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: djfried2@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 17, 2021

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.

3. Variable Frequency Drives (VFDs) for roof-mounted Air Handling Units shall either be installed at the factory in an enclosure integral to the AHU or be mounted indoors. Contractor-installed VFDs exposed to weather are not acceptable.

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
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

Updated October 15, 2021

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. UNC Greensboro prefers to utilize efficient, economical lighting for both indoor and outdoor applications. The Designer, therefore, is encouraged to apply state of the art designs and solutions for campus facilities and to reference the latest version of the “Energy Efficient Lighting Guidance Document for New Construction and Retrofits: The State of North Carolina” document available on the State Construction Office website, Design Review tab, “Solid State Lighting Guidelines.” Typical expectations include the following:

4.1 Indoor Correlated Color Temperature (CCT) should be in the range of 3000K to 4000K depending on location and application, i.e., use of the space.
4.2 Minimum Indoor Lighting Color Rendering Index (CRI) = 80.
4.3 Lighting Power Density and Occupancy/Vacancy Sensors are to be implemented as required by the current North Carolina Energy Conservation Code.
4.4 Flicker shall not exceed 5% or per current IEEE recommended practice.
4.5 Minimum LED life (L70) of 50,000 hours.
4.6 Minimum five (5) year warranty on LED drivers is preferred.

16520. EXTERIOR LIGHTING FIXTURES
Updated October 15, 2021

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° 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. UNC Greensboro prefers to utilize efficient, economical lighting for both indoor and outdoor applications. The Designer, therefore, is encouraged to apply state of the art designs and solutions for campus facilities and to reference the latest version of the “Energy Efficient Lighting Guidance Document for New Construction and Retrofits: The State of North Carolina” document available on the State Construction Office website, Design Review tab, “Solid State Lighting Guidelines.” Typical expectations include the following:

3.1 Outdoor Correlated Color Temperature (CCT) can range from 4000K to 5000K depending on application.
3.2 Minimum Outdoor Lighting Color Rendering Index (CRI) = 70.
3.3 Flicker shall not exceed 5% or per current IEEE recommended practice.
3.4 Minimum LED life (L70) of 50,000 hours.
3.5 Minimum five (5) year warranty on LED drivers is preferred.

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
Updated: May 11, 2020

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1. TELECOMMUNICATIONS SYSTEM

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


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)

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-inch conduits stubbed no higher than 4-inch AFF with bushings, for all buildings. One of the conduits shall be filled with three inner-ducts (two 1.5-inch and one 1-inch) 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. **All doors shall open out into the hallway.**

The contractor shall provide racks, as described in 5.4 Racks section of this guideline. Rack count and exact location to be determined by UNCG.

Provide dedicated 20-amp electrical circuits to a quad outlet receptacle (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 components and associated patch cabling are provided by UNCG. Any necessary fiber optic 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-inch AC grade plywood, painted on both sides with two coats of white intumescent paint. Alternatively, ¾-inch 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 once installed. The designer shall indicate on project drawings that the plywood shall be completely painted, leaving the fire-retardant stamping showing, 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. All doors shall open out into the hallway.

Provide three 4-inch 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 as described in 5.4 Racks section of this guideline. From the IDF cables will run from racks via cable pathways, to wall outlets, in a star topology. 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-inch AC grade plywood, painted on both sides with two coats of white intumescent paint. Alternatively, ¾-inch 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, leaving the fire-retardant stamping showing, 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 IDFs, Velcro only.

4. BUILDING BACKBONE
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-inch conduit risers between telecommunication rooms stubbed 4-inch above finished floor with bushings. Fill two of the 4-inch conduit with two 1.5-inch inner-duct, one 1-inch 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-inch conduits. Provide a Telecommunications Bonding Backbone (TBB) # 6 insulated minimum.

4.1 Backbone Terminations
4.1.1 Fiber
The fiber shall be factory terminated cassettes with LC type connectors using fusion splice pigtails. Anaerobic or 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 CABLEING

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. In areas with hard ceilings provide a minimum of (3) 4” conduits with a pull rope. Walls shall have a 4-inch square box with a 1-inch (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-inch 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) and blue in color. All cables shall be plenum rated.

5.2 Outlets
All outlet cables shall be terminated in a RJ45 type jack, black in color Category 6 rated with 568B configuration.

5.3 Closet Terminations
All cables shall be terminated on rack mounted Category 6 angled 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.
5.4 Racks
The contractor will provide floor racks in each MDF/IDF.

The 7’ floor-mounted open racks shall generally have
- 19-inch mounting space
- a footprint of 32-inch wide x 24-inch deep with 36-inch clearance front and back. This allows 32-inch for the width (including (2) 6-inch vertical cable-management), 24-inch depth for equipment, and 36-inch clearance for workspace.
- 16-inch ladder type cable runways from wall-to-wall across each floor rack and on the wall perimeter
- one fiber optic enclosure at the top (or two units of mounting space at the top of each rack in MDF/IDF for a future fiber optic patch panel)
- one to four 48-port Category 6 angled patch panels, beginning at the third U from the top of the rack. Provide each rack with the number of 48-port angled patch panels specified by Owner.
- an individual bonding connection to the telecommunication grounding bus bar (# 6 insulated minimum)
- a minimum 6-inch vertical cable 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 (when using angled patch panels, horizontal management is not required)
- adequate space for switching equipment, which is provided by Owner.

6. WORKSPACE CONFIGURATION

A typical outlet is defined as consisting of three blue category 6 cables, in a four-port faceplate with Category 6 jacks (black in color). 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 typical outlet. 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 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.

6.5 Point-of-Sale
Each location shall be provided with one outlet consisting of one typical outlet.

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

6.7 Spaces Not Listed
Other spaces shall be evaluated by the University and may be required to have University telephone, data, or CATV outlets.

6.8 ATM Machines
Each location for ATM machines shall have one typical outlet.

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

6.10 Security Cameras
If a security camera is required, each security camera location shall have one terminated category 6 cable for the camera to connect to the network, mounted at a height and location to be determined via consultation with UNCG police.

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 can perform all tests as required by this specification and has been factory calibrated within the past year.

8. MISCELLANEOUS

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 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 Guidelines 14200 for telephone requirements.

8.4 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 (2)
1.5-inch conduits for low-voltage cabling and (1) 1-inch conduit for electrical 120-volt receptacle.

8.4.1 Emergency Phone Cabling
For outdoor emergency telephones, provide two outdoor rated, Category 6 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.

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

8.5 Control Systems
Provide a typical outlet beside the building’s HVAC direct digital control system main controller.

8.6 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.
This drawing is diagrammatic and not intended to show minor details and exact locations.

CABLE IDENTIFIER: 241-2-1A-01
RE: SECOND OUTLET, NJ 1A-02, IN ROOM 241

CENTER HUNG CABLE TRAY

CABLE MUST SUPPORT SYSTEM UNTIL MINIMUM OF 16" RUNWAY (LADDER).
PLYWOOD, 3/4", FINISH SIDE, NFPA COMPLIANT.
USE 7' FLOOR MOUNTED CABLE MOUNT RACKS.

NETWORK TERMINATION HARDWARE (NCF, IFJ)
CAT5E, 568B PINNED ANGLED PATCH PANEL, UPPER LEFT CORNER LABELING, LABEL IN SEQUENCE A,B C TO TOP SIDE, LABEL EACH PATCH PANEL PORT WITH ROOM, OUTLET & JACK IDENTIFIERS.

EX: TERMINATING HARDWARE PORT #1 LABEL 208-2/C, USE LASER PRINTED LABELS CONSISTENT WITH CURRENT INFRASTRUCTURE PATCH PANEL LABELING.

*CONSULT BANK CB-06/2008

NOTE – Use cable trays or ladder support system attached to beam, purlin, or deck for supporting cable bundles weighing in excess of 45 pounds per foot. Cable or cable bundle of less than 45 pounds per foot can be supported by category five rated j hooks spaced at 4 foot maximum distance. The cable support system installed as specified in NEC/NEFAA-70 article 800, BCS, and ANSI/TIA/EIA 568A specification.

Figure 1
Figure 2
8.7 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

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 IDFs.

The HVAC system that serves the MDF and IDFs 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 IDFs. 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 & IDFs), 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. FIRE DETECTION AND ALARM
Updated: August 06, 2019

PART 1 GENERAL

1.1 REQUIREMENTS
A. This Contractor shall furnish and install a complete combination fire alarm, smoke detection, and mass notification system as indicated on drawings and as specified herein. The system shall be electrically supervised with intelligent analog alarm initiation and addressable devices. The system shall comply with applicable provisions of the NC Building Code (available for review at NCDOI website), and the National Fire Alarm Code (NFPA 72). The Contractor shall furnish all parts, materials, and labor customarily required or provided for a completely coordinated, logical, and satisfactorily operating system, in accordance with all requirements applicable, even if every such item is not specifically shown or described in the project plans or specifications.

B. System shall satisfy the requirements of all current State (NC Building Code), NFPA 72 (2013 edition), and local building codes.
C. System shall operate and function in compliance with NFPA 72 and NFPA 101.

D. This specification has been written with the intent of complying with the NC SCO consensus document “Fire Alarm Guidelines and Policies” dated 2011 (available for review at NC SCO website).

E. Approval of samples, cut sheets, shop drawings, and other matter submitted by the contractor shall not relieve the contractor of responsibility for full compliance with project plans and specifications, unless the attention of the engineer is called to each non-complying feature by accompanying letter, and the engineer has given written authorization for the specific deviation(s).

F. Fire Alarm Contractor shall specialize in fire alarm system installation, be factory trained and certified, with a minimum of five (5) years documented experience installing and maintaining fire alarm system for similar installations. Fire Alarm Contractor shall be located within 100 miles of UNC-G.

PART 2 PRODUCTS

2.1 MATERIALS

A. The system provided shall be a fully addressable type. The materials and equipment specified herein are that of the EST 3 series system. Similar and equivalent systems by Simplex (4100ES) or Notifier (NFS2-3030). System and components shall be U.L. listed as a fire alarm system. All equipment supplied shall be specifically listed for its intended use and shall be installed in accordance with any instructions included in its listing. System shall use a nominal 24 Vdc operating voltage.

1. Fire Alarm/Mass Notification System Control – EST 3 series fire alarm control panel with all standard features plus the modules necessary to meet the functions specified herein and on the drawings. System shall be equipped with a separate and independent source of secondary power (battery back-up); 60 hours in the quiescent mode and 15 minutes of alarm (supplier shall submit calculations on determining battery size to meet this requirement per NFPA 72). System shall be capable of handling initiating zones and control output signals (HVAC shutdown, etc. - not alarm signals) as indicated on the drawings and specified herein. Shall be equipped with necessary module and contacts for connecting to campus remote communication system. Panel shall have surface mounted steel cabinet with indicator viewing window, hinged door with cylinder lock, dead front construction, and factory baked enamel finish. System display shall have LCD display, and an alphanumeric keypad for programming and operation of panel. Panel memory shall be non-volatile. System shall be field programmable without the use of special hardware or software, and shall be password protected. The system shall have multiple access levels so Owner’s authorized personnel can disable individual alarm inputs or normal system responses (outputs) from alarms, without changing the system’s executive programming or affecting the operation of the rest of the system. How to instructions shall be included in the training required to be given to the Owner’s designated personnel, and must also be part of the written documentation provided by the fire alarm equipment supplier. Panel shall be UL 9th Edition compliant.

Each addressable fire alarm system shall include a LCD-type annunciator at (or in) the FA/MNS CU, or in another location if acceptable to the AHJ. Each annunciator shall be monitored individually for power loss, communications loss, etc.

FA/MNS CU shall have dual contact time-relay (minimum 60 second capability) installed at
the main FA/MNS CU to delay trouble signals to the Emergency Communications Center.

2. Digital Alarm Communicator Transmitter: System shall be equipped with a 10-channel (minimum) DACT for transmission of fire alarm, supervisory, and trouble signals to a Central or Proprietary Supervising Station or Owner’s alarm receiving equipment. DACT shall be compatible with Owner’s alarm receiving equipment. Contractor shall confirm compatibility prior to installation. The fire alarm contractor shall program the PROM, connect each DACT to telecommunications line provided, and verify proper signal receipt by supervising station. System shall have two telephone lines for redundant dial out capability. The transmission means shall comply with NFPA 72. Final testing and acceptance of the fire alarm system depends on proper functioning of the interconnection of the fire alarm control panel and the owner’s supervising station.

The following signals shall be reported in Contact ID format provided by the University (requirements shall be coordinated at part of the fire alarm pre-construction meeting):

a) Fire alarm (smoke)
b) Sprinkler water-flow alarm
c) Sprinkler valve tamper (closed) supervisory signal
d) Burglary/Intrusion/Duress/Other Security or Emergency Alarm
e) Fire alarm system AC power trouble (only if 120 VAC interrupted for 8 hours maximum)
f) Fire alarm system loss of telephone line trouble

Precedence of these signal shall be as follows:

1. Fire Alarm/Water Flow
2. Supervisory Signal
3. Trouble Signal
4. Security

3. The fire alarm system DACT shall communicate separate signals for the following. It shall not just send a generic/general trouble. The list below is used only as an example:

a) Smoke Detector Trouble
b) Pull Station Trouble
c) Sprinkler Tamper Trouble
d) Sprinkler Waterflow Trouble
e) Ground Fault Trouble
f) SLC Open/Short trouble
g) AC loss trouble
h) NAC trouble
i) Speaker circuit trouble
j) Relay trouble
k) System in bypass trouble
l) All other zones/signals required for specific installations shall be coordinated and approved by UNCG before installation and programming.

4. The contractor shall provide two (2) RJ31X jacks adjacent to the DACT. Provide a Category 6 plenum rated cable (Yellow) from each jack to the closest telecommunications room (IDF/MDF) (coordinate location with Owner). Cables shall be terminated on a 66 block located on a red backboard or as otherwise directed by the Owner. In addition, the contractor shall provide one (1) Category 6 plenum rated cable (color to be confirmed with the University)
from the closest telecommunications room (IDF/MDF) for connection to a WEBS (Wide-Area Emergency Broadcast System) device (Talk A Phone WEBS-CM-2 – WEBS Communications Module) located adjacent to the FA/MNS CU.

5. System event printer: Provide a system event printer that will print out each event showing date and time and event description. Printer shall use non-thermal sprocket-drive paper. Printer shall be furnished with desktop floor stand or wall mounted rack, as appropriate for location that will house printer and paper, including printout copy. Confirm installation location with Owner. The printer shall be operational and tested by the Contractor prior to Engineer and Owner testing. Contractor shall provide a copy of Contractor 100% system testing results to Engineer and Owner prior to Engineer and Owner testing.

6. Each AC input to the system panel and SNAC panel(s) shall be protected by a feed-through (not a shunt type) branch circuit transient arrestor such as EFI E100HW120, Leviton 51020OWM, Emerson/Northern Technologies TCS-HWR, Transtector ACP100BW Series, or equivalent UL 1449 – Third Edition listed device submitted to and approved by the Engineer in writing. Unit shall be rated for “Lightning Surges” since building is equipped with a lightning protection system. Install suppressor in a listed enclosure near the branch circuit panel, trimming excess lead lengths. Wind a small coil in the branch circuit conductor just downstream of the suppressor connection. Coil to be 5 to 10 turns, about 1” in diameter, and securely tie-wraped. This series impedance will improve the effectiveness of suppressor on clipping fast rise time voltage transients. Surge Protector location shall be shown on asbuilt drawings.

7. Each DC circuit extending outside the building (such as the PIV, etc.) adjacent to FA/MNS CU and also near point of entry to outside building, shall be protected by a “pi”-type filter on each leg consisting of a primary arrestror, series impedance, and a fast acting secondary arrestror that clamps at no more than 15V above nominal circuit voltage. Acceptable models are Innovative Technologies D2S33-2ML, Simplex 2081-9027/-9028, Transtector TSP8601, Ditek DTKxLVL series, Citel America B280-24V, Leviton 3824-OWM, Northern Technologies DLP-42. Specifications on equivalent models may be submitted to and approval by the engineer in writing. UL 497B listing is a prerequisite for consideration. Devices using only MOV active elements are not acceptable. Surge protectors shall be shown on asbuilt drawings.

A recessed annunciator, designed around EST series type, shall be provided in a location indicated on plans. Final location shall be approved by the owner.

8. Two (2) framed, detailed, graphic representation of the building, floor plans, zones, and devices, labeled to match the digital readout on the FA/MNS CU, shall be provided adjacent to the FA/MNS CU in main electrical room and annunciator in a location near the main entrance as shown on the plans. Final locations shall be approved by the owner.

9. Pull Stations: Pull Stations: EST series addressable type, dual-action, with Lexan cover; flush back-box. Mount at 46” AFF to center. Pull stations in field area shall have clear protective lift cover. All pull stations shall be provided with keyed locks for resetting purposes. Allen key type locks are unacceptable. Two (2) keys for each pull station shall be supplied to UNCG.

10. Combination Audio/Visual and Visual Indicating Signals: designed around EST wall-mount series type, 15, 30, 75, 110, or higher candela (as required to comply with ADA) clear xenon
strobe with 1Hz flash rate, selectable output speaker with \( \frac{1}{4}, \frac{1}{2}, 1 \), and 2 watt field selectable adjustments, and 25.0 or 70.7V, ADA compliant, white housing. Alarm notification appliances, both audible and visual, shall comply with NFPA 72 requirements for intensity and placement. System shall be equipped with necessary module(s) such that all speakers (on all floors) are synchronized and all strobes (on all floors) are synchronized. The strobe flush-mounted back-boxes shall be mounted 80 inches AFF or 6" below ceiling whichever is lower; and meet Accessibility Code. Indicate candela and wattage on submittal building drawings. The exterior of the wall mount device including back box shall be aesthetically pleasing.

11. Ceiling Mounted Audio/Visual and Visual Indicating Signals: designed around EST ceiling mount series type; 15, 30, 75, 95, 115, or higher candela (as required to comply with ADA) clear xenon strobe with 1Hz flash rate, selectable output speaker with \( \frac{1}{4}, \frac{1}{2}, 1 \), and 2 watt field selectable adjustments, and 25.0 or 70.7V ADA compliant, white housing. Alarm notification appliances, both audible and visual, shall comply with NFPA 72 requirements for intensity and placement. System shall be equipped with necessary module(s) such that all speakers (on all floors) are synchronized and all strobes (on all floors) are synchronized. Ceiling mounted. Indicate candela and wattage on submittal building drawings.

12. Ceiling Smoke Detector: designed around EST addressable, intelligent, analog, low-profile, multi-sensor detector with base. Smoke detectors shall be capable of magnet test. Ceiling mounted. Covers shall remain on detectors until building is free of dust and dirt.

13. Ceiling Smoke Detector with Sounder Base: designed around EST addressable, intelligent, analog, low-profile, multi-sensor detector with 520 Hz sounder base. Smoke detectors shall be capable of magnet test. Ceiling mounted. Covers shall remain on detectors until building is free of dust and dirt.

14. Duct smoke detector: Probe length shall extend through duct and shall be provided with far end support for stability. Lengths to be determined by Electrical and Mechanical Contractor together. Furnish each duct detector unit with a remote alarm indicator light (RAIL) and test station. Mount remote indicator light/test station on wall at the same height as notification devices in the nearest corridor or public area. Detectors shall be turned over to HVAC Contractor for him to install in ducts. Electrical Contractor shall wire to fire alarm system. Fire alarm AHU shutdown circuits shall be wired from the fire alarm control panel to a termination point, adjacent to the AHU control by fire alarm contractor. Mechanical Contractor shall make all control wiring connections for shutdown of respective AHU via addressable control relay(s) at termination point activated by the fire alarm control panel. Addressable control relays shall be installed within three (3) feet of the controller for the equipment being controlled. All air handling systems shall be shut down directly by the FACP during alarm shutdowns. Building automation systems shall not be used for alarm shutdowns of air handling systems.

15. Each duct detector installation shall have a hinged or latched duct access panel, 12x12 inches minimum, for sampling tube inspection and cleaning. Indicate airflow direction on the duct, adjacent to the detector, using stencil or permanent decal.

16. A supervised “AHU Shutdown Defeat” switch shall be provided in/adjacent to the FA/MNS CU. Provide an informative engraved label at the switch provided in/adjacent to the FA/MNS CU. The switch shall cause a system “trouble” indication when the switch is placed in the off-normal (“Shutdown Defeated”) position.

17. Unless the AHJ requires otherwise, all duct detectors shall be programmed for fire alarm (not supervisory annunciation).
18. Door Release Mechanism: EST series. Provided by Electrical Contractor. E.C. to make all wiring connections except connect to FACP. Connection at FA/MNS CP shall be by certified installer. Shall operate on 24 VDC provided by fire alarm control panel. The resulting current drain shall be included in the standby battery calculations or the system shall be programmed to drop the door hold open magnet load 60 seconds after loss of 120 VAC Coordinate exact holder mounting and requirements with General Contractor. Provide and install appropriate bracing/backing in the wall for mounting box equipment. Flush wall mounting type devices shall be utilized, with all wiring routed concealed in wall unless required otherwise. Provide where shown on engineering drawings and/or where indicated in architectural door schedules.

19. Interface devices: Monitor module. Devices shall be used to monitor sprinkler water flow switches, sprinkler tamper switches, etc. Locate these devices in environmentally controlled areas which do not exceed listed parameters. Devices shall have visible LED(s) on cover. All monitor modules shall be labeled with device address and what it monitors.

20. Control Relay Device: Addressable relay module with contacts rated for 120vac, 20 amps (or add an auxiliary relay with contacts so rated). Addressable control relays shall be installed within three (3) feet of the controller for the equipment being controlled. Devices shall have visible LED(s) on cover that give indication when active. Control relays shall be labeled with device address and what it is controlling. If 120v is located in the same junction box, that it shall also be labeled, “CAUTION 120 VOLTS”.


22. The fire alarm system shall monitor 120 VAC power to shunt trip breakers used in conjunction with fire suppression systems. Examples include a shunt trip used for cooking appliance power shut-off when the kitchen hood fire suppression system discharges, or primary elevator power shut-down upon sprinkler water flow in any elevator equipment space or shaft. Use an addressable monitor module to accomplish this supervisory function. Devices used for elevator recall and elevator power shut-down shall be placed within 24” of the sprinkler head in each respective area.

23. Elevator Recall System: Provide two (2) fire alarm control relay devices in each elevator machine room for the purpose of signaling the elevator to home to the designated floors. Any elevator lobby smoke detector(s) on other than the Third Floor, or the smoke detector(s) in the elevator machine room hoistway(s) in alarm shall cause the elevator(s) to return to the Third Floor landing (or primary landing as designated by the Fire Marshall). The smoke detector(s) in the Third Floor elevator lobby(ies) in alarm shall cause the elevators to return to the Second Floor (or secondary landing as designated by the Fire Marshall). Fire alarm system shall provide logic to operate the control relay devices as described. Elevator control logic for proper homing of the elevators shall be by the elevator supplier. In addition, provide relay(s) for Fire Hat and, if required, battery override. Control relay devices shall be equipped with auxiliary relay with contacts rated 120 volts, 20 amps.

24. HVAC Controls: Provide control relay devices for each control point as indicated on the plans. In general, each air handler will require a control device relay to shut down unit. All control relay devices shall be equipped with an auxiliary relay with contacts rated for 120 volts, 20 amps. Addressable control relays shall be installed within three (3) feet of the controller for the equipment being controlled. Coordinate all with Mechanical plans and controls contractor.
25. Remote terminal cabinets: Size as required to house isolation modules, surge protectors, and wiring terminals. Locate in the individual floor electrical rooms or other convenient location (confirm with Owner). In multi-story buildings, all circuits leaving the riser on each floor shall feed through a labeled terminal block in a hinged enclosure accessible from the floor. Terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.

26. Fault isolation modules: Provide and install after each 20 devices and control points on any addressable loop, or a lesser number where recommended by manufacturer (confirm with installation instructions); for each addressable circuit that extends outside the building; in or immediately adjacent to the FA/MNS CU, at each end of the addressable loop (shall be in the same room and within 15 feet of the FA/MNS CU); and for loops with less than 20 devices and control points, install an isolator at the approximate middle of the loop (in addition to those at the FA/MNS CU). Each isolation module shall be clearly labeled, readily accessible for convenient inspection (not above lay-in ceiling), and shown on the as-built drawings. Devices shall have visible LED(s) on cover. When wall mounted isolation modules are utilized, mount at same height of notification appliances. All isolation modules shall be located in common areas (i.e. no dorm rooms).

27. Not used.

28. Wiring and cabling shall be provided as required by the manufacturer for proper function of the system. Addressable loop (signaling line) circuits shall be wired with Type FPL/FPLR/FPLP fire alarm cable, 18 AWG minimum, low capacitance, twisted, shielded copper pair. Cable shield drain wires are to be connected at each device on the loop to maintain continuity, taped to insulate from ground, and terminated at the FA/MNS CU. Acceptable cables include Atlas 228-18-1-1STP, BSCC S1802S19 (same as EEC 7806LC), West Penn D975, D991 (16 AWG), D995 (14 AWG), or equal wire having capacitance of 30 pc per foot maximum between conductors. Belden 5320FJ is acceptable if only FPL rating is required. All other circuits in the system shall be wired with minimum 14 AWG, stranded copper, THHN/THWN conductors. All wiring and cabling shall be installed in metal conduit.

Exception #1: Unshielded cable, otherwise equal to the above, is permitted to be used where the manufacturer’s installation instructions unequivocally require, or state a preference for, the use of unshielded cable for all systems.

Exception #2: In underground conduit, provide Type TC or PLTC cable (PE insulated) to avoid problems with moisture.

29. Color code for fire alarm wiring shall be as follows (unless specifically required otherwise by the manufacturer of the fire alarm system) without color change in any wire run:

a) Addressable loop – red cable jacket with red(+) and black(-) conductors.
b) Alarm notification appliance circuits – blue(+) and black(-) conductors.
c) Separate 24VDC operating power – yellow(+) and brown(-) conductors.
d) Door control circuits – orange conductors.
e) Circuits for addressable monitor modules to monitored devices (AWG 14) – violet(+) and grey(-) conductors.

Note: THHN/THWN conductors only are permitted if greater than AWG 16 (NCSEC
30. Notification Appliance Circuit booster ("SNAC") power supplies shall be individually monitored by the FA/MNS CU and protected by a smoke detector per NFPA 72. They shall not be located above a ceiling, or in non-conditioned space. All SNACs shall include an onboard LED to denote ground fault activation, 120V power loss, and SNAC trouble. There shall not be any monitor or control modules installed within the SNAC enclosure.

31. Emergency Voice/Alarm Communications:

The system shall have Mass Notification Communications capability. This shall include:

One-way Voice (PA) Communications System

The One-way Voice/Alarm (PA) Communications System shall meet the requirements of below:

Each floor, stairway, elevator bank, and Assembly space (>300) shall be a separate communication zone. Speakers shall be spaced to provide required sound levels. Check audio levels in all areas; adjust taps and/or install additional speakers, as required to meet Code compliant levels. Strobe lights shall not be installed in elevator cars, stairways, or photo darkrooms.

NOTE: Speakers in stairways shall be installed at every third floor landing, to avoid excessive audio levels and reverberation. Speakers in elevator cars, restrooms, and other very small, confined spaces shall be tapped on very low power levels or, where permitted by the AHJ, muted to reduce sound output. Intelligibility is improved in most building areas by installing speakers closer together and using lower wattage, as opposed to the opposite. Some mechanical spaces (especially chiller rooms) and factory-industrial occupancies may have sound levels that are too high to permit effective audible alarm notification. In those situations, provide visible alarm notification appliances with ratings and spacing selected for compliance with NFPA 72. Large Assembly occupancies generally require special system design and procedural considerations to assure safe and effective egress of large crowds in a fire (or other) emergency, without causing panic.

Normal audio amplifier power shall be a minimum of 120% of the system design load, per channel. For purposes of this calculation, use the amplifier's continuous two-tone output rating and the designed power setting of each individual speaker. Provide a copy of this calculation with the shop drawing submittal to the engineer. Also include on the "calculations" sheet included as part of the as-built drawings.

At least one (1) backup amplifier shall be provided for each channel, equal in power to the largest primary amplifier. For systems with distributed amplifiers, provide one backup at each transponder location. Failure of any amplifier shall automatically result in the defective unit being switched off-line and replaced with the backup.

The audible emergency evacuation signal shall comply with NFPA 72. This does not preclude the system from providing additional (non-evacuation) notification signals, including recorded voice messages, for specific emergency situations. Visible alarm notification appliances shall be provided per NC Code and ADA requirements.

One-way Voice/Alarm digital audio circuits shall be wired with twisted pair copper conductors (AWG 18 minimum) in jacketed cable, or with fiber optic cable. Analog audio circuits shall
be wired with AWG 18 minimum twisted pair copper conductors in shielded cable, Belden 8790, West Penn 293, or equal. Cable jacket color shall be gray, with red (+) and black (-) conductor insulation. For shielded cables, the shield shall be continuously connected from the amplifiers to the end of line. Tape the shield splice at each speaker and handset, to insulate from ground. Single point ground the shield at the amplifier or control unit unless prohibited by system manufacturer.

Provide Talk A Phone WEB-CM-2 – WEBS Communications Module for interconnection to Wide-Area Emergency Broadcast System.

32. 24 VDC power circuits serving addressable control relays shall also be monitored for integrity.

B. Each individual addressable device (addressable loop number, device number) shall be uniquely identified. Addressable devices shall be numbered to indicate the direction in which the wire was pulled. Each individual notification device (panel, circuit number, device number on circuit) shall also be uniquely identified. This shall be shown on the “as-built” plans and in the System Status and Programming Report. A permanently mounted label shall be placed on each device base or device housing, whichever is appropriate, indicating its address or device number and associated SNAC panel and circuit. On all devices, labels shall be made using electronic labeling system with black letters on clear background, unless panel color is black. If panel color is black, labels shall be made using electronic labeling system with black letters on white background. Write-on labels are prohibited. These labels shall be such that they can be read when standing on the floor at the device.¹

All batteries shall be labeled with the date installed. Labels shall be made using electronic labeling system with black letters on white background. Write-on labels are prohibited.

All tamper and flow switches shall be provided with label permanently attached to device with address from fire alarm program similar to above.

Each SNAC panel shall be uniquely identified. Each SNAC shall include a permanently mounted label indicating its name, what it feeds (ie. fire alarm strobes, mass notification strobes, etc.), The SNAC identification shall match device labels and asbuilds. 120V panelboard name, circuit number, and room name and number of breaker location). These labels shall be such that they can be read when standing on the floor at the device. Each circuit/pair of wires shall be taped together and identified with circuit number, and area of coverage. FA/MNS CU shall be labeled in a similar manner.

Contractor shall label all wires terminating in FA/MNS CU, SNACs, junction boxes and riser boxes. These labels shall be self-adhesive wire numbers. Labels shall clearly identify what wire/cable is connected to including area of coverage.

Each 120v surge protection device shall be labeled with a permanently mounted engraved placard. It shall be placed on each device junction box and housing indicating its breaker location (ie room number), panel name, and circuit number. These labels shall be such that they can be read when standing on the floor at the device. All 120v surge protectors shall be located by the 120v panel.
Contractor shall provide a typed legend for all SNACs, power supplies, junction boxes and riser boxes corresponding to these labels. Legend shall be mounted in riser boxes. If system does not have riser boxes, contractor shall provide legend to UNCG at time of acceptance.

C. The following spare parts shall be provided, each individually packaged and labeled, and turned over to the owner upon acceptance of the system (minimum of two (2) each; otherwise, round fractional quantities to next higher number). All spare parts shall be new and unused.

1. Two (2) fuses of each type and size used in the system.
2. 2% of total installed manual pull stations.
3. 4% of total installed addressable control relays.
4. 4% of total installed speaker/strobes (of both wall and ceiling).
5. 4% of total installed strobes (of both wall and ceiling).
6. 4% of total installed monitor modules (addressable interface).
7. 4% of total installed isolation modules/isolation bases.
8. 4% of total installed addressable heat detectors.
9. 6% of total installed ceiling smoke detectors.
10. 6% of total installed sounder bases.
11. Two (2) keys per installed pull station.
12. Two (2) AC surge protection devices.
13. Two (2) DC surge protection devices.
14. Full box of printer paper following Engineer and Owner testing (in addition to paper required for Contractor, Engineer, and Owner testing).
15. One (1) printer ribbon.

D. The contractor shall provide any special equipment, tools, and programming devices required for the operation, maintenance or repair of the installed fire alarm system.

2.2 FUNCTION

A. Activation of any alarm initiating device (detector, pull station, etc.) shall cause the following:

1. Sound audible devices throughout the facility.
2. Strobe lights shall flash.
3. All smoke door release mechanisms shall de-energize, causing all smoke doors throughout the facility to close.
4. An alarm shall sound and a visual signal indication at the fire alarm control panel and at any remote annunciators.
5. The device from which the alarm originated shall be distinctly annunciated at the fire alarm control panel and at any remote annunciator panels. Also the annunciation shall indicate the device type in alarm.
6. The contacts for the remote communications shall be activated.

B. Air handling systems and fans shall be shut down by activation of the fire alarm system. These signals shall be accomplished by relay controls and contacts furnished as part of the fire alarm system.
HVAC control wiring into the relays and contacts shall be by the Mechanical Contractor. Program relays as directed by the Mechanical Contractor. Shut down shall be wired so that there is no delay in the shutdown of unit when fire alarm relay is activated.  

C. System trouble shall be indicated audibly and visually at the fire alarm control panel. This shall be a sound that is individually distinguishable from the alarm signal.

D. Alarm initiating loops shall be supervised. Wiring and type devices used shall be such that failure of any device on a loop shall cause a distinctive trouble signal at annunciator panels, but failure of any device on a loop shall not preclude initiation of an alarm signal by any other device on the loop. In addition, all loops shall be supervised to provide a trouble indication in case of an open circuit or ground fault in either (or any) conductor. Also provide supervision of annunciator. 

E. Alarm notification appliance circuits (NAC) shall be NFPA 72 Style Y (Class B). The load connected to each circuit must not exceed 80% of rated module output and the coverage of each shall be limited to one floor. The NAC voltage drop during alarm shall not exceed 14% of the voltage measured across the batteries at that time. The contractor shall use power outage testing to verify the NAC circuit is designed and installed properly. Shop drawings must show calculated NAC current draw and voltage drop at the EOL.

F. Addressable loop controller (signaling line) circuits shall be fully NFPA Style 6 (Class A) with no “T” taps. Each loop must have a minimum of 20% spare address for future use. At a minimum, provide one addressable loop per floor. The supply and return conduit shall have at least one (1) foot vertically and four (4) feet horizontally of separation between them at all times.

G. All addressable spot type and duct smoke detectors shall be the analog type and the alarm system shall automatically compensate for detector sensitivity changes due to ambient conditions and dust build-up within detectors. This feature shall be armed and sensitivities set prior to acceptance of the system. Smoke detectors’ sensitivity shall be monitored at panel, and alarm threshold for each shall be adjustable. Contractor shall verify sensitivity settings of all devices.

H. Dormitory and student apartment sleeping rooms and suite areas shall have smoke detectors with “sounder” based controlled by the FA/MNS CU, to assure audibility, unless the AHJ approves otherwise. The detectors shall be programmed so sleeping room smoke initiates local alarm in room, pre-signal indication at the FACU, and notification at the Supervising Station. Any additional initiating device (ie room detector, in the same dorm or any other dorm.) shall activate a general alarm throughout the building. In suites, the detectors shall be programmed so smoke initiates local alarm in all rooms of the suite (ie. wire in tandem), pre-signal indication at the FACU, and notification at the Supervising Station. Any common area alarm must cause immediate general alarm throughout the building, including all sounder bases in sleeping rooms. All sounder bases shall be capable of being disabled by FA/MNS CU. This requirement includes a bypass switch to accommodate (bypass shall allow testing of room smoke detectors without sounder base activating.) 

I. Spot type detector shall be the plug-in type with a separate base (not mounting ring) to facilitate replacement and maintenance. The bases shall have integral terminal strips for circuit connections rather than wire pigtales. Each detector or detector base shall incorporate an LED to indicate alarm.
J. Spot type smoke detectors shall have a built-in locking device to secure the head to the base for tamper resistance. For detectors mounted within 12 feet of the floor, activate this lock after the system has been inspected and given final acceptance.

K. Install breaker locks for circuit(s) feeding FA/MNS CU and SNAC panels. In addition, provide ¼” painted red dot to handle or exposed body area.

L. The following by-pass switches shall be programmed into the system: audio/visual by-pass; tamper switch by-pass; water flow by-pass (shall include water flow bell); sounder base bypass; elevator bypass; MNS activation; HVAC/Damper bypass/defeat; door holder bypass. For all bypasses, FA/MNS CU shall transmit trouble signal to police department (PD) and all by-passes shall indicate a trouble on FA/MNS CU indicating which bypass is active. All bypass switches shall be equipment with an LED that turns on when active. All bypasses shall be programmed prior to doing 100% Contractor testing. Verification that by-passes work properly shall be included as part of Contractor 100% testing.

M. Activation of mass notification shall override fire alarm strobes and speakers. Once mass notification is deactivated, the fire alarm strobes and speakers shall activate as required. All mass notification strobes shall be synchronized.

PART 3 EXECUTION

3.1 INSTALLATION

A. All wiring shall be in metal raceway. All conduits that penetrate outside walls from air conditioned space must have internal sealing (duct-seal), to prevent condensation from infiltrating humid air.

B. The FA/MNS CU and all other control equipment locations, including any transponders, subpanels, annunciators, DACT, and booster power supplies, shall be protected by a spot type smoke detector located within 15 feet of the equipment (measured horizontally).

C. At a minimum, provide one (1) loop per floor.

D. All junction and pull boxes shall be painted red prior to pulling wire unless installed in finished areas.

E. No T-taps are allowed in system wiring.

F. No splices are allowed in the system wiring. All wiring runs shall be continuous between devices. Use terminals on devices or terminal cabinets on each floor. “Wire nuts” and crimp splices shall not be permitted. Floating terminal strips shall not be permitted.

G. Permanent wire markers shall be used to identify all connections at the FA/MNS CU and other control equipment, at the power supplies, and in terminal cabinets. In addition, for wiring inside terminal cabinets, affix typed professional legend to inside of terminal cabinet doors indicating wiring diagrams, line/load direction, etc.

H. Addressable interface modules (used to monitor all contact type initiating devices) shall be located in a conditioned space, unless they are tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed location. With AHJ approval they may be permitted to serve as many as three (3) sprinkler system valve supervisory switches, or six (6) heat detectors, in a single space.
I. On fire alarm notification circuits and end-of-line resistor shall be located as follows:

1. In a location that is accessible to the fire alarm maintenance personnel.
2. In an area where maintenance or testing at the EOL resistor location will not be disruptive to the normal use of the facility.
3. In an area that is not easily accessible to the normal building occupants (objective is to avoid accidental or malicious damage by building occupants).
4. In an area that is no higher than 9’0” or lower than 7’0” from the finished floor level.
5. Shall not be located in a stairway, bathroom, or dorm room-suite.
6. Shall EOL located in the field shall be a factory made (6” minimum) wire lead resistor.
7. All EOL shall be clearly marked on devices and on asbuilt drawings.

J. No isolation modules, relay modules, interface modules, terminal cabinets, etc. shall be located above drop ceilings.

K. Unless suitably protected against dust, paint, etc., spot type smoke detectors shall not be installed until the final construction clean-up has been completed. In the event of contamination during construction, the detectors shall be replaced at the contractor’s expense. Covers supplied with smoke detector heads do not provide protection against heavy construction dust, spray painting, etc., and shall not be used for that purpose. These covers are suitable only during final, minor cleanup or touch up operations.

L. Electrical and Mechanical Contractors shall include two (2) relocations per duct detector specified on drawings to assure working placement in ducts. Coordinate with Mechanical Contractor.

M. Notification Appliance Circuit booster (“ADA”) power supplies must be individually monitored for integrity and are not permitted to be located above a ceiling, or in non-conditioned space. Any 24vdc power circuits serving, but not limited to, addressable control relays must also be monitored for integrity. No control or monitor modules used for ADA rooms shall be located within the dorm room.

N. Installation shall be performed under the supervision and instruction of the manufacturer or a manufacturer authorized distributor. All connections to FA/MNS CU and system’s programming shall be performed only by supervision and the manufacturer or a manufacturer authorized distributor. Manufacturer trained and certified installers shall be used for all connections to the fire alarm control panel and for all system programming. This manufacturer’s specific training and certification must have occurred within the most recent 24 months, except NICET Level III Certification will extend to 36 months. Copies of the certifications for the specific FA/MNS CU model/series being installed shall be included with the contractor’s submittal package. The submittal package will not be approved without this information. Manufacturer’s authorized distributor shall stock a full complement of spare parts locally for the system. The technician who makes the final connections and programs the FA/MNS CU is legally the “installer”. The responsibility for assuring a proper installation overall rests with this individual.

O. Programming of the system shall include activating the automatic drift compensation feature for all spot-type smoke detectors. Set smoke detector sensitivities to normal/medium, unless directed otherwise by the Engineer or Owner. Program alarm verification for smoke detectors only. In addition, FA/MNS CU shall have the capability to provide report of smoke detectors that are approaching a dirty level or a maintenance alert prior to a system trouble.

P. All intelligent fire alarm systems shall be zoned. Systems shall be zoned first by floor, then by wing (N,S,E,W), if applicable. System shall also be zoned at any fire partitions or identifiable building features. System devices shall be zoned by type (i.e. smoke detectors, pull stations, heat detectors, duct detectors, sprinkler system monitoring components, etc. shall be on separate zones. Combining
To separate types of devices on the same zone is prohibited. Any LED type annunciators shall have separate zone lights for alarm (red) and trouble (amber). All supervisory LEDs shall be amber in color.

Q. Print-out a complete “System Status and Programming Report” after completing the above. This printout shall include the program settings for each alarm initiating device and for smoke detectors, its current sensitivity.

R. The manufacturer or the authorized distributor shall 100% test all site-specific software functions for the system and then provide a detailed report showing the system’s operational matrix. This documentation shall be a part of the “System Status and Programming Report” described herein. Contractor shall provide written notification to engineer of the 100% test one week prior to testing commencement to allow the option of witnessing any or all of the testing.

The Contractor shall submit the System Status and Programming Report to the Engineer and University for review and approval. Modifications shall subsequently be input and a new report provided for review and final approval.

S. After completion of the installation and all programming, the fire alarm technician shall test every alarm initiating device for proper response and indication, and all alarm notification appliance for effectiveness. Also, in coordination with the other building system contractors, all other system functions shall be verified, including (where applicable) elevator recall, control of HVAC systems, release of smoke doors, etc. This final testing of the system shall be under the direct supervision of the manufacturer or the authorized distributor. A print out of all of the above testing shall be provided to the Engineer and Owner.

T. Testing of smoke sensing devices shall be accomplished using manufacturer and NFPA approved methods for all devices.

U. After all tests are complete, the Contractor shall submit the following documentation to the owner, through the engineer, prior to the owner demonstration described below:

1. NFPA 72-2013, Figure 7.8.2(a) “System Record of Completion” Form. No substitutions are acceptable. Form shall confirm (a) it was installed and tested per Code and (b) the Code required 100% test was performed. The fire alarm installer shall sign Form in the applicable locations. If a representative of the AHJ, Owner, or engineer witnesses the tests, they sign the last line of the form to signify that fact only (annotating the form as needed).
2. NFPA 72-2013, Inspection and Testing Form.
3. An HVAC balance report in the smoke control/purge mode (if smoke evacuation system is provided).
4. The fire alarm installer shall provide UNCG a copy of the CMS after all devices are programmed, after the contractor has completed 100% test, and NO less than ten (10) days prior to the Engineer’s final inspection and certification of NFPA 72.
5. UNCG requires a minimum of ten (10) days to allow UNCG personnel to program the required contact ID information at the central monitoring station at the UNCG Campus Police Building.
6. The “System Status and Programming Report” described above. This report shall be one generated on the day of the system acceptance inspection.
7. Battery calculations per NFPA 72.
8. Written verification the system was tested and successfully completed the Fire Alarm System Checklist provided in the Appendix (Note: Checklist shall be completed by Contractor as part of initial 100% testing to assure all items have been addressed that will
subsequently be tested as part of the Engineer’s testing). Engineer will certify the system based on the checklist.

V. Owner shall be thoroughly instructed and trained on the function, use, and maintenance of the system. A minimum of eight (8) hours on-site time will be allocated for this purpose. An additional two (2) hours of instruction shall be individually provided for the second and third shifts. Provide two copies of a written, bound summary of the training for future reference. Written verification of this training shall be forwarded to the Engineer. Training shall include, but not be limited to, the following: how to replace heads and set addresses if not set automatically; how to locate a short in a circuit; how to replace electronic cards (shall be third party listed) and where to mount them in the panel; get familiar with the functionality of each electronic card; how to perform/generate dirty head test report and sensitivity test report; how to synchronize strobes for the entire building; how to check circuit ground faults and how to clear them; how to interpret the display field codes (A=Alarm, S=Supervisory, T=Trouble, M=Modules, etc.); and how to locate faulty modules from the trouble display codes. At the completion of training, the contractor shall install a faulty smoke head within the system. The trainees shall then find the fault and correct it under the supervision of the contractor.

On-site training shall also include:

1. variable changes
2. programming changes
3. report creations and changes
4. system functional changes
5. hardware repair and maintenance of all building panels and devices, including but not limited to, diagnostic procedures, system expansion, and maintenance techniques.

W. Contractor shall provide the training, technical manuals, spare parts, and system documentation prior to system acceptance testing by Engineer, Owner and State Construction Office.

X. After completion of the Code required 100% test described above and submission of documentation, training and parts described above, a demonstration of the entire system shall be provided for the Owner and Engineer. System shall have operated for at least two full days prior to this demonstration. Manufacturer's field engineer or technician shall be present for these demonstrations and shall assist the Contractor in performing the demonstration. This demonstration shall consist of functional testing of the system as directed by the owner and engineer.

Y. Contractor shall arrange to have the necessary number of people, 2-way radios, label maker, ladder, compressed air, CO tester (where applicable), test leads for isolation modules, multi-meter, etc. including the manufacturer's representative on hand for these demonstrations of the system. Again, demonstrations shall use approved smoke methods and smoke "bombs", not magnets. Contractor shall furnish a smoke machine and smoke "bombs" as necessary to test system for all testing – Code, Owner/Engineer, and State Construction Office. Contractor shall provide printed copy of asbuilt drawings prior to inspection.

Z. During the Engineer’s final inspection, UNCG will have Facilities personnel at the central monitoring station confirming that the events at the site accurately reflect the identification number of the device, the location of the device, and the type of communication (fire status, general alarm, and trouble) are reported accurately at each test.
AA. Once the system is operational and accepted by the Owner and Engineer, the Contractor shall be prepared for a complete demonstration of the system for the State Construction Office during their inspection. The manufacturer's field engineer or technician shall also be present for this demonstration.

3.2 SUBMITTALS

A. Contractor shall submit complete shop drawings to Engineer for approval prior to performing any work. These shall clearly demonstrate compliance with the drawings and specifications. Any non compliant features shall be fully described.

B. Contractor shall submit a site specific single line riser diagram (manufacturer’s typical wiring diagrams are not acceptable) and site specific building plan drawings showing cabling and wiring requirements, Class A loops, conduit sizes, outlet and equipment locations, device addresses, and color coding of system (fire alarm and mass notification) submitted in electronic format (ACAD 2004). Drawings shall include design ambient sound level, audible alarm device sound power and alarm sound level for each space or Contractor shall certify the design meets NFPA 72 for sound levels. Any additional devices required while verifying the system shall be at Contractor’s expense.

C. Submittals shall include a copy of the system battery sizing calculation. Contractor shall use manufacturer’s battery discharge curve to determine expected battery voltage after 24 hours of providing standby power. In addition, the contractor shall use the calculated NAC current draw in the alarm mode to determine expected voltage drop at end of line (EOL), based on the conductor resistance per manufacturer’s data sheet or latest edition of the NEC. Circuit resistance shall include doubling the ohms per foot to incorporate two conductors required to power circuit. In addition, include any inherent voltage drop caused by the system’s power supply.

The voltage drop at EOL shall not exceed 14% of the expected battery voltage, after the required standby time plus alarm time. Contractor shall determine worst case voltage at the far end of each NAC by subtracting the calculated voltage drop from the expected battery voltage. The result shall be no less than the minimum listed operating voltage for the alarm notification appliances being used.

All of the calculation noted above shall be placed on a dedicated sheet of as-built drawings. NAC voltage drops shall be verified during system testing by contractor.

D. A pre-construction meeting shall be mandatory for the electrical contractor and fire alarm subcontractor to meet with the Owner and Engineer to review the specifications, submittals, items noted in A. above, as well as discuss any other pertinent items.

E. After final asbuilts have been approved, the following shall be provided. Two (2) framed, detailed, graphic representation of the building, floor plans, zones, and devices, labeled to match the digital readout on the FACP, shall be provided adjacent to the FA/MNS CU in main electrical room and annunciator in a location near the main entrance as shown on the plans. Final locations shall be approved by the Owner. A laminated copy of floor plans, and a complete copy of asbuilts shall be located in a permanently mounted PVC tube that is easily accessible. A complete points list/program report showing all addressable devices and panel circuits. (If EST panel is installed a print out of each SLC map, shall also be provided. A copy of the drawings in PDF and CAD.

F. Upon satisfactory installation and testing, the Contractor shall provide to the engineer two (2) bound copies of the following technical data for transmittal to the Owner:
1. “As-built” site specific single line wiring riser diagram showing all loop numbers and device addresses in the system, plus equipment terminal numbers.
2. “As-built” site specific building plan drawings similar to drawings required per 3.2.B.
3. “As-built” voltage drop and battery sizing calculation sheets.
4. Manufacturer’s detailed maintenance requirements.
5. Technical literature on all control equipment, isolation modules, power supplies, alarm/ supervisory signal devices, alarm notification appliances, relays, etc.
6. Electronic copies (ACAD 2004) on CD/DVD for items 1, 2, and 3, and PDF’s for items 1, 2, 3, 4, and 5.
7. Contractor shall provide all programming and software required for full system maintenance and upgrades to fire alarm and mass notification system including any device changes, additions, or deletions. Programming and software requirements include:
   a) Provide all software, hardware, interfaces, adapters, and cables required for all programming and maintenance functions.
   b) If the contractor would normally use a laptop to program the system, a Dell Latitude14 Rugged 5414, shall be supplied even if programming from the FA/MNS CU keypad is available.
   c) Contractor shall provide all levels of password access with documentation; Software and Panel passwords.

G. Complete configuration data (site-specific programming) for the system shall be stored on electronic media and archived by the fire alarm system manufacturer or authorized distributor. A CD copy of this data shall be submitted to the owner via the engineer prior to acceptance of the system.

H. The manufacturer of authorized distributor shall maintain software version records on the system installed. System software shall be upgraded free of charge during the warranty period if any new versions are released during that time period. If a new upgrade is released to correct operating problems, a free upgrade shall be provided during the entire life of the system.

I. Basic operating instructions shall be framed and permanently mounted at the fire alarm control panel. If owner concurs, they may be affixed to the inside of the control panel door instead. In addition, a copy of the NFPA 72 “Record of Completion” shall be provided at or in the FACP in a rigid pocket provided by the contractor.

J. Provide an engraved label meeting Section 26 05 53 of these specifications on the at each fire alarm system control unit, system sub-panel or data gathering panel, supplementary notification appliance panel, digital alarm communicator panel, etc., identifying the 120VAC power source as follows: panel location, panel identification, and branch circuit number.

K. Contractor shall provide a factory sponsored certified technical training for system installed. This training shall certify two (2) technicians to maintain, service, and program installed system and receive direct manufacturer’s technical support for these systems, to include software updates if applicable. All expenses to include tuition, transportation, meal allowance, and lodging for this training, shall be the responsibility of the contractor.

3.3 WARRANTY

A. After acceptance by the Owner, a full year of maintenance in perfect operating condition shall be provided by Contractor and supplier at no additional expense to the Owner. This warranty coverage shall include parts, labor and travel to and from job site. The manufacturer shall be able to provide
after hours (24 hours a day/ 7 days a week) service in the event of a warranty issue, at no additional charge.

B. One annual preventive maintenance (PM) test shall be performed on the entire fire alarm system between six (6) and twelve (12) months after UNCG’s acceptance. All system deficiencies found shall be documented and corrected. This PM shall include all items to be annually tested as defined by the edition of NFPA 72 enforced at the time of system acceptance, in addition to the following:

1. A complete software backup.
2. A fifteen work-day notice of testing scheduled by the Contractor through UNCG. Testing shall be witnessed by a representative designated by UNCG.
3. A report consisting of the NFPA Inspection and Testing Form furnished by the contractor, to the Engineer of Record and UNCG within two (2) days after completion of this test.

C. Contractor shall provide all software updates during the warranty period and upgrades to software following the warranty period that address system operating failures or defects during the life of the system.

D. Submit a quote for a maintenance contract to provide all maintenance, test, and repair described below and/or in accordance with NFPA-72, "Guide for Testing Protection Signaling Systems". Include also a quote of unscheduled maintenance/repair, including hourly rates for technicians trained on this equipment, and response travel costs. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty. Maintenance and testing shall be on a semiannual basis or as required by the local AHJ whichever is the most restrictive. A preventive maintenance schedule shall be provided by the Contractor that shall describe the protocol for preventive maintenance. The schedule shall include:

1. Semi-annual systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, water flow switches and all the accessories of the fire alarm system.
2. Semi-annual testing of each circuit in the fire alarm system.
3. Semi-annual testing of each smoke detector in accordance with the requirements of NFPA 72.

16722. ELECTRONIC DOOR ACCESS & MONITORING
Updated: 8/6/2019

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 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 - (Exit only)
      • Monitor and Unlock (Secondary entrances)
      • Monitor, Unlock, and Card Access (Major building entrances and Exterior
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, including locations of all access equipment and accessories (master controllers, door controllers and power supplies, etc.). Equipment shall not be located in IT closets. Construction shop drawings are required to confirm all equipment locations. 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
16723. Surveillance Cameras
Updated: May 11, 2020

1) Purpose
   a) The following guideline addresses camera requirements for university buildings, facilities, and grounds.

2) General Requirements
   a) UNCG Police utilize an existing IP network video recording (NVR) management system. The NVR management software is Exacq Vision. Security Cameras installed on campus will be integrated into this system.
   b) Cameras will be installed by the University; building infrastructure to support camera systems is provided within the project.
   c) Provide clear border definition of controlled spaces to clearly identify public, private, and semi-private spaces. Design shall accommodate compartmentalization of public and private spaces so that layers of security are created which can be secured and maintained independently.
   d) Site development and building design must maximize natural surveillance and minimize concealment opportunities. Fencing, loading docks, service areas, landscaping, and site furnishings are areas of concern.
   e) Buildings that have lobby areas should have a clear line of sight to elevators, lobby restrooms, stair access, and primary building entry. Security cameras are required at all exterior entrance and exit door locations.
      i) At exterior doors, the cameras are typically installed on the interior of the building.
   f) If additional camera locations are required (e.g. public lobbies, elevators, point of sale areas, classrooms, loading docks, etc.), specific requirements will be determined during the design phase.
   g) The quantity and location of openings penetrating a security perimeter (fence, building envelope, secure lab or office suite) must be minimized.
   h) Consult UNCG Police during the design phase of new construction or renovations to best determine location, type and quantity of any cameras to be installed on campus regardless whether the camera will be integrated into the UNCG police network video recording management system. Other items to sort out during this phase are any required associated servers, workstations, data storage, software licensing, and related peripherals (mounts, patch cords, power injectors etc.)
      i) The university uses Axis cameras throughout campus. The designer shall include a preferred brand alternate and a sole-source justification is provided and public meeting held to for sole-source items for continuity across the university.
   j) Camera submittals shall be reviewed by campus Police department prior to release of equipment.
   k) Any contractor installing Axis cameras must be an Axis Certified Installer.
   l) The security camera integrator shall ensure updated firmware, program as needed, install & focus all cameras.
m) UNCG Police has final quality control on all installs and will verify that the camera has the latest firmware, is functioning as expected and focused to their satisfaction prior to final project acceptance.

3) Technical Requirements

a) All Cameras
   a. Outdoor cameras shall be fully coordinated with the UNCG Police during the design phase of the project.
   b. All camera Cat-6 cables must have a termination point at the camera location in order to test the cable without having to remove the camera.
   c. Necessary camera mounting brackets and adapter plates are to be furnished & installed by security camera integrator.
   d. Indoor cabling shall be Cat-6 plenum cable.
   e. All cables must be tested per 16700, TELECOMMUNICATIONS SYSTEMS – 7.0 TESTING of this document.
   f. All cables must be labeled per 16700, TELECOMMUNICATIONS SYSTEMS – 8.6 IDENTIFICATION of this document.
   g. Cameras shall be powered via Power over Ethernet (POE).

b) Outdoor Camera Installations
   a. Outdoor cabling shall be Cat-6 outdoor rated cable.
   b. Lightning protection shall be installed on both ends of cable.
   c. When you install cameras on a roof-mount pole or wall-mount bracket, either the bracket or the equipment case needs to be directly connected to a known ground point. Additionally, the outdoor camera must have a Cat-6 termination point at the first point the Cat-6 cable enters the building or secured cabinet in order to test the cable without having to remove the camera.
   d. Dielectric Grease: Use dielectric grease (which is uniformly non-conducting) on all outdoor connections to prevent corrosion and in all RJ-45 Ethernet connectors. The best practice is to use enough grease to fill the RJ-45 female connector, and then insert the RJ-45 male connector and push the grease further into the canopy unit and around the RJ-45 connector. Excess grease can be wiped over the connector area to provide some resistance to water ingress around the connector.

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.