure appropriate paint and leave labels viewable.
i. Door Hardware Schedule shall be prepared by opening and listed in a common schedule. ALL doors should be included with ALL hardware to be installed. NO EXCEPTIONS. A statement describing the Method of Operation for each door type should be included with each hardware set.
j. Door hardware should be left such that it can only be operated with the electronic hardware. Keys and dogging features should be removed or dramatically restricted.
k. Minimum of 2 network connections required in the Access Control controller area in close proximity to Access Control enclosures. If more than 16 doors involved add one network connection per 8 doors.
l. The specifications should include a requirement for shop drawings for the security hardware installation and coordination with standard hardware prior to door frame approval. The needs of the security hardware equipment should be reflected and specifically noted on the door frame submittal.
m. Require a pre-installation conference with all Contractors involved with this work including the Designer and FDC construction project manager.
n. Some exterior doors and all interior doors will require a key override.

3. CONTRACTOR REQUIREMENTS

a. Electrical Contractor
   1. Responsible for pathway from door/opening to Door Access Controller Area.
   2. ¾" Conduit to be used within walls.
   3. Permissible to use cable tray between doors and Door Access Controller Area. Residence Life requires cable in conduit from door to enclosure.
   4. Maintain all fire ratings.
   5. Responsible for pulling wire in path as detailed by owner.
   6. Minimum of 2 feet should be provided at each device location. Wire should be protected when pulled such that it doesn't get damaged during construction.
   7. Minimum of 20 feet should be provided in Access control controller area.
   8. Wire and cable shall be marked clearly on both ends by door/opening number and device. Example: door 1101 ext REX.
   9. Provide 1- 20 amp 110VAC circuit per 8 door controllers. Each controller to plug into receptacle.
   10. Wire to be 18 gauge, 12 conductor, shielded wire, minimum or a composite cable as required by FDC design project manager.

b. Access Control Contractor
   1. Access Control Contractor must be Blackboard Transact certified. Preferred minimum 5 years' experience.
   2. Inspect wiring for labels and visual defects.
   3. Terminate wire at door/opening and add device.

4. Terminate and label wiring in Access Control Area.
5. Label enclosures.
6. Connect master controllers to data jacks.
7. Test and commission.
8. All network connections will be made by UNCG Information Technology Services.

c. Hardware Contractor
   1. Installs all door hardware and associated equipment such as power supplies.
   2. Coordinates location of all access control and hardware equipment.

4. MATERIALS REQUIRED
   a. Door hardware: Industry Grade 1 hardware 24 VDC <1 Amp.
   b. Power Supply: Certified by door hardware provider to work appropriately with hardware usually needed for electric exit devices.
   c. Request to Exit (REX) devices: 24 VDC with Normally Open Trigger
   d. Door Position Switch: Contact is closed when door is closed.
   e. Door readers should be "dual-use" swipe and contactless. Must be Blackboard Transact certified “dual-use” magnetic-stripe/NFC (13.56MHz, ISO 14443A) units.
   f. Wire to be 18 gauge, 12 conductor, shielded wire, minimum.

16740. GPS WIRELESS CLOCK SYSTEM

A Primex satellite clock system is used on the UNCG campus. The system operates by receiving a time signal from the U.S. government’s global positioning system, and then retransmitting a signal to wireless clocks located throughout the campus. The campus uses black 12 ½ inch clocks in most areas. Additional information concerning this system may be found at www.primexwireless.com.

When renovations or new building construction occurs, the designer shall show all clock locations on drawings, and shall indicate these as owner provided. UNCG’s Facility Operations department furnishes and installs new clocks. Clocks shall be installed only in classrooms, seminar rooms, instructional labs, and similar teaching areas. They should be located on the wall opposite the instructor’s normal teaching position so the instructor will typically be facing the clock. Offices and office suites, corridors, conference rooms, etc., shall not have clocks installed unless a project or department specifically requests clocks.

UNCG has receiver/transmitters strategically located throughout the main campus, and these existing units cover the campus with sufficient signal strength for all clocks being installed within the core campus. No additional receiver/transmitters will be required when installing or extending clocks on the main campus. For classrooms or other instructional areas not on the main campus, additional receiver/transmitters will likely be required, and provisions for 120 volt power, an antenna cable, and an antenna that can be pointed to a satellite should be designed into the project.

The receiver/transmitters, antenna cables, and antennas will be installed by the UNCG Facility Operations department.

The UNCG Design Project Manager shall coordinate with the Facility Operations department and capture a cost for the installation of clocks. This cost shall appear as a separate line item on the Design Project Manager's PreConstruction Expense form, so that the clocks may be paid for out of project funds.

16741. POLICE BI-DIRECTIONAL AMPLIFIER

In some larger buildings, the UNCG police department has experienced difficulties when communicating with officers using police radios. To help eliminate radio reception problems, where necessary, a radio bi-directional repeater/amplifier can be installed. These units receive and re-transmit radio signals eliminating communication "blind spots", or areas without police/emergency radio coverage in a building.

On renovation projects, the UNCG Project Manager shall contact the UNCG police to discuss radio reception in the building and determine if there is any need for this equipment. In buildings where radio reception has been acceptable in the past no new equipment will be required. For new construction, the Project Manager should contact the police and the GPD Group for assistance in determining the need for this equipment.

On those projects where the bi-directional amplifier will be installed, the Designer shall make provisions and leave space for the installation of this radio unit, coaxial cables, and antennas by others. The radio equipment will require an accessible space within a secure area to house the equipment; typically an electrical room at the top of the building. The radio equipment requires a wall space of approximately 2 feet by 2 feet, as shown in Figure 1, as well as a dedicated 120 volt duplex outlet is required beside the space for power.

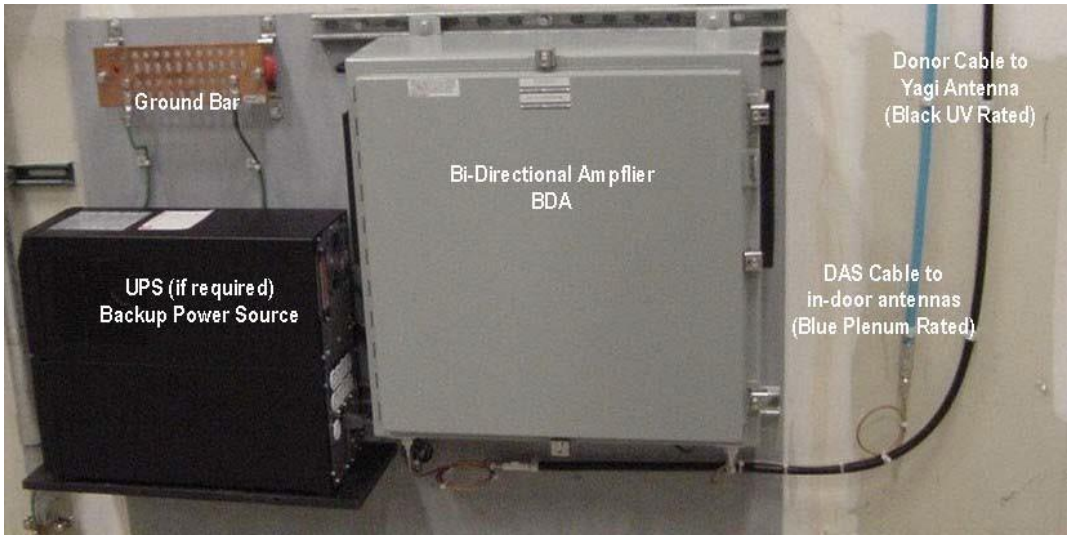

Figure 1

A ½ inch, UV rated foam core coaxial antenna cable, provided by the radio installer, will run from the bi-directional amplifier (Figure 1) to connect to a Yagi antenna that will be mounted on the roof by one of the methods shown in Figure 2 and/or as describe below.

Figure 2

Because this type of coaxial cable is difficult to bend, a straight run of 1" conduit with no junction boxes should be run to just below the roof. The penetration through the roof for the cable should be made with a minimum of a 2" rigid steel conduit extending 24" above the roof, with a gooseneck to prevent rain from entering the building. The open end of the gooseneck on the conduit above the roof will be sealed by the radio installer once the coaxial cable has been properly installed and secured.

The radio installer will run plenum-rated coaxial cable from the bi-directional amplifier output throughout specified areas within the building that require in-building antennas for effective communication. The radio installer will secure the plenum-rated coaxial cable above ceilings and terminate it into in-building antennas as shown in Figure 3. The installation of the plenum-rated cable needs to be coordinated with the radio technicians to make sure that sleeves through walls and floors are provided in order to run this interior antenna cable to locations chosen by the installer.

Figure 3

(For the UNCG Design Project Manager - UNCG's contact for additional information is Jim Riche with the GPD Group. He may be contacted at (770) 752-7197 or by emailing at jriche@gpdgroup.com.)

16920. MOTOR CONTROL CENTERS

1. Motor Control Centers shall be Class 1, Type C with terminal strip terminations.

2. Motor Control Centers shall not be located where ambient temperature could cause de-rating of overload devices.

3. Overload Heater Charts shall be mounted inside doors of cabinets or framed and mounted outside the equipment.

4. Motor starters and protective devices shall be of a type not affected by ambient temperature. The module shall be plug-in type to permit safe replacement without shutting down the Motor Control Center.