THE UNIVERSITY *of* NORTH CAROLINA
GREENSBORO

Design and Construction Guidelines

Jan2011 Edition

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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.

01001. GENERAL INFORMATION

Updated: October 11, 2019

Consideration shall be given to the inclusion of unisex bathrooms in the design of any new construction or major renovation in buildings.

01010. PROJECT ADMINISTRATION

1. UNCG ORGANIZATIONAL SUMMARY

The Designer's contract is with The University of North Carolina at Greensboro (UNCG), an agency of the State of North Carolina. The University department that Designers work with directly is the Facilities Design and Construction (FDC) Department, which manages the design and construction phases of projects. Any involvement with other University departments will be conducted through the Facilities Design and Construction Department.

2. STATE REQUIREMENTS

All design work shall comply with the procedures outlined in the North Carolina State Construction Manual (The Blue Book) prepared by the North Carolina Department of Administration's State Construction Office. Designers should familiarize themselves with the State Construction Office policies, guidelines, and other information. The intent of the UNCG Design & Construction Guidelines is to help Designers understand the particular needs and desires of the University and not duplicate or supersede State Construction Office requirements. There are many state agencies that have plan review authority, and these are explained in the North Carolina State Construction Manual.

2.1. Building Codes: References to codes or standards in these guidelines always mean the most recent version of that code or standard. The facility shall comply with the North Carolina Building Code. The Designer shall identify and reconcile disparities between state and local code jurisdictions. Changes in the work during construction resulting in non-compliance shall be the financial responsibility of the Designer to correct.

2.2. OSHA Compliance: The Designer shall be familiar with and implement the requirements of the Federal, Occupational Safety and Health Act, and Occupational Safety and Health Act of North Carolina, administered by the NC

Department of Labor. These standards provide safeguards for the safety and health of all University employees and students.

2.3. Sales Tax Reporting: State law requires UNCG to report sales tax; therefore the following shall be included in a project's specifications:

With each Application for Payment submitted, Contractors must provide a statement of materials purchased for and/or used in the University project. Included should be the purchase date, type of property, University project name, North Carolina County of purchase, cost of property and county sales and use tax paid. Forms should include the period of time covered and should be signed and dated. You may use the form entitled "UNCG Contractor Statement of Property Purchased" or a comparable one so long as all information listed above is provided. This form is available for download from the "Resources" section of the FDC website.

Only those building materials, supplies, fixtures and equipment which actually become part of the building or structure are to be included on this form. The statement must also include the cost of any tangible personal property withdrawn from the Contractor's warehouse stock and the amount of county sales or use tax paid thereon by the Contractor. Similar statements by subcontractors must be obtained by the General Contractor and furnished to the University. In the event that several purchases are made from the same vendor, the certified statement must indicate invoice numbers. This statement of property and county tax paid is required by General Statute 105-164.14 (e).

The statement SHOULD NOT INCLUDE tax paid on supplies, tools and equipment used to perform contracts.

If no taxable materials have been used during the period, submit a form stating "No Taxable Materials This Period". Give all other information regarding project name and period covered and sign and date the form. This will let us know that the form has not simply been omitted.

2.4. For construction contracts funded in whole or in part with federal resources and exceeding $2000, subcontracts must contain the clause: "no laborer or mechanic employed directly on the site of the work shall receive less than the prevailing wage rates as determined by the Secretary of Labor." The Project Manager from UNCG will be able to tell whether federal funds are being used.

3. UNIVERSITY AND DESIGNER

3.1. Designer's Representative: The Designer shall designate a Project Manager for all

formal communications with the University and other agencies throughout the design and construction phases of the project.

3.2. Owner's Representative: The University will identify the Design Project Manager who will be the University's representative throughout the programming and design phases of the project. During these phases all communications shall be directed to this person and the Designer shall accept direction only from this person. It is the Owner representative's responsibility to develop consensus and to resolve disparate input within the University.

During the bidding phase both the Design Project Manager and the Construction Project Manager will have responsibilities with the project. Both will be represented at the Pre-bid Conference and the Bid Opening.

After opening bids, when it is determined that the project is within budget, the University's Construction Project Manager will be the University's contact person for the remainder of the project. All direction and communication from the University during the construction phase shall be through the Construction Project Manager only.

3.3. Other University Departments with Project Involvement: There are other departments within the University from whom involvement may be required during the design and construction of the project. It is the responsibility of the Project Managers identified above to orchestrate the involvement of any other groups.

3.4. Program Statement: For large or complex projects, a program statement is prepared by the Facilities Design and Construction Department in cooperation with other University departments and, perhaps, with the Designer. It is the Designer's responsibility to incorporate all aspects of the program statement into the project. Therefore, it is essential at the beginning of design, that the Designer request and obtain clarification from the University regarding any question about the program statement.

3.5. Project Budget: There is a fixed budget for capital improvement projects which will be reflected in the Owner/Designer contract. The University believes the project is adequately budgeted for the scope of work and the Designer shall verify this before proceeding with design. If the Designer believes the budget is inadequate he shall advise the University in writing of the extent to which the scope must be reduced in order to design a quality, cost effective project for the available funds.

3.6. Project Schedule: In preparation for the Owner/Designer Contract negotiations, a design phase kickoff meeting will be scheduled by the Design Project Manager. One of the agenda items for this meeting will be review of the University's anticipated project schedule. The project schedule will include time periods required for each element in the design process including the start date, reviews,

approvals, bidding, award of construction contracts, notice to proceed, construction duration, construction completion, and final inspection. Once agreed to by all parties, the Designer must adhere to the schedule. The University has a project tracking process and the Designer may be asked to provide a brief, monthly status report on work accomplished, and indicate any change to the original schedule.

01100. ALTERNATES

A limited number of alternates may be used as a means of insuring base bids within the available construction funds. Additive alternates are preferred to deductive alternates.

Care must be exercised to coordinate Plumbing, HVAC, Electrical and General Contract alternates. Alternates contingent upon one another should be given the same number, as: P-2, HVAC-2, E-2, G-2.

01200. PROJECT MEETINGS

See requirements in the N.C. Construction Manual (Section 111) for Preconstruction, Monthly Progress and Final Inspection Meetings.

Additionally:

1. PRECONSTRUCTION MEETINGS

   The FDC Construction Project Manager will provide the Designer with a list of special UNCG items to be included with the Designer's normal agenda for the preconstruction meeting.

2. CONSTRUCTION PROGRESS MEETINGS

   During construction the designated Project Manager for the Designer will attend weekly and monthly construction meetings to provide liaison and inspection services necessary to ensure compliance with plans and specifications. The Designer will take the Meeting Minutes for the monthly construction meetings and distribute to all attendees within three (3) days. Upon instructions of the Designer, the frequency of meetings may be increased or decreased as required by the progress of the work.

   All in-house and contract consultants participating in the design of the project will attend weekly and monthly meetings while work related to their design is in progress.

3. PRE-INSTALLATION MEETINGS
   Updated 6/15/15

The Designer will include in the project specifications a list of pre-installation meetings to be conducted by the General Contractor during construction, prior to start of installation of major building components. Examples of building components requiring pre-installation meetings may include, but not necessarily limited to:

- Site Work – Demolition, clearing, grading and soil compaction
- Landscaping – topsoil requirements, selection, planting, maintenance
- Cast-in-place concrete – excavation, formwork, reinforcement, concrete placement and curing, foundation waterproofing
- Pre-cast concrete – fabrication, delivery, storage, handling, erection and welding
- Masonry – material selection and sample panels, storage, laying, reinforcement, joints, flashing, etc.
- Windows – storefront and curtain wall installation
- Hardware – doors, electronic access control and coordination
- Roofing – material storage, installation, protection
- Sealants – waterproofing, caulking, expansion joints, etc.
- Plumbing, Fire Sprinklers, Electrical Systems – installation, operation, scheduling
- Security/Audio Video Systems – installation, operation, scheduling, coordination of door installation and hardware

Attendees to these meetings will be the Designer and any associated consultant(s), the Prime Contractor (Superintendent, Project Manager or Office Representative, Foreman) and involved subcontractors (superintendent, foreman and/or crew), the Owner, and any specialized equipment or material supplier(s) or manufacturer(s) representative and any third-party testing company as required. The purpose of these meetings is to review work related shop drawings, submittals, coordination drawings, installation and quality requirements, and coordinate the work among the various trades making sure that all coordination issues are reviewed, considered and resolved prior to the start of installation. The Designer is required to prepare the pre-construction conference agenda with help from the Owner and Contractor, conduct the meeting, take notes and distribute the minutes (within 5 days).

4. ELEVEN MONTH WARRANTY REVIEW

The Designer may be required to perform an eleven (11) month warranty review which will consist of the Owner and Designer, including his consulting engineers (PM&E), performing an on-site review of the project prior to the expiration of the twelve (12) month warranty period. The Designer is to provide a written list of warranty items to the General Contractor.

01210. CONSTRUCTION REQUESTS FOR PROPOSALS

The following steps should be followed as closely as possible in the change order process. Restraints, such as time, may require that some steps be accelerated by verbal or fax

communications and documented later with the appropriate written or hard copy correspondence. In all cases the Designer should keep the State Construction Office representative and the University Construction Project Manager appraised of the status of change order items.

1. Proposal Request (AIA G709 form or equal) - issued by the Designer to all prime Contractors and copied to the University. The proposal request shall contain complete information, including texts and drawings, needed to make a fair and realistic proposal.

2. Proposal - from the Contractor in writing to the Designer (with a copy to the University) with a breakdown detailed enough to accurately evaluate the cost. The State Construction Office will require a detailed breakdown with the change order. Unit prices without fixed quantities may be acceptable in some emergency situations when the work needs to be done quickly, however a not-to-exceed figure will be required. The proposal shall include appropriate subcontractor proposals and effect, if any, on the work schedule or completion date.

3. Designer's recommendation - to the University (no copy to the Contractor) including a brief description of the request, cost of the proposal, date by which the Contractor requests a decision and the Designer's recommendation on whether or not to proceed with the change. It is the Designer's obligation to evaluate the proposal amount and verify that the cost is reasonable and consistent with current prices for doing the work. The Designer shall inform the Contractor if they believe the cost is excessive and have the Contractor re-submit as necessary in order to present a fair cost.

4. Owner's acceptance or rejection - to the Designer (with a copy to the Contractor) authorizing inclusion in a change order or disapproving the proposal.

5. Designer's notice to the Contractor (with copy to the University) - informing the Contractor of the final resolution. Prompt issuance of the change order may eliminate this step.

6. Change order - prepared by the Designer and follows the normal process as described in the project documents and the North Carolina Construction Manual. Note that it usually takes six weeks to execute a change order and that six originals should be prepared and then signed in the following order: Contractor, Designer, University, and State Construction. The Contractor cannot request payment for any change order work until the change order is fully executed with all four signatures and returned from State Construction. The Designer shall promptly notify the Contractor when the change order is returned and distribute the fully executed change order to the Contractor and surety.

01300. SUBMITTALS.

1. DESIGN SUBMISSIONS FOR REVIEW

The University will review design submissions (various phases of construction documents)

from the Designer, usually within three weeks of receipt of the submittal. The submissions presented to FDC will be further distributed to all other appropriate University departments for their reviews. The Designer will submit a minimum of four (4) copies of review documents to the Design Project Manager. Reviews will be generalized and shall not be considered an office check of the drawings and specifications. The Designer shall be responsible for a complete office check of all phases of drawings and specifications.

Written comments will be returned to the Design Project Manager by the various University offices involved with the review. FDC will compile these comments with their own and will transmit the total list of University review comments to the Designer. The Designer will provide written responses to all review comments as part of the next design submission.

2. CONSTRUCTION SCHEDULE

For large or critical projects the University will hire an independent scheduling consultant to assist with the construction schedule. Facilities Design and Construction will provide a specification to include in the contract documents for this requirement.

01301. SPACE UTILIZATION AND PLANNING DRAWING REQUIREMENTS

1. DELIVERY OF FLOOR PLAN DRAWINGS

Base floor plans for all projects will be provided to design architects, vendors or contractors by UNCG. These base plans should be used to make updates for any plan alterations.

A floor plan shall be submitted for review at the Construction Document (CD) submission. Drawings should show room layouts and room numbering. The drawing shall be free of construction related notations including but not limited to dimensions, schedules, construction related notes, etc. All external reference drawings (xrefs) must be bound to the drawing.

The design architect, vendor, or contractor is responsible for providing the UNCG's Facilities Design and Construction department with accurate AutoCAD base floor plan drawings, 30 days after the acceptance date of the project.

As-built drawings must visually depict the final "move-in" condition of permanent architectural elements as represented in simplified floor plan format. Drawings will need to be polylined for this submission with no xrefs.

All drawings should be at a 1:1 scale and georeferenced

All drawings shall be prepared in accordance with the National CAD Standards available at: http://www.nationalcadstandard.org/.

2. POLYLINE REQUIREMENTS

Space Polylines

For every architectural floor plan provided to the University, the Architect shall provide polylines for the following:

Exterior Gross Polylines

The exterior gross area of a building floor is defined as all the area within exterior surface of exterior walls, i.e., the total constructed area of a building.

This polyline shall be drawn on layer A-AREA-GROS. Line color is to be cyan.

Space/Room Area Polylines

Room area polylines shall be added to all spaces and/or rooms, including vertical penetrations (stairs, elevators, shafts& chases) building service areas (restrooms, mechanical rooms, etc.) and circulation spaces.

Polylines will measure from the inside face of surfaces that form the boundaries of the designated areas. Polylines shall be a closed line polygon with vertex points located at every interior corner ofthe space or room.

Polylines shall not wrap into the door opening. Polylines shall go through building columns and minor projections.

Space and/or rooms polylines shall be drawn on layer A-AREA. Line color is magenta. All polylines for vertical penetrations, building service areas and circulation spaces shall be drawn on layer A-AREA-COMN. Line color is to be red.

01310. LAND SURVEYS

1. AIA Document G601 - Land Survey Agreement shall be used to secure the services of a surveyor. This document includes a request for a proposal, an agreement form for surveying services and a description of the information to be provided by the survey.

2. The drawings shall show complete information, being careful to include underground items, inverts, utility lines, plants, etc. The survey shall also indicate all abandoned underground utility lines and structures, identifying their original use and noting their source and termination locations. All symbols and abbreviations shall be clearly explained on the drawings.

3. All Surveys shall be oriented to the "UNCG Control Network". All boundary, topographic, and design surveys, and design drawings and digital files resultant of these surveys, shall be oriented horizontally, and vertically if containing elevations, to the UNCG Local Coordinate System for inclusion in the UNCG Geographic Information System. This orientation, within applicable accuracy standards, shall be inclusive of all geographic information presented as a result of these surveys.

   Information pertaining to the location and coordinates of UNCG control Monuments on which the UNCG Local Coordinate System is based is available from the UNCG Facilities Design and Construction Office.

   A minimum of (2) survey control points of semi-permanent material such as rebar or iron pipe oriented to this system shall be established at the project location. The coordinates of these points and the coordinates of the UNCG Control Monument on which they are based shall be labeled. The bearing and distance measured from at least one of the project control points to the UNCG Control Monument used shall also be labeled.

   These requirements shall be in addition to all professional standards and requirements in effect at the time these design services are performed.

01340. SHOP DRAWINGS AND SAMPLES

1. SHOP DRAWINGS

   The specifications shall list items for which shop drawings or samples are required. Two approved copies of shop drawings shall be submitted to the Construction Project Manager after the Designer has reviewed and stamped them.

2. SAMPLES

   After consultation with the University, the Designer shall specify in the contract documents items for which samples will be required and stipulate the number of each sample required. The Designer will specify that the Contractor is required to submit all color and material samples requiring Owner and Designer approval at the same time. All samples and color chips must be approved by the University. If samples are expensive or are complete assemblies suitable for inclusion in the work, e.g., precast concrete panels, door hardware, equipment; approved samples may be installed in the work. The

Designer will incorporate all of the color and material samples from the General Contractor onto a Construction Phase Color Board for review and approval by the University.

3. MODELS AND PATTERNS

Specifications for ornamental work which require models or patterns, shall specifically stipulate that models and patterns become the property of the University after the ornamental work has been installed.

4. COORDINATION DRAWINGS

Coordination drawings are frequently used to coordinate trade installations, especially PME installations. When the Contractors request base drawings, the design team shall provide electronic AutoCad drawing files to the Contractor, in a version that is acceptable to the Contractor.

01400. CRAFTSMANSHIP – QUALITY AWARD PROGRAM

Updated: June 15, 2015

The University will be sponsoring a Craftsmanship Quality Award Program for the project. This program will consist of setting up a nominating team and giving awards to the quality crew/individual of the month. UNCG will provide the awards and the site for the meetings. Designers will be required to be in attendance in order to determine the recipient. The goal or desired outcome of this program is to foster cooperation, peer recognition and create a mild competitive environment so high quality work is valued and publically recognized.

1. QUALITY NOMINATION TEAM

The team responsible for determining the monthly recipient will be made up of the following people:

- UNCG Construction Project Manager
- Designer Representative (usually Project Architect or Engineer)
- UNCG end user
- Contractor Representative (usually Superintendent or Project Manager)
- Major Subcontractor Representatives, if desired
- Scheduling Consultant, if desired
- Office of State Construction Representative
- Other knowledgeable individuals, depending on project

2. JUDGING CRITERIA

The judging criteria for the award shall be determined by the Quality Nomination Team at their first meeting and be posted at the jobsite in a prominent location. The judging criteria should take into account some or all of the following:

- Quality of the work in place and meeting or exceeding the project's specifications
- Cooperation with other contractors and overall attitude (i.e., anticipating the following contractors' needs in order to produce a high quality product)
- Schedule adherence or completing work ahead of schedule
- Shop drawings and submittal turnaround time
- Jobsite cleanliness and orderliness
- Lack of nonconformance reports and limited punch list items
- Jobsite safety
- Communication

3. CERTIFICATE AND LETTER

The award will be a certificate to the winning crew each month and hard hat stickers for all members of the winning crew. The certificate and a letter addressed to the president of the firm, will state the reasons why the team was selected, the names of all members of the winning crew, and will be sent to the firm's home office. There should be no limit on how many times a team can win. The Designer, Consultant, Owner's Representative, or anyone involved with the project are eligible to win as well as the Contractors.

The awards will be given to the recipient(s) at a gathering of all workmen on site to promote peer recognition and foster a desire for others to be recognized in the future. The hard hat stickers are given directly to the recipient(s) by UNCG's Director of Facilities Design and Construction, the Assistant Director of Construction or Construction Project Manager.

This information is to be included in the project's specifications so all parties know about it before bidding. Any further refinements and/or clarifications are welcome by the University. Please feel free to make further refinements or suggestions in order to make this a better program for all parties involved.

01500. TEMPORARY FACILITIES AND CONTROLS

1. TEMPORARY UTILITIES

Requirements are generally as stated in the General Conditions, Article 40. Contractors must arrange for and pay for all temporary utilities required for execution of the work unless directed otherwise by the University. Specifications shall be written to stress this point.

1.1. Plans for running temporary lines through University property shall be approved by the Designer and the University. If connections to University utilities are permitted, the Designer shall consult the University regarding services available and points of connections. Services may require metering through meters furnished by the Contractors with the University being reimbursed for utilities consumed.

1.2. Costs for providing temporary services shall be included in the Contractors' bids. Specifications shall clearly identify each Contractor's responsibility for the installation of service lines and payment for services, whether services are furnished by the utility company or by the University. The University will pay for steam and electricity supplied through the building's permanent utility connections. Temporary utilities for construction trailers and construction work will be provided by and paid for by the appropriate Contractor.

2. CONSTRUCTION AIDS

2.1. Elevators shall not be used for construction purposes unless written arrangements are made including:

2.1.1. Protective covering of car interior, doors and entrance.

2.1.2. Weekly cleaning and servicing by the elevator installer.

2.1.3. Complete restoration of all elevator system components to like new condition.

2.1.4. The repair and warranty period required by the contract will not be diminished by authorizing this use.

2.2. Existing elevators shall not be used during construction without permission of the University.

2.3. No elevators shall be loaded beyond their capacity.

3. BARRIERS

3.1. Ingress and egress for buildings: During University occupancy of buildings, all marked exits must be maintained to meet code requirements.

3.2. Construction fence should be clearly identified on the drawings and in the specifications. The location of the construction fence should be coordinated with the Owner during the design phase of the project.

3.2.1. The location of the construction fence should not impede pedestrian or vehicle traffic. If necessary, alternative routes will have to be identified and shown on the drawings.

3.2.2. All accessible entrance and/or fire exits must be maintained by the general Contractor during the period of construction in University occupied buildings.

3.2.3. The construction fence shall not block or infringe upon emergency vehicle access, block fire hydrants, blue phones/emergency phones, PIVs, or Fire Department connections.

3.2.4. The construction fence shall be a minimum of 6' - 0" high chain link fence with green privacy screen installed on the inside of the fence to obscure vision into the site. Chain link fence posts should be supported on surface

pedestals to prevent the need for post holes.

3.2.5. The Contractor will be responsible for maintaining the fence during construction and for removing the fence at the end of construction.

3.2.6. The Contractor will provide appropriate utility work barricades, construction fence, informational signage, etc. for excavations outside the construction fence area.

3.2.7. The Contractor will provide accident prevention signage per N.C. OSHA.

3.2.8. All Contractor parking shall be restricted to the fenced in area of the construction site.

3.3 Utility Protection: All valves, manholes, hand holes, etc. within the construction site must be protected at all times. Barriers shall be installed prior to any construction and shall remain until construction and site cleanup are complete. The barriers shall be of substantial material, minimum construction should consist of 4' high metal posts with orange construction fencing.

4. SITE SECURITY

Except during working hours, fence gates shall be kept locked by the Contractor at all times. Three keys to the gates shall be provided to the University for distribution to the Project Manager, University Police and the University Locksmith. An optional arrangement of locking the gate is with a chain and double padlock, one of which will be provided by the University for University access.

UNCG will supply only the security measures required for University operations. The Contractor shall provide the necessary security means to protect his work, materials, tools, and construction equipment. Watchman services shall be supplied by the Contractor as he deems necessary. Any watchman service set up by the Contractor shall be approved by the Owner. The Contractor shall be responsible for replacement of his materials, machinery, equipment, tools and supplies due to theft or mysterious disappearance. All tools and equipment shall be clearly marked with the Contractor's identification. All toolboxes shall be clearly marked by the Contractor.

5. TRAFFIC AND PARKING

5.1. Construction area access: If existing streets and roads on campus must be used for more than normal construction traffic, a plan of the traffic patterns must be worked out in cooperation with the University and shown on the project drawings.

5.2. Maintenance of traffic flow: The University's Project Manager must be notified at least one week in advance of any anticipated work affecting traffic flow. To assure

maintenance of flow and safety, a field inspection of the area shall be made jointly by the Designer, University, and Contractor prior to performing any work which would interrupt normal traffic patterns. The Contractor, whose work requires interruption of traffic, shall be required to post signs in all affected areas in sufficient numbers and with appropriate messages to warn motorists entering the construction zone and to alleviate conflicts and confusion among motorists or pedestrians. Temporary lanes shall be well marked, and obstructions, barriers, lane changes, or detours shall be indicated by appropriate signage at each point of potential confusion, as well as at each change in direction of a temporary route. University Police shall be notified in advance of the anticipated time of return to normal traffic patterns. Upon completion of construction affecting streets or traffic flow, but before temporary control devices and lane markings are removed, the area shall be restored to receive traffic in the normal pattern. If it is evident that traffic will become hazardous or restricted in any manner, uniformed special duty police officers must be provided by and at the Contractor's expense.

5.3. Parking: Updated December 18, 2014. The Designer shall review all changes to existing parking with UNCG Parking Operations & Campus Access Management (POCAM). Projects that permanently eliminate parking spaces on campus shall either replace the spaces with spaces similarly located on the campus, or pay into the parking fund balance account the then-current cost for an equal number of parking deck spaces. This cost will be reviewed with POCAM for each project.

Construction staging plans should be included in the Design Development submittal and developed in consultation with the Parking Operations & Campus Access Management regarding construction parking and/or use of parking facilities for construction staging. Access to parking on campus is extremely limited. Carpooling or the use of alternative transportation is encouraged. This cost for disruption of parking will be reviewed with POCAM for each project.

There may be projects on a case by case basis which may not follow this guideline. In this case, a letter of agreement or memorandum of understanding signed by all parties concerned documenting this charge shall be required.

5.4. Access to facilities: While the University is a publicly owned institution, its function and facilities are dedicated to serve specific operations and programs. Therefore, Contractor’s personnel may be barred from using existing toilet, food service, or other facilities.

6. CONSTRUCTION AREA MAINTENANCE

6.1. Debris and weeds: Updated December 18, 2014. Site shall be well maintained including removal of debris. Debris shall be removed from University property. Use of University trash receptacles is prohibited. The Contractor must cut grass and weeds inside the project boundary as necessary to maintain a neat appearance at the

site. Use only herbicides approved by the University. The use of pesticides is prohibited.

6.2. Noise and dust control: In occupied buildings the Designer shall indicate areas for which noise and dust control must be provided and shall specify methods of control and responsibility for installation. If details of installations are involved, specify these in the applicable sections of the technical specifications.

7. PROJECT IDENTIFICATION

Normally a project identification sign is required. The University will determine the need for the sign. If a sign is required, the location and design shall be shown on the drawings. The sign should generally be white letters on a navy blue background with gold trim unless other design considerations are desired. A copy of the University standard project identification sign is available from the Design Project Manager. A shop drawing showing layout of the text is required. No additional signs identifying participants shall be permitted.

8. SITE LIMITS

The limits of the construction site, including staging and parking if appropriate, are to be clearly shown on the construction drawings.

9. FINAL CONTRACTOR CLEAN

9.1. Project construction cost of work under $500,000, the designer shall include in the specifications final contractor clean prior to turnover of the building.
9.2. Project construction cost of work over $500,000, the designer shall include in the specifications final contractor clean prior to turnover shall be performed by a **professional cleaning company**.

01600. MATERIAL AND EQUIPMENT

1. MATERIAL STORAGE

Each Contractor shall provide weather-tight storage sheds, adequate to hold materials required on the site at one time, for materials which might be damaged by the weather. Outdoor storage of materials shall be confined to the area within the construction fence. Temporary storage structures shall be painted with at least one coat of paint; color shall be approved by the University. No signs except small identification signs are permitted on sheds. Corridors, stairs, and other public spaces shall not be used for storage.

2. SURPLUS MATERIAL AND EQUIPMENT

During a renovation where certain equipment, fixtures, or materials are to be removed by

the Contractor, the Designer shall prepare a list of this equipment during the planning stage of the project and present the list to the Design Project Manager. The University will decide if the surplus equipment is salvageable. Salvageable equipment and fixtures that are removed will be transported by the Contractor to a designated location.

01610. ATTIC STOCK

1. Construction contracts may require the contractor to deliver additional stock for various materials and spare parts for equipment used in the project.

2. Designer to develop attic stock, spare part list and quantities with owner in the Construction Document (CD) phase of the project.

3. Designer to specific attic stock, spare part list and quantities in the contract specifications of each specific project.

4. At 80% project completion, the designer shall prepare and distribute the attic stock and spare part list to the contractor and monitor the progress of turn over in the project progress meeting until all items are received. All times are to be received by 95% project completion

5. Typical items in the list of attic stock include but are not limited to:
   - Ceramic tile
   - Acoustical ceiling tile
   - VCT
   - Carpet
   - Wall coverings
   - Wall tile
   - HVAC filters and belts
   - Fire alarm pull stations and smoke detectors
   - Fire sprinkler system spare heads, head removal tool, etc.
   - Spare Door Hardware (locksets, cylinders, exit devices, etc.)

6. The designer/contractor shall prepare a transmittal to Facilities Operations for all attic stock, spare part list and quantities delivered. Transmittal to have signatures from the designer, contractor and facilities operations to ensure acceptance of attic stock.

7. Ensure delivery of attic stock and spare parts is included in the punch list if not received by prefinal inspections.

01700. PROJECT CLOSEOUT

1. PROJECT RECORD (AS-BUILT) DOCUMENTS
   Updated: September 17, 2014

   At least once per month, the Designer will review the Contractor's on-site as-built drawings to confirm that the drawings are being kept up to date. After final acceptance of the project, the Designer shall revise the construction document drawings to accurately record the project as-built. Identify the addenda, change order, alternate, etc. for each item. Label all as-built documents as "RECORD DOCUMENTS".

Two sets of white bond paper record drawings (one bound with durable covers and the other set provided loose), two copies of "bound" AutoCAD and PDF files of all project drawings, and Word copies of specifications on CAD storage media, and three copies of the Final Report are required. On projects that are developed using BIM, deliverables must include one electronic copy of the Record (as-built) BIM in a Revit-supported format as a project record archive to document the as-constructed building and its components for use in future projects and O&M activities. The Record BIM must be delivered on DVD or other mobile storage media capable of handling large files. **It is noted that all changes made to reflect the project as-built shall be made on the CAD media so the electronic media will print the same document as the hard-copy record drawings.** All electronic record documents shall be submitted with the paper record documents within 60 days of the project acceptance.

2. OPERATION AND MAINTENANCE DATA
Updated: September 17, 2014 / May 13, 2015

Detailed requirements should be stipulated in the appropriate sections of the specifications. For items of General Construction, specify that information for care and maintenance be furnished for any item requiring more than ordinary custodial care. For mechanized and electrical equipment, specify that operation manuals be provided. Note any items that relate to LEED Certification or N.C.G.S. 143-135.35 through 143-135.40 and on-going maintenance for sustainability and energy efficiency. For special equipment stipulate that, in addition to operation manuals, the manufacturer provide demonstrations and operating instructions by factory trained employees to designated University personnel who will be operating the equipment. On projects involving complex operational systems, the Designer shall prepare and submit an overall detailed system operation guide to the University at the end of construction.

~~Two~~ Three (3) identical hard copies and one (1) electronic copy in PDF format of operation and maintenance manuals shall be provided to the FDC Project Manager after review and approval by the Designer. They shall consist of manufacturers' operation and maintenance instructions, shop drawings or catalog cut sheets, and other data listed herein; all bound in 8-1/2" x 11" x 3" (maximum thickness) binders. Material shall be assembled as follows:

2.1. Binder cover, spine and title page stating: "UNCG (name of project)", "Operation & Maintenance Manual for (name of equipment or system(s))", "PREPARED BY (name of Contractor), (date)". Additionally, for the title page, include the names, addresses and phone numbers of the prime Contractor and major subcontractors or material suppliers.

2.2. Table of contents ordered alphabetically (may be combined with title page). If the quantity of material is such that it requires more than one binder the manual may be divided into volumes and the table of contents in each volume shall list the total contents for all volumes. Material in the volumes should be grouped by systems as

reasonably as possible (electrical might be in 3 volumes, for example power, lighting and alarm system).

2.3. Contents with index tabs.

2.3.1 Description of system contents, where located and how each part functions individually and concluded with a list of all equipment incorporated into the project with supplier's name, address, and phone number and service needed with reference to the data in the binder which describes proper service.

2.3.2 Approved shop drawings and product data including parts and maintenance information.

2.3.3 Manufacturer's operating instructions including how to start, stop and restart each piece of equipment, how to set temperature and humidity for normal operation, and caution notices.

2.3.4 O&M Manuals and cut sheets must clearly identify make, model number, and serial number for each piece of equipment that is installed. Include belt size, filter size, motor HP and voltage.

3. DEMONSTRATION AND TRAINING

Prior to beginning equipment demonstrations and trainings, the O&M manuals shall be delivered to the Owner so they can be referenced by the maintenance personnel during the organized training sessions. Equipment start-up operations will not be considered part of the training sessions. The Equipment Contractor will develop a training schedule that minimizes disruption of the Owner’s operations and assure the training of the Owner’s multiple shift personnel. The Equipment Contractor will develop specific learning objectives for each training session. The Equipment Contractor will inform the Owner of the course content and coordinate the dates, times and durations of the instruction sessions. The Contractor will provide advance notice to the Owner a minimum of three (3) business days prior to each training session. Training will be provided by the equipment manufacturer’s “service” representative. The subcontractor or sales representative may be utilized for general overview of the entire building operation.

A video of each training session will be provided to the Owner. The video can be factory supplied or may be recorded on site during the training sessions. If recorded on site, the vendor will provide an experienced, professional videographer who has experience recording demonstration and training events similar to those required. Three reproducible electronic copies (DVDs or Thumb Drives) of the training video recordings will be provided to the Owner within seven (7) days after the completion of each training session. Each video will be labeled as follows:

a) Name of project

b) Subject of training session or demonstration
c) Name and address of Manufacturer
d) Name and address of Videographer
e) Name and address of Contractor
f) Date of video recording.

4. FINAL INSPECTION

Procedures shall be as outlined in the Construction Manual with the following additions:

4.1 The preliminary inspection shall include the Designer, Designer's consultants, Contractors and University.

4.2 The Designer's consultants shall participate in preliminary and final inspections and shall inspect their respective parts of the work. The Owner's, Designer's and consultant's punch lists shall be compiled into one punch list by the Designer.

4.3 Punch lists shall indicate which Contractor is responsible for each item and clearly indicate the location of each item.

4.4 Inspections of concealed areas shall be made when the areas are visually accessible.

5. LIQUIDATED DAMAGES

Refer to the NC State Construction Manual, Section 303, Article 23, for state requirements concerning liquidated damages. Reasonable amounts for liquidated damages vary according to real loss to the University, therefore each project must be considered on its own and the amount determined in conjunction with the University.

If it becomes apparent that a project will exceed its contractual completion time, the Designer shall notify the Contractor in writing and withhold from all subsequent applications for payment an adequate amount of money to cover the cost of liquidated damages that may be incurred.

01800. GENERAL DESIGN STANDARDS

The following items are listed for convenience to enumerate certain standards that the University expects in all projects.

1. MASTER PLAN AND UTILITIES MASTER PLAN

The University Master Plan and Utilities Master Plans shall be studied by each Designer to ensure the compatibility of design with Master Plan objectives. FDC will provide a copy of the Plans when appropriate to the project.

2. LIFE CYCLE COST AND MAINTAINABILITY
Updated: January 29, 2015

Designers shall consider long-term durability and maintainability when selecting and specifying materials and equipment.

Life cycle cost including installation, maintenance, and disposal will be considered in the selection of building systems and equipment. The designer must develop life cycle cost studies and present the information for review by the University to assist with the selection of materials and equipment on major renovation and new construction projects.

In general, the Designer shall specify materials and equipment with which the Facilities Operations is familiar and prepared to operate and maintain utilizing existing methods and materials. Where a single proprietary manufacturer's product is listed it is because of the need for compatibility and the words "No substitution" will follow.

2.1 Serviceability and Accessibility to equipment shall be incorporated in the design of all new and renovated facilities. All building equipment, including VAV boxes, sensors, controls, duct detectors, dampers, light fixtures, valves, etc., that will require inspection, maintenance, or replacement over the service life of the building, shall be installed in locations that are safely accessible by service personnel. It is preferred that equipment be accessible from floor level if possible or a short ladder if necessary. The Designer will consider the location of the equipment with respect to the possible location of fixed furniture, or fixed seating, that may impact accessibility to the equipment. The Designer will consider the type of ceiling, and accessibility to the equipment through the ceiling. Access panels should be sized to allow maintenance access and removal of equipment, especially duct detectors, fire dampers, door controllers, and fire sprinkler equipment. Equipment should be positioned to minimize obstruction of connections and service elements by adjacent piping and duct runs. If necessary, the Designer will include in the design, work platforms and personal fall protection tie-offs to facilitate safe work access to and around the equipment. Door and window openings shall be sized to allow replacement of equipment within the space without structural modifications whenever possible. Design drawings shall include a ¼" scale or larger drawing showing the layout and elevations of equipment in primary mechanical rooms and electrical rooms.

Each mechanical/electrical room shall have at least one light on an emergency circuit. Gypboard, sprayed ceilings, or sprayed on fireproofing in mechanical rooms is to be avoided. Primary mechanical/electrical equipment rooms shall be located with access to the building exterior and allow for convenient service vehicle access and equipment removal. These spaces shall not be combined with custodian closets. All walls shall be constructed of concrete masonry units (CMU). Floor penetrations shall be core drilled and sleeved to three inches above the finished floor.

University policy requires that custodial spaces, and mechanical and electrical equipment rooms are not accessible to occupants of the building. It is therefore necessary that occupants' equipment and controls be located so that the occupants will not have to enter these rooms for routine operation of equipment. This includes fuses, circuit breakers, switches, valves, etc., that might serve departmental equipment.

Roof access must be as safe as possible. Code compliant permanent ladders or stairs must be built into the structure for all such access. Provide adequate, permanent access to all roof areas from the building interior. Walk-out access by way of stairwell extensions or via penthouses is preferred. From the rooftop, permanent, exterior ladders may be provided to connect different roof levels. Ladders longer than 20 feet shall be caged in accordance with the Federal Occupational Safety and Health Administration (OSHA). For steep-sloped roofs, it is preferred that perimeter roof access from the ground level be provided, if possible, for access to gutters and other items requiring maintenance by a boom lift. On low-rise buildings, ladders that extend from grade to rooftop are discouraged. Roof access through windows is unacceptable.

2.1.1 Building Maintenance Systems: During the design of all facilities, consideration shall be given to the safety of personnel during future maintenance operations. Provisions shall be made to provide safe access and working platforms for the maintenance of roofs, rooftop-mounted HVAC units, elevated equipment, lighting, etc. New buildings will incorporate design elements that eliminate the need for supplemental fall restraint or fall arrest systems. For low-sloped roof sections, the incorporation of at least 45 inch parapet walls into the design is required as an edge treatment for both the control of water run-off, and the safety of maintenance personnel. Gravel stop edges and low parapets less than 45 inches shall be avoided. Methods of fall protection for existing buildings shall be evaluated on a case-by-case basis and recommendations for incorporation shall be discussed with Facilities Design and Construction. Analysis of the existing roof structure will be required as part of the evaluation process. When supplemental fall protection is required, the Designer shall provide a design in accordance with OSHA requirements. The design of fall protection shall be included in the construction documents as part of the base bid. Permanent, supplemental fall restraint and fall arrest equipment shall be designed, fabricated, installed, tested, and certified by a firm specializing in this type of work. Drawings indicating all arrest elements shall be sealed by a North Carolina registered professional engineer. Recommendations shall be based on the type of roof and other project specific issues.

2.1.2 The Designer will meet with the FDC Design Project Manager and the UNCG Office of Safety to coordinate the identification, selection and design

of building maintenance systems on all projects.

2.1.3 In buildings with new HVAC or Lighting System installations (New Buildings or Renovations) that require special knowledge to operate, the Design Engineer will provide operating instructions for the Owner. These instructions will include diagrams if required, written and illustrated for the use of laypersons unfamiliar with the operation of these systems. The instructions will be further developed and finalized after bidding once the final systems have been identified. The Design Engineer will work closely with the system contractor and manufacturer to define these instructions and they will be included as final deliverables at final inspection.

2.2 Supply Storage Room for Custodians shall be provided in every building of 40,000 square feet or larger. The room shall be at least 200 square feet in size, be located close to the freight or service entrance, have shelving on at least one wall, and have a minimum of three electrical outlets on each of the long walls.

2.3 Custodian Closets shall not be less than 60 square feet in size and shall have no dimensions less than six (6) linear feet. Provide one (1) custodian closet for each 15,000 - 18,000 square feet of building floor space with a minimum of one (1) for each floor. They shall not be located on a stair landing, inside another room, under stairways, or in narrow spaces. Passageways, mechanical equipment rooms, pipe chases, etc., shall not serve as custodian closets; nor shall elevator controls, electrical panels, telephone equipment, roof access hatches, etc. be located in custodian closets.

Each custodian closet shall have:

2.3.1 Hard surface walls.

2.3.2 Provide barrier-free, wall mounted, recessed cabinet, swing down, stainless steel eyewash stations with integral drain. Custodian closets to receive eyewash stations will be identified through discussions with Facilities Operations, Housekeeping, and the University Safety Office departments. Eyewash stations will be located so that the swing down door will not be blocked from opening. Access to the unit must be kept clear of obstructions at all times. Installation will be based on the types of chemicals to be stored in the closet and the possibility that mixing of chemicals may occur in these locations.

2.3.3 A 36" door that swings out, not into the room. Where the door must swing into the room, a minimum of 80 square feet is required.

2.3.4 Hot and cold water. Faucet shall be threaded for a hose connection, mounted

36" above the floor and provided with a vacuum breaker before the threaded portion.

2.3.5 Ceramic or quarry tile mop sink located in one corner on the wall beside the entrance door. The floor shall be pitched to the receptor or a floor drain.

2.3.6 A GFI duplex receptacle in the "open" wall.

2.3.7 Adequate lighting, but no light fixtures or sprinkler heads located above mop receptor. Provide occupancy sensors for lighting controls.

2.4 Building Refuse

2.4.1 The University is concerned about the appearance of its campus; careful attention must be given to solutions for handling building waste. Refuse removal is contracted with an outside provider, but waste disposal will be included in review of project requirements at the outset of the design effort. Areas to hold trash and trash compaction devices will be screened. The University uses front loader trucks and containers; therefore, the location and screening should support that method of removal. Provisions will be made for proper separation of refuse for recycling as required under North Carolina General Statute 13A-309.

2.4.2 Recycling Rooms shall be provided for the collection of recyclable waste materials on each floor of a new facility or building renovation. Recycling rooms should be located off of a main corridor with nearby access to an elevator, an exterior delivery area or a loading dock. Recycling rooms should be no less than 11'-8" long x 6'-8" wide. Typical University collection containers are 2'-6" w x 3'-0" d x 3'-10" h.

2.5 Service Entrances shall be level with the street where possible. Where ground floor elevation is above street level at the service entrance, a loading platform with a minimum height of 3 feet shall be provided. An area shall be provided to accommodate service trucks with a minimum depth of 54 feet; 64 feet is preferred; and a minimum width of 12 feet.

Factory-built laminated rubber dock bumpers shall be provided. Consideration should be given to the use of adjustable type dock levelers to accommodate the varying heights of truck beds.

2.6 Attic ventilation shall be such that good air flow is obtained for the entire cross section and is adequate by the code (as a minimum). It is desirable to have more than minimum ventilation when a dark roof is used. Mechanical ventilation may be required in borderline cases.

2.7 Mechanical Rooms should generally not be located above occupiable spaces because of the risk of water damage to the spaces below. When equipment is located above spaces where water damage could occur, provide water containment areas around all equipment, piping and devices capable of generating water to protect spaces below the mechanical room from damage. These water containment areas are in addition to drain pans that are provided with the individual pieces of equipment. Water containment areas shall have at least one floor drain adequate to drain the containment area, and have a minimum of 4" high perimeter curbs. A walkable applied waterproofing membrane shall be applied to the floor and turned up and over curbs. All floor penetrations within the curbed containment area shall be provided with curbs or sleeves, 4" minimum above finished floor, and sealed to prevent leakage of water to the space below. When equipment is located adjacent to, but not above, spaces where water damage could occur, provide a similar water containment system to prevent water damage to adjacent classrooms, offices, laboratories, work rooms, storage rooms, and the like. The system shall include water containment at interior doorways to the mechanical room.

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.

02001. EXISTING TOPOGRAPHY

All new project site plans shall be developed from a new topographical map developed specifically for that project; not from "as-built" information or previous project grading plans. Accurate information is essential and "special" conditions such as the presence of asbestos, lead paint, underground tank leaks, contaminated soil, etc. shall be addressed.

02010. SUBSURFACE EXPLORATION

1. DESIGNER'S RESPONSIBILITIES

   The Designer shall direct a soils exploration program (see N. C. Construction Manual, Section 204.1.c) as judged necessary in consultation with the University. The Designer shall contact Facilities Design & Construction and submit a Request for Proposals for soils exploration. Facilities Design & Construction will provide names of pre-qualified testing companies. This will include investigative work and surveyor reports, laboratory tests (including test borings), soil analysis (including load bearing capabilities) and related site analysis. The Designer shall study plans of existing underground utilities and shall locate borings to avoid these utilities. Bored holes are to be backfilled, finish graded and seeded. Submit two copies of the site exploration report to the University.

2. INFORMATION TO BE INCLUDED IN CONTRACT DOCUMENTS

   Show all boring locations, cross sections and soil conditions. Also show all existing conduits, drains, utility lines, sewers, tunnels, cables, trees, paving, walks, foundations and other objects or obstructions, whether in use or abandoned. Facilities Operations will assist with identifying existing conditions by providing "as-built" drawings as available. Clearly indicate the project boundary.

02080. ASBESTOS ABATEMENT

1. Demolition, renovation or remodeling projects are likely to involve some asbestos abatement. The University will provide all current information on identified asbestos on any site. The Designer will conduct his own independent study to identify all asbestos containing materials. A separate prime construction contract may be appropriate for asbestos abatement work.

2. It is noted that the Designer shall provide a design for asbestos removal, if required, as part of the design contract as per the State Construction Manual.

3. The University requires the Designer to provide for asbestos abatement on structures on the site scheduled for demolition. All asbestos abatement work shall be done in compliance with the North Carolina Department of Environment, Health and Natural Resources; Asbestos Hazardous Management Branch.

02110. DEMOLITION

1. STRUCTURE REMOVAL

In open areas, foundations of structures shall be removed to a minimum of 3 feet below finish grade elevations. Where new structures will replace existing structures, indicate extent of foundation removal on the drawings. Existing slabs remaining under fill, minimum of 3'-0" below finish grade, for new structures shall be broken to provide for drainage and ground water equalization. Recycle demolished material to the greatest extent possible.

2. RELOCATED EQUIPMENT

Special concern shall be taken with equipment to be reused. Establish schedule for removal and reinstallation through the University. Relocation of existing equipment shall include:

2.1. Disconnecting and moving.

2.2. Restoration and capping of utilities at the old location.

2.3. Recording existing piping arrangements to facilitate reinstallation.

2.4. Replacing unsalvageable piping, ductwork and wiring, and furnishing any new piping, ductwork, and wiring as required to complete reinstallation, without additional cost to the University.

3. BLASTING

Every reasonable effort should be made to avoid blasting because of the close proximity of other structures. If blasting is utilized, control dust and excessive noise when surroundings require. Document conditions of adjacent structures, before and after blasting, when collateral damage is possible. Seismographic monitoring may be required on adjacent buildings.

02102. CLEARING AND GRUBBING

1. All objectionable growth shall be stripped. Debris resulting from stripping and clearing operations shall be promptly removed from University property and recycled to the greatest extent possible.

2. GRUBBING

   Removal of trees and shrubs shall include the removal of stumps and roots to the extent that no root greater than 3 inches in diameter remains within 5 feet of an underground structure or utility line nor under footings or paved areas. Grubbing in open areas shall include removal of stumps and 3 inch or greater roots to 2 feet below finish grade elevations.

02210. SITE GRADING

1. GRADING

   Maintain existing grade inside drip line of trees wherever possible. Do not allow open excavations in the vicinity of trees for longer than two days to prevent soil moisture reduction.

2. FINISH GRADING

   Slopes shall be shallow enough to allow mowing (generally 1:3 or less); steeper slopes will be permitted only in areas where maintenance-free erosion control (groundcover planting, rip-rap, etc.) is planned. All areas disturbed by construction operations and not covered by building, paving, etc. shall be fine graded and seeded.

02220. EXCAVATING AND BACKFILLING

1. Excavations shall not be permitted which undermine the integrity of adjacent structures, paving or utilities.

2. Rock removal allowances shall be realistic estimates based on historical data for similar projects and the subsurface exploration data. Every allowance shall be accompanied by a Unit Cost to be used to adjust the contract if actual quantities are over or below the allowance quantity.

02225. TRENCH BACKFILL AND COMPACTION

Density of trench backfill shall be equal to densities specified for adjacent fill and backfill.

02226. STRUCTURE BACKFILL AND COMPACTION

1. BACKFILL

1.1. Backfill material shall be free of debris.

1.2. Excess material or topsoil not required nor permitted as fill shall be removed from University property at the contractor's expense.

2. Specify that soils be compacted to the following minimum densities determined by Standard Proctor Tests (ASTM D-698) unless special conditions override:

2.1. ROAD BEDS AND PARKING AREAS: 95% up to 12" below subgrade, 100% for upper 12" below subgrade. Compaction is required for the entire subgrade area for the full width and depth of slope of embankments supporting berms and pavement.

2.2. INSIDE THE STRUCTURES

2.2.1. UNDER NON-STRUCTURAL SLABS ON GRADE, with normal loading: 95%.

2.2.2. UNDER FOUNDATIONS, ISOLATED PADS, AND FOOTINGS: 100%.

2.3 OUTSIDE THE STRUCTURES

Extreme care shall be taken to obtain proper compaction in areas which abut walls, curbs, adjacent slabs, and other structures where use of mechanical compactors is difficult.

2.3.1. FOUNDATION BACKFILL UNDER PLANTING BEDS AND LAWN: The upper 2 feet of soil below finish grade - 90% maximum. Remainder of backfill - 95% if depth is less than 10 feet; - 100% if depth exceeds 10 feet.

2.3.2. FOUNDATION BACKFILL UNDER PAVEMENTS: 100%.

2.3.3. UNDER PAVED PEDESTRIAN WALKS AND COURTS: 95%.

2.3.4. BACKFILL AROUND MANHOLES AND OTHER UNDERGROUND STRUCTURES: 95% if depth is less than 10 feet; 100% if depth is more than 10 feet.

2.3.5. UNDER LAWN AND PLANTING AREAS NOT ADJACENT TO STRUCTURES: The upper 1 foot of soil below finish grade - 90% maximum. Remainder - 95%.

02230. SOIL COMPACTION CONTROL

1. Compaction control shall be provided for all fill, backfill, and embankments, both inside and outside the perimeter of the structure. Field compaction tests and related laboratory analyses shall be performed by a qualified independent laboratory (conforming to American Society for Testing and Materials standards), under the supervision of a registered professional engineer specializing in soils engineering. Soils proposed for fill, backfill, and embankments shall be analyzed by the soils engineer to determine acceptability; no soil shall be placed until it is approved by the soils engineer. A representative of the testing laboratory shall provide continuous inspection during placement and compaction operations; tests shall be made in a quantity that will assure uniform compaction and density of each course or lift of fill.

2. The University solicits proposals for the testing laboratory shortly after the receipt of construction bids. The Designer should contact the University prior to this time regarding any specific requirements for the proposal request. Note that this construction materials testing program is different from the soils exploration program in 02010.

02300. PILE FOUNDATIONS

1. Before a decision is made to use pile foundations, the Designer shall make a thorough examination of structures and occupancies and equipment adjacent to the site to determine what effect vibratory forces will have. Wood piles are prohibited.

2. INSPECTION SERVICES

   The Designer shall devise tests of pile foundations and provide full time inspection of pile driving and caisson construction to assure conformance with the drawings and specifications.

02500. SITE DRAINAGE

Updated: December 23, 2014

1. SURFACE DRAINAGE

   Slope sites to insure positive drainage without wet spots. Drain away from buildings, sidewalks and driveways.

2. In stairwells, areaways and similar locations where leaf clogging of conventional drains would be expected, provide scupper or dome type drains.

3. Reference City of Greensboro standards for storm drainage construction where applicable. Drain grates shall be designed to prevent bike tires from falling in them.

4. Consider the use of bioswales, bio-retention areas, and other storm water devices to treat and slow runoff water.

02550. SITE UTILITIES

Updated: December 12, 2014

1. COORDINATION OF DIVISIONS OF THE WORK

Care is required in preparation of documents to assure no overlapping and no gaps between the work for the various contracts. Each contractor shall be required to perform excavation, trenching, and backfill for his installations. Materials and compaction of fill materials shall meet the requirements stipulated in Division 2, regardless of who performs this work; therefore, in Divisions 15 and 16 the requirements for earthwork may be best specified by making reference to Division 2.

2. UTILITY LOCATOR

The Designer will note on the site utility installation drawings that all underground utilities will be made electronically locatable. The designer will provide specifications and drawings that detail how the utility will be made electronically detectable.

The Designer in bold print, on all site utility installation drawings, will provide a note stating that prior to digging, the contractor will contact “NC 811” at 1-800-632-4949 (www.nc811.org) to have all public utilities located and marked.

The Designer, in bold print, on all site utility installation drawings, will provide a note stating that prior to digging the contractor will contact a third party Underground Utility Location company, approved by the Owner, to locate and mark all of the University’s underground utilities located in the area of excavation.

3. MANHOLES

Manhole frame, cover and grate castings shall include the name and location of the manufacturer. Covers shall be at finish grade and have cast identification of "STORM DRAIN", "SANITARY", "STEAM", "ELECTRICAL", TELEPHONE", etc. as appropriate. Manhole covers 36” in diameter or greater shall be equipped with hooks for attaching chains to aid in removing them. Masonry manholes shall be parge coated inside and outside. Manholes are considered confined spaces and appropriate safety measures should be taken when entering them.

02600. PAVING AND SURFACING

1. This is a pedestrian oriented campus and as such, designs will be prepared with pedestrian traffic (including those with mobility impairments) as the highest priority.

2. The campus has a handicapped accessibility route designated to provide access throughout the campus. This route will be augmented by new construction and must remain intact during construction work or an alternate route shall be provided.

3. Roads, parking, service courts, subgrade and related work shall be constructed by road building firms fully qualified and equipped to perform the total work.

02610. PAVING

1. BASE DRAINAGE

   Over impervious subbases, drainage trenches filled with stone shall be provided for drainage of the aggregate base. These drainage trenches shall be located at low points and at intervals of 100 feet or less.

2. PROTECTION OF SURFACE COURSE

   After completion of surface course, no vehicular traffic or parking shall be permitted on the pavement until the surface has cured.

3. REPAIRS

   Depressions and abutments to existing pavement shall be repaired by cutting out the surfacing to a minimum depth of one inch with vertical cuts, filling, and rolling the areas. Feathering of patches and abutments to existing pavement is prohibited.

4. CONCRETE PAVING

   Heavy duty, reinforced concrete paving shall be used for loading dock and dumpster areas. Refer to Section 02760, Item 1.3.

02620. CURBS AND GUTTERS

1. CAST-IN-PLACE CONCRETE shall be used unless other design is required to match existing conditions. Minimum 28-day strength shall be 4000 psi with 4% to 6% entrained air.

2. EXPANSION JOINTS shall be specified and shown on the drawings.

3. Curbs shall pitch to catch or release water as required by adjacent paving grades. Pitch sections shall be clearly designated on the drawings.

02630. WALKS

1. Typical width shall be 6 feet for minor walks and 8 feet for major walks and walks that may have vehicular use.

2. DESIGN CONSIDERATIONS
Updated: December 24, 2014

Selection of paving material should be based on all of the following criteria as a whole:

2.1. Existing paving material in the vicinity.

2.2. Cost and economic factors.

2.3. Maintenance and durability.

2.4. Aesthetic value.

2.5 Reduce the on-site heat island effect for non-roof hardscape surfaces by specifying High Solar Reflectance Index (SRI) materials for paving, or ensure that hardscape areas are shaded within the prescribed time period by the current LEED Rating System.

3. CONCRETE WALKS

Typical concrete walks shall be 4 inches thick, 3000 PSI concrete with welded wire fabric over 4 inches of gravel base; designed suitable for vehicular use; and have a light broom finish perpendicular to traffic flow. Where a service vehicle is likely to drive on a wide walk, a 6 inch concrete thickness with appropriate welded wire fabric shall be used.

4. BITUMINOUS WALKS

Typical bituminous walks shall be a full 2 inch compacted thickness on a 4 inch compacted gravel base. The base and the bituminous material shall each be compacted to 98% of their test densities.

5. MASONRY PAVERS

When pavers are used, it is preferred to have them on a concrete, mortar or asphalt substrate rather than a sand bed.

6. COMPANION RAMPS

When a curb ramp is built on one side of a street, a companion ramp is required on the opposite side of the street. When project limits would normally end within a street intersection, the limits must be extended to allow construction of a companion ramp on the opposite side of the intersection.

02760. SITE FURNISHINGS

Updated 7/8/13 (Trash and Recycling Cans + Exterior Benches moved to Guideline #10000)

1. DUMPSTERS & COMPACTORS

The number, location and size of dumpsters and compactors must be evaluated for each specific project. The following information is for a typical dumpster or compactor on the UNCG campus:

1.1 Cost: Cost of dumpsters, recycling containers, compactors, etc. shall be included in the movable equipment budget for projects. Cost estimates will be available from Facilities Operations.

1.2. Location: Dumpsters, compactors and enclosures shall be located in close proximity to the service area of each building. Paved access for staff to deposit waste and vehicle access by a 20 cubic yard front load refuse truck shall be considered in the location. Provide truck turn-around route or access without creating a traffic hazard. At least 50’ of straight clearance is needed for truck access to the dumpster/ compactor. See attached drawings for specific dimensions and configurations. Provide highway grade paving for the route that the refuse truck will take to service the container. Locations shall reduce the visual impact of the dumpster. Built or landscaped screening shall be provided for each location. Gates or other devices requiring operator time are not desired. The dumpster/compactor screen should typically accommodate an 8yd front-load trash dumpster, an 8 yd co-mingled or cardboard dumpster (7’ tall, 4’8” deep, 6’ wide), and a 6 yd. front feed compactor (Vert-I-Pac or similar) with 3’ clearance around each dumpster/compactor and 25’ overhead clearance. Dumpsters will be provided by the project’s moveable equipment budget. Compactors may be provided by the moveable or fixed equipment budget, but power for the compactor should be designed and provided in the project with final power connection by the contractor. A lockable fused disconnect switch should be provided within sight of the compactor’s electrical panel box and not more than 50’ from the compactor.

1.3. Pad: Provide a level concrete pad sized to accommodate the dumpster/compactor enclosure and a minimum 10’ deep apron immediately in front of the enclosure for the dumpster truck’s front wheels to sit on while empting the container. The

pad and approach must be on the same plane. The pad and apron shall be 6" thick, 4000 psi minimum concrete reinforced with 6x6-W2.0xW2.0 WWF on 6" of compact aggregate and compacted subgrade. The pad and apron should be thickened to 14" at the edges with two horizontal #4 rebars placed over each other.

1.4. Piedmont Disposal Front Load Truck dimensions (truck currently in use at UNCG):

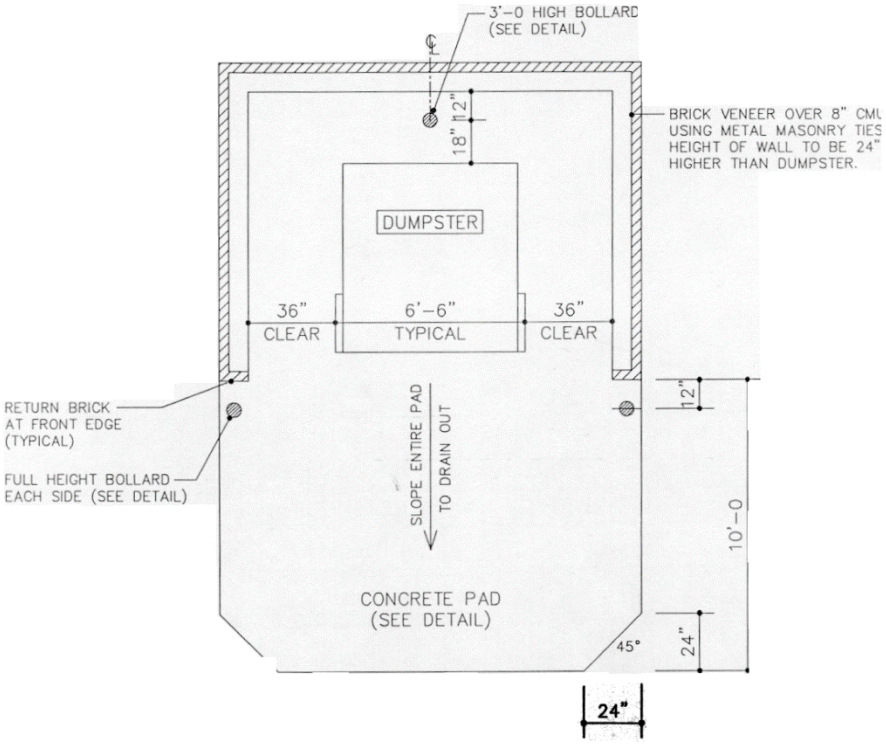
Height:	13'-3"
Vertical Clearance:	18'-0"
Width:	8'-0"
Side Clearance needed:	12'-0" (two feet each side, total of 4 extra feet)
Weight:	24 tons (empty)

1.5. Bollard to be primed and painted safety yellow.

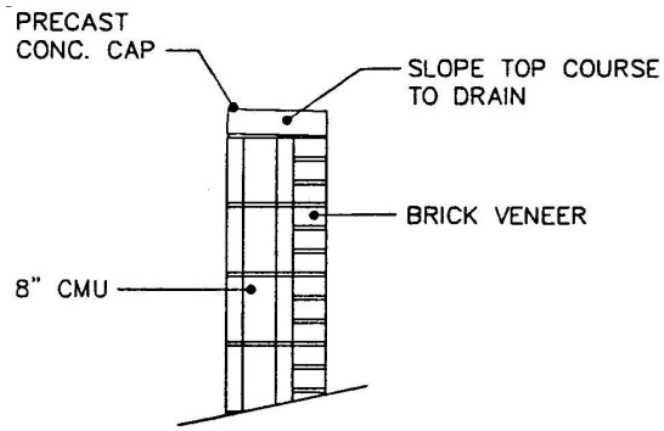
STANDARD DUMPSTER HEIGHTS & DEPTHS VARY. STD. WIDTH IS 6'-0 PLUS THE HANDLES. SIZE SCREEN ACCORDING TO UNIT USED.

IF TWO DUMPSTERS ARE LOCATED WITHIN ONE ENCLOSURE ALLOW A MINIMUM OF 36" BETWEEN BOTH DUMPSTERS AS WELL AS OUTER SIDES.

STANDARD DUMPSTER HEIGHTS & DEPTHS			
SIZE	HT.	DEPTH	WD.
A	42"	36"	
B	48"	54"	
C	60"	66"	
D	80"	66"	
2 cu.yd.			4'
8 cu.yd.			6'
30 cu.yd.			8'

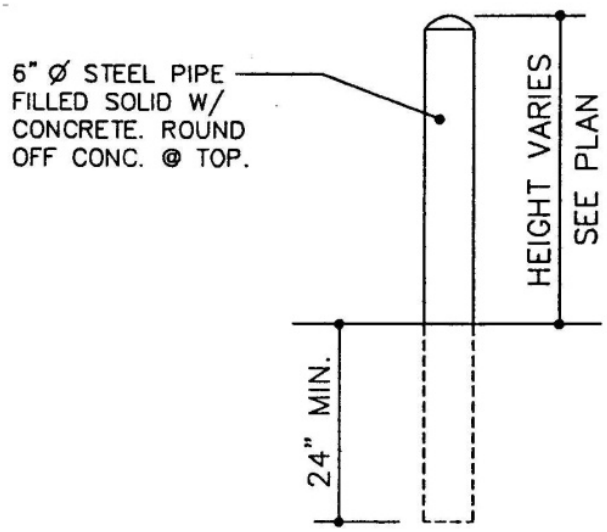


TYPICAL DUMPSTER PAD SCALE: ¼" = 1'-0
W/ BRICK SCREEN WALL



TOP OF WALL DETAIL SCALE: ½" = 1'–0

W/ BRICK SCREEN WALL



BOLLARD DETAIL SCALE: ½" = 1'–0

02800. LANDSCAPING

Plant material selections must be made from stock indigenous to the specific locations where it will be placed. Persons selecting materials must be knowledgeable about the plants that will survive in the specific area. Refer to the Grounds Superintendent for assistance. Plant lists shall contain both common and technical names, quantities and plant delivery method (B&B, bare roots, etc.).

02820. LAWNS

1. GENERAL

1.1. Grades: The areas to be grassed will be at finished grade prior to seeding and this grade shall be maintained.

1.2. Guarantee: The contractor shall guarantee a live stand of permanent grass consisting of 95% coverage minimum for seeded grass with no bare spots greater than 1 square foot. Acceptance will be made after the grass has been mowed at least once by the Contractor and shows sufficient stand and cover as specified.

2. MATERIALS
Updated: December 23, 2014

2.1. A soil analysis shall be prepared by a testing agency approved by the Designer. The contractor shall provide all elements recommended by the analysis.

2.2. Permanent grass: Shall be 99% pure; 85% to 95% Turf type tall Fescue, such as Olympic or Rebel, sown at a rate of 5 lbs/1000 square feet. Red Fescue may be used for heavily shaded areas. All seed must be free of weed seed.

2.3. Fertilizer: Shall be a commercial fertilizer delivered in unopened original containers each bearing the manufacturer's guaranteed analysis. Any fertilizer which comes caked or otherwise damaged shall not be accepted. Fertilizer selection and application rate shall be determined by soil analysis. Lime shall be granulated agricultural limestone applied at a rate according to soil sample analysis. Small disturbed lawn areas that require reseeding shall receive 40 pounds of 5-10-10 fertilizer and 75 pounds of lime per 1000 sq. ft. of yard. When available, use organic fertilizers in lieu of chemical fertilizers.

2.4. Mulch: Shall be weed-free grain straw. Quantity shall be 3,300 pounds per acre (approximately 75 pounds per 1000 square feet) or 65 bales per acre (1-1/2 bales per 1000 square feet).

3. EXECUTION

3.1. Cultivation: Spread average 4" deep layer of topsoil after scarification to a depth of 6" minimum. Spread lime evenly at the rate determined by soil sample analysis and work it into the soil by plowing and cross plowing all areas to a minimum depth of 6" including new 4" topsoil. Pulverize the soil with a roller type pulverizer with 4" tines. Hand rake the soil to level and remove loose stones and other debris leaving a smooth friable condition suitable for seeding.

3.2. Fertilization: Apply fertilizer uniformly at specified rate with an approved distributor prior to seeding. Fertilizer shall be worked into the top three to four inches of the soil.

3.3. Seeding: Shall be with soil moist but not wet and broadcast by means which will insure uniform distribution and thorough coverage of the entire area. Seed shall be covered lightly (1/4") and rolled with a light roller or cultipacker to firm the seed in the soil. Mulch shall be applied to the area evenly and lightly. Areas which do not show a prompt "catch" or have been washed shall be reseeded for thorough coverage.

4. MAINTENANCE

4.1. Watering: The Contractor shall sufficiently irrigate seeded areas to maintain a continually moist condition until the seed has germinated and become established. Watering shall continue to assure maximum survival of grass till acceptance of work. One inch/week of water after grass is established is a minimum requirement.

4.2. Mowing: The Contractor shall conduct mowing operations to keep the lawn in a neat and well groomed appearance. The lawn shall only be cut when grass and soil are dry. Not more than 1/3 of the total leaf surface is to be removed at one mowing. It is not necessary to remove clippings if grass is mowed according to these specifications. Prior to acceptance, a final mowing shall be conducted. Mowing for Fescue shall be done with rotary type mower set at 3 inches. Bermuda should be cut at 1-1/2 inches.

4.3. Responsibility of lawn care: The care of the lawn shall be the responsibility of the Contractor until the Project is accepted. Lawn care shall include watering, feeding, and cutting consistent with general practice of care for the type of lawn. The Contractor shall fully maintain the lawn throughout the warranty period except for mowing and watering. Facilities Operations will be responsible for mowing and watering but this will in no way void the warranty.

4.4. Submittals: Submit soil analysis, seed and fertilizer data, and instructions for planting and care of the lawn for approval by Facilities Design & Construction, with copy to Grounds Superintendent, prior to purchase of material.

02831. TREE PROTECTION

1. GENERAL

It is desirable to save existing trees whenever possible. During design, the Designer should identify specifically those trees to be saved and those which must be removed. Trees which must be damaged by construction to the point that they have little chance to survive should be considered for removal. On projects that have a large amount of specimen trees the University normally requires the Designer hire a Natural Resource tree specialist as part of the team to prepare Natural Resource drawings. The Design Project Manager will help the Designer choose an acceptable consultant.

2. PROTECTION

2.1. All trees to remain are to have protective barriers set outside the drip line of the tree. Barriers shall be installed prior to any construction and shall remain until construction and site cleanup is complete. The tree protection barrier fence shall be made of 4'-0" minimum height woven wire fence of minimum 14.5 gauge with 6'-0" "T" bar metal fence posts with rebar caps on each post. Spacing between posts to be 10'-0" center to center maximum. Attach flagging to the fencing for visibility and use "Arctic" weight orange flagging. No construction material, debris or excavated material shall be stored within the barricade area.

2.2. Protect root system from compaction, flooding, erosion and noxious materials in solution from spillage of construction materials. Do not park vehicles under existing trees.

3. EXCAVATION AROUND TREES

3.1. Care must be taken in excavating foundations and installation of utility lines adjacent to trees that are to be saved.

3.2. Excavate within drip line of trees only where indicated on plans. If excavation will damage trees extensively, the trees should be removed and replaced.

3.3. Where trenching for utilities is required within the drip line, tunnel under or around roots by hand digging. Do not cut main lateral or tap roots. Cut smaller roots which interfere with a sharp pruning tool; do not chop or break.

3.4. Do not allow exposed roots to dry out before backfill is placed; provide temporary earth or moist burlap cover.

3.5. Any tree to remain that has had excavation within the drip line shall be pruned by a professional arborist according to the National Arborist Association Standards Class

IV -Cutting Back or Drop Crotch Pruning (see Sheet #2).

Cutting back or drop crotch pruning shall consist of the reduction of tops, sides, underbranches or individual limbs. This practice is to be undertaken only in cases of utility line interference, or where certain portions of the roots or root systems have been severed or severely damaged.

The following specifications shall apply:

3.5.1. All cuts shall be made sufficiently close to the trunk or parent limb, without cutting into the branch collar or leaving a protruding stub, so that closure can readily start under normal conditions. All cuts shall be clean. It is necessary to precut branches too heavy to handle to prevent splitting or peeling the bark. Where necessary, to prevent tree or property damage, branches shall be lowered to the ground by proper ropes or equipment.

3.5.2. Remove the weaker, least desirable, crossed or rubbed branches. Such removal should not leave holes in the general outline of the tree.

3.5.3. Treatment of cuts and wounds, with tree wound dressing, is optional except where open wounds in certain trees may attract insects that carry disease or allow fungus invasion. If such treatment is made, materials non-toxic to the cambium layer must be used, and care taken to treat only the exposed wood with a thin coat of dressing. Old injuries are to be inspected. Those not closing properly and where the callus growth is not already completely established should be traced where appropriate. If desired, for cosmetic purposes, the wound may be treated with a thin coat of wound dressing.

3.5.4. Generally, in reducing size (cutting back) not more than one-third of the total area should be reduced at a single operation. When cutting back, only drop crotch as much as necessary. Where practical, avoid cutting back to small suckers. All effort should be made to cut back to a lateral, one-third the diameter of the cut being made. In reducing overall size, attention is to be given to the symmetrical appearance. Top is to be higher and sides reduced in order to maintain a tree-like form. When cutting back trees, one should have in mind to make them shapely and typical of their species.

3.5.5. On thin bark trees, just enough limbs shall be removed to get the effect wanted without admitting too much sunlight to the trunk of the tree or the top of large branches. Care should be taken with the following species: lindens, maples, beeches, apples, oaks, and other trees susceptible to sunscald, growing in different geographical areas. The damage may be minimized by doing work on susceptible species during the dormant season.

3.5.6. In lifting the lower bottom branches of trees for underclearance, care should be given to symmetrical appearance, and cuts should not be made so large that they will prevent normal sap flow.

3.5.7. Periodical drop crotching or cutting back of silver maples, poplars, and other trees with brittle and soft wood is an established practice and has proven beneficial in maintaining the safety of these trees over long periods of growth. Other trees with soft and brittle wood growing in different geographic areas may be specifically named when it is common practice to control growth by cut-back. An alternate method in some situations for maintaining the safety of these trees would be cabling and bracing.

4. GRADING

Maintain existing grade outside drip line of trees, unless otherwise indicated on plan. Do not leave open excavations in the vicinity of protected trees for longer than 2 days to prevent soil moisture reduction.

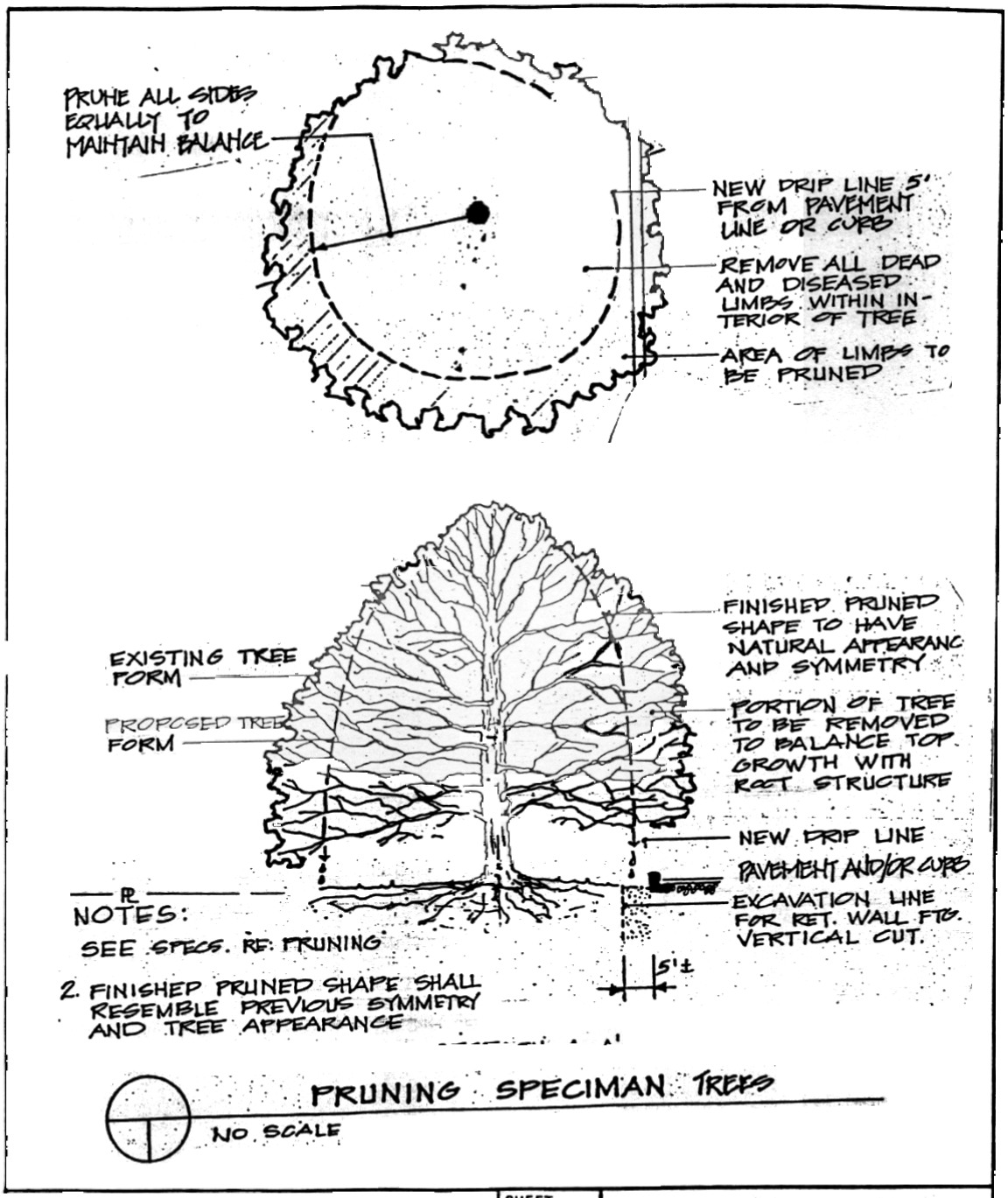
5. FERTILIZATION

The specifications shall define proper fertilization and the contractor shall fertilize affected trees during construction.

6. REPAIRS TO DAMAGED TREES

6.1. Repairs to damaged trees shall be performed by a professional arborist following the preceding instructions for pruning.

6.2. Trees damaged beyond repair or that do not survive will be removed by the contractor. A replacement cost will be determined by the Designer and paid by the contractor. The University will reserve the option of having the contractor replace the tree with one of equal size and quality.


PRUNE ALL SIDES EQUALLY TO MAINTAIN BALANCE
NEW DRIP LINE 5' FROM PAVEMENT LINE OR CURB
REMOVE ALL DEAD AND DISEASED LIMBS WITHIN INTERIOR OF TREE
AREA OF LIMBS TO BE PRUNED
EXISTING TREE FORM
PROPOSED TREE FORM
FINISHED PRUNED SHAPE TO HAVE NATURAL APPEARANC AND SYMMETRY
PORTION OF TREE TO BE REMOVED TO BALANCE TOP GROWTH WITH ROOT STRUCTURE
NEW DRIP LINE
PAVEMENT AND/OR CURB
EXCAVATION LINE FOR RET. WALL FTG. VERTICAL CUT.
5'±
NOTES:
SEE SPECS. RE: PRUNING
2. FINISHED PRUNED SHAPE SHALL RESEMBLE PREVIOUS SYMMETRY AND TREE APPEARANCE
PRUNING SPECIMAN TREES
NO SCALE
TREE PROTECTION STANDARD
SHEET: 2
BY: M.M.
CHECKED:
WORK ORDER/PROJECT #:
DATE: 11-15-'88
SCALE:
THE UNIVERSITY OF NORTH CAROLINA GREENSBORO
PHYSICAL PLANT DEPARTMENT

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.

03300. CAST-IN-PLACE CONCRETE

1. MIX DESIGNS shall be submitted by the Contractor to the engineer for approval well before they are needed for construction.

2. PROPER TRANSPORTING, CONVEYING, DEPOSITING AND CURING methods shall be clearly defined by the Designer.

3. HOT AND COLD WEATHER requirements shall be defined or clearly referenced.

4. ADMIXTURES
Updated: December 23, 2014

   4.1. Calcium chloride or admixtures containing chloride shall not be used.

   4.2. An approved air-entraining admixture shall be used for all concrete exposed to weather.

   4.3 Colored concrete shall be avoided. If desired by the Designer for some reason, it shall be discussed with FDC before specifying.

   4.4. The use of fly-ash is encouraged when specifying concrete mix designs. The engineer shall evaluate the properties and the potential contributions in meeting the sustainable goals of the project.

   4.5. When fly ash is specified, it shall be with tight tolerances on carbon. This is especially important when fly ash is used with air-entraining admixtures.

5. ALUMINUM CONDUITS AND PIPES shall not be embedded in any concrete.

6. CONTROL JOINTS, EXPANSION JOINTS AND CONSTRUCTION JOINTS shall be clearly defined using appropriate details. Control and expansion joints shall be coordinated with interior partition walls where possible.

7. METAL NOSINGS with non-slip surfaces shall be provided on all concrete steps.

8. COMPRESSION TESTS and related laboratory analyses shall be performed by a qualified independent laboratory (conforming to American Society for Testing and Materials standards) selected and paid for by the Owner in accordance with the North Carolina Construction Manual. The University solicits proposals for the testing laboratory shortly after the receipt

of construction bids. The Designer should contact the University prior to this time and provide the scope of work for testing as per the North Carolina Construction Manual and any other specific requirements for the proposal request.

9. REPAIR of defective concrete must meet the approval of both the structural engineer and Owner before the Designer gives approval for the repair. Durability, maintenance and aesthetics are factors to be considered.

03350. CONCRETE FINISH

Updated: December 23, 2014

1. A SAMPLE PANEL for exposed concrete may be required at the site prior to beginning production. The panel shall show all of the various finishing techniques required in the structure, i.e. joints, texture, color, workmanship, sandblasting, etc. The concrete used shall be provided from the project supplier and shall represent the approved project mix in all aspects. Panel shall be protected from construction operations, but shall be left exposed to the elements and left in place until all architectural concrete has been approved. Special attention shall be given to areas that routinely have caused concern in concrete construction such as:

   1.1. Adequate cover over reinforcing steel.

   1.2. Sealing and waterproofing.

   1.3. Proper drainage.

   1.4. Joints and connections.

   1.5. Protection of in-place work during construction, especially protection from vandalism. Both drawings and specifications shall note that the Contractor is responsible to protect the work and take whatever precautions necessary to assure the work is not vandalized (i.e. writing in flatwork). Vandalized work is not acceptable to the Owner.

   1.6. Proper dimension and sizing for embedded items.

   1.7. Coordination of the electrical and mechanical requirements for penetrations and across expansion joints.

2. INTERIOR CONCRETE FLOORS shall receive a durable finish to minimize staining and maintenance. Mechanical and electrical rooms are noted in particular. Any admixtures, hardeners or curing compounds shall be compatible with finish and adhesives or mastics used with the flooring system. All adhesives and sealants used on the interior of the building must comply with the VOC requirements of South Coast Air Quality Management District Rule 1168.

03400. PRECAST CONCRETE

1. QUALITY ASSURANCE: Precast manufacturing plants shall be certified by the Pre-stressed Concrete Institute's Plant Certification Program or meet equal qualifications. Visits to the precast plant by the Designer and Owner may be applicable to inspect the work process and quality. All welded connections shall be made by a certified welder.

2. TESTING: Precast manufacturers shall employ their own testing services with the Designer specifying frequency of testing.

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04200. UNIT MASONRY

Updated: December 23, 2014

1. The basis of design for brick and mortar will be made by the University and designer during the design phase based on the building and location. This is due to the University's long review and approval process for brick and mortar selections. The designer should include this scope of work in their design contract. Preference shall be given to masonry that is manufactured regionally.

2. The designer should include in the specifications the construction of up to 6 masonry sample panels (48" x 48") for selection of brick and 6 mortar sample panels (48" x 48") for selection of mortar color. Brick sample panels should be erected immediately after the Notice to Proceed in order to accommodate the sometimes lengthy approval process and not delay the contractor. SAMPLE PANELS SHOULD CURE FOR AT LEAST 10 DAYS PRIOR TO REVIEW BY UNCG AND THE DESIGNER.

3. The specifications should require construction of an exterior wall mockup panel. This panel should be a minimum of 4'-0" high by 5'-4" wide and provide all materials and finishes to be included in the exterior wall construction including interior and exterior wythes of masonry with required air space, reinforcements, brick ties, flashing, weeps, mortar netting, any precast banding or accents, special brick shapes or coursing, partial window frame installation, etc. using approved masonry materials and mortar. THE MOCKUP SHOULD CURE FOR AT LEAST 10 DAYS PRIOR TO REVIEW BY UNCG AND THE DESIGNER. The mockup will be used as the standard for judging workmanship. The contractor shall maintain the mockup in an undisturbed condition throughout construction. The contractor will be responsible for demolition and removal of the mockup at the end of construction, but only after the designer has approved removal.

4. In general, standard running bond coursing should be used for new masonry work unless required to match adjacent building brick coursing for existing buildings. Tooled concave or vee mortar joints are preferred over raked or flush joints unless required to match existing buildings. Special shapes shall be inspected by the designer for uniformity of size and color against the approved sample panel prior to installation.

5. The designer should note in the specifications that masonry walls or columns shall be adequately braced during construction.

6. The designer's construction documents should provide detail drawings and instructions to the contractor showing installation of all materials used in masonry wall construction.

Examples of details include structural connections, placement of reinforcement, ties and anchors, through-wall penetrations, installation of flashing, forming of end dams and corners, installation of termination bars, drip edges and expansion joints.

7. Weeps should be provided in head joints in exterior wythes of first course of masonry immediately above embedded flashing at a maximum of 24 inches on center. Provide cellular plastic weep vents, full height and width of head joints. Provide free-draining mortar netting designed to prevent mortar blockage of weeps and prevent bridging within the wall cavity.

8. Through wall flashing shall be pre-formed 22 gauge stainless steel. Bottom edge of flashing shall be hemmed and bent to form a drip edge. Flashing to have welded pre-formed corner (inside and outside) and end dams. Joints in long runs of flashing to be lapped 6" sealed between with silicone sealant, and lapped with a 6" wide strip of peel & stick centered over top exposed edge of the lap.

9. The designer shall indicate an adequate number of expansion and control joints both vertically and horizontally to avoid cracking and control movement in masonry construction.

10. On free-standing exterior masonry screen walls and retaining walls with brick caps, (not precast concrete or metal copings), use an integral polymeric admixture in mortar (at cap joints only) equal to "Krete Gard" mortar mix by Krete Industries, Inc.

11. Updated: July 24, 2013
The work of this section shall be bid and performed by a firm who is certified as a "North Carolina Masonry Contractors Association Certified Masonry Contractor" or installed under the direct supervision of individuals designated by the North Carolina Masonry Contractors Association Masonry Certification Program as a "CMP-Certified Masonry Professional" or "CME-Certified Masonry Executive" as described in the most current version or the NCMCA's "Guide to Masonry Contractor Certification." (North Carolina Masonry Contractors Association, PO Box 3463, Hickory, NC 28603-3463, 828-324-1564, information @ncmca.com)

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05000. METALS

1. DESIGN

1.1. Structures shall be designed with due regard for vibration, deflection and avoidance of ponding. It is noted that this criteria may govern over strength.

1.2. Take expansion and contraction into account in the design and detailing. Handrails and long members are noted in particular, especially when they span over an expansion joint in other materials.

1.3. Try to design column base plates for ease of installation, i.e. use anchor rods with nuts above and below base plate with 1-1/2"± space to grout after leveling.

1.4. Clearly define limits and type of paint for metal elements including primers. Shop painting is preferred. Preparation methods prior to applications of primers and paints shall be described in the specifications.

1.5. All exterior ferrous metals shall be hot-dip galvanized after fabrication. Field welds shall be ground and have cold galvanizing applied. The Designer should try to limit field welding on hot-dip galvanized pieces.

1.6. Specify that work be temporarily braced during construction until the structural system is adequate to brace itself.

1.7. Handrail pockets, sleeves or anchor plates shall be designed to shed water and prevent corrosion. Provide drawing details for installation and/or describe fabrication methods if critical to the finished product.

2. TESTING

2.1. Structural tests on welds, bolts, shear studs, etc. shall be performed by a qualified independent laboratory (conforming to American Society for Testing and Materials standards) selected and paid for by the Owner in accordance with the North Carolina Construction Manual. The University solicits proposals for the testing laboratory shortly after the receipt of construction bids. The Designer should contact the University prior to this time and provide the scope of work for testing and any other unique requirements for the proposal request. The Designer should contact Facilities Design & Construction during the design phase of the project to discuss testing frequency to be included in the specifications.

2.2. The structural design engineer shall clearly define and approve testing methods for both shop and field work. A preconstruction conference with the structural designer, metal fabricator and testing laboratory shall be held to clarify any testing requirements prior to fabrication. The designer shall designate critical pieces that should be approved at the fabrication shop with appropriate testing methods.

2.3 The Owner desires steel fabrication by an American Institute of Steel Construction (AISC) certified shop. If for some reason the Designer desires to not use a certified fabricator, they must explain the rationale to the Facilities Design and Construction Project Manager to get approval prior to completing the specifications. The use of a certified shop usually eliminates the need to visit the fabrication shop by the Owner and testing company.

2.4. Stored materials shall be stored in such a way as to permit access for inspection and identification and to protect them from deterioration.

3. QUALITY ASSURANCE

3.1. Visits to the fabrication plant by the Designer and Owner may be applicable to inspect the process and quality of the work.

3.2. All welded connections shall be made by a certified welder. The use of "pre-qualified welds" is encouraged.

3.3. The Designer shall be careful to avoid galvanic corrosion due to contact between dissimilar metals.

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06000. WOOD

Since the University has used very little wood in the past, most guidelines have been adequate; however some of the problem areas, primarily in roof and attic spaces, are noted below.

1. Truss bearing shall be noted in the construction documents and checked for adequacy and tolerances in the field. Also, refer to the NC Construction Manual, Design Criteria and Policies Section, for truss design requirements.

2. Wood roofs shall be designed such that adequate capacity exists for the future installation of slate shingles.

3. Plywood shall be correctly specified for its application and inspected during construction for conformance to specifications.

4. Nailing shall be carefully specified, especially for plywood sheathing. This includes nail size and spacing. Field-verify size and spacing of nails being used. It is noted that some gun nails are smaller in diameter than the corresponding common nail. Also, verify that the fastener specification is compatible with recommendations of the American Plywood Association.

5. Nails that miss the structural support are to be removed (i.e. nails that go through plywood sheathing and miss the rafter).

6. Attic ventilation shall be such that good air flow is obtained for the entire cross section and is adequate by the code (as a minimum). It is desirable to have more than minimum ventilation when a dark roof is used. Mechanical ventilation may be required in borderline cases.

7. Fire retardant roof framing or sheathing is not to be used.

8. For millwork or areas exposed to view, it is recommended to use wood with a moisture content of 19% or below to control shrinkage. The design shall take shrinkage into account if wood is allowed with a moisture content greater than 19%.

9. The design shall not allow timber to be exposed to weather or moisture such as direct contact with masonry or concrete. There shall be an air gap or metal separation from moisture where concrete or masonry attach to wood. Any wood in direct contact with concrete or masonry shall be treated to provide decay resistance as per the NC Construction Manual, Design Criteria and Policies Section, and any other code requirements.

10. Wood structures that are under construction shall be properly braced to prevent collapse or overturning. Trusses are noted in particular. The designer shall verify that the design has adequate blocking or bracing for the completed structure.

11. Wood that must be on the site prior to use shall be stored away from moisture and soil contact. This wood (especially wood flooring) shall be acclimated to the final environment for at least one week (or as required for the specific application) prior to installation such that the moisture content stabilizes to what it will be in the final environment. Millwork and wood doors shall not be delivered to the job site until needed and the building is sufficiently dried in and heated.

12. For wood with preservative or fire retardant treatment, the designer shall verify that the size and material type of each fastener shall be resistant to corrosion from the chemical preservative.

13. Do not use exposed, chromate copper arsenate (CCA) pressure treated wood.

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07100. WATERPROOFING

1. GENERAL

1.1 Provide waterproofing at the following locations:

1.1.1 Vertical walls below grade
1.1.2 Plaza decks and elevated walkways
1.1.3 Floors of all mechanical rooms located above other occupied areas
1.1.4 Toilets, housekeeping closets, shower rooms, and around all floor drains except when located in a slab-on-grade
1.1.5 Utility tunnels and vaults

1.2 Waterproofing systems should be designed with the following performance requirements in mind:

1.2.1 Be compatible with the substrate to which it is applied and achieve complete adhesion to it
1.2.2 To perform in a constantly wet environment
1.2.3 Have the durability to withstand subsequent construction activity
1.2.4 Accommodate anticipated structural movement of the substrate(s) to which it is applied

2. QUALITY ASSURANCE

2.1 The manufacturer of the waterproofing material shall submit a letter stating that the applicator has been approved to apply the waterproofing system specified.

2.2 The suitability of the substrate upon which the waterproofing system is to be installed must be remediated prior to installation of the waterproofing system.

3. GUARANTEE

Waterproofing systems shall be guaranteed for a minimum of two years. The Contractor shall agree to repair or replace work that fails to perform due to failures of materials or workmanship.

4. FOUNDATION DRAINAGE

4.1 Provide foundation drainage for all exterior walls where floors are below grade.

4.2 Provide positive slope for all foundation drainage connected to the storm drainage system.

4.3 Do not connect downspouts to foundation drainage systems.

07216. INSULATION

1. INSULATION

1.1 When specifying insulation, the Designer should make the calculation for "R" factors, "U" factors, and "K" factors and specify the type and thickness of the insulation required, not simply specify that the insulation meet those factors. The Designer should use in-service "R" values where applicable.

1.2 The Designer should specify the application requirements for insulation. Roof insulation, when used for the control of heat flow, should be installed in two or more layers with joints staggered.

2. INSULATION ASSEMBLY

The final thickness of the insulation assembly should be calculated in the overall design of the roofing system in order to comply with the minimum 8 inch clear flashing height above the finished roof surface.

3. INSULATION DENSITY

The density of insulation for roofing systems must be sufficient to allow for foot traffic and have a high compressive strength, rigidity and impact resistance. The insulation must be moisture resistant and dimensionally stable.

4. INSULATION COMPONENTS

Roof insulation, cover boards, fasteners/adhesives are to be considered components of a total system assembly and must be specified as part of, and included in, the total system warranty issued by the roofing manufacturer.

07300. ROOFING GENERAL REQUIREMENTS

Updated: December 23, 2014

1. DESIGN CONSIDERATIONS

1.1 UNCG endeavors to maximize the life and performance of new roofing systems by specifying high quality, proven materials that are appropriate for the specific application; designing roofs with simplified drainage systems of adequate capacity and slope; designing sound, functional details; incorporating quality accessories and flashing materials; and, providing access for future maintenance and replacement of the roof and rooftop-mounted equipment.

1.2 Careful consideration should be given to the following criteria:

1.2.1 Building and roof life expectancy
1.2.2 Thermal requirements
1.2.3 Solar Reflectance Index (SRI)
1.2.4 Positive slope and dependable drainage
1.2.5 Fire, wind and impact resistance
1.2.5 Ease of maintenance

1.3 For new buildings, pitched roofs are strongly preferred over low-sloped roofs. If low-sloped roofs are provided, the incorporation of parapet walls into the design is preferred as an edge treatment both for the control of water run-off and safety of maintenance personnel. Gravel stop edges and low parapets less than 42 inches should be avoided.

1.4 Green roofing systems are recognized for their social, aesthetic and environmental benefits. Consult with UNCG before proposing the use of "green" or "pre-vegetated" roof systems to determine if the location is appropriate.

1.5 Avoid installation of roof-mounted equipment. Install air-handling equipment in attic spaces of steep-sloping roofs.

1.6 Details at roof-to-wall intersections should allow for adequate flashing heights and future maintenance. Minimum flashing heights of 8 inches above the finished roof surface should be maintained at all walls, curbs, roof penetrations, and under windows directly adjacent to roof surfaces.

1.7 Storage of Materials

Roofing felts, membranes and insulation are to be stored in a dry trailer or building. Roofing felts or insulation, which become wet must be removed and replaced. Wet materials shall not be dried and used. Wetted membrane must be evaluated to determine the effect on adhesion, lap seals or blister potential. Remove any such material if there is any possibility of failure.

2. REFERENCES AND CODES

All new roof and reroofing projects shall comply with the applicable building codes and guidelines described in the latest edition of the following publications:

- North Carolina Construction Office's "Roofing Design Criteria"
- N.C. Building Code
- NRCA Roofing and Waterproofing Manual
- SMACNA Architectural Sheet Metal Manual
- UL and FM Manuals
- Asphalt Roofing Manufacturers Association Manuals
- Steel Deck Institute Roof Deck Design Manual
- Copper Development Association Manual
- Copper and Common Sense Publication by Revere Copper, Inc.
- "The Slate Book" as authored by Brian Sterns, Alan Stearns and John Meyer

3. REROOFING

3.1 Reroofing projects should integrate the same criteria used in new roof design. In addition, the pre-design work for reroofing should include a detailed examination and evaluation of the existing roofing system and its deficiencies, the existing roof deck and below deck conditions, the existing drainage system, and the usability and/or limitations of existing flashings.

3.2 Reroofing over an existing roof is prohibited except in special conditions.

3.3 When an existing roof is to be removed, the Contractor shall remove no more than can be dried-in during the same day. Care shall be taken to keep materials from blowing off the roof and littering surrounding areas. The roof shall be watertight at the end of each work period and when rain threatens.

3.4 Existing roof-mounted equipment that is abandoned should be removed and the roof deck properly repaired.

4. DESIGN COORDINATION

It is the University's preference that a Registered Roof Consultant (RRC) be engaged as part of the project design team. At a minimum, the design of any roofing system shall be reviewed by an approved Registered Roof Consultant.

5. DRAWINGS

5.1 Providing adequate number of well conceived, fundamentally sound details that accurately illustrate how all of the components of the roofing system interface is critical for a successful roofing project.

5.2 Provide details that clearly illustrate membrane and sheet metal flashings, drains, terminations, junctions, corners, transitions, penetrations, joints, etc. for each unique condition. Isometric drawings shall be provided for complex assemblies.

5.3 In order to adequately communicate information to Contractors, UNCG prefers the scale of roof details to be 3" = 1'-0".

6. ROOFTOP ACCESSIBILITY

6.1 Provide adequate, permanent access to all roof areas from the building interior. Walk-out access by way of stairwell extensions or via penthouses is preferred. Door thresholds should allow for continuation of adjacent wall and counter flashing under the door sill. When these options for roof access are not practicable, a roof hatch should be provided. The hatch should be a minimum of 2' x 3' and have a fixed ladder.

6.2 From the rooftop, permanent, exterior ladders may be provided to connect different roof levels. The bottoms and upper walk-through platforms of ladders should be designed to keep them from interfering with proper flashing of the roof. Ladders longer than 20 feet must be caged in accordance with requirements of the federal Occupational Safety and Health Administration (OSHA).

6.3 On low-rise buildings, ladders that extend from grade to the rooftop are discouraged.

6.4 Roof access through windows is unacceptable.

6.5 Doors and hatches providing roof access shall be lockable.

7. ROOF DECKS

7.1 The roof deck should be chosen on the basis of suitability to provide structural support, dimensional stability, and fire resistance for the roof assembly. Additionally, it should be designed with adequate attachment to the building structure, accommodate slope and drainage, limit deflection due to concentrated and uniform loading, and allow for building and roof movement.

7.2 The Designer shall inspect and approve the roof deck construction prior to the installation of the roofing system.

8. DRAINAGE DESIGN FOR LOW-SLOPED ROOFS

8.1 All buildings shall have a positive means of conducting rainwater from the roof to an underground storm water system. Designer to confirm invert elevations of

existing storm water pipe and manholes that will receive the rainwater from the roof.

8.2 Drains and slopes should be shown on a separate architectural roof plan. Key elevations and slope arrows should be given.

8.3 The consultant should not simply specify a standard per-foot slope, but should make provisions in the design for complete, positive drainage throughout the entire roof area.

8.4 All roofs shall be designed to have positive drainage equivalent to ¼" per foot slope after all loading deflections or camber of the roof deck are calculated. Overly complex roof geometries that result in complicated drainage layouts should be avoided. "Four-way" slope should be utilized to the greatest extent practicable. The use of saddles and crickets should be minimized. However, when required, properly calculated tapered saddles should be designed between drains, and crickets should be designed on the upslope side of mechanical, skylight and other curbs to promote drainage of these areas. Ponding water is not acceptable.

8.5 Structural slope is preferred over the use of tapered insulation systems to provide drainage.

8.6 Primary drains and scuppers should be recessed, or sumped below the roof membrane surface.

8.7 Drainage Type

8.7.1 Internal drainage systems are preferred for low-sloped roof systems.

8.7.2 The use of external drainage systems (gutter and downspout) for low-sloped roofs is discouraged, and requires prior approval of the University.

8.8 Drainage Capacity

8.8.1 Primary and secondary roof drainage capacities shall be carefully calculated to meet or exceed the prevailing building and plumbing codes.

8.8.2 Each major roof section should have at least two drains, or four per 150 squares of roof area.

8.8.3 Minimum size of drains and drain piping shall be 4-inch diameter.

8.9 Overflows

8.9.1 Overflow drains should not be located in drain sumps.

8.9.2 Scuppers shall be sloped outward and downward.

8.9.3 The scupper length should not be less than four times the calculated head of water and not less than 6 inches.

8.9.4 The bottom of the scupper should be no more than 4 inches above the lowest roof surface.

8.10 Drain Type

8.10.1 Cast iron body with cast iron dome shall be used. The drains strainer should be easily removable and its top must extend at least 4 inches above the adjacent roof surface.

8.10.2 Drain receivers should be used on metal decks and other types of decks that may need the distributed loading for a secure connection to the deck.

9. EXTERNAL DRAINAGE SYSTEMS FOR STEEP-SLOPED ROOFS

9.1 When designing external drainage, the consultant shall follow the recommendations for materials, gauges, shapes, and details published in the SMACNA Architectural Sheet Metal Manual. Reference to this manual in the contract documents shall not be a substitute for appropriate specifications and details.

9.2 Downspouts shall be securely fastened to the vertical plane, emptying at grade, into a cast iron boot with an integral clean out and connected to the storm water system.

9.3 Conductor heads, when used, should have an overflow port permitting water to escape if the downspout becomes obstructed.

10. FASTENERS

10.1 Fastening requirements for all insulation and overlay boards must be illustrated and/or specified, including density for the “field” and any required increases for perimeter and corner attachment.

10.2 Fasteners and flashing patterns shall be approved by the roofing manufacturer for the application and system rating. Pullout tests may be required for some deck types.

10.3 If unique tools or specific installation techniques are necessary to properly install fasteners, a pre-installation meeting or training session held with the Contractor and the manufacturer's technical representative should be required.

10.4 Fasteners should be corrosive resistant and meet or exceed FM Specification #4470.

11. PENETRATIONS AND MECHANICAL CURBS

11.1 The Designers shall make every effort to minimize penetrations through the roof membrane. Alternate routing for pipes, conduit, etc. that utilize side wall penetrations and alternate methods such as sheet metal enclosures shall be used when possible.

11.2 The structural design of the roof deck should allow for the concentrated loading of mechanical equipment.

11.3 Mechanical equipment housings must be watertight and insulated. The installation of drainage piping is encouraged to direct equipment discharge water to adjacent roof drains, primary scuppers, or self-draining roof perimeters.

11.4 The maximum amount of space available (a minimum of 12 inches) should be provided between mechanical units, perimeters, penetrations, walls, drains, etc. to allow for the proper installation of roofing materials.

11.5 The use of "pitch-pockets" or "pitch-pans" around projections is discouraged because they necessitate maintenance.

12. PIPING AND CONDUIT SUPPORTS

Piping and conduit shall be supported by pre-manufactured pipe supports, not pressure treated lumber. Samples of each type of support shall be submitted for approval.

13. BUILDING MAINTENANCE SYSTEM

13.1 The Designer should consider including in the design of all new and reroofing projects a building maintenance system(s) for the protection of workers and maintenance personnel.

13.2 Building maintenance systems should be installed in accordance with OSHA requirements.

14. TESTING

For re-roofing projects, all roof drains shall be tested prior to tear-off of the existing roof and at the completion of the new roof to insure proper operation of the drains. Testing shall be done in the presence of the consultant and the Owner's representative.

15. GUARANTEE

The Contractor shall be responsible for all repairs of water damage to the building, including furnishings, occurring during the construction phase of the project. The Designer shall survey, in the presence of the Owner and Contractor, existing water damage prior to construction and prepare a written and photographic record of this survey with copies distributed to both the Owner and Contractor. The Contractor shall be responsible for all damage not so documented.

07310. SHINGLES AND ROOFING TILES

1. Natural slate shingles, clay or concrete roofing tiles are preferred. Fiberglass and asphalt composition shingles are to be avoided.

2. Provide asphalt-saturated organic felt underlayment, un-perforated, 30 lb. minimum.

3. Provide 16 oz. lead-coated copper flashings for hips, ridges and valleys.

4. Provide copper or stainless steel slating nails of appropriate gauge and length such that the point of the nail penetrates through the roof deck except where the underside of the roof deck is exposed to view, where shorter nails may be used.

5. Match existing tiles and shingles on reroofing projects.

6. Install shingles and tiles in accordance with the National Roofing Contractors Association.

7. Snow/ice protection will be specified and detailed on drawings at building perimeters and entrance to prevent snow/ice slides off of sloped roofs. Spacing of guards will be per manufacturer's recommendation. Acceptable materials are copper and stainless steel.

07400. METAL PANELING ROOFING

1. SYSTEM DESIGN CONSIDERATIONS

1.1 The minimum slope for non-structural, architectural metal roofing is 4 inches per foot.

1.2 Apply architectural metal roofing panels over a solid substrate (roof deck) with an appropriate underlayment.

1.3 Condensation is a critical factor when designing metal roofing systems. Careful consideration must be made when evaluating the performance criteria and placement of vapor barriers, insulation, and underlayment used as part of the system. Ventilation between the underside of the metal panels and the substrate is recommended because of the potential for condensation on the underside of roof panels. In addition to ventilation, certain metals may necessitate the use of underside coatings on the panels.

1.4 Provide one piece, single length panels where possible.

2. PANEL SEAMING

2.1 Traditional double interlocked standing seams or mechanically seamed panels are preferred.

2.2 Batten seamed and flat-locked soldered seams may be considered when matching those traditional panel types on existing buildings.

3. PANEL MATERIALS

Panel and trim materials may be made of aluminum, aluminum-zinc-coated steel, copper, lead-coated copper, terne-coated stainless steel or zinc. The Designer will discuss with Facilities Design and Construction various options most suitable for specific project issues and applications.

4. PANEL CLIPS, FASTENERS, TRIM AND ACCESSORIES

Provide all components required for a complete sheet metal roofing assembly including trim, copings, fascia, corner units, ridge closures, clips, flashings, sealants and similar items.

5. SINGLE SOURCE

Roofing panels, clips, closures, and other accessories must be the standard products by the same manufacturer.

6. UNDERLAYMENT

Select proper underlayment or combinations of underlayment materials. Consider self-adhering modified bitumen underlayment for ice dam protection and at ridges, hip, valley, and sidewall locations. The use of self-adhering modified bitumen underlayment over an entire roof area is normally not recommended. The higher protection value of low-perm underlayment used continuously over the roof area must be measured against its vapor retarding effect. Care should be used to insure that condensation problems are not created with this type of application.

7. WARRANTIES

7.1 Watertight Warranty – Furnish the roof panel manufacturer's non-prorated, 20-year no dollar limit warranty, guaranteeing that the complete system will be watertight and free from leaks.

7.2 Color/Finish Warranty – Manufacturer's 20-year no dollar limit warranty for the factory color finish (if applicable) warranting against color change, cracking, peeling or delaminating.

7.3 Roof System Installer warranty – Roofing installer's 2-year warranty against leaks and defective workmanship.

07600. METAL FLASHING, TRIM, DOWNSPOUTS

1. Design, fabrication and installation of new flashing and sheet metal work should provide a permanently watertight condition.

2. Flashings, trim, gutters and downspouts should be designed and installed in accordance with the current edition of the SMACNA Architectural Sheet Metal Manual.

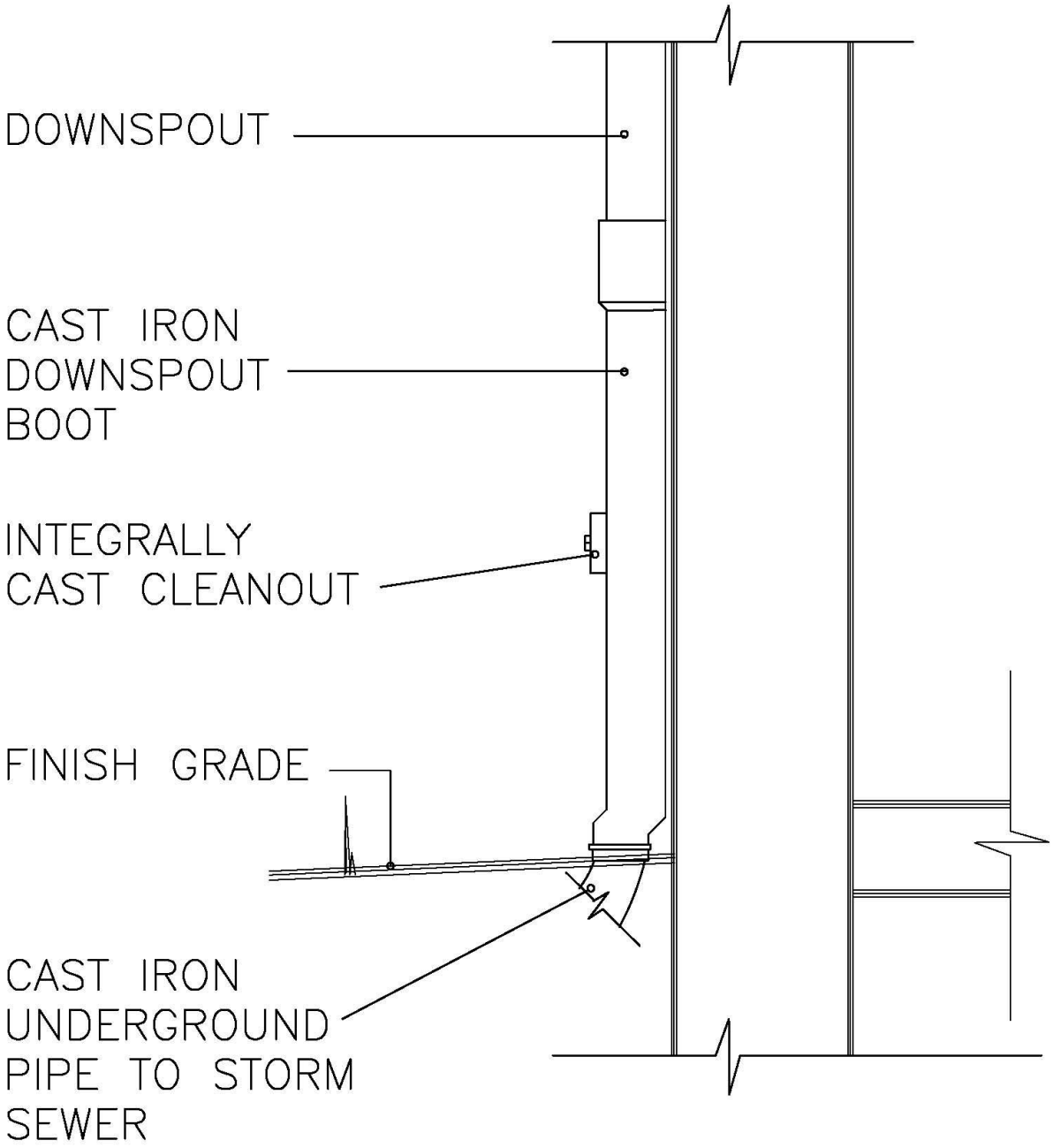
3. The basis of design and materials for all flashings, trim, downspouts and gutters should be reviewed with the University during design development on a case by case basis for each project.

4. Downspouts should be sealed at the bottom with a cast iron boot and have a slip joint on the lower 10' section to allow removal from the boot for cleaning.

5. Downspouts and underground pipe (new and existing) must be tested by the Contractor with a fire hose at the completion of roof work. Facilities Operations will provide the hose and the test must be done in the presence of Facilities Operations personnel.

6. Screens must protect the tops of all downspouts.

7. A cast iron boot should be used as a transition from the metal downspout to the underground storm water piping system to prevent damage to the exposed downspout. The boot should be constructed with an integral cleanout and brass screw-on cover for ease in rodding the underground portion of the drain pipe. The cast iron boot must match the size and shape of the downspout. (See diagram below.)



07901. SEALANTS

Updated: December 23, 2014

1. The University prefers silicone joint sealants for continuous weatherproof and airtight results throughout the building envelope.

    1.1 Provide one-part, non-sag, neutral-cure, medium modulus, UV-resistant, high-performance silicone sealant for glazing and general weathersealing applications.

    1.2 Provide one-part, non-sag, neutral-cure, low-modulus/ultra-low-modulus, UV-resistant, high-performance silicone sealant for high-movement expansion and control joints.

2. Provide acoustical sealant for applications consistent with the materials and conditions required to meet the design criteria for the project.

3. Provide cylindrical sealant backings, bond-breaker tape, masking tape, primers and wall coatings compatible with sealant manufacturer's current written instructions for optimum sealant performance.

4. Provide traffic grade sealants for exterior on-grade surfaces and elevated structures appropriate to the specific application.

5. The Designer should include field-adhesion testing in the construction documents to ensure proper quality control of sealant installations.

6. All sealants used on the interior and exterior of the building must comply with the VOC requirements of South Coast Air Quality Management District Rule 1168.

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 the following: djfried2@uncg.edu

08100. DOORS

Updated: January 29, 2024

Early in the Design Development phase, the Designer will initiate the scheduling of a meeting with the University Locksmith, end user group and FDC Project Manager to review and discuss the hardware needs of the project including automatic doors, access controls, card readers, etc. Additional meetings may be necessary during or after the DD and CD review periods. The Designer will keep and produce all meeting minutes and will provide copies to all meeting attendees.

1. GENERAL INFORMATION

1.1. Public usage doors shall have a minimum width of 3'0".

1.2. Exterior doors shall be preferably aluminum or steel. Wood is acceptable if plastic faced, paint grade.

1.3. Narrow-stile doors will not be accepted; stile width shall be 3-1/2" minimum. Stile width may be greater than 3-1/2" to accommodate specified hardware.

1.4. Specifications shall clearly call for proper inserts to receive hardware (both wood and metal doors), provide for adequate reinforcing, and indicate gauge of door skin, inserts and reinforcing.

1.5. Inserts for steel doors shall be 3/16" minimum thickness. For aluminum doors, inserts shall be 1/4" minimum thickness.

1.6. Inserts shall be securely anchored in place and tapped to receive hardware. No loose inaccessible nuts will be permitted.

1.7. Where through-bolts are used to attach hardware to metal doors, spacer sleeves in doors shall be provided to prevent collapse of the door.

1.8. Doors shall have a minimum height of 6'-8".

1.9. Steel doors and frames shall be minimum 16-gauge thickness provided with a 3/16" reinforcing channel welded into place behind the hinge straps. Tap all mounting screws through the reinforcing channel.

1.10. Provide 1/8" steel reinforcing for all other mortised and surface mounted hardware.

1.11. All doors shall be certified to have asbestos free cores.

1.12. Designer shall consult with the FDC Project Manager, UNCG Lock Shop, and Architectural Hardware Consultant (AHC) to determine the appropriate level of weather protection for all exterior openings, including but not limited to door sweeps and weather stripping.

1.13. Provide ADA accessible automatic door operators (electronically operated) on at least one main entrance to each major University building to allow disabled people greater access beyond that required by building codes.

1.14. There shall also be at least one set of automatic door operators (electronically operated) or an "airport entry" (no doors) on a set of toilets (men/women) on the main or most used accessible floor of the building. All other interior doors are to be set to operate at or below a 5 pound push/pull pressure.

1.15. Provide electronic security controls on main entrance to each major University building for allowing authorized access to buildings after hours.

Hardware for steel and aluminum entrance doors shall be specified in detail, and this hardware shall be included in regular finish hardware schedule as material to be furnished by the finish hardware supplier and not by the door manufacturer. Hardware attached to metal doors shall be attached with through-bolts having spacer sleeves to be backed up by inserts of sufficient weight and thickness to insure permanent fastening with conventional screws.

Heavy duty mortise locksets with dead latches are required. Minimum throw of latch shall be 3/4". Inside trim shall include a turn knob to permit egress when door is locked. Additional dead bolts are not acceptable except in special cases such as stores, snack bars, etc.

Where panic devices are required, outside trim shall be pull and cylinder (no movable knob or handle) with cylinder dogging inside. Rim type panic devices are required. **Vertical rod hardware is not acceptable.**

Closing of entrance doors shall be by a closer of adequate size and not exposed to the weather. Closer shall be mounted in a standard arm position or in a parallel arm position. Surface mounted overhead closers are preferred. The use of floor closers is prohibited. Closer shall have a back check feature.

Butt mounting is preferred. Where pivots are required, intermediate pivots shall be provided.

Pulls on exterior doors shall be of a design that will not create a lever action at the point of

attachment to door.

2. STAIR DOORS

2.1 Stair doors to the outside shall have panic devices.

2.2 Stair doors to the inside of the building shall have closers, latches and stops. Latches shall be activated by panic devices equipped with rim type panic devices.

2.3 Stair doors opening onto roofs or into mechanical penthouses shall be equipped with a self locking lockset having free knob on the roof or mechanical area side with access by key only. Doors shall be equipped with closers. In the case of doors opening onto roofs, closer shall be mounted out of the weather.

3. ROOF ACCESS DOORS

Roof access doors from areas other than stairs shall be equipped in the same manner as those from stairs.

4. DOORS TO MECHANICAL, CUSTODIAN, TRANSFORMER AND ELEVATOR MACHINE ROOMS

Doors to these rooms shall have self-locking locks with lever handles on the inside with access by key only. Elevator machine room and transformer vault doors shall be equipped with door closers. Exterior mechanical room doors shall have closers. Unless required by code door closers shall not be installed at Custodian rooms. Refer to Section 17 of this guideline which pertains to hardware on doors to hazardous areas.

5. ELECTRICAL ROOMS

All electrical rooms with equipment rated 1200 amperes or more that contain overcurrent devices, switching devices or control devices shall have minimum 36” x 80” doors at each end of the working space. Each door shall open in the direction of egress and be equipped with panic devices.

6. TELECOMMUNICATION ROOMS

All telecommunication rooms shall be equipped with Transact electronic access, electronic locks with proximity card readers. Refer to Guideline Section 16722, Electronic Door Access & Monitoring, for additional related information.

7. CORRIDOR DOORS

Corridor doors which are required to be fire doors or smoke doors must be equipped with magnetic hold-open devices. It is preferred that doors be so equipped when doors will be

frequently used and subject to the abuse of heavy traffic.

8. DOUBLE DOORS

Double doors to individual rooms shall have keyed, removable mullions, manual flush bolts on the inactive side, mortise lock on the active side and shall be paired LH and RH.

9. DOOR SIGNS

Door signs and numbers shall be provided by the appropriate construction contract. Signs and numbers shall not be attached to the door. All signage to be ADA and UNCG sign guidelines compliant. See UNCG Way Finding for signage guidelines.

10. DOOR NUMBERS

Door numbers shall be assigned in the door schedule and shall be coordinated with the floor level and room numbers to which they open. Include doors to all spaces: service closets, electrical and mechanical spaces, bathrooms, etc.

11. FRAMES

Interior door frames shall be hollow metal shop primed and field painted. Knock-down frames are acceptable only on renovations provided all joints are mitered, welded and ground smooth.

Exterior frames shall be hollow metal, shop primed and field painted, or storefront aluminum.

Door frames shall be reinforced with a 3/16" welded channel behind the hinge straps to receive hardware.

Dry storage shall be provided for doors and frames. If frames are open on the job site, they shall be raised above the ground, wrapped in a weather tight plastic film and covered with canvas. Covering shall be tied down to prevent its being blown off. Steel doors shall not be delivered until they can be placed in a dry area.

12. PAINTING
Updated: December 23, 2014

1. Before finish paint is applied to doors and frames, all abraded areas shall be thoroughly sanded and re-primed.

2. Paints and coatings used on the interior of the building shall not exceed the VOC content limits established in the South Coast Air Quality Management District Rule 1113.

08300. DOOR HARDWARE

Updated: January 25, 2022

1. GENERAL

The architect shall furnish with his final working drawings and specifications when submitting for review, a folio containing manufacturer's cut sheets and other descriptive data describing in detail all hardware items specified to be furnished. This package will be reviewed by the University locksmith.

During construction when receiving shop drawings the architect shall obtain from the Contractor and furnish with the hardware submittal, a second folio containing cut sheets and other descriptive data describing in detail all hardware items which the Contractor proposes to furnish. **All drawings, submittals, cut sheets, etc. shall be reviewed and approved by the University locksmith prior to approval.**

In summary, all submittals regarding hardware items shall be accompanied by manufacturer's cut sheets, descriptive data, etc.

The Contractor shall provide competent craftsmen skilled in the installation of hardware. Each workman shall demonstrate his proficiency by installing hardware on one door. This door will be inspected and approved by the architect and the University locksmith before further hardware installation continues.

Specifications shall require that the hardware supplier have available locally a qualified hardware consultant who shall be available to the Contractor and the architect so that consultation and installation problems can be promptly handled. Minimum job site visitation by the hardware consultant shall include one visit during installation and one visit after hardware is installed. The requirement is not intended to shift the responsibility of inspection of the work away from the architect or to relieve the Contractor of the responsibility of providing competent craftsmen and making proper installation of the hardware.

2. RENOVATIONS TO EXISTING ENTRANCE AND HIGH TRAFFIC DOORS

2.1. Provide complete new hardware set including ball bearing hinges.

2.2. Replace door and frame if it does not provide sound mounting for new hardware.

2.3. All exterior doors will be capped and finished to match the door finish.

3. SPARE HARDWARE

Provide spare hardware items (locksets, cylinders, exit alarms and devices) with the job. Items and quantities for each job shall be determined by consultation with the University

locksmith and according to the hardware schedule. A Minimum of two of each hardware items shall be provided or five percent whichever is greater, and they shall also be listed in the hardware schedule.

4. LOCKSETS, TRIM

Heavy duty builder's hardware mortise locksets will be acceptable. All locksets shall be Corbin Russwin to match the University standard. Mortising for locksets shall be neat and accurate. The mortised slot shall be neither too loose nor too tight. Screws shall be installed in properly sized pilot holes. Screws shall not be driven with a hammer nor spun out with power screw driver.

Hardware shall be tightly mounted, properly fitted and correctly aligned.

The lock function on all locksets shall permit the lever on the side opposite the lock cylinder to be free to operate the latch.

4.1. Corbin Russwin mortise type locksets (2000 series) with through bolted roses shall be specified as follows:

4.1.1. ML2057 storeroom function for mechanical rooms, electrical rooms, telephone cable rooms, custodial closets and storerooms.

4.1.2. ML2051 entry functions for offices and conference rooms.

4.1.3. ML2065 function for dorm rooms and areas needing deadbolt security.

4.1.4. ML2065 with M19N thumb turn - entrance function with indicator for classrooms. All classrooms are defined as classrooms schedule by the registrar’s office or rooms.

4.2 Trim to match existing styles in use.

4.3 Finish US26D or US32D where appropriate. US10 may be substituted on renovations to better coordinate with existing hardware.

5. CLOSERS

Closers without hold-open feature shall be provided. If necessary to hold door open, other means shall be provided.

Overhead door closers shall be mounted with through-bolts where attached to the door. Solid blocking reinforcement shall be provided in the door jamb for attachment of closer or closer arm. Mounting of the closer may be on the door, inverted on frame, or if parallel arm position is used, care shall be taken to specify a closer of adequate size. Semi-concealed and

floor closers are not acceptable.

Closers shall be prevented from hitting walls or other surfaces when doors are opened to full swing. Minimum full swing shall be 90 degrees.

5.1. No track arms are permitted.

5.2. Finish - SBL; DBL may be used on renovations to coordinate with existing hardware.

5.3. Mounting - Wood screws in solid wood blocks; machine screws tapped into 1/8" thick reinforcing plate; sexnuts, bolts and reinforcing plate when mounted over mineral core.

6. PUSH/PULLS

Push/pull finishes shall match other hardware used.

7. MUTES (SILENCERS)

All frames shall be provided with silencers or mutes (minimum 3 per door).

8. THRESHOLDS

Thresholders shall be provided for all thresholds to be anchored to concrete floors. Expansion shields of any kind will not be acceptable. Thresholds shall be caulked for waterproofing and to deaden sound. Fully secured anchors shall be installed at each recess provided. Dummy blanks will not be used.

9. STOPS

Overhead stops or "Cush" arms on closers are not permitted. Knob bumpers mounted on dry wall construction must be backed up by a stud or intermediate reinforcement.

Floor stops shall be positioned a proper distance from the hinged edge of the door. Stops shall be located 2/3 the width of the door from the hinged edge and never less than 1/2 the width of the door.

Doors may be held open by means of magnetic holders or, select hold-open features on door closers. See other specific requirements regarding entrance doors and corridor doors.

10. CYLINDERS, CORES, KEYS

10.1. All locks shall be great grand master keyed to the existing UNCG Corbin key system only after review and approval by the University Locksmith. A factory

bitting list shall be provided documenting keying used on project including **50** spare key changes per master. All exterior and exit device cylinders shall be Corbin removable core.

10.2. All Keys shall be 12 Bow and VKCO from factory.

10.3. All permanent cylinders will be delivered to and installed by the University Locksmith when the project is completed and turned over to the University.

10.4. Provide two plain bow keys factory stamped "DO NOT DUPLICATE" per cylinder (VKC0).

10.5. Specific keying requirements to be determined and checked by the University locksmith.

10.6. All permanent lock, thermostat, paper towel dispenser, displays, elevator, etc. keys will be delivered directly to the University Locksmith by the manufacturer.

10.7. Provide a minimum of 200 ”12” bow, manufacturer's original key blanks in each key section used on the job.

10.8. All permanent cylinders and keys will be delivered to and installed by the University Locksmith.

11. EXIT DEVICES, FIRE DEVICES

Panic devices shall be installed where required by code.

11.1. Exit devices to be rim type device and provide optional built in exit alarm feature. All exit devices, alarmed and standard, to be the same model: Von Duprin Model 99 or Model 33.

11.2. Use key removable mullions on pairs of doors.

11.3. No vertical rod devices unless specifically required by code, i.e. oversize doors.

11.4. Pull side trim - latching fire doors (stairs, corridors) lever handle - no key cylinder.

11.5. Pull side trim - locking doors - NL (key and pull) or DT (pull only) function only - only one NL function per pair, set or bank of doors.

11.6. Finish matching US26D - i.e. US28XUS32D. US10ANXUS10 may be used on renovations to coordinate with existing hardware.

11.7. Use cylinder dogging where dogging is required.

12. FLUSH BOLTS

Where flush bolts are required, dust-proof strikes shall be provided for the foot bolts. Automatic flush bolts are not acceptable unless approved by University locksmith.

13. HINGES

All doors shall have a minimum of three hinges, except those wider than 3'0" shall have four hinges. Doors wider than 3'0" or which have closers shall have ball bearing joints. **Continuous hinges are not acceptable.**

14. LOCKS FOR YARD HYDRANT CABINETS

Slot-type locks that are operable with a screw driver shall be provided whenever possible. Key locks in walkway cabinets are not acceptable.

15. BUTTS

15.1. All exterior butt hinges to be non-removable pin ball bearing.

15.2. Finish US26D.

16. AUTOMATIC OPERATORS

Automatic Door Operators (electronically operated) are required on ADA entrances and bathrooms. The University prefers LCN 4820 Series operators.

17. DOORS TO HAZARDOUS AREAS

17.1. Doors that lead to areas that may prove dangerous to visually impaired persons (e.g. doors leading to loading docks or platforms, mechanical rooms, electrical rooms, etc.) shall be made readily identifiable to the touch by a textured surface on the door handle, knob, pull or other operating hardware device.

17.2. Textured surfaces may be made by knurling, roughing or by applying an abrasive surface to the door operating hardware.

18. SECURITY ACCESS

18.1. The University uses the Blackboard Transact One-Card Access Control System to provide and monitor access into buildings from the exterior and some interior spaces as defined in Section 16722. A. The Designer shall 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 shall be included in the project as a Preferred Brand Alternate and as one of the three manufacturers in the base bid.

18.2. The Designer shall refer to Section 16000 for additional information and to coordinate electrical issues for this work. The specifications shall include shop drawings for the security hardware installation and coordination with standard hardware prior to door frame approval. The needs of the security hardware equipment shall be reflected and specifically noted on the door frame submittal.

18.3. The Designer shall require a pre-installation conference with all Contractors involved with this work including the Designer and FDC project manager soon after the Notice to Proceed.

19. KNOX BOXES
Updated: April 24, 2013

The University does not use knox boxes for emergency access into buildings. The University Police are first responders to any emergency and will provide whatever access is required.

20. CABINET LOCKS FOR CASEWORK
Updated: March 17, 2021

The preferred brand for cabinet locks for casework is Olympus Locks, Inc., National Keyway.

08700. WINDOWS

1. GENERAL

Energy conservation shall be given prime consideration when incorporating fenestration into building design.

Window materials and glazed areas shall be compatible with design objectives of each project. Aluminum window systems shall be provided with an anodized finish or a "Duranar" (or fluoropolymer finish). Stools shall be metal, masonry, natural stone, or cast stone.

Provision shall be made to allow for exterior cleaning of all windows with minimum inconvenience and hazard; e.g., double hung windows or windows which open into building. (Removable sash features have not proven satisfactory.)

2. PLATE GLASS

Glass shall be 1/4" minimum thickness, clear, polished plate. Glass of 1/8" thickness will not be accepted.

3. TEMPERED GLASS OR SAFETY GLASS

Where tempered glass is used, glazing stops which will cover the mill marks in the glass shall be provided.

All doors with full glazing and any exit or entrance doors with over six square feet of glass shall be glazed with fully-tempered glass which passed the test requirements of USAS Z 97.1 - 1966.

4. INSULATING GLASS

Low-e, clear, insulating glass is generally preferred to conserve energy. All insulating glass used shall be vacuum sealed to prevent condensation between the two glass layers.

5. WIRE GLASS

Wire glass which is specified to have Underwriter's Laboratories, Inc. approval shall have the label left on the glass. The Owner will remove the labels after acceptance of the building.

Wire glass shall have wire strands which run diagonally at 45 degrees to the floor.

6. SCREENS

6.1. Insect screens shall be included on all operable windows for residence halls.

6.2. Security screens shall be provided on all first floor windows of residence halls.

7. WINDOW REPLACEMENT AND/OR RESTORATION PROJECTS

Clearly delineate in the scope of work what parts of existing windows are to be replaced and/or restored. Clearly identify accessories such as curtains and blinds that are included in the project. If existing weights are reused, use nylon (as opposed to cotton) sash cord to carry the weights.

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09001. GENERAL

Updated: February 9, 2017

The Designer shall consider specifying low or no VOC products for interior finishes, where appropriate and economically feasible. All adhesives, sealants, paints and coatings used on the interior and exterior of buildings must comply with the VOC limits established in the South Coast Air Quality Management District Rules 1113 and 1168.

Maintenance stock for each color, type, pattern, etc. of the following materials (and others as appropriate) shall be provided in full unopened boxes. Each is to be packaged, protected, identified and stored by the Contractor at a location within the building to be indicated in the specifications. A check list will be provided by the Contractor indicating all maintenance stock items and signed by the Contractor, Construction Project Manager and Facilities Operations Buildings Manager or designee. A copy of the check list will also be included in the project closeout documentation.

1. Carpet – 10 square yards
2. Ceiling Tile – 4 boxes
3. Wall Covering – 1 full roll
4. Tile (floor, wall, etc.) – 1 box for each
5. Any special order items as requested in the design documents.
6. No other material is to be left by the Contractor other than what is specified.

09002. COLORS

Updated: February 9, 2017

Color presentation boards will be developed by the Designer and presented to FDC and the end user for approval twice during the course of the project: once for approval of the basic design, as part of the Design Development Phase; and once during the Construction Phase using the actual color and material submittals provided by the Contractor. For the construction color boards, the Designer will select color and material samples based on the original, approved color and material boards. The Designer will include in the specifications and as part of the pre-construction meeting agenda direction to the General Contractor to provide all color and material samples as soon as possible following the start of construction. The color board presentations will be arranged by the FDC

Design and Construction Project Managers, respectively.

In an effort to make the submittals consistent, UNCG has prepared the following requirements for all color board submittals by the Designer. These color boards will be submitted twice, once during the Design Phase and again during the Construction Phase. The requirements for each submission are the same and are as follows:

1. The background board color is to be a neutral gray.

2. Colors or materials that will be next to each other in the building shall be placed adjacent to one another on the board with no gap in between. This may require some creative placement on the board which is OK. Use your creativity!

3. Colors and/or samples should be of a representative or proportional size to indicate the overall feeling of the space – (i.e. do not have a smaller wall sample next to a large rubber base sample). Pictures or other representations of the overall floor pattern should be shown along with actual samples.

4. Have a color board or portion of a board dedicated to each "major" space in the building. If you have 20 classrooms or offices that are all similar in size and function, one representative board will suffice for all of them. However, each space that has a different purpose or special condition needs to have its own board.

5. The front of the boards should include a label with the project name and should identify the "major" space being presented. A separate sheet of paper may be passed around to the viewers as a key to understanding the boards when viewed at a distance.

6. It is recommended that samples be attached with Velcro for ease in changing or viewing adjacent samples.

7. Some standard colors used by the University are as follows:

    a) UNCG official colors - gold (Pantone Matching System (PMS) 116), navy (PMS 281) and white
    b) Exterior signage - terra cotta (Munsell Palette 7.5R 3/6) background. Matte Finish.
    c) Interior signage - white letters on warm gray (PMS 404) or cool gray (PMS 421)
    d) Exterior equipment and fixtures such as posts, bicycle racks, railings and bollards - Benjamin Moore Black Walnut #13361
    e) Mechanical room color codes

e.1) Piping Updated: February 9, 2017

In all cases, piping labels will be color coded and clearly marked with words describing the material in the pipe and direction of flow as follows:

- Chilled Water – Aqua (Green)
- City Water (domestic) – Blue (Green)
- Communications– Orange
- Compressed Air - Blue
- Condensate – Brown
- Fire Protection – Red
- Hot water (Non-potable) – Dark Blue (Green)
- Natural Gas or Fuel Oil – Yellow
- Sewer and drain – Green
- Steam, High Pressure – Yellow-Orange
- Steam, Low Pressure – Yellow

Stencil labels may be required when many pipes of the same general character must be differentiated from one another such as steam pipes of various pressures. Coded banding systems without lettering to differentiate pipes from one another may not be used. Standard pipe labels may be used and where different, the color in parentheses may be used.

e.2) Other mechanical room surfaces

- Ceilings & Walls - white
- Floors, gratings and platforms - gray
- Hand rails - safety yellow

Other colors may be more appropriate to the specific location or be governed by OSHA standards and each situation shall be considered individually. Stencil labels are also required where color blindness or poor lighting conditions render color coding ineffective. Fluid flow direction may be indicated by piping label or arrows painted on the piping.

e.3) Valve Covers

Valve access covers or access points will be color coded in accordance with the color code above.

09100. STUCCO

Stucco use should be avoided at ground level where it may be easily damaged. Stucco used in locations such as soffits shall be glass-fiber reinforced type.

09500. ACOUSTICAL TREATMENT

Noise control as measured by decibel reduction through partitions and floors shall be thoroughly reviewed during the design.

09510. ACOUSTICAL CEILINGS

Updated: December 23, 2014

Acoustical ceiling tile shall not be installed until work above ceilings has been completed and temperature and humidity will be maintained as indicated for final occupancy. Two by two grid configurations are preferred. Tile selection shall be based on standard types by national suppliers and costs of maintenance and replacement must be considered in the selection. Concealed grid systems, such as tee-and-spline systems, which are not accessible, are not acceptable. Access to all utilities shall be provided to the fullest extent possible regardless of the ceiling type used.

Mineral fiber and fiberglass ceiling tiles are 100% recyclable and should be recycled on each renovation project where feasible. All new ceiling tile should be specified to meet the specific attributes required for the project, including the consideration for high recycled content.

09700. FLOORING

Updated: December 23, 2014

The following flooring materials are preferred at the locations indicated:

1. High traffic areas such as lobbies and corridors - high wear resistant material such as ceramic tile or terrazzo. Consider the use of other durable, rapidly renewing materials in appropriate locations.
2. General purpose rooms - vinyl composition tile. Consider substituting bio-based tile in appropriate locations.
3. Offices, conference, auditorium aisles (with permanent seating), teacher lounges, music or language listening rooms – carpet. Preference is for carpet tiles to ease the cost of replacing damaged sections. Designer to consider the recycled content and recyclability when specifying these products.
4. Bathrooms and showers - ceramic tile
5. Food service areas - quarry tile or antibacterial cement
6. Laboratories - monolithic systems with no seams or cracks
7. Mechanical, storage and custodial rooms - sealed concrete with steel trowel finish

(See Section 1900.2.7 for mechanical room floors above occupied areas)

8. Computer rooms - raised removable panels supported on interconnecting grids and pedestals providing an under-floor plenum for air distribution and utilities (where the extra utilities access needed for these rooms is not provided some other way)

Address all transitions between flooring materials, especially carpet to resilient flooring, with detailed designs, thresholds, or resilient nosing accessories. All transition elements must meet ADA requirements for wheeled traffic.

Base boards should generally be rubber (except in wet or high humidity areas), set on top of the flooring, with pre-molded inside and outside corners.

09900. PAINTING

Standard paint finishes preferred by the University are:

1. Walls - eggshell
2. Doors - gloss
3. Door and Window Trim - gloss
4. Ceilings - flat
5. Mechanical Room Walls - epoxy paint on block
6. Mechanical Room Floors - multi-coat sealer adequate for wear and dust protection on concrete
7. Mechanical Room Equipment - Glidden Glid-Guard Alkyd Gloss Enamel #4500 or equal (except boilers and burners - Glidden Glid-Guard Silicon-Alkyd Enamel #5539 or equal)

Items especially noted to be painted:

1. Paint grade woodwork should be painted, not stained.
2. Visible surfaces on interior of ducts behind louvers, diffusers, registers and grills shall be primed and painted (typically flat black enamel).
3. Painting of all insulated piping shall be clearly put in the general construction specifications since this contract contains the majority of painting. Colors are noted in 09002.

Items typically not to be painted:

1. Ducts, conduit and mechanical equipment where concealed from view and not susceptible to rusting.
2. Items completely finished at the factory.
3. Stainless steel, aluminum, copper and other non-ferrous metals.
4. Prefinished millwork and casework.
5. Acoustical tile and grid system.

09950. WALL COVERING

The following wall covering materials are preferred at the locations indicated:

1. High traffic areas such as corridors and stairwells - enamel paint
2. Bathrooms and showers - ceramic tile
3. Food service areas - quarry tile

When special wall finishes are used, the University shall be provided with maintenance instructions.

Use of vinyl wall covering is discouraged and must be limited to specially approved areas.

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10160. TOILET AND SHOWER PARTITIONS

Solid (homogenous color, not coated or laminated) plastic toilet and shower partitions are preferred over other materials such as steel or laminates and should be hung from the ceiling where possible. Provide heavy duty stainless steel trim and hardware with self closing door hinges. Latches that do not depend on precision alignment of door and wall to operate are preferred.

10400. ROOM NUMBERING CONVENTIONS

The Designer is responsible for incorporating into the design the following signage and graphics: room identification, directories, directional signage, exterior building identification and parking regulation signage. All should be handled in accordance with the University's Signage Program, a copy of which is available from FDC Design Project Manager. The Designer is responsible for developing compatible graphics for any required applications not addressed by the Signage Program, including a directory map, if needed. The Designer shall indicate locations for emergency egress route plans and occupant load signs (for assembly spaces greater than 49 persons) that will be produced and installed by the University's Facilities Operations Department. The Designer shall provide floor plans in CAD format that can be used to produce 8 1/2" x 11" emergency plans.

Numbering: All spaces shall have assigned numbers as designated by the Office of Space Management. It is desirable that the construction numbering system be retained throughout the life of the facility. The Designer therefore is to submit a numbering system no later than the design development stage. FDC will provide OSM with a working copy of the drawings at or before the Schematic Design (SD) review to apply UNCG room numbering protocol. OSM will also be involved in the final drawing review before going out to bid. For minor remodeling projects, the project manager will request room numbers from OSM during the design phase. Following are general guides for space numbering in all buildings.

1. Room numbers shall be 3 to 4 numerical digits with optional alpha suffixes and prefixed with the floor level number. For example, "201" for second floor rooms, or "415J" for rooms on the fourth floor. The level using the number 1 as its first digit shall be the primary level entered at grade. In below grade levels, room numbers should begin with 0. Avoid floor names that may project a negative image such as "Basement or Sub-Basement". Some buildings may have floors with a significant number of rooms. In that case, four numerical digits with an optional alpha code should be used. The first digit will identify the floor, the second digit will identify the section of the building and the last two will identify the room. For example "2301" for second floor rooms, or "2301A".

2. Numbers “100” or “200,” etc. will be reserved for numbering corridors; therefore, room numbers will begin with “101,” “102,” etc., and shall move around the floor in a logical fashion. For example, corridors on the third floor might be 300A, 300B, 300C, 300D. Consistency of corridor numbers from floor to floor is desirable and shall be maintained if at all possible.

3. Staircases shall be uniquely numbered. Staircase numbers shall maintain consistency from floor to floor. For example, first floor staircase is “ST1-1”, at second floor it is “ST1-2”. A sign must be installed on each floor for each staircase.

4. Elevators shall be uniquely numbered and maintain consistency from floor to floor. For example first floor elevator is EL1-1, at second floor it is EL1-2.

5. Room numbers will begin at the main entrance and are to follow a simple, logical sequence which takes into account building circulation patterns. Room numbers should flow in ascending order from one end to another in buildings with one primary dividing corridor, with odd numbered rooms on one side (generally left/west/north) and even on the other (generally right/east/south). Room numbers should follow in ascending order in a clockwise direction from the main entrance in buildings with circular or more complex corridor systems. Some buildings may have floors with too many significant rooms to be numbered. In that case, four numerical digits with an optional alpha code should be used. For example, “2001” or “2001A” for second floor rooms.

6. Rooms with modular partitions (cubicles) are to be assigned one room number. Cubicles and partitions within will be assigned an alpha suffix following standard room numbering protocol. For examples: 215 is the suite number with cubicles numbered 215A, 215B, etc.

7. Begin room numbers with a digit or character designating the floor level. Do not use decimals or fractions to designate intermediate levels. Non-numeric floor level codes shall follow the alpha list below where appropriate and may, in some cases need to add a digit as well. For example, a building with a mezzanine may have level “M”. A building with two mezzanine levels may have floors “M1” and “M2”.

C	CONCOURSE	Concourse Level
M	MEZZANINE	Partial Floor Above Base Floor Plan

8. Make the room numbering sequence flexible to allow for expansion or renovation. Several room numbers shall be reserved or skipped for large spaces to allow for future additions or division. When adding to buildings, do not duplicate numbers in the original building.

9. Room numbers across hallways should be sequential.

10. Combinations of letters and numbers shall be used to identify dependant spaces, such as closets. Combinations of a letter and numbers may also be used to identify rooms in a

suite. For example, a storage closet entered from room "312" can be numbered as "312A". Avoid I, O and Q, which may be interpreted as numbers.

11. Make the room numbering system as consistent as possible from floor to floor. Rooms on different floors with the same digits in the last 2 positions shall be located in about the same plan location in the building as long as this does not create other inconsistencies or major difficulties.

10800. TOILET & BATH ACCESSORIES

Updated: March 27, 2018

1. Toilet and bath accessories shall be selected and specified on the basis of prevention of communicable diseases. Individuals shall not have to touch anything after they have washed their hands. The Designer shall schedule a meeting to consult with the FDC Design Project Manager for project-specific questions and situations.

2. The University will furnish automatic paper towel dispensers to be installed by the Contractor at locations described in the contract documents.

3. The University will furnish automatic hand-soap dispensers to be installed by the Contractor at locations described in the contract documents.

4. Toilet tissue holders shall be jumbo roll, dual dispensing system equipped to hold two rolls of 9' toilet tissue and furnished with locked covers and theft resistant spindles. The typical dispenser is the Vondrehle jumbo roll dispenser model #3253 color: smoke.

5. Provide coat hooks inside toilet partitions.

6. Provide a 12" wide shelf in all toilet rooms to accommodate books and bookbags. The length of the shelf shall be proportionate to the length of the lavatory countertop.

7. A minimum of one waste receptacle with a minimum 18 gallon capacity shall be provided for every two lavatories. Capacity and number of receptacles shall be appropriate to the number of fixtures and building type. Locate receptacles adjacent to the exit of each toilet room. Receptacles shall not use flaps or doors to control deposit of waste. Women's restroom stalls shall include sanitary napkin receptacles.

8. Provide battery powered, sensor activated controls for faucets on lavatories. Provide battery powered, sensor activated flush valves for water closets and urinals.

9. Provide a mirror above each lavatory or one continuous mirror above multiple lavatories.

10. The entrance to toilets on the main floor shall try to be designed to avoid installation of doors (similar to airport-style toilets). If airport-style toilets are not practical, use automatic openers on doors with sufficient space for the door to swing out without causing a safety

hazard, (i.e. in a protected area not in the general line of traffic in a hallway).

10900. WARDROBE SPECIALTIES

Coat and hat racks or hooks, installed in a manner not be hazardous to pedestrians, are required in classroom and office buildings.

10910. FIRE EXTINGUISHERS

All facilities shall be provided with 10 lb. nominal charge, ABC multi-purpose dry chemical portable fire extinguishers along with other types and sizes as required. Extinguishers in public areas should be mounted in recessed or semi-recessed cabinets capable of holding the extinguisher without the use of hooks or brackets. Locked cabinets with means of emergency access (striker, etc.) should be provided in areas especially susceptible to malicious use. Hooks (where cabinets are not used) for extinguishers should extend 2 1/2" from the wall with the turned up portion at the end 3/8" wide and ½" tall (all dimensions + 1/8"). Any hooks used must be designed for the extinguisher they are provided with. All portable extinguishers should be in visible locations and free from obstructions. Signage shall be provided to indicate the extinguisher location where visual obstructions cannot be avoided.

10920. BIKE RACKS

1. Designer shall review Campus Bike Rack Master Plan. Bike racks should be furnished at each major facility and shall be installed in a convenient, accessible and safe manner. Racks should not interfere with pedestrians or other site furnishings. Racks should be placed near the building entrance without causing conflicts with the path of pedestrian egress.

2. "Individual" racks shall be hot dipped galvanized, 2.375" OD, 36" high inverted "U" shape, ASTM schedule 40 steel pipe, with black thermoplastic coating installed on concrete pads. Depending on the project, hot dipped galvanized may be the final finish. Install individual racks by core drilling new concrete pads. For existing concrete surfaces, furnish racks with integral base plates and install with stainless steel anchor bolts. Multiple racks should be installed to allow at least 30" minimum spacing between racks and 36" minimum clearance from adjoining structures or other vertical surfaces. (Acceptable manufacturers include Huntco Supply, Portland OR; DERO, Minneapolis MN; Madrax of Trilary, Middleton WI; SARIS, Mdison, WI; or approved equal).

3. "Stadium" racks shall be fabricated of similar materials as the individual racks noted above, except the inverted U shapes shall be pre-fabricated on two channel bases in sizes to hold two to sixteen bicycles. Install stadium racks with stainless steel anchor bolts and washers on existing concrete surfaces through pre-drilled holes in the channel bases.

10930. TRASH AND RECYCLING CANS
Updated 7/8/13 (moved from Guideline #02760 SITE FURNISHINGS)

The design of all facilities will include provisions for exterior trash and recycling receptacles. The designer will consult with the FDC Design Project Manager in determining the number and location of trash receptacles for each project. Receptacles shall be placed in pairs, one for trash and one for recyclable waste. Typically each trash/recycling station will consist of a 4" thick concrete pad sized to accommodate two identical round ornamental metal containers, each holding a 36-gallon receptacle. Where exterior trash/recycling receptacles are to be included as part of a project, their location shall be shown on the construction drawings and included in the project specifications by the designer.

1. Trash cans – shall be side door opening 36 gallon litter receptacles, Victor Stanley, Inc. (VS) raised dome lid type S-2, latching side door, and non-locking latch. Color shall be the manufacturers standard VS Tavern Square Green. Include a 2 ¼" high steel band label around the can with a clear background and white lettering "Trash Only." All shall match existing receptacles currently used on campus. Provide a 36-Gallon High-Density plastic liner sitting on a protective, rodent–resistant 1/8" thick steel plate cover.

2. Recycling cans – shall be side door opening 36 gallon litter receptacles, Victor Stanley, Inc. (VS) raised dome lid type S-2, latching side door, and non-locking latch. Specify plaques with lettering "Recycle," plaque size 16 3/8" x 6", max label size 13" x 5". Plaque should be white, lettering should be Navy Blue. Specify decal labels for lid label with lettering "Recycle" on top label, 2 recycling symbols on the side labels and "Comingled" on the bottom label. White background with navy lettering. Color shall be the manufacturers standard VS Tavern Square Green. All shall match existing receptacles currently used on campus. Provide a 36-Gallon High-Density plastic liner sitting on a protective, rodent-resistant 1/8" thick steel plate cover.

10940. EXTERIOR BENCHES
Updated 7/8/13 (moved from Guideline #02760 SITE FURNISHINGS)

The design of all facilities will include an evaluation of the need for exterior benches for pedestrian seating. The designer will consult with the FDC Design Project Manager in determining the need for pedestrian seating. If seating is determined to be required the designer will provide recommendations for the number, location, and placement of exterior benches for each project and also recommend whether the benches should be painted metal or wood. Benches shall be placed in convenient locations along major pedestrian pathways (painted metal bench) and in quite, contemplative settings (exterior wood bench) such as pocket parks or garden areas. Typically, benches will be anchored to a concrete pad adjacent to a sidewalk, and positioned so as not to obstruct pedestrian traffic. In some cases benches may be located close to waste and recycling receptacles.

The University typically uses either a wood or painted metal bench, depending on location and design of the exterior space or route. The University standard exterior wood bench is the Meridian

- Teak Wood Bench by “Country Casual.” The University standard painted metal bench is the Victor Stanley Inc., “Steelsites RB Bench” Model RB-28, with powder coat finish, color matching Victor Stanley – “Tavern Square Green.” Both benches are typically 96 inches in length or as appropriate for the location. A proprietary alternate will be included on the project bid form for the selected style of bench to be used.

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11000. GENERAL PROVISIONS

Capital improvement project equipment is in one of two categories:

Fixed (built-in) Equipment is defined as equipment that will become an integral part of the project by the fact that it will require connections with the structural, mechanical, plumbing, electrical or data systems. It is acquired through the construction contracts and is in the project construction budget. This includes such items as shelving, food service equipment, unit kitchens, cabinets, laboratory work benches, fume hoods, landscape furniture/cubicles, and fixed seating. The specifications shall clearly define which Contractors have responsibilities relative to equipment receiving, inventory and installation (including utility hook-ups and testing).

Moveable Equipment is generally defined as equipment that does not have a permanent attachment to the building's systems. Usually, there is a budget for moveable equipment within the total project authorization. This equipment will be purchased by the University directly and is not part of any construction contract. Most of the items will be purchased by the University's Purchasing Department and, therefore, are governed by state purchasing regulations (i.e., competition is required on large or numerous items and a specific brand or model might not be obtained due to the bid process). In some instances, the end user will opt to purchase Moveable Equipment utilitizing a separate Budget Source and the cost for Moveable Equipment may not be included in the total project authorization.

There may be a preliminary list of moveable equipment in the project's program statement and the Designer may be asked to help develop the final moveable equipment list.

It is generally desirable to install the moveable equipment after most of the construction is complete. Some of the equipment may require connections to the project structure or utilities; therefore allowances for connections shall be made in the project design (power, data, water, waste, etc.). Both specifications and drawings shall clearly define who is responsible for receiving, installing and connecting the equipment.

11480. VENDING EQUIPMENT

Vending areas shall be provided at each major facility. FDC will coordinate vending area requirements to be included in the design. Connection requirements of equipment (power, data, water, etc.) shall be provided to the Designer and included in the design. Equipment shall be provided by the University or vending companies having contracts with the University. Requirements for a typical vending area are as follows:

1. Space shall be provided for four (4) individual vending machines, excluding washers and dryers in residential areas.

2. Each vending machine requires a 20amp duplex receptacle fed by an individual 20 amp circuit.

3. All water and electrical/data outlets should be 18 inches above finished floor level.

4. Floor finishes should be hard surface (ceramic tile, etc.).

5. Each vending machine requires a single data outlet, including washers and dryers.

6. Each vending machine requires a minimum width of 42 inches and a minimum depth of 36 inches. There should be an allowance of 2 inches from each end wall and between each machine. There should be an allowance of 4 inches behind each machine.

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12001. GENERAL

Updated: December 23, 2014

The Designer shall consider specifying and selecting furnishings with an emphasis on material life cycle costs, durability, recycled content, recyclability and materials with low emissions for use indoors.

12002. FURNITURE SELECTION

The Designer will assist in the selection and purchase of furnishings for new construction and renovation projects. The Designer, with input from the University End Users and FDC Department, will develop furniture plans and cost estimates for University review at the Design Development and Construction Document submission stages. Selection of furnishings will be based on the needs of the End Users and will be in keeping with the overall project design.

Once the furniture plans and purchasing budget have been approved, the Designer will work with FDC and the University Purchasing Department to develop bid documents for the University Purchasing Department to issue for bidding.

These guidelines are updated periodically, and users are encouraged to check this site as needed for the most current edition. Comments and suggestions concerning improvements to this section of the guidelines may be submitted to the following: djfried2@uncg.edu.

14200. ELEVATORS

Updated: August 17, 2022

1. All multi-story buildings should be equipped with at least one elevator to allow for the movement of physically impaired persons and equipment between floors. The minimum capacity for any elevator shall be 2500 lbs.

2. In multi-story buildings, at least one elevator should serve the penthouse and/or basement mechanical equipment rooms. This elevator should be a service/hospital type.

3. For low-rise buildings, with a maximum travel distance of less than 45 feet, the use of conventional, in-ground hydraulic elevators are preferred. No telescoping hydraulic elevator systems should be used. Hole-less hydraulic elevators may be considered for travel distances less than 15 feet.

4. For buildings where the travel distance exceeds 45 feet, geared traction elevators are preferred. The use of machine room-less (MRL) elevators systems should also be evaluated for these projects.

5. A separate freight elevator should be provided in buildings, or portions of buildings, where movement of large objects, materials or heavy equipment is likely to occur on a regular basis.

6. Design elevator systems that are consistent with the program requirements of the project and fulfill the basic building functions and occupant load. For accessibility concerns in the event of an elevator malfunction, and for the general efficiency of the occupants, two elevators shall be considered for buildings of four stories or more. For added efficiency, a duplex elevator system should be evaluated when multiple elevators will be installed.

7. Elevators for parking structures and other open spaces should be designed in a sheltered area where rain and snow cannot reach the elevator entrances or hoistways.

8. For elevator modernization projects, UNCG recommends the Designer employ the services of an Elevator Consultant.

9. DESIGN CRITERIA

    9.1. Designers should obtain and use the “Elevator Specifications Guides” for hydraulic and traction elevators developed by the North Carolina Department of Labor – Elevator Division to assist them when preparing elevator specifications.

9.2. The major elevator components should be the products of one manufacturer of established reputation, except they may be the products, either wholly or in part, of another manufacturer of established reputation provided such items are engineered and produced under coordinated specifications. It is a requirement that any elevator manufacturer shall have their product approved by the North Carolina Department of Labor – Elevator Bureau, prior to bidding.

9.3. Provide non-proprietary microprocessor-based elevator control systems that are serviceable and maintainable by any qualified maintenance provider. All such systems shall be free from secret codes and decaying circuits that must be periodically reprogrammed by the manufacturer.

9.4. The manufacturer shall furnish, and turn over to the Owner, any and all diagnostic tools and/or instruments, and all software or written operation and instruction manuals needed to use the diagnostic tools for adjusting any and all computer parameters, and/or troubleshooting the equipment provided. These diagnostic tools shall be provided at no additional cost to the Owner.

9.5. The Contractor shall provide the Owner's selected representative(s) with training on the use of the diagnostic tool(s) and operation of the elevator system.

9.6. Auto Lowering

9.6.1. The Controller should include an auto lowering system which, in the event of a power failure, will cause the car to descend to the next lowest level.

9.6.2. In buildings with generator supplied emergency power, auto lowering should be accomplished using an emergency power circuit to operate the elevator auto lowering controls.

9.6.3. In buildings without generator supplied emergency power, auto lowering should be powered from a storage battery.

9.7. Provide all required clearances and allow ample room for servicing, maintaining, and removing equipment without disassembly of the equipment.

9.8. Car Enclosures

9.8.1. Elevator car doors should be protected by infrared screen-type detector/reversal devices at all car door entrances.

9.8.2. Car light fixtures should utilize LED technology and all lighting equipment should be accessible from inside the car enclosure.

9.8.3. Raised, embossed stainless steel panels for rear and side walls of cab are preferred.

9.8.4. Pads and hooks

9.8.4.1. Pads shall be fire-resistant quilted canvas conforming to ASME A17.1.

9.8.4.2. Provide pads for the rear wall, side walls and car front returns with openings for the car operating panels.

9.8.4.3. UNCG prefers protective pad hooks made of brushed finish stainless steel, vandal-resistant type and permanently mounted by the elevator Contractor at the sides, rear, and fronts of the car enclosure.

9.8.4.4. Preferred floor finishes are VCT, LVP, raised design rubber floor tile, and carpet tile.

9.8.5. Car railings shall be stainless steel.

9.9. Hoistway Entrances: UNCG prefers doors and hoistway entrances made of satin finish stainless steel with stainless-steel floor-level numbers on each side.

9.10. Signal, Buttons, and Operating Fixtures: All signal, buttons, and operating fixtures should be vandal resistant stainless steel and all cover plates should be #4 brushed stainless steel.

10. GUARANTEES, SERVICE AND MAINTENANCE

10.1. Warranty: The elevator Contractor shall guarantee the materials and workmanship against defect due to faulty materials or faulty workmanship or negligence for a period of 12 months following the date of final acceptance of the project. Where items of equipment or material carry a manufacturer's warranty for any period, more than 12 months, then the manufacturer's warranty shall apply for that particular piece of equipment of material. Defective materials, equipment or workmanship shall be replaced without additional cost to the Owner within the stipulated guarantee period.

10.2. Maintenance: Starting at the date of final acceptance of the project, the elevator Contractor shall provide an all-inclusive, systematic inspection, preventive maintenance, and repair program for each elevator; including 24-hour emergency callbacks for a period of 12 months concurrent with the project warranty period. The requirements of this maintenance and call-back service shall be equivalent to the provisions of the current campus-wide Full Preventive Maintenance Contract for elevators and dumbwaiters administered by UNCG Facilities Operations.

10.3. Use of Elevator during Construction: The Elevator shall not be used for building construction purposes unless specifically allowed by the Owner.

10.4. If the Contractor is allowed to use the elevator prior to substantial completion of the project, the elevator warranty and service period shall not be compromised and shall begin with the date of acceptance for the entire project as defined in the General Conditions of the Contract.

11. SPECIAL FEATURES

11.1. Emergency Communication System: 2019 A17.1 Elevator Code or most current NCDOL requirement. Use vandal resistant nonproprietary communication operating panel system, wired back to the elevator machine room. UNCG Police monitors the campus elevators. The system must be capable to communicate with UNCG's Emergency Dispatcher Station. The final connection of the system circuit in the controller is to be made by the elevator Contractor and must be coordinated with UNCG. It is the contractor's responsibility to ensure that provided devices communicate with UNCG's system.

11.2. Provide an Independent Service switch, key operated, located in each car operating panel.

11.3. The stop switch in the car must be wired to the alarm bell.

11.4. When a floor lockout key switch is required to limit access to mechanical penthouse or basement floor landing, the car operating panel shall have a factory-installed momentary contact switch capable of receiving a Corbin/Russwin cylinder matching the building lock cylinders and compatible with the University master key system.

11.5. Graphics indicating "In case of fire, do not use elevators, use stairways" are to be integral with, and permanently engraved on, the stainless-steel face plate of the call button station at each floor.

11.6. In addition to any other sets required by the specifications, the Elevator Contractor shall provide one (1) set of full-sized, plastic laminated, as-built wiring diagrams. This set shall be wall mounted in the machine room. The minimum size of the wiring diagrams shall be not less than 17 inches by 21 inches.

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

15001. GENERAL INFORMATION

Updated: December 18, 2014

On July 31, 2013, the University adopted *Getting to Zero: The UNCG Climate Action Plan* (see http://facsustainability.uncg.edu/climate-change/ for more info). The Energy Use Intensity (EUI) represents the energy consumed by a building relative to its size. Current EUI goals for new construction are:

1. Laboratory buildings: 169 kBTU/gsf
2. Residence halls: 68 kBTU/gsf
3. Classroom buildings: 56 kBTU/gsf

15050. BASIC MATERIALS AND METHODS

Updated: December 17, 2021

1. The Designer is referred to Division 1 of these guidelines for information concerning maintainability and energy conservation. All valves, VAV boxes, air handlers, air distribution equipment, etc. shall be provided with proper access for operation and maintenance.

2. The Designer is urged to utilize central and total air conditioning. Return air shall be ducted; ceiling return air plenums shall not be used. Outside air shall be positively controlled and shall be utilized for cooling where applicable.

3. On water-cooled systems, water shall not be wasted. Where year around operation is expected, provisions shall be made to prevent freezing and to allow for low temperature ambient operation.

4. Waste heat recovery shall be considered when appropriate for energy conservation.

5. The University's intent is to utilize chillers that use an environmentally safe refrigerant that will be readily available and cost efficient for future recharging. The University prefers centrifugal or other energy-efficient Trane, McQuay or Carrier brand chillers using non-CFC refrigerants. Selection of centrifugal chillers shall be based on potential rebates from the Duke Energy Company rebate program. Chillers are selected on 20-year life cycle cost. Chillers shall be installed such that the noise level 6' away from the chiller shall be 90 dB or less. Sound attenuating blankets or covers may be required to achieve this noise level rating. The University's preference is for the Designer to confirm available capacity and tie onto the University's McIver Chiller Plant and South Chiller Plant via the chilled water loop.

6. Hot-dipped galvanized steel or concrete shall be used for outside mechanical equipment supports. Details of mechanical supports shall be shown on the drawings. Rooftop equipment shall be minimized to reduce roof damage and access requirements. If rooftop mounting is unavoidable, use bolted, hot-dipped galvanized steel support structure with "feet" integrated into roofing system instead of a structure welded together on site.

7. MECHANICAL IDENTIFICATION

7.1. Mechanical equipment shall be labeled with name, number as designated on Designer's contract documents, service and operational requirements, safety and emergency precautions, design capacity and other design parameters such as pressure drop, entering and leaving conditions, rpm, etc. Ductwork shall be identified as supply, return, exhaust, intake or relief with signs and arrows showing service and direction of flow. Pipe shall be identified with colored signs and arrows indicating its respective system and direction of flow. See Division 9002, Colors, for equipment and piping color schedule. New equipment will be pre-painted by the equipment supplier before shipment.

7.2. All valves (except plumbing fixture faucets, convenience hose bibs, shut offs at plumbing fixtures, and similar rough-in connections of end-use fixtures) shall be provided with 19-gage polished brass valve tags with stamp-engraved piping system abbreviation and sequenced valve numbers. Valve tags shall be attached with brass chains or S-hooks.

7.3. Valve schedules shall be mounted in glazed display frames at the facility and shall include valve number, piping system, system abbreviation (as shown on valve tag) and location of valve (room or space). Valves intended for emergency shut-off and similar special uses shall be marked by "flags" in the margin of the schedule.

7.4. Permanent, bright colored, continuous plastic tape, intended for direct-burial, shall be installed 8" below finished grade directly over all buried utilities. Tape shall be printed to most accurately indicate type of buried utility. Provide tracer wire/tape for all non-metallic utility pipes.

8. The General Contractor shall pay for temporary filters and/or roll media over return air grills as needed during the construction phase prior to the project's acceptance. The HVAC Contractor shall install all filters and roll media provided by the General Contractor and operate HVAC equipment including temporary thermostats as required to give temperature and humidity ranges to do the finish operations. The time which the HVAC equipment is used to complete the finish work of the project is not to be included in the guarantee period of the equipment.

9. 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.

15060. PIPE AND PIPE FITTINGS

1. Supply and waste run-out piping shall be exposed wherever possible. Supply run-outs shall be valved at point of connection to main or riser and valves shall be accessible for operation and maintenance.

2. Water supply lines, both hot and cold, sizes 3" and larger, shall be ductile iron where installed underground. All other water lines shall be copper. Copper lines l-l/2" and larger shall be sweat-joined with silver solder, and smaller lines with a lead-free product equivalent in strength to 95-5 tin/antimony solder. Water lines shall be tested and shown to withstand 150 psi hydrostatic pressure.

3. Hot water lines shall be free to expand without rubbing against adjacent building materials.

4. Sanitary and laboratory sewers from buildings shall be in separate lines. Dilution of acid waste is desirable. Both sanitary and laboratory wastes shall empty into a manhole within ten feet of the building at invert elevation of the manhole. Waste cleanouts shall be accessible for maintenance.

5. Interior floor drains shall empty into the sanitary sewer and exterior drains into the storm sewer. Where floor drains are subject to receiving large amounts of hot water (such as a boiler plant), care shall be taken to properly flash vent pipes to prevent steam from entering the roofing material.

6. Insulation shall be used on all cold water supply lines including cooling water for air conditioning. Waste lines shall also be insulated where "sweating" would be detrimental. All floor drains receiving condensate from mechanical equipment shall be insulated where exposed to interior conditioned air.

7. Water meters reading in cubic feet shall be located in the primary mechanical room of each building where they are easily accessible to a meter reader. Meters shall be installed with a 3-valve bypass. Provide submeters for mechanical equipment and irrigation systems.

15120. CONTROL VALVES

1. Provide isolation valves to isolate at least each riser, bathroom, hose bib, every branch off of main lines, and each terminal device such as a VAV (Variable Air Volume) box with reheat coil. All isolation valves are to be accessible for operation and maintenance. Include other isolation valves at locations designated by the Owner.

2. STEAM CONTROLS FOR HEATING SYSTEMS

    2.1. Controls for regulating heating of individual spaces shall be considered where applicable. Regulating valves shall be equipped with a standard globe valve on the

initial side and a standard gate valve on the low or discharge side. A bypass around the regulating valve equipped with a globe valve one half of the size of pipe on the initial side of the regulating valve shall be provided. The safety valve shall be set for not more than 15 psi above operating pressure. The safety valve shall have a releasing capacity equal to 55% of the regulating valve. The discharge shall be piped to the outside of the building to a point that will cause neither personal hazard nor property damage and shall be piped down to within 18" of finished grade.

2.2. A standard steam gauge shall be placed on each side of the regulating valve to indicate initial and reduced pressure. The dials shall be graduated approximately 75% to 100% above actual working pressure. Each gauge shall be identified and mounted on a panel at a location for easy group reading.

2.3. Temperature control valves, where used, shall be by the same manufacturer as the temperature controls.

2.4. Steam shall not be used on heating equipment when a modulating control is used.

2.5. Steam pressure reducing valves shall be by Spence Regulator (Preferred-Brand Alternate) to comply with campus standards. Reduction from 125 psig shall be in two stages. All valves are to be easily accessible for manual operation and maintenance.

2.6 No high-pressure steam is to be used inside buildings for heating equipment. Where high-pressure steam enters the building, it shall immediately be reduced in pressure to low-pressure steam for "terminal" equipment. High pressure to medium pressure to low pressure.

15170. METERING

Updated: March 6, 2018

The University operates main campus utility distribution systems for electricity, steam/condensate, chilled water, and potable water. Natural gas is provided by Piedmont Natural Gas Company. Cost distribution for utilities is accomplished through a metering system and a prorated assignment of cost.

1. Electricity. Duke Energy provides electricity to UNCG's main campus via a substation that includes Duke Energy's meters. UNCG meters individual main campus buildings and submeters various loads in buildings with project-provided electricity meters. Utilize Appendix A to these Guidelines, the "Facilities Operations Utility Meter Setup Guide," for details related to UNCG's preferred electricity meters and configuration.

2. Steam. UNCG has selected a campus-standard steam meter. Utilize the "Facilities Operations Utility Meter Setup Guide" for details related to UNCG's steam and condensate meters and configuration.

3. Potable Domestic Water metering shall be by turbine or nutating disk meter with magnetic drive. Meter to be located in mechanical room, easily accessible, read in hundreds of cubic feet and provide output that is tied into the Building Automation System. Utilize the "Facilities Operations Utility Meter Setup Guide" for further details.

4. Non-sewered water (consumed but not returned to the sewer, e.g. irrigation, cooling tower makeup, etc.) shall be metered at its source. Meter shall be located in mechanical room, easily accessible, read in hundreds of cubic feet and provide output that is tied into the Building Automation System. Utilize the "Facilities Operations Utility Meter Setup Guide" for further details.

5. Chilled Water flow, temperature differential, and energy consumption shall be measured and calculated for both the main building and any isolated structure. Output shall be in Ton-hours or BTU, be available at the unit, and be tied to the Building Automation System. Utilize the "Facilities Operations Utility Meter Setup Guide" for details related to UNCG's campus-standard chilled water meter and configuration.

6. Natural Gas metering shall comply with all requirements of Piedmont Natural Gas. The natural gas supply pressure provided inside a building shall be the lowest that will meet the required pressure at natural-gas-consuming equipment. The University does NOT want to own, operate, or maintain any natural gas meters; therefore, the Designer shall consult with Piedmont Natural Gas for provision of multiple meters or service points as required. Utilize the "Facilities Operations Utility Meter Setup Guide" for further details.

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

15180. INSULATION

1. The thickness of pipe insulation shall be carefully evaluated to determine the most effective insulation.

2. Insulation of pipes in concealed spaces shall be protected from deterioration by use of a banded asphalt-impregnated felt jacket or other suitable material. In areas where insulated pipes are subject to physical abuse, an aluminum or canvas covering shall be applied around the insulation. All heating distribution supply and return mains (steam or hot water) shall be insulated. Uninsulated mains or run-outs shall not be used as heat sources. Chases and stack areas carrying heating lines in the building shall be adequately ventilated to prevent transfer of waste heat. Calcium silicate insulation shall be used on all high-pressure steam services.

15460. PLUMBING FIXTURES

Updated: August 17, 2022

1. Water closets and urinals shall be vitreous china wall hung. A battery-powered automatic, pressure-type water saving flush valve, shall be used on urinals and water closets. Water closets shall be siphon jet action with 2 1/2" waterway. Closet bowls shall be of the elongated pattern. Water closets shall be low-flow 1.28 gallons per flush or less. Urinals should use the least amount of water that is reasonable (pint per flush). Designer shall discuss this during Design Development. Delta flush valves by Delta Faucet Company are preferred.

2. Plumbing fixture stops shall have handwheels; except as noted otherwise. Key stops are not acceptable.

3. Showers shall be factory-assembled, surface-mounted, vandal-proof units of standard length; shall have a non-scald pressure mixing valve, with single spindle and pressure-actuated piston contained in spindle, integral stops, l/2" copper tubing to limit of unit and institutional head bracket fitting. Shower heads shall have flow-limiting devices (2.5 GPM or less). Bathtubs shall include shower enclosure. Delta mixing valves and shower heads are preferred.

4. Lavatories in rest rooms of public facilities shall be porcelain enameled steel and equipped with outlet devices which limit the flow of hot water to a maximum of the current water efficiency standard (0.5 GPM or less). American Standard Brand lavatories and Delta faucets are preferred.

5. Hose bibs shall be threaded for a 3/4" hose, have a removable "T" handle and a non-removable vacuum breaker. Exterior hose bibs shall have covered boxes with locking devices. One bib shall be located at each building corner, and in the center of any side of the building exceeding 200 feet in length. Products by Watts or Woodford Manufacturing Company, a Division of WCM Industries, Inc. are preferred.

6. Water coolers with compressors remotely located away from the drinking fountain are not to be used. Drinking fountains shall be a complete self-contained split-level unit with an integral bottle filler kit. Install at least one bottle-filling station per building. Elkay products are preferred.

7. Floor sinks shall be used in all Mechanical Spaces and Housekeeping Closets.

15500. FIRE PROTECTION - GENERAL

1. Include work related to Fire Protection within the scope of the Plumbing Contract except for fire extinguishers which are in Division 10 as part of the General Contract.

2. Installation shall comply with the latest version of the North Carolina State Construction Office standards.

3. Tests on wet or dry pipe sprinkler systems and fire pumps shall be performed by the Contractor in the presence of Designer, UNCG and Industrial Risk Insurer representatives.

4. Note that the University is served by the City of Greensboro Fire Department, who requires that all Fire Department Connections (FDCs) be 4" Storz. Consult the University for determining which station is designated First Responder.

5. Post indicating valves located in areas subject to damage shall be protected by concrete filled bollards. Always tie the post indicating valve into the existing or new fire alarm system.

15510. SPRINKLER EQUIPMENT

1. STATE REQUIREMENTS

   1.1. Protection of building occupants from injury is foremost in consideration of fire extinguishing systems.

   1.2. All automatic sprinkler systems shall meet the North Carolina State Construction Office requirements for Automatic Sprinkler Systems and applicable NFPA Standards.

2. UNIVERSITY REQUIREMENTS

   2.1. Sprinkler piping shall be Schedule 40 seamless black iron pipe (ASTM A53/A53M).

   2.2. On dry pipe systems, pipe size shall be 1 1/4" minimum and have a low-pressure switch to detect any loss of air pressure. Connect switch to fire alarm system as a distinct zone. Air compressor shall be on a dedicated electrical circuit.

   2.3. New buildings and major renovations shall be 100% sprinkled unless non-sprinkled areas are separated by four-hour rated construction.

   2.4. Extra Hazard Group II is the minimum acceptable design density for flammable or hazardous materials storage areas and laboratories. Extra Hazard Group I is the minimum acceptable design density for laboratories not classified as hazardous materials laboratories.

   2.5. In Extra Hazard Applications, 100 square foot area coverage per sprinkler head will be the maximum allowed.

   2.6. Inspector test valves shall be as remote as possible for each zone, have piped-in drainage to allow for testing without the use of hoses or special adapters, be located in stairwells or other easily accessible location and contain a sight glass for visual inspection of the flow.

15531. FIRE HYDRANTS

1. Fire hydrants shall have a compression type main valve, open counter clockwise and closing with line pressure. Nominal main valve opening shall be 4 1/2", with bronze to bronze seating and 6" mechanical joint supply inlet with cast iron American Water Works Association gate valve for isolation of the hydrant. Hydrants shall have one 4 1/2" pumper nozzle and two 2 1/2" hose nozzles all with American National Standard threads. Other hydrant features shall be a breakable safety stem coupling and breakable safety flange design, dry top design, a weather cap/shield around the operation nut and a 4 1/2 ' bury body. The interior of the hydrant base and all ferrous metals of the lower valve plate assembly shall be coated with a minimum of 4 mils of fusion bonded or brush applied liquid epoxy. The liquid epoxy shall be American Water Works Association approved for potable water. Barrel to be painted red (Glidden Radiant Red or equal); top and outlet covers to be painted reflective white. Bonnet to be coated with two coats of primer and one coat of 3M #7216 Codit paint. Hydrants shall comply with American Water Works Association Standard C-502 including compliance to the maximum permissible loss of head for hydrants.

2. Hydrants shall be Mueller Centurion, American Mark 73-5, Kennedy K-81A or M&H Model 929.

3. Each hydrant shall be provided with a two cubic foot gravel sump at the drain outlet.

15720. STEAM SPECIALTIES

Updated: August 06, 2019

1. Steam is provided by the University's steam plant at 125 psi and generally reaches the buildings at this pressure.

2. Wherever possible, all pipe work (including steam, condensate lines and traps) shall be installed in a manner that will permit the condensate to drain by gravity from the steam side to the return lines.

3. On 125 psig steam distribution system piping, valves, fittings, flanges, etc. shall be rated at 250 psig up to and through the first reducing valve.

4. Steam condensate piping and fittings shall be Schedule 80.

5. Steam line gaskets shall be Flexitallic brand.

6. Provide two manhole covers (30" over sump pit and 36” over ladder) on each steam manhole for egress and ventilation. Covers shall be reinforced for vehicle loads and set at grade or provided with a minimum of 24" soil cover where required to be below grade, such

as a playing field. Provide steel ladder to 6" below cover in lieu of cast-in-place steps. Show detail of knockout panel for future line connections. Run rebar through knockout panel. Indicate sump location. Provide "U" bend or mushroom-top vent to nearest protected location. Provide cast iron gravity drains to nearest storm sewer. Use sump pumps only where gravity drains are not possible. Waterproof all manhole structures to keep ground water out. Provide a 120 Volt duplex grounded GFCI electrical receptacle in each manhole.

7. Duplex pumped condensate receivers shall have a minimum discharge pressure of 75 PSIG to tie into and properly operate with the campus pumped condensate loop.

8. All steam trap stations shall use schedule 80 or 300# threaded fittings/nipples to connect the station together from the inlet side of the first isolation valve through to the outlet side of the second isolation valve. It shall layout as the following:

   (Steam line drip leg, Isolation valve (300#), Strainer (300#) with blowdown valve, Steam Trap, union (300#), Test Tee with blowdown valve, Check Valve (300#), Isolation Valve (300#)).

   - Adequate drain legs shall be provided to ensure the collection and storage of condensate prior to the trap to permit operation free of water hammer. Size of drain legs shall be the same as the equipment outlet connection and generally 18" - 24" long. Their length is generally limited based on the equipment installation and clearances to grade.

   - A Y-type strainer (integral or separate) with a blowdown valve is essential. Dirt is a major cause of steam trap failures. The strainer catches impurities and can then be flushed to remove them. In addition to protection from dirt, a strainer is also a good diagnostic tool.

   - A test tee shall be installed in systems after the steam trap but before the Check Valve. A test tee after the trap provides a quick visual examination of trap discharge for ease of checking and troubleshooting.

   - Steam trap stations that include isolation block valves allow steam trap maintenance to be performed without having to turn off the steam supply at the root valve (that is, steam supply valve or the first valve in the system).

   - Backup steam trap with the necessary valves, strainers and so on in parallel is preferred and is the best arrangement with bypasses in-between steam traps stations with a globe valve as the isolation valve in bypass piping.

   - Preferred Brand for steam traps will be as follows (This keeps the UNCG Steam System uniform for repair inventory purposes)

     - Inverted Bucket Steam Trap – Armstrong
     - Float and Thermostatic Trap – Hoffman

- Radiator Trap - Hoffman 17c

9. High-Pressure steam trap stations shall not be directly injected into the UNCG Steam System Main Condensate line for any reason. A separate Condensate return line shall return the Steam Trap Condensate back to a Flash tank or Condensate receiver (Preferably into a building mechanical room) for the de-energization of the condensate/flash steam before being introduced back into the UNCG Condensate Mainline. No use of Sparge Pipe will be allowed on UNCG Steam/Condensate mainline systems. Flashing condensate must be considered when sizing return lines flowing from the trap to a vented vessel. The volume of flash steam overwhelms the water volume in most systems and is typically the main sizing consideration.

15800. AIR DISTRIBUTION

1. Careful consideration shall be given to velocity and direction of air supplies and noise.

2. Suitable throwaway filters shall be specified.

3. Heating and cooling media shall be available to each air handling unit or mixing box. Change from heating to cooling shall be accomplished automatically.

4. Controls shall be provided on outside air to provide adequate ventilation based on ASHRAE standards and use of the space. See also Section 1900.4, Energy Conservation.

5. Appropriate exhaust air shall be provided to prevent pressure build-up in buildings.

6. Provide makeup air to all spaces that have mechanical exhaust.

7. Opposed blade dampers with gasketed blade edges shall be used where air flow is controlled or completely shut off.

8. Air intake and exhaust grilles shall have hardware cloth on the outside. Stationary weatherproof louvers shall be provided in air intake ducts. Air systems utilizing large quantities of outside air shall be provided with outside air prefilters accessible through a plenum or filter rack.

9. Air distribution shall be balanced and placed in proper operation by skilled personnel trained and experienced in air distribution systems. The Contractor will be required to show proof of the competence of personnel used for air balancing. Testing and balancing shall be performed in accordance with Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) standards.

   Air balance reports shall be supplied to the Designer and the University prior to final inspection. For State Construction Office projects, the final test & balance report shall be

reviewed and approved by the Designer prior to the final inspection.

10. Internally lined ducts are not permitted.

11. Diffusers need to have 90 degree elbows to transition from flex duct, primarily to prevent crimping of the flex duct and the resultant choking of air flow.

12. A minimum of three (3) sets of HVAC filters shall be supplied by the Contractor for all Air Handling Units: (1) Startup Set, (2) Test and balance set, and (3) Attic Stock Set for the University's use.

15900. HVAC CONTROLS AND INSTRUMENTATION

Updated: September 12, 2023

The HVAC control system shall provide each building with a standalone environmental and energy control system that is responsive to the needs of its occupants as well as provide optimal energy use for the University. Each HVAC equipment room shall have stand-alone direct digital control (DDC) of its equipment. The campus-wide Building Automation System (BAS) communicates between buildings over the campus network.

1. The Designer is responsible for developing project specific specifications for the Building Automation System (BAS), which includes heating, ventilating, and air conditioning (HVAC) control applications. The specifications are to be appropriate and specific for the type of equipment specified to ensure proper control, to aid in energy management, and to allow the BAS to be used as a measurement and verification tool.

2. The University of North Carolina at Greensboro has published a Guide Specification which the Designer can use as a starting point. However, it should be noted that the technologies available in BAS products change very rapidly and the Designer shall review the current state of the art before proceeding with the BAS design. Designer is to request a current copy of the Guide Specification from UNCG. Utilize Appendix D to these Guidelines, the "UNCG Niagara N4 BMS DDC Guide Specification," for further details.

3. The Designer is to generally follow ASHRAE Guideline 13-2015 Specifying Building Automation Systems in order to provide the University with a BAS that provides the functionality and flexibility needed in today's higher education environment while simultaneously conforming to North Carolina State-mandated requirements and University energy conservation and sustainability goals. The Designer is to include all control schematics, point list tables, and sequences of operation on the drawings or in the specifications. Examples are included in ASHRAE Guideline 13. After ASHRAE publishes Guideline 36, the Designer is to reference the document for best-in-class control sequences that meet or exceed the requirements of published ASHRAE standards such as 90.1, 62.1, and 55.

4. UNCG uses its BAS as a data collection system for University-owned utility meters [See 15170 Metering]. The Designer is to ensure that all utility meters furnished and installed by the project are integrated properly into the BAS, including confirming proper trending of meter readings every fifteen (15) minutes. Trends are to be stored in the University's server in the McNutt Data Center, not in the local control panels in the building. The Designer is to require the meter supplier/integrator to ensure that each meter's readings shown in the BAS match the readings displayed on the meter. This is most easily accomplished by requiring the meter supplier/integrator to implement proper protocol communications between the BAS controller and the meter in order to directly read, for example, the cumulative consumption number directly from the meter's data storage register in lieu of attempting to count pulses or other less accurate method of obtaining and trending the data.

5. UNCG's enterprise Building Automation System is currently a Niagara AX Tridium server located in the McNutt Data Center. The Designer is to require that the project's DDC controls be integrated into the existing Tridium BAS with equivalent graphics. The installation of additional servers is not permitted. The project shall provide the appropriate number of Niagara based network controllers to integrate the DDC system as necessary. The network controllers for the project shall be Niagara 4 (N4) controllers either backset to Niagara AX Revision 3.8.111 or higher and integrated into the University's existing Niagara AX server or integrated into a new Niagara 4 (N4) server as directed by the University. BACnet is the preferred protocol within the building.

6. Acceptable Controls Contractors.
Controls Contractor shall have a full-service office within one hundred (100) miles of the UNCG campus. A full-service office is defined as a home office of applications engineers, supervisors, and field technicians having all required skills and equipment to successfully install, test, and troubleshoot the BAS. Controls Contractors shall be factory-authorized agent or dealer of controllers and control hardware as manufactured by:
    1. Trane
    2. Distech Controls
    3. Schneider Electric

7. Provide dedicated circuits for 120V control power to controllers. Provide the electrical panel board name, location, and circuit number on mechanical and electrical plans. All control wiring shall be installed in conduit. Provide each top-level building control panel with a UPS/battery backup to prevent power blips and brief power outages from knocking them offline.

8. Mount all DDC control devices in UL listed panels. Show each DDC controller on mechanical plans within equipment rooms in relation to other equipment in the same room. Specify mounting height of control panels.

9. All control panel wiring terminations shall be on terminal blocks. No wire nuts are

allowed within panels.

10. Show location and height for all HVAC control thermostats on plans. All thermostats shall be box mounted in walls, unless noted otherwise.

11. Show location of all HVAC field-mounted control devices on plans such as duct static sensors, night low limits, timed-override switches, emergency stop switches, outdoor air temperature and humidity sensor, etc. Specify mounting height of each device.

12. Show a separate detail of how each DDC controller ties together into the network within the building and then into existing campus DDC system, i.e. network riser diagram. Include a specific note that describes the campus data network connection to the DDC controller.

13. Show each DDC controller input/output for digital and analog points in table format in either specification booklet or on mechanical plans. Include a matrix "Points List" for each type of equipment, such as air handling unit, VAV box, heat exchanger, pump, etc.

14. Installed DDC system must be compatible and communicate with existing campus control network.

15. Provide dehumidifier with drain line piped to a floor drain for controls air compressor.

16. Provide 0-20 psig pneumatic air gauge at each control valve, damper, electric to pneumatic transducer, and at main air feeds into control panels.

17. Paint all control junction boxes and cover plates dark or navy blue.

18. 100% outdoor air units shall have end switches on outdoor air dampers interlocked with fan for safety.

19. Before any training can be scheduled with UNCG personnel, controls contractor shall walk through every control panel on project with general contractor and mechanical contractor to verify that control wiring, numbering, and labels match as-built drawings.

20. Provide with O&M manuals a section of graphic schematic printouts.

21. HVAC control sequence of operation shall be included on mechanical plans or specifications, stating setpoints for supply air temperature, space temperature, etc., and whether each unit setpoint is controlled by supply air temperature, return air temperature, space temperature, etc.

22. All utility meters provided with digital outputs shall be connected to building DDC controls, including hardware, software, and graphics necessary for campus energy analysis by UNCG Facilities Operations.

23. The Designer is to email to the Director of Facilities Operations the HVAC Controls/Metering submittal upon receipt from Contractor so UNCG can perform a simultaneous review and approval.

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 18, 2014

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

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

16300. POWER TRANSMISSION

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

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

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

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

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

16350. MANHOLES

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

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

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

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

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

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

16405. ARC FLASH

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

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

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

16440. METERING

Updated: 6/11/2013

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

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

The electrical design specifications should include the following requirements:

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

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

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

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

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

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

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

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

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

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

16480. BRANCH CIRCUITS

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

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

16510. INTERIOR LIGHTING FIXTURES

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: March 2024

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

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

2. MAIN DISTRIBUTION FRAME (MDF)

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

A dedicated telecommunication room (MDF) shall be large enough to house equipment, controllers, LAN racks, fiber optic equipment and telephone lines. MDF's and IDF's that house life safety equipment shall be tied to the building backup Generator. All doors shall open out into the hallway.

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

Provide dedicated 20 amp electrical circuits to a quad outlet receptacles (NEMA 5-20) 120 volt one mounted on the ladder type cable tray every other rack and the other two spaced at 6' intervals on perimeter walls. (Do not use surface mounted conduit on walls). Provide a minimum of two NEMA L5-30R 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.
If required, 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" AC grade plywood, painted on both sides with two coats of white intumescent paint. Alternatively, ¾" fire retardant

plywood may be used and painted with regular white paint, as long as the fire retardant stamping on each sheet of plywood is left unpainted and is clearly visible. The designer shall indicate on project drawings that the plywood shall be completely painted prior to mounting anything on the walls. The grade "C" surface shall be installed against the wall. All screws must be flush mounted.

3. INTERMEDIATE DISTRIBUTION FRAME (IDF)

The dedicated telecommunication room (IDF) shall be large enough to house equipment, controllers, LAN racks, fiber optic equipment and telephone lines. For larger buildings, it is desirable to have a room on each floor and in alignment (stacked) for multiple floors. All IDF's that house life safety equipment shall be tied to the building backup Generator. All doors shall open out into the hallway.

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

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

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

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

4. BUILDING BACKBONE

Provide an un-spliced Corning cable containing 24 strands single-mode fiber (minimum) from the MDF to each IDF (in a star topology). Run the fiber in inner duct. Provide a minimum of three 4" conduit risers between telecommunication rooms stubbed 4" above finished floor with bushings. Fill two of the 4" conduit with two 1.5" inner-duct, one 1" inner-duct, and a footage delineated pull tape. Locate backbone cabling in cable trays, and where runs go through equipment rooms or inaccessible areas, provide a minimum of three 4" conduits. Provide a Telecommunications Bonding Backbone (TBB) # 6 insulated minimum.

The fiber shall be factory terminated cassettes with LC type connectors using fusion splice pigtails. Anaerobic or Uni-cam terminations are not allowed.

5. HORIZONTAL CABLING

Horizontal cabling shall be configured so that each outlet is directly connected to a telecommunication room. Category 6A (CS44PSD) (small diameter) or equivalent 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" square box with a 1-1/4" (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 1/4" 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 6A (CS44PSD) (small diameter) or equivalent (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 6A rated with568B configuration.

5.3 Closet Terminations

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

5.4 Racks

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

For specified voice jacks, provide a four pair solid conductor patch cable with a RJ45 mod plug at the patch panel, the other end shall be terminated on a 66-style block on the backboard. All four pairs shall be terminated.
Provide a minimum 6" vertical wire manager on each side of every rack. Chatsworth Evolution vertical 72 x 6 x 24 part # 35521-701 and horizontal part # 35441-702 or equivalent

Note: when using angled patch panels, horizontal management is not required.

6. WORKSPACE CONFIGURATION

A typical outlet is defined as consisting of two blue category 6A cables, in a four-port faceplate with Category 6A jacks (black in color). All horizontal cabling requires 1' of slack above ceiling. A typical floor box shall have a minimum of four blue category 6A cables.

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

Each room will be provided with a minimum of one outlet with four data connections. The outlet shall be located in a convenient location near the front of the room. For Conference rooms (1) typical floor box outlet and (1) typical 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 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. 6A and (1) one-1 ¼" 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. 6A and (1) one-1 ¼" 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.6A and (1) 1 ¼" 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 6A 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 6A 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 6A 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.

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

8. MISCELLANEOUS

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 6A cables (Yellow), shall be run from each jack to the closest telecommunications room (IDF / MDF) and terminated in a patch panel. Patch cords shall be Red. 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

See the UNCG Design and Construction Guidelines - Elevators 14200 Section 11; Special Features 11.1 Emergency Communications System

8.4 Campus Emergency Telephones

Emergency telephones are in buildings throughout campus. These telephones provide a voice connection to the University Police Department for immediate assistance to a user. 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.

Emergency Phone Cabling

For outdoor emergency telephones, provide two outdoor rated, Category 6A 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. Installation requires (2) 1.5" conduits for low-voltage cabling, (1) 1" for electrical 120-volt receptacle.

8.5 Control Systems

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

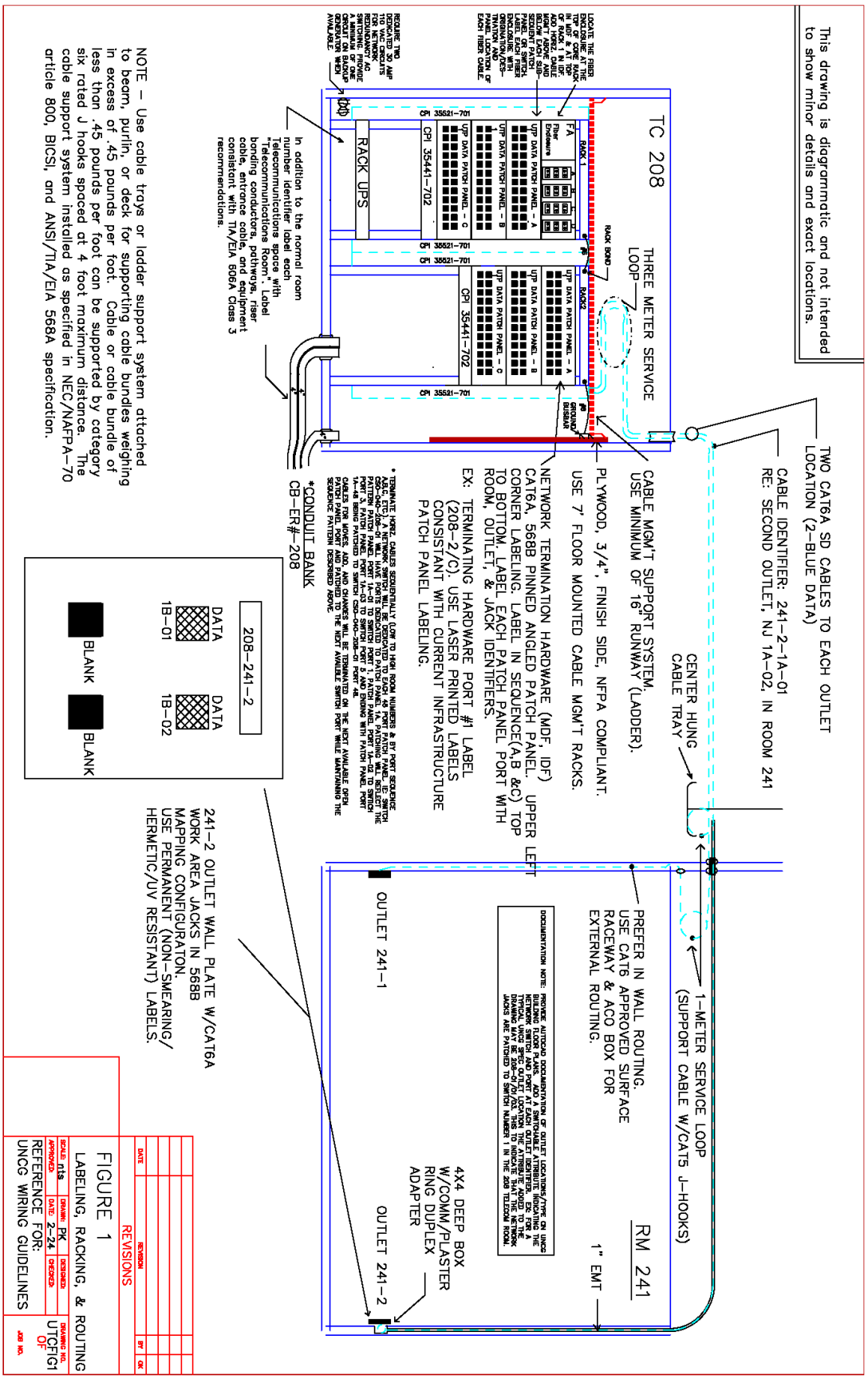
8.6 Identification

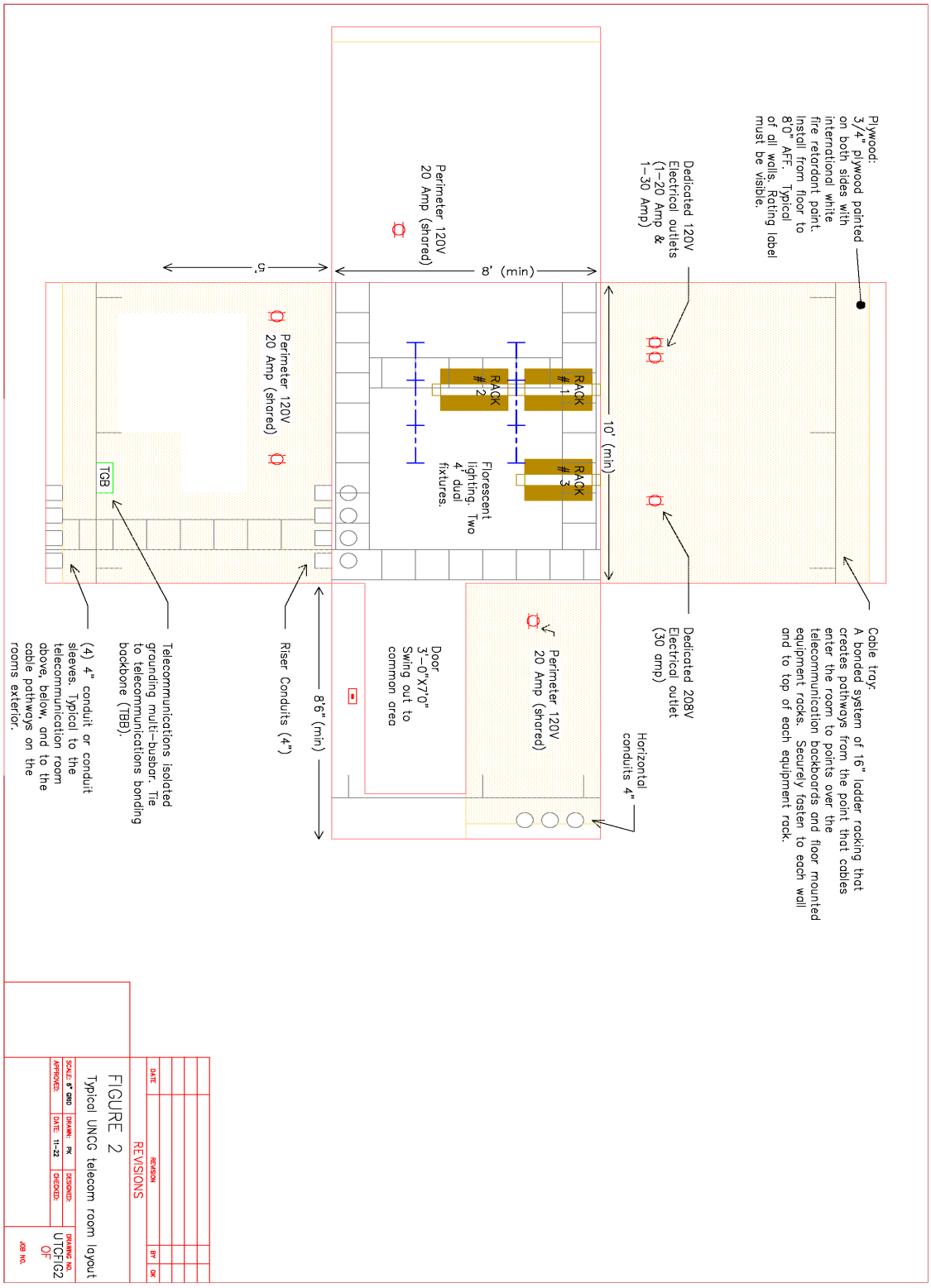
The University and various subcontractors maintain and provide additions, moves, and changes for the overall campus telecommunications systems. Because of the dependence of the University upon its telecommunications systems, it is critical that labeling be clear and informative. Prior to labeling any 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.

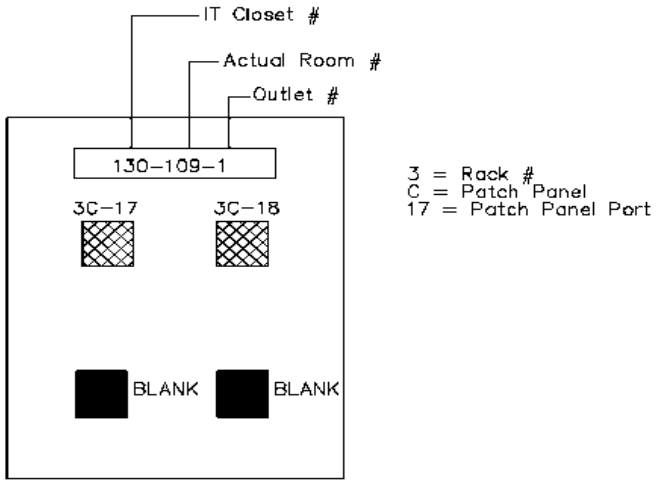
Refer to UNCG Wiring Guidelines Figure 1 for current UNCG labeling scheme and Figure 2 for Closet layout.

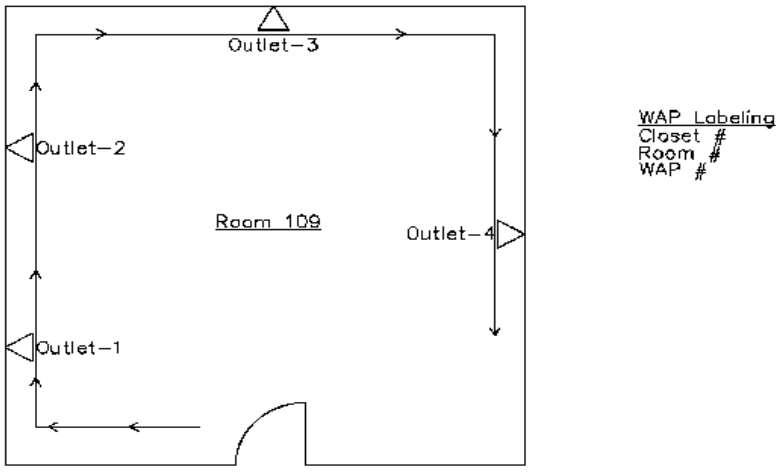
F


This drawing is diagrammatic and not intended to show minor details and exact locations.
TWO CAT6A SD CABLES TO EACH OUTLET LOCATION (2-BLUE DATA)
CABLE IDENTIFIER: 241-2-1A-01
RE: SECOND OUTLET, NJ 1A-02, IN ROOM 241
CENTER HUNG CABLE TRAY
1-METER SERVICE LOOP (SUPPORT CABLE W/CAT5 J-HOOKS)
TC 208
THREE METER SERVICE LOOP
RACK BOND
CABLE MGM'T SUPPORT SYSTEM. USE MINIMUM OF 16" RUNWAY (LADDER).
PLYWOOD, 3/4", FINISH SIDE, NFPA COMPLIANT.
USE 7' FLOOR MOUNTED CABLE MGM'T RACKS.
RACK UPS
RACK 1
RACK 2
CPI 35521-701
CPI 35441-702
NETWORK TERMINATION HARDWARE (MDF, IDF)
CAT6A, 568B PINNED ANGLED PATCH PANEL. UPPER LEFT CORNER LABELING: LABEL IN SEQUENCE(A,B &C) TOP TO BOTTOM. LABEL EACH PATCH PANEL PORT WITH ROOM, OUTLET, & JACK IDENTIFIERS.
EX: TERMINATING HARDWARE PORT #1 LABEL (208-2/C). USE LASER PRINTED LABELS CONSISTANT WITH CURRENT INFRASTRUCTURE PATCH PANEL LABELING.
PREFER IN WALL ROUTING. USE CAT6 APPROVED SURFACE RACEWAY & ACO BOX FOR EXTERNAL ROUTING.
RM 241
1" EMT
OUTLET 241-1
OUTLET 241-2
4X4 DEEP BOX W/COMM/PLASTER RING DUPLEX ADAPTER
*CONDUIT BANK CB-ER#-208
208-241-2
DATA 1B-01
DATA 1B-02
BLANK
BLANK
241-2 OUTLET WALL PLATE W/CAT6A WORK AREA JACKS IN 568B MAPPING CONFIGURATON. USE PERMANENT (NON-SMEARING/ HERMETIC/UV RESISTANT) LABELS.
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 six rated J hooks spaced at 4 foot maximum distance. The cable support system installed as specified in NEC/NAFPA-70 article 800, BICSI, and ANSI/TIA/EIA 568A specification.
In addition to the normal room number identifier label each "Telecommunications Room", Label bonding conductors, pathways, riser cable, entrance cable, and equipment consistent with TIA/EIA 606A Class 3 recommendations.
REVISIONS
FIGURE 1
LABELING, RACKING, & ROUTING
UNCG WIRING GUIDELINES
REFERENCE FOR:
UTCFIG1


Plywood: 3/4" plywood painted on both sides with international white fire retardant paint. Install from floor to 8'0" AFF. Typical of all walls. Rating label must be visible.
Dedicated 120V Electrical outlets (1-20 Amp & 1-30 Amp)
Perimeter 120V 20 Amp (shared)
5'
8' (min)
10' (min)
RACK #1
RACK #2
RACK #3
Florescent lighting. Two 4' dual fixtures.
Perimeter 120V 20 Amp (shared)
TGB
Cable tray: A bonded system of 16" ladder racking that creates pathways from the point that cables enter the room to points over the telecommunication backboards and floor mounted equipment racks. Securely fasten to each wall and to top of each equipment rack.
Dedicated 208V Electrical outlet (30 amp)
Horizontal conduits 4"
Perimeter 120V 20 Amp (shared)
Door 3'-0"x7'0" Swing out to common area
8'6" (min)
Riser Conduits (4")
Telecommunications isolated grounding multi-busbar. Tie to telecommunications bonding backbone (TBB).
(4) 4" conduit or conduit sleeves. Typical to the telecommunication room above, below, and to the cable pathways on the rooms exterior.
REVISIONS
DATE
REVISION
BY
OK
FIGURE 2
Typical UNCG telecom room layout
SCALE: 0" GRID
DRAWN: PK
DESIGNED:
APPROVED:
DATE: 11-22
CHECKED:
DRAWING NO.
UTCFIG2
OF
JOB NO.

Labeling Legend Detail





Labeling Example

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 6A 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 (2) 1 ½" and (1) 1" 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, electrical panels and/or housekeeping supplies shall be installed or placed within these rooms.

16720. FIRE DETECTION AND ALARM

Updated: August 6, 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 shell 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-wrapped. 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 arrestor, series impedance, and a fast acting secondary arrestor 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 ¼, ½, 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 ¼, ½, 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. [1]

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. [1] 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".

21. Heat detectors: ceiling mounted, with fixed temperature and rate-of-rise sensing.

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 760.49(B)).

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 asbuilts. 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. All 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. [1]

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. [1]

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.) [1] If heat detectors are installed in dorm kitchens/near shower they shall initiate a general alarm. No smoke detector shall be located within 10' of a bathroom room which contains a shower. If coverage is required a heat detector shall be used.

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 pigtails. 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 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 print out 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. [1]

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. [1]
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. [1]
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 as-builts 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: 3/14/2024

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 MEP doors)
   c. Interior doors that may require access control are:
      - Rooms where audit trails are required by law or regulation (designated IT

Secure Areas, HIPPA, etc.)
- Rooms that serve a large, broad group of the University community (computer labs, library)
- Rooms with sensitive equipment and/or access, where unauthorized access may impair educational goals or pose a significant liability risk (scientific and computer labs, chemical storage)

d. Refer to Hardware Guidelines (section 08000 Doors/Windows and section 16700 Telecommunications Systems) for additional requirements.

2. DESIGNER REQUIREMENTS

a. The designer shall specify that the door access system must be a turn-key operation and complete installation.

b. Include separate floor plans to show all access control openings. This should include all devices relevant to life safety and necessary to provide a comprehensive plan for access control, including locations of all access equipment and accessories (master controllers, door controllers and power supplies, etc.). 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 Transact certified "dual-use" magnetic-stripe/NFC (13.56MHz, ISO 14443A) units.
   f. Wire to be 18 gauge, 12 conductor, shielded wire, minimum.

16723. Cameras

Updated: February 5, 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 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 particular 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 door (entrances and exits) locations. At exterior doors, the cameras are typically installed on the interior of the building. Outdoor cameras are rarely specified and must be carefully coordinated with the UNCG Police.
   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 and for continuity the same brand should be used.
   j) Any contractor installing Axis cameras must be an Axis Certified Installer.
   k) The security camera integrator shall ensure updated firmware, program as needed, install & focus all cameras.
   l) 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 signing off on the contract.

3) Technical Requirements

a) All Cameras
   a. 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.
   b. Necessary camera mounting brackets and adapter plates are to be furnished & installed by security camera integrator.
   c. Indoor cabling shall be Cat-6 plenum cable.
   d. All cables must be tested per 16700. TELECOMMUNICATIONS SYSTEMS – 7.0 TESTING of this document.
   e. All cables must be labeled per 16700. TELECOMMUNICATIONS SYSTEMS – 8.6 IDENTIFICATION of this document.
   f. Cameras shall be powered via 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. Dielectic 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.

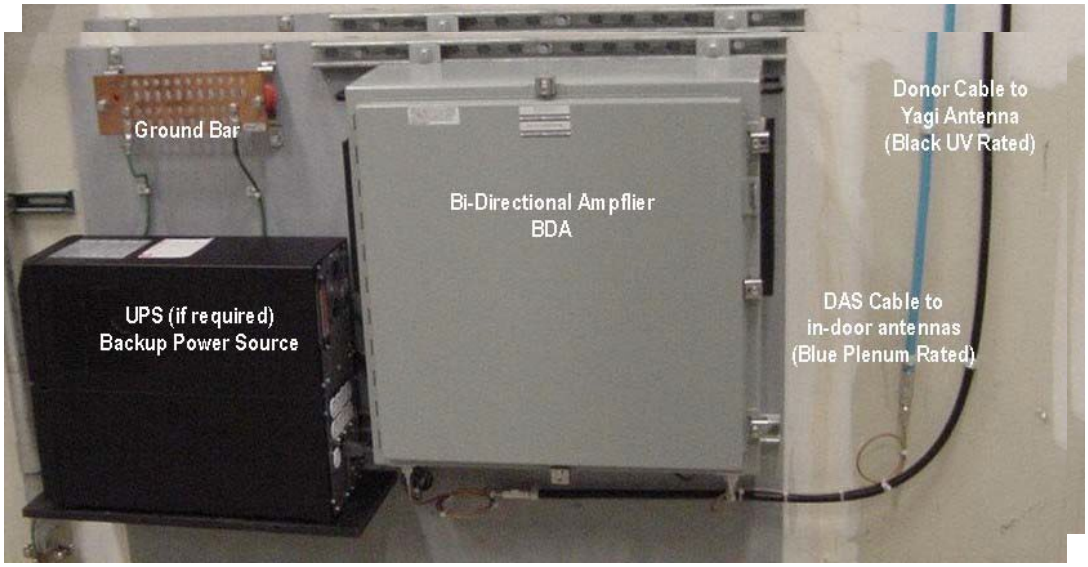


Figure 1

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.

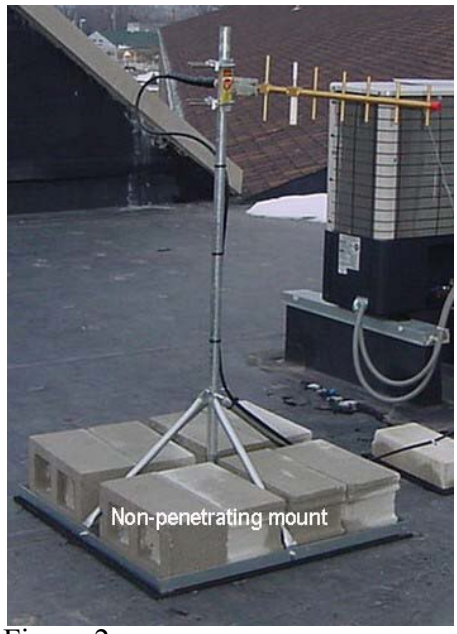


Figure 2

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.

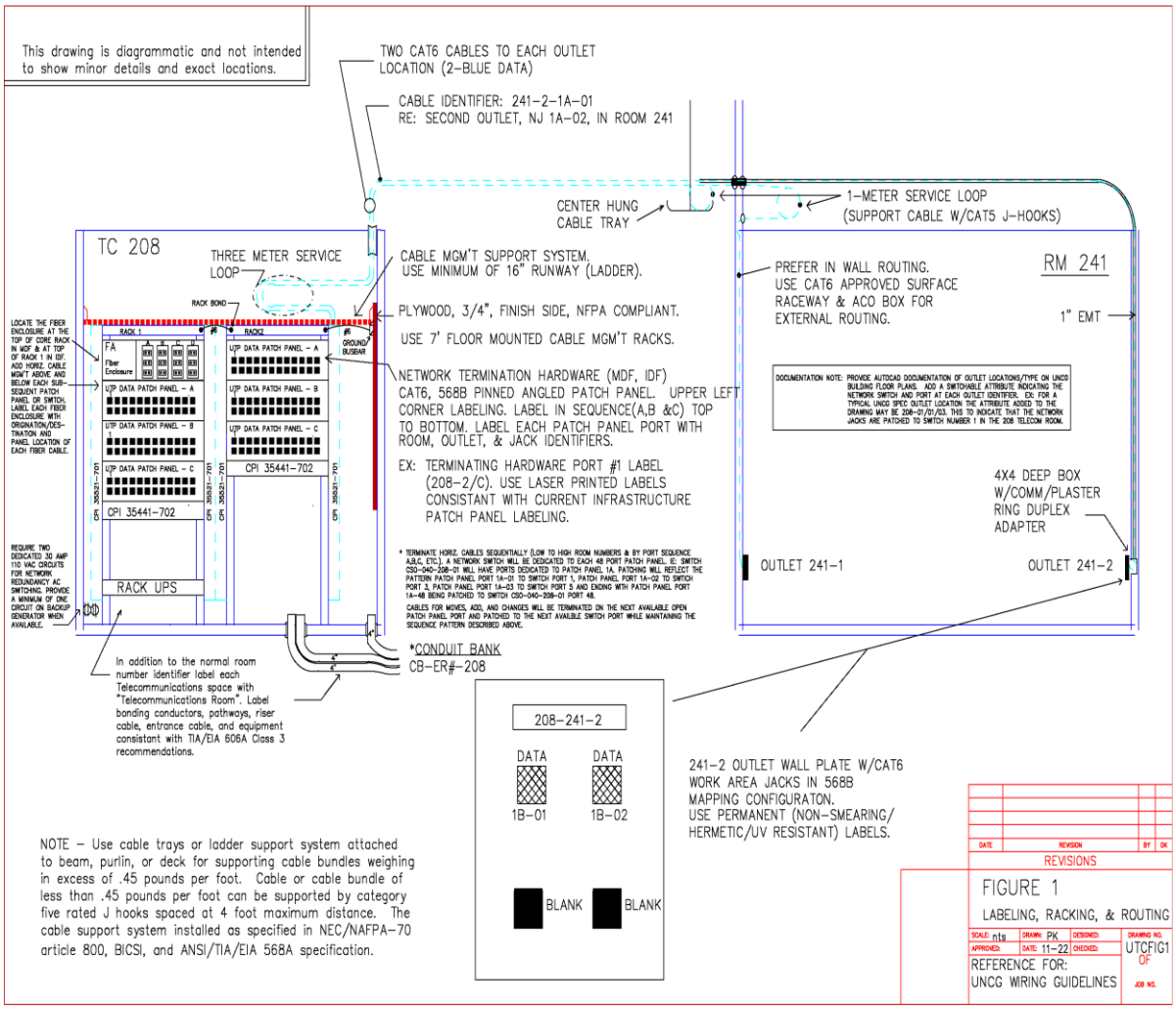

This drawing is diagrammatic and not intended to show minor details and exact locations.
TWO CAT6 CABLES TO EACH OUTLET LOCATION (2-BLUE DATA)
CABLE IDENTIFIER: 241-2-1A-01
RE: SECOND OUTLET, NJ 1A-02, IN ROOM 241
CENTER HUNG CABLE TRAY
1-METER SERVICE LOOP (SUPPORT CABLE W/CAT5 J-HOOKS)
TC 208
THREE METER SERVICE LOOP
CABLE MGM'T SUPPORT SYSTEM. USE MINIMUM OF 16" RUNWAY (LADDER).
RM 241
PREFER IN WALL ROUTING. USE CAT6 APPROVED SURFACE RACEWAY & ACO BOX FOR EXTERNAL ROUTING.
1" EMT
RACK BOND
PLYWOOD, 3/4", FINISH SIDE, NFPA COMPLIANT.
USE 7' FLOOR MOUNTED CABLE MGM'T RACKS.
LOCATE THE FIBER ENCLOSURE AT THE TOP OF CORE RACK IN MDF & AT TOP OF RACK 1 IN IDF. ADD HORIZ. CABLE MGM'T ABOVE AND BELOW EACH SUB-SEQUENT PATCH PANEL OR SWITCH. LABEL EACH FIBER ENCLOSURE WITH ORIGINATION/DES-TINATION AND PANEL LOCATION OF EACH FIBER CABLE.
RACK 1
RACK2
FA
Fiber Enclosure
GROUND BUSBAR
U/P DATA PATCH PANEL - A
U/P DATA PATCH PANEL - B
U/P DATA PATCH PANEL - C
U/P DATA PATCH PANEL - A
U/P DATA PATCH PANEL - B
U/P DATA PATCH PANEL - C
CPI 35441-702
CPI 35441-702
CPI 35521-701
CPI 35521-701
CPI 35521-701
CPI 35521-701
NETWORK TERMINATION HARDWARE (MDF, IDF) CAT6, 568B PINNED ANGLED PATCH PANEL. UPPER LEFT CORNER LABELING. LABEL IN SEQUENCE(A,B &C) TOP TO BOTTOM. LABEL EACH PATCH PANEL PORT WITH ROOM, OUTLET, & JACK IDENTIFIERS.
EX: TERMINATING HARDWARE PORT #1 LABEL (208-2/C). USE LASER PRINTED LABELS CONSISTANT WITH CURRENT INFRASTRUCTURE PATCH PANEL LABELING.
DOCUMENTATION NOTE: PROVIDE AUTOCAD DOCUMENTATION OF OUTLET LOCATIONS/TYPE ON UNCG BUILDING FLOOR PLANS. ADD A SWITCHABLE ATTRIBUTE INDICATING THE NETWORK SWITCH AND PORT AT EACH OUTLET IDENTIFIER. EX: FOR A TYPICAL UNCG SPEC OUTLET LOCATION THE ATTRIBUTE ADDED TO THE DRAWING MAY BE 208-01/01/03. THIS TO INDICATE THAT THE NETWORK JACKS ARE PATCHED TO SWITCH NUMBER 1 IN THE 208 TELECOM ROOM.
4X4 DEEP BOX W/COMM/PLASTER RING DUPLEX ADAPTER
OUTLET 241-1
OUTLET 241-2
REQUIRE TWO DEDICATED 30 AMP 110 VAC CIRCUITS FOR NETWORK REDUNDANCY AC SWITCHING. PROVIDE A MINIMUM OF ONE CIRCUIT ON BACKUP GENERATOR WHEN AVAILABLE.
RACK UPS
* TERMINATE HORIZ. CABLES SEQUENTIALLY (LOW TO HIGH ROOM NUMBERS & BY PORT SEQUENCE A,B,C, ETC.). A NETWORK SWITCH WILL BE DEDICATED TO EACH 48 PORT PATCH PANEL. IE: SWITCH CSD-040-208-01 WILL HAVE PORTS DEDICATED TO PATCH PANEL 1A. PATCHING WILL REFLECT THE PATTERN PATCH PANEL PORT 1A-01 TO SWITCH PORT 1, PATCH PANEL PORT 1A-02 TO SWITCH PORT 2, PATCH PANEL PORT 1A-03 TO SWITCH PORT 3 AND ENDING WITH PATCH PANEL PORT 1A-48 BEING PATCHED TO SWITCH CSD-040-208-01 PORT 48.
CABLES FOR MOVES, ADD, AND CHANGES WILL BE TERMINATED ON THE NEXT AVAILABLE OPEN PATCH PANEL PORT AND PATCHED TO THE NEXT AVAILBLE SWITCH PORT WHILE MAINTAINING THE SEQUENCE PATTERN DESCRIBED ABOVE.
*CONDUIT BANK
CB-ER#-208
In addition to the normal room number identifier label each Telecommunications space with "Telecommunications Room". Label bonding conductors, pathways, riser cable, entrance cable, and equipment consistant with TIA/EIA 606A Class 3 recommendations.
208-241-2
DATA
DATA
1B-01
1B-02
BLANK
BLANK
241-2 OUTLET WALL PLATE W/CAT6 WORK AREA JACKS IN 568B MAPPING CONFIGURATON. USE PERMANENT (NON-SMEARING/ HERMETIC/UV RESISTANT) LABELS.
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/NAFPA-70 article 800, BICSI, and ANSI/TIA/EIA 568A specification.
DATE
REVISON
BY
OK
REVISIONS
FIGURE 1
LABELING, RACKING, & ROUTING
SCALE: nts
DRAWN: PK
DESIGNED:
DRAWING NO.
APPROVED:
DATE: 11-22
CHECKED:
UTCFIG1
OF
REFERENCE FOR:
UNCG WIRING GUIDELINES
JOB NO.

Figure 1

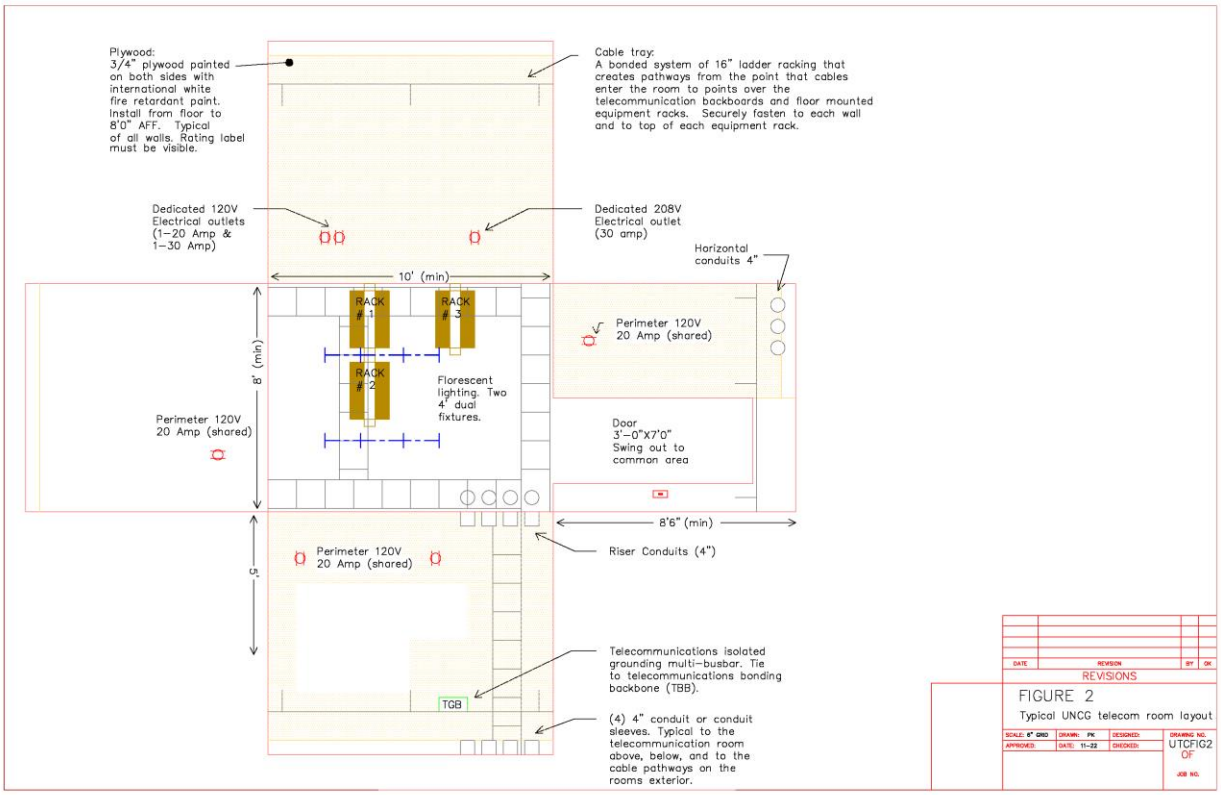

Plywood:
3/4" plywood painted on both sides with international white fire retardant paint. Install from floor to 8'0" AFF. Typical of all walls. Rating label must be visible.
Cable tray:
A bonded system of 16" ladder racking that creates pathways from the point that cables enter the room to points over the telecommunication backboards and floor mounted equipment racks. Securely fasten to each wall and to top of each equipment rack.
Dedicated 120V Electrical outlets (1-20 Amp & 1-30 Amp)
Dedicated 208V Electrical outlet (30 amp)
Horizontal conduits 4"
10' (min)
RACK #1
RACK #3
RACK #2
Florescent lighting. Two 4' dual fixtures.
Perimeter 120V 20 Amp (shared)
8' (min)
Perimeter 120V 20 Amp (shared)
Door 3'-0"X7'0" Swing out to common area
8'6" (min)
Riser Conduits (4")
5'
Perimeter 120V 20 Amp (shared)
Telecommunications isolated grounding multi-busbar. Tie to telecommunications bonding backbone (TBB).
TGB
(4) 4" conduit or conduit sleeves. Typical to the telecommunication room above, below, and to the cable pathways on the rooms exterior.
DATE
REVISION
BY
OK
REVISIONS
FIGURE 2
Typical UNCG telecom room layout
SCALE: 6" GRID
DRAWN: PK
DESIGNED:
DRAWING NO.
APPROVED:
DATE: 11-22
CHECKED:
UTCFIG2
OF
JOB NO.

Figure 2

Utility Meter Setup Guide
The University of North Carolina at Greensboro
Facilities Operations

August 28, 2023

Version 2.3

The purpose of this document is to communicate fundamental information for setting up utility meters for The University of North Carolina at Greensboro. This document covers the units to be displayed for each different utility meter, parameters for setting up electricity meters on the University's campus-wide Ethernet utility network, and communications with the University's building automation/utility monitoring system.

A. Integration of Utility Meter Readings into UNCG's Building Automation System (Tridium server).
   1. It is the meter supplier/integrator's responsibility to ensure that each meter's readings shown and trended in Tridium match the readings displayed on the face of the meter. Also, the readings displayed on the meter are to be verified as correct.
   2. The definition of the word "integrate" in all its forms as used in this document includes not only running conduit, pulling and connecting wiring, loading software, etc. but also ensuring and confirming that the readings shown and trended in the University's Tridium Building Automation System (BAS) match the readings displayed on the face of the meter. Without such confirmation, which includes more than just the initial setup, the integration effort is incomplete and will not be accepted by the University regardless of the recommendations, opinions, or decisions of other parties besides the University. The University's preferred method of integration for all meters is via the Modbus, BACnet, or RS-485 protocol whereby the BAS reads the number(s) directly from the meter's storage register(s). This implies, of course, that all meters are preferred to be digital meters with electronic storage registers. If connecting to an existing system, then just match the existing protocol.
   3. UNCG uses its BAS as a data collection system for utility meters. The Designer is to ensure that all utility meters furnished and installed by the project are integrated properly into the BAS, including confirming proper trending of meter readings every fifteen (15) minutes. Trends are to be stored in the University's server in the McNutt Data Center, not in the local control panels in the building. The Designer is to require the meter supplier/integrator to ensure that each meter's readings shown and trended in the BAS match the readings displayed on the meter.

B. Natural Gas Meter
   1. These are rare, but the reading (point) to be integrated into the University's Building Automation System, Tridium, is **cumulative** cubic feet (cu. ft.). This reading is to be obtained directly from the meter's storage register via the Modbus protocol, which is now available from Piedmont Natural Gas. The University does NOT want to own, operate, or maintain any natural gas meters; therefore, the Designer should consult with Piedmont Natural Gas for provision of multiple meters or service points as required.

C. Electricity Meters
   1. Electricity meters are typically installed when a building is fed from UNCG's 12,470 Volt underground electrical distribution system or when fed directly from Duke Energy and submetering is required.

2. The University's preferred electricity meters are both manufactured by SATEC, Inc.: SATEC EM920-9S main meter and the SATEC PRO PM335 submeter. The SATEC EM920-9S meter is to be used for metering an entire building and the SATEC PRO PM335 submeter is to be used for submetering loads such as mechanical equipment and lighting.
3. All electricity meters are to "reside" on the University's campus-wide Ethernet utility network, which means that each meter must have an Ethernet port (data drop) to plug into. This configuration is necessary so that both the Building Automation System (BAS) and a separate direct-access meter reading software application can communicate with each electricity meter simultaneously. Full integration into the University's BAS, Tridium, is required. PAS version 1.5.5.0 or newer software is required for both SATEC EM920-9S and SATEC PRO PM335 meter setup from www.satec-global.com
4. Each electricity meter must be "registered" with the UNCG Information Technology Services Department before it can be connected to the University's network. In order to be registered, the installer of the electricity meter(s) must provide a list [preferred format is an Excel spreadsheet] of each electricity meter, the manufacturer, the model name and model number, the designated installation location including the room number and load served, and the MAC address (Ethernet address) unique to each meter which is assigned by the manufacturer and never changes. The load served description should include not only a panel designation (if applicable), but also a description in English that people unfamiliar with the project or building can understand. UNCG ITS will assign an IP address for each meter which allows other devices connected to the utility network to locate each specific meter and know what load that meter is measuring. UNCG Facilities Operations will assign a Meter ID for internal use. The Excel spreadsheet can be forwarded via e-mail to the next recipient and will facilitate capturing all of the key information in one document, including UNCG ITS adding the IP addresses.
    a. Note: The Calibration Reports for both the EM920-9S and PRO PM335 meters are shipped with the meter and are to be provided to the University. The "Device Profile Report" shipped with the EM920-9S and PRO PM335 meters includes key data and the MAC Address for each meter and is to be provided to the University.
5. EACH ELECTRICITY METER MUST BE INSTALLED IN THE SAME LOCATION AS DESIGNATED AT THE TIME OF REGISTRATION. Otherwise, the pre-installation assignment of meters to loads gets scrambled.
6. SATEC EM920-9S Main Electricity Meter
    a. IP address: Provided by UNCG ITS. Each meter is to be set for DHCP (Dynamic Host Configuration Protocol).
    b. Units: kWh (kiloWatt-hours, **<u>whole number</u>** [no decimals], maximum number of digits)
        kW (kiloWatt demand)
    c. Scrolling Meter Display: To be set up to automatically and continuously scroll through the following screens for about seven (7) seconds per screen:
        1. Building Name (Meter Name)
        2. kWh Received (kiloWatt-hours, whole number [no decimals], maximum number of digits)
        3. Peak kW Demand Received (whole number, no digits to the right of a decimal)
        4. Date/Time kW Demand was Last Reset
        5. Device Information Screen
        6. Voltage, Current, Power Factor, Phasor Diagram, etc.

7. SATEC PRO PM335 Electricity Submeter
   a. IP address: Provided by UNCG ITS and is NOT to be statically programmed into the meter. SATEC PRO PM335 submeters are to be set to perform DHCP (Dynamic Host Configuration Protocol). Failure to set the submeter to DHCP will cause network errors and will result in a notification from UNCG ITS to fix the problem.
   b. Units: kWh (kiloWatt-hours, **whole number**, maximum number of digits with NO DIGITS to the right of a decimal point).
      kW (kiloWatt demand)
   c. Other readings to display include voltage, current, power factor, phasor diagram, device information, etc. and the submeter is to be set up to automatically and continuously scroll through all available data screens that are selectable on the meter's face.

D. Domestic Water Meter

1. The reading to be integrated into the University's Tridium server is **cumulative** cubic feet (cu.ft.). If the meter display includes a fixed zero or two fixed zeros, be sure to multiply the reading by 10 or 100 as needed to display the correct reading in Tridium. THE WATER METER SHOULD BE SPECIFIED TO MEASURE **CUBIC FEET** SO THAT NO CONVERSION FACTOR IS NEEDED TO CONVERT FROM GALLONS TO CUBIC FEET.

2. If digital, electronic water meters with Modbus or BACnet protocol are not available, then it is acceptable to use a contact closure (switch) to indicate, for example, that ten (10) cubic feet of water have passed through the water meter. The water meter can then be integrated into the University's Tridium BAS by counting each switch closure as ten (10) cubic feet and adding that to the running cumulative total cubic feet consumption. Water meter manufacturers have a specific register to generate this switch closure (Neptune TRICON/S is preferred).

3. **NON-Sewered Water**: The Designer is to incorporate water submeters reading in **CUBIC FEET** as needed to measure the quantity of water that is NOT discharged into the City of Greensboro's sewer system. This non-sewered water typically includes water used for irrigation, make-up water to a cooling tower/condenser water system, makeup water to a chilled water system, makeup water to mechanical equipment, and the like. These water submeters are read by the University on a monthly basis and the readings are provided to the City of Greensboro Water Resources Department in order to obtain a credit on the University's water bill. Recent experience has revealed that the City of Greensboro can refuse to allow the credits if a new or renovated facility includes new water submeters that read in gallons instead of **CUBIC FEET.**

The Designer is to contact the City of Greensboro Water Resources Department at 336-373-4755 to obtain their current requirements for "Deduct Meters" and is to incorporate into the project those requirements, including any radio transmitter equipment, absolute encoder register, etc. that will allow for automated communication with the City of Greensboro's AMI (Advanced Metering Infrastructure) equipment. Designer's failure to do this will force UNCG to seek reimbursement from the Designer for non-sewered water credits lost as a result of installation non-conformance.

E. Chilled Water Meter

1. The UNCG campus standard chilled water meter is the Onicon Incorporated (Clearwater, FL) System-10 Btu Meter with F-1200 Series Dual Turbine Flow Meter (or F-3500 Series Insertion Electromagnetic Flow Meter with System-20 Btu Meter) and RTD insertion temperature sensors.

2. The following readings are typically integrated into the University's Tridium server:
   a. Chilled Water Supply Temperature (degrees F).
   b. Chilled Water Return Temperature (degrees F).
   c. Delta T (degrees F).
   d. Chilled Water Flow in gallons per minute (gal/min.).
   e. Current or Instantaneous tons.
   f. **Cumulative** "ton-hours" (NOT "ton-hours X 1K" or "tons/hr" or "Btu"). This is NOT a monthly cumulative number, but continuous like the odometer on an automobile.

F. Steam Meter
   1. The UNCG campus standard steam meter is the Spirax Sarco TVA Saturated Steam meter with board (part number 9380115) to convert the communications protocol to RS-485. The factory representative is to commission the meter on-site as required and the Controls Contractor is to integrate the steam meter into the BAS. When integrated into the BAS, the readings are to be checked and verified as accurate by comparing the numbers shown on the visual display of the steam meter to the numbers displayed in the BAS.
   2. The two readings to be integrated into the University's Tridium server are Steam Flow in pounds per hour (lb./hr) and **Cumulative** Steam Usage in pounds (lb.).

G. Steam Condensate Meter
   1. The two readings to be integrated into the University's Tridium server are Condensate Flow in gallons per minute (gal/min) and **Cumulative** Condensate Usage in gallons (gal).

H. The Physical Location of each utility meter in the building must be such that a meter reader can read the meter's display **while standing on the floor**.

I. Once the utility meters are set up they generally should NOT be reset. The University reads the utility meters monthly and uses many of the readings for on-campus billing purposes. If any meters have to be "pulled" to be repaired or replaced, the last readings on the meter being removed are to be written down and provided to the University along with the date and time that the meter was "pulled". This should be performed by a qualified individual and coordinated with UNCG Facilities Operations Controls Shop personnel for re-integration of the replacement meter to ensure accuracy and prevent loss of data.

Referenced in Design Guidelines Sections(s):
15170. METERING
15900. HVAC CONTROLS AND INSTRUMENTATION
16440. METERING

UNCG Fire Alarm Programming Guidelines
Revised February 2015

These guidelines are intended to provide specific programming requirements to the fire alarm system installer so that the fire alarm building panel and the panel at the central monitoring station at the UNCG Campus Police Building communicate appropriately. Additionally, these guidelines are intended to ensure that testing and confirmation of accurate communication between the fire alarm building panel and the central monitoring station at the UNCG Campus Police Building is confirmed by the designer prior to occupancy.

Design phase:

On traditional style residence hall projects:

- Activation of one smoke detector within the sleeping room shall activate a sounder base within the same sleeping room and shall send a "pre signal notification" to the monitoring station. This does NOT create a general building alarm. The “pre-signal notification” shall be received at the UNCG Campus Police Building monitoring station as a “Fire status” producing a “yellow” light alert. The building audible, flashing lights, and evacuation should be reserved for "General Alarms" only.
- Activation of any second smoke detector in the building shall be received at the UNCG Campus Police Building monitoring station as a “General alarm”, producing a “red” light alert.
- Activation of any pull station, common area smoke detector, heat detector or water flow switch in the building shall be received at the UNCG Campus Police Building monitoring station as a “General alarm”, producing a “red” light alert.

On apartment and suite style residence hall projects:

- Activation of one smoke detector within the suite/apartment unit shall activate sounder bases and strobes in all areas of the suite/apartment and shall send a "pre signal notification" to the monitoring station. This does NOT create a general building alarm. The “pre-signal notification” shall be received at the UNCG Campus Police Building monitoring station as a “Fire status” producing a “yellow” light alert. The building audible, flashing lights, and evacuation should be reserved for "General Alarms" only.
- Activation of a SECOND smoke detector within the BUILDING (including within the same suite or apartment unit) shall be received at the UNCG Campus Police Building monitoring station as a “General alarm”, producing a “red” light alert.
  Activation of any pull station, common area smoke detector, heat detector or water flow switch in the building shall be received at the UNCG Campus Police Building monitoring station as a “General alarm”, producing a “red” light alert.

All other buildings:

- Activation of a single smoke detector in the building shall be received at the UNCG Campus Police Building monitoring station as a “general alarm” producing a “red” light alert.

Construction phase:

- A fire alarm system pre installation conference is required prior to the fire alarm installer starting work. Programming requirements, quality concerns and schedule shall be reviewed at this conference.
- The fire alarm installer shall provide to UNCG a copy of the CMS after all devices are programmed, after the contractor has completed 100% test, and NO less than five days prior to the engineer's final inspection and certification of NFPA 72.
- UNCG requires a minimum of five days to allow UNCG personnel to program the required contact ID information at the central monitoring station at the UNCG Campus Police Building.
- 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 that type of communication (fire status, general alarm, and trouble) are reported accurately at each test.

Definitions:
(The following definitions are from NFPA 72 2007 edition)

Signal – A status indication communicated by electrical or other means.

Alarm Signal – A signal indicating an emergency condition or an alert that requires action.

Fire Alarm Signal - A signal initiated by a fire alarm-initiating device such as a manual fire alarm box, automatic fire detector, waterflow switch, or other device in which activation is indicative of the presence of a fire or fire signature.

Supervisory Signal - A signal indicating the need for action in connection with the supervision of guard tours, the fire suppression systems or equipment, or the maintenance features of related systems.

Trouble Signal - A signal initiated by a system or device indicative of a fault in a monitored circuit, system, or component.

UNCG Specific Status Outputs:

Fire Status - This type of alarm is used in the Alarmcenter software at the UNC-G dispatch center. Once an alarm has been received from a panel on campus, the signal is translated into an alert that would need to have a dispatcher interact with the software. Historically, the general use at UNC-G of "Fire Status" type alarms are supervisory signals and single detector room activation in dealing with Housing and Residence Life buildings.

SYSTEM OUTPUTS

	CONTROL UNIT ANNUNCIATION					NOTIFICATION								REQUIRED FIRE SAFETY CONTROL						SUPPLEMENARY									
	ACTUATE COMMON ALARM SIGNAL INDICATOR	ACTUATE AUDIBLE ALARM SIGNAL	ACTUATE COMMON AUDIBLE SUPERVISORY SIGNAL	ACTUATE COMMON AUDIBLE SUPERVISORY SIGNAL INDICATOR	ACTUATE ZONE ALARM INDICATOR	ACTUATE AUDIBLE COMMON TROUBLE SIGNAL	ACTUATE COMMON TROUBLE SIGNAL INDICATOR	ACTUATE EVACUATION SIGNAL	DISPLAY/PRINT CHANGE OF STATUS	TRANSMIT FIRE ALARM SIGNAL TO SUPERVISING STATION	TRANSMIT SUPERVISORY SIGNAL TO SUPERVISING STATION	TRANSMIT TROUBLE SIGNAL TO SUPERVISING STATION	ACTUATE SOUNDER BASE(S) LOCAL UNITS IN ROOM/SUITE	TRANSMIT "ROOM ALARM" SIGNAL TO SUPERVISING STATION	ACTUATE ALL SOUNDER BASES	TEMPORARILY SILENCE FIRE ALARM SIGNAL TO SUPERVISING STATION	TEMPORARILY SUSPEND SOUNDER BASES	RELEASE MAGNETICALLY HELD SMOKE DOORS	RELEASE SMOKE DAMPERS	RECALL ELEVATORS TO PRIMARY RECALL FLOOR	ACTUATE ELEVATOR "FIRE HAT" LIGHT	ACTUATE LOCAL/REMOTE LED INDICATORS	UNLOCK EXIT DOORS	ACTUATE GRAPHICS SYSTEM - DISPLAY LED INDICATORS	SHUTDOWN AHU'S	ACTUATE EXTERIOR STROBE	ACTUATE HEARING ACCESSIBLE STROBE(S)	ACTUATE MASS NOTIFICATION UNITS	SHUNT TRIP ELEVATOR POWER	
SYSTEM INPUTS	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	
1	SMOKE DETECTORS	o	o					o		o	o	o					o				o	o				o	o	o	o	o	o	o			1
2	IN-DUCT SMOKE DETECTORS	o	o					o		o	o	o					o				o	o				o	o	o	o	o	o	o			2
3	FIRST SMOKE DETECTOR WITH SOUNDER BASE														o	o																		3
4	SUBSEQUENT SMOKE DETECTOR WITH SOUNDER BASE	o	o					o		o	o	o					o				o	o				o	o	o	o	o	o	o			4
5	FIRST SMOKE DETECTOR/HEARING ACCESSIBLE ROOM														o	o																o			5
6	SUBSEQUENT SMOKE DETECTOR/HEARING ACCESSIBLE RM.	o	o					o		o	o	o					o				o	o				o	o	o	o	o	o	o			6
7	ELEVATOR (PRI) SMOKE DETECTORS	o	o					o		o	o	o									o	o	o			o									7
8	ELEVATOR (ALT) SMOKE DETECTORS	o	o					o		o	o	o									o	o		o		o									8
9	ELEVATOR SHAFT/MECH. RM. SMOKE DETECTORS	o	o					o		o	o	o									o	o			o	o									9
10	THERMAL DETECTORS	o	o					o		o	o	o					o				o	o				o	o	o	o	o	o	o			10
11	THERMAL DETECTOR SHAFT/MECH. RM.	o	o					o		o	o	o					o				o	o				o	o	o	o	o	o	o		o	11
12	PULL STATIONS	o	o					o		o	o	o					o				o	o				o	o	o	o	o	o	o			12
13																																			13
14	LOOP OPEN/SHORT CIRCUIT					o	o				o			o													o	o							14
15	LOOP GROUND FAULT					o	o				o			o													o	o							15
16	LOOP FAILURE					o	o				o			o													o	o							16
17																																			17
18	NAC OPEN/SHORT CIRCUIT					o	o				o			o													o	o							18
19	NAC GROUND FAULT					o	o				o			o													o	o							19
20	NAC FAILURE					o	o				o			o													o	o							20
21	LOSS OF AC POWER					o	o				o																o	o							21
22	LOSS OF AC POWER (>3 HR)			o	o						o		o														o	o							22
23	BATTERY/CHARGER FAILURE			o	o						o		o														o	o							23
24	LOW BATTERY					o	o				o			o													o								24
25	AHU OVERRIDE					o	o				o			o													o								25
26	LOSS OF AC POWER FOR ELEV. SHUNT TRIP			o	o						o		o														o								26
27																																			27
28	SPRINKLER WATER FLOW	o	o					o		o	o	o					o				o	o				o	o	o	o	o	o	o			28
29	SPRINKLER TAMPER SWITCHES			o	o						o		o														o	o							29
30																																			30
31																																			31
32	REMOTE (UPD) MASS NOTIFICATION ACTIVATION																	o	o	o												o			32
33	MASS NOTIFICATION ACTIVATION																	o	o	o												o			33
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	

The following definitions are from NFPA 72 2007 edition:

3.3.172 Signal. A status indication communicated by electrical or other means. (SIG-FUN)

3.3.172.1 Alarm Signal. A signal indicating an emergency condition or an alert that requires action. (SIG-FUN)

3.3.172.4 Fire Alarm Signal. A signal initiated by a fire alarm-initiating device such as a manual fire alarm box, automatic fire detector, waterflow switch, or other device in which activation is indicative of the presence of a fire or fire signature. (SIG-FUN)

3.3.172.6 Supervisory Signal. A signal indicating the need for action in connection with the supervision of guard tours, the fire suppression systems or equipment, or the maintenance features of related systems. (SIG-FUN)

3.3.172.7 Trouble Signal. A signal initiated by a system or device indicative of a fault in a monitored circuit, system, or component. (SIG-FUN)

Fire Status:

This type of alarm is used in the Alarmcenter software at the UNC-G dispatch center. Once an alarm has been received from a panel on campus, the signal is translated into an alert that would need to have a dispatcher interact with the software. Historically, the general use at UNC-G of “Fire Status” type alarms are supervisory signals and single detector room activation in dealing with Housing and Residence Life buildings.

Contact ID reporting takes the following format:

CCCC Q EEE GG ZZZ

CCCC = customer (subscriber account number)

Q = event qualifier, E = new event, R = restore

EEE = event code

GG = partition number, 00-08 (always 00 for non-partitioned panels)

ZZZ = zone ID number reporting the alarm (001-099), or user number for open/close reports.

* System status messages (i.e. AC Loss, Low Battery) contain zeros in the ZZZ location.

Examples of raw data received into Alarmcenter:

1a012 0058181602000003/03/1220:16:30ÿ -Bryan Building

1a016 0009181200000356 09/05/1413:46:24ÿ - Lee Residence Hall

Common event codes we interact with on Campus:

Fire Alarm event codes:

110 FIRE

200 FIRE SUPERVISORY

300 System Trouble

301 AC LOSS

302 LOW SYSTEM BATTERY

350 Communication Trouble

351 TELCO 1 FAULT

352 TELCO 2 FAULT

Panic Alarm event codes:

120 Panic Alarm

121 DURESS

122 SILENT

Burglary alarm panel event codes:

130 Burglary

131 PERIMETER

132 INTERIOR

134 ENTRY/EXIT

TEST / MISC:

602 PERIODIC TEST Test-Periodic (Restore Not Applicable)

UNCG Facilities Operations Preferred Brands
Version 3.1 August 28, 2023

Building Automation System: Schneider Electric, Inc. Tridium Niagara

Chillers, water-cooled: Trane, Inc. a subsidiary of Ingersoll Rand

Door Exit Devices: Von Duprin by Allegion, PLC
Locksets: Corbin Russwin, Inc. (ASSA ABLOY Group)
Door Closers: LCN 4000 Series by Allegion, PLC
Automatic Door Operators: LCN 4640 Series by Allegion, PLC
Cabinet Locks: Olympus Lock, Inc.

Elevators, New: Otis Elevator Company, Inc.
Schindler Elevator Corporation
Thyssenkrupp Elevator Corporation
Elevators, Modernization: Otis Elevator Company, Inc.
Schindler Elevator Corporation
Oracle Elevator Company (Smartrise Controller)
Southern Elevator Company, Inc. (Smartrise Controller)

Fire Alarm Control Panels: EST4 by Edwards, a part of UTC Climate, Controls & Security, a unit of United Technologies Corp.

Paper Towel Dispensers: enMotion® #59462A Black
by Georgia-Pacific Consumer Products LP
or enMotion® #59488A single roll for under cabinets (NIB)
Plumbing Fixtures:
- Flush Valves: Delta by Delta Faucet Company
- Lavatories & Faucets: American Standard Brand lavatories and Delta faucets
- Hose Bibs: Watts or Woodford Manufacturing Company, a Division of WCM Industries, Inc.
- Shower Mixing Valves and Shower Heads: Delta

Security Access Control System: Blackboard Transact by Transact Holdings, Inc.

Toilet Tissue Dispensers: von Drehle 3253 Twin Jumbo Tissue Dispenser

Utility Meters:
- Electricity Meters: Main = EM920-9S-60Hz-5-ETH by SATEC, Inc.
  Submeter = PRO-PM335-HACS-60Hz-ACDC-IOS by SATEC, Inc.
- Steam Meters: TVA by Spirax Sarco Limited.
- Chilled Water Meters: Onicon, Inc.
- Water Meters: Neptune (CUBIC FEET) by Neptune Technology Group, Inc.

VFDs: ABB or Yaskawa
Waste Receptacles, Outdoor: Bigbelly, Inc.

Water Coolers, Bottle Filling Station:
- Single, Wall Hung: Elkay Light Gray LZS8WSLK (ezH_20®)
- Dual, Wall Hung with Bi-Level ADA Cooler: Elkay Light Gray LZSTL8WSLK (ezH_20®)
- Dual, Recessed & Integral SwirlFlo Fountain: Elkay Stainless LZWS-LRPBM28K (ezH_20®)

SECTION 230923 – DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the Building Management System (BMS) control equipment for HVAC systems and components, including open protocol control components for terminal heating and cooling units.

1.3 BID ALTERNATES

A. Provide Owner-Preferred Alternate Bid for Schneider Electric to provide all work associated with this section.

1.4 SYSTEM DESCRIPTION

A. Furnish all labor, materials, equipment, and service necessary for a complete and operating temperature control system, utilizing a high speed peer-to-peer network of interoperable Direct Digital Controls (DDC), Graphical User Interface (GUI) with color graphic displays available on at least 64 client computers, and electronic interfaces and actuation devices, as shown on the drawings and as described herein.

B. The University intends to monitor and control the entire FMS DDC system for this project from the existing browser-based Facility Management System (FMS) as installed by Schneider Electric. A Niagara N4 server is located in the McNutt Data Center and as of March 30, 2023 the current version is 4.10.0.154. It is the intent of the University to integrate the FMS DDC system for this project to the existing Niagara server. The installation of additional servers is not permitted. The entire FMS system including the products and labor detailed in the specifications shall be provided by one of the acceptable control systems integrators. Provide the appropriate number of Niagara based Network Controllers to integrate the DDC system as necessary. The FMS DDC system for this project shall be the same Niagara software version as is currently being used in the University's existing Niagara server.

C. The entire Facility Management System (FMS) shall be comprised of a network of interoperable, stand-alone digital controllers communicating via an open protocol communication network to the Niagara based server. The communication from a building to the server shall be standardized for maintenance and trouble-shooting considerations and shall be via a Network Controller (NC) over the campus Network.

D. UTILITY MONITORING SOFTWARE INTEGRATION: The University requires the creation of specific FMS graphics that detail energy consumption related information in a predetermined

format. The Systems Integrator is responsible for creating and providing these energy consumption FMS graphics.

E. The Local Area Network (LAN) shall be a 100/1000 Mbps Ethernet network supporting BACnet, XML, HTTP, and CORBA IIOP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Controllers, user workstations and a local host computer system. Any form of wireless controls is not allowed and will not be accepted by UNCG.

F. The Enterprise Ethernet (IEEE 802.3) LAN shall utilize Carrier Sense Multiple/Access/Collision Detect (CSMA/CD), Address Resolution Protocol (ARP) and User Datagram Protocol (UDP) operating at 100/1000 Mbps.

G. The University prefers that the system will consist of an open architecture that utilizes the ANSI/ASHRAE Standard 135 BACnet as the common communication protocol between all controllers to assure interoperability between all system components. The ANSI/ASHRAE Standard 135 BACnet protocol is required to assure that the project is fully supported by the leading HVAC open protocol to reduce future building maintenance, upgrade, and expansion costs.

H. The system will consist of an architecture that utilizes a MS/TP selectable 9.6-76.8 K Baud protocol, as the common communication protocol between all controllers and integral ANSI/ASHRAE Standard 135 BACnet functionality to assure interoperability between all system components. Capability of communications as a MS/TP device or as a BACnet IP device communicating at 100/1000 Mbps on a TCP/IP trunk is required.

I. The products used in constructing the BMS shall be BACnet Testing Laboratories (BTL) Certified.

J. The software tools required to network manage the ANSI/ASHRAE Standard 135 BACnet protocol must be provided with the system. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans, that are required to meet the functional intent, shall be provided without additional cost to the Owner. Minimum BACnet compliance is BTL Certification; with the ability to support data read and write functionality. Physical connection of BACnet devices can be via Ethernet/Ethernet IP or MS/TP.

K. The Ethernet communication protocols must be fully compatible with the Campus-Wide Ethernet communication specifications. The Systems Integrator must coordinate with Campus Information Technology Services (ITS) personnel to obtain written approval to operate on the Campus-Wide Network.

L. Complete temperature control system to be DDC with electronic sensors and electronic/electric actuation of Mechanical Equipment Room (MER) valves and dampers and electronic actuation of terminal equipment valves and actuators as specified herein. The BMS is intended to seamlessly connect devices throughout the building regardless of subsystem type, for example: variable frequency drives, low voltage lighting systems, electrical circuit breakers, power metering and card access should easily coexist on the same network channel.
   1. The supplied system must incorporate the ability to access all data using readily-available web browsers without requiring proprietary operator interface and configuration programs.
   2. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage.
      a. This data shall reside on a supplier-installed server for all database access.

b. Systems requiring proprietary database and user interface programs shall not be acceptable.
c. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network.
d. Systems employing a "flat" single tiered architecture shall not be acceptable.

M. All work described in this section shall be installed, wired, circuit tested and calibrated by factory-certified technicians qualified for this work and in the regular employment of the approved manufacturer's local field office. The approved manufacturer's local field office shall have a minimum of 5 years of installation experience with the manufacturer and shall provide documentation in the bid and submittal package verifying longevity of the installing company's relationship with the manufacturer when requested. Supervision, hardware and software engineering, calibration and checkout of the system shall be by the employees of the approved manufacturer's local field office and shall not be subcontracted. The control contractor shall have an in place support facility within 100 miles of the site with factory-certified technicians, spare parts inventory and all necessary test and diagnostic equipment for the installed system, and the control contractor shall have 24 hours/day, 7 days/week emergency service available.

N. Provide a Commissioning Configuration and Diagnostic Tool (CCDT), software, and interfaces to provide uploading/downloading of High Point Count Controller, Unitary Equipment Controller (UEC) and VAV controller monitoring all BACnet objects, monitoring and overrides of all controller physical input/output points, and editing of controller-resident time schedules. CCDT connectivity shall be via digital wall sensor connected to controller, through a MS/TP jack on the controller, through tunneling using a Network Controller, and Wi-Fi wireless connection.

O. Provide software, and interfaces to provide uploading/downloading of Custom Application Controller and Application Specific Controllers databases, monitoring and overrides of all controller physical input/output points, and editing of controller resident time schedules. POT connectivity shall be via digital wall sensor connected to controller.

P. University Policy for Vendor Access to the University's Virtual Private Network (VPN) and Computing Resources. Persons who are not being paid via The University of North Carolina at Greensboro (UNCG) Payroll but who provide services to UNCG (Affiliates) may need access to computing resources requiring computing accounts at UNCG. To receive Affiliate Accounts, the nature of such a relationship must first be defined, approved, and recorded in UNCG's Information System (Banner). Accounts are then automatically issued in the same conventional manner as employees. For more details, see/request "Non-UNCG Payroll Persons with UNCG Relationship." Affiliate Accounts are subject to the same acceptable use agreements, password policies, and multi-factor authentication requirements as all UNCG accounts, no exceptions.

1.5 INSTALLATION OF PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION.

A. Hydronic Piping:
1. Control Valves.
2. Flow Switches.
3. Temperature Sensor Wells and Sockets.
4. Flow meters.

B. Ductwork Accessories:
1. Automatic Dampers.

2. Airflow Stations.
3. Terminal Unit Controls.

1.6 SUBMITTALS.

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
1. Each control device labeled with setting or adjustable range of control.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, and method of field assembly, components, and location and size of each field connection.
1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
3. Details of control panel faces, including controls, instruments, and labeling.
4. Written description of sequences of operation.
5. Schedule of dampers including size, leakage, and flow characteristics.
6. Schedule of valves including close-off and flow characteristics.
7. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
8. Listing of connected data points, including connected control unit and input device.
9. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
10. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

C. BACnet Protocol Implementation Conformance Statement clarifying which BACnet objects and services are supported by each controller.

D. External Interface Files: XIF files or object diagrams for each DDC system component (Custom Application Controller and Application Specific Controller) proposed.

E. ANSI/ASHRAE Standard 135 BACnet: Proof of BTL Certification is required to protect building Owner by reducing future maintenance and expansion costs.

F. Samples: For each color required, of each type of thermostat cover.

G. Software and Firmware Operational Documentation: Include the following:
1. Engineering, Installation, Operation and Maintenance manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Licenses, guarantee, and warranty documents for all equipment and systems.

H. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

I. Maintenance Data: For systems to include in maintenance manuals specified in Division 1. Include the following:
   1. Maintenance instructions and lists of spare parts for each type of control device and compressed air station.
   2. Interconnection wiring diagrams with identified and numbered system components and devices.
   3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
   4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
   5. Calibration records and list of set points.

J. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

K. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.

1.7 QUALITY ASSURANCE.

A. Bids by wholesalers, distributors, and contractors who are non-franchised or are not factory-authorized to install proposed controls components shall not be acceptable.

B. The system manufacturer shall, as a minimum, manufacture and supply the Custom Application Controller, Application Specific Controller, Variable Air Volume Direct Digital Controller, Unitary Equipment Controller, Advanced Application Controller, Graphical User Interface, damper actuators, and valve actuator assemblies.

C. All work described in this section shall be installed, wired, circuit tested and calibrated by factory-certified technicians qualified for this work and in the regular employment of the temperature control system manufacturer's local field office.

D. The Building Management System contractor shall have a full service facility within 100 miles of the project with technical staff trained in integrating interoperable systems and technicians fully capable of providing ANSI/ASHRAE Standard 135 BACnet instructions and routine emergency maintenance service on all system components.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 National Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Comply with NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

G. Comply with National Electrical Code, UL-916 Energy Management Systems, ULC, FCC Part 15, subpart J, Class B Computing Devices.

1.8 DELIVERY, STORAGE AND HANDLING.

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

1.9 COORDINATION.

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment from other divisions including "Intrusion Detection," "Lighting Controls," "Motor Control Centers," "Panelboards," and "Fire Alarm" to achieve compatibility with equipment that interfaces with those systems.

C. Coordinate supply of conditioned electrical circuits for control units and operator workstation.

D. Coordinate location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete".

E. Coordinate with the Owner's ITS department on locations for Network Controllers, Ethernet communication cabling, and network addresses.

1.10 WARRANTY AND MAINTENANCE.

A. All components, system software, and parts furnished and installed by the FMS contractor shall be guaranteed against defects in materials and workmanship for 1 year after substantial completion/project acceptance by the University. Labor to repair, reprogram, or replace these components shall be furnished by the FMS contractor at no charge during normal working hours during the warranty period. Materials furnished but not installed by the FMS contractor shall be covered to the extent of the product only. Installation labor shall be the responsibility of the trade contractor performing the installation. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software storage media. The Contractor shall respond to the Owner's request for warranty service within two (2) hours.

1.11 OWNERSHIP OF PROPRIETARY MATERIAL.

A. The Owner shall sign a copy of the manufacturer’s standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer’s license agreement but shall protect manufacturer’s rights to disclosure of trade secrets contained within such software. All project-developed software and documentation shall become the property of the Owner. These include, but are not limited to project graphic images, record drawings, project database, project specific application programming code, and all other associated documentation.

B. The Owner has signed a software and firmware licensing agreement for the FMS software. Systems Integrators that participate in the integration of direct digital control systems must:
1. Be certified in the use, application, and service of Niagara software and shall provide documentation from the manufacturer’s training center as such. However, certification in the above does not automatically qualify an integrator to bid on proposed UNCG projects. Only approved integrators listed in this specification are eligible to participate in the project.
2. Agree to use on any UNCG project any application standards, html pages, graphics templates, etc. developed by or for UNCG for the purpose of digital control, scheduling, alarming, graphics, etc.

3. Agree that the application standards, html pages, graphics templates, etc. developed by or for UNCG are the property of UNCG (subject to the manufacturer's license agreement) and shall not be reproduced, etc. for use on any other customer, project, etc. without the expressed written permission of the UNCG facilities staff.
4. Agree that certification on the manufacturer's software does not guarantee continued participation in UNCG FMS projects.
5. Agree to provide UNCG staff with the highest level of administrative password.
6. Agree that UNCG staff and other Systems Integrators can use the onsite UNCG software tools to modify NACs, license files, passwords, provide software maintenance, etc. after warranty period expires.

C. The Owner requires that all Niagara based software and hardware on this project have the Niagara Information and Conformance Statement (NICS). Organizations without the NICS shall not be allowed to bid.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following pre-qualified manufacturers:
1. Direct Digital Control Systems and Approved Installing Contractors:
   a. Schneider Electric – Niagara 4 Series Controls - installed by approved manufacturer's local field office.
   b. CMS Controls – Distech Controls - installed by approved manufacturer's local field office.
   c. Brady – Trane Tracer SC Controls - installed by approved manufacturer's local field office.

B. Application engineers working on this project shall be certified in Niagara and certified by the DDC controls manufacturer to perform all engineering services. The Systems shall be installed by trained mechanics either in direct employ of Systems Integrator or by subcontractors who are under direct supervision of Systems Integrator's field representative. Submit resumes of application engineers and field supervisors to be assigned to this project within 30 days after contract award. Application engineers shall have prior experience with at least 2 similar types of projects. UNCG reserves right to exclude any engineers or field supervisors whose past experience is not sufficient to meet the needs of the project.

C. Systems Integrators labor shall include, but is not limited to:
1. Engineering services to size all valve and dampers based on design criteria specified.
2. Engineering services to produce all submittals requested and working construction drawings and record drawings as specified here within.
3. Engineering services for all software programming required.
4. Engineering services for all software programming specified.
5. Project management services with single point contact to coordinate all construction related activities.
6. Field mechanics for installation of pneumatic tubing and related control devices.
7. Field mechanics for installation of control wiring and related control devices.
8. Field technicians to start-up, calibrate, adjust, and tune all control loops per specifications.

9. Field technicians to perform system checkout, testing and complete required reports.
10. Full time field supervisor during controls installation and start-up.
11. Field technicians to assist testing and balancing contractor in adjusting controls and determining set points related to his scope of work.
12. Field representatives and classroom instructors to provide Owner training as specified.

D. Controls Systems Integrator shall be responsible for complete installation of all control devices, except as noted, wiring and pneumatic terminations at panel locations to accomplish control sequences specified in this project manual or on drawings. Systems Integrator is also responsible for any additional instrumentation described in any point schedules found in this contract document, which may not be related to any specified control sequences.

2.2 DDC EQUIPMENT

A. Workstation Server Hardware Station:
1. The UNCG FMS Niagara N4 Server/Platform is existing and historically has resided in the McNutt Data Center.

B. Graphical User Interface Software:

UNCG has licensed a Niagara Supervisor for the development of their FMS logic and graphics. This user interface shall allow, with proper password access, full interaction with the system including, but not limited to, viewing and modifying data, database administration, configuration of communications parameters, password and security administration, programming and configuration of components, receipt, routing and acknowledgement of alarms, and development of graphic screens.

1. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands, and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
2. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
    a. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
    b. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
    c. Graphics shall support layering and each graphic object shall be configurable for assignment to one a layer. A minimum of six layers shall be supported.
    d. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
        1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
        2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

3. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
4. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.
5. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
    a. Create, delete, or modify control strategies.
    b. Add/delete objects to the system.
    c. Tune control loops through the adjustment of control loop parameters.
    d. Enable or disable control strategies.
    e. Generate hard copy records or control strategies on a printer.
    f. Select points to be alarmable and define the alarm state.
    g. Select points to be trended over a period of time and initiate the recording of values automatically.
6. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.
7. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
8. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
9. Alarm Console
    a. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
    b. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

C. Web Browser Clients
1. The system shall be capable of supporting 64 clients using a standard web browser. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, are only acceptable if 64 licensed copies of the client machine software are provided, installed, and tested.
2. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function

with the FMCS, shall only be acceptable if 64 workstations or workstation hardware upgrades are provided.

3. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.
4. The Web browser client shall support at a minimum, the following functions:
   a. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
   b. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
   c. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
   d. Storage of the graphical screens shall be in the Building Control Units (BC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
   e. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
   f. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
      1) Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
         a) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
         b) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
      2) Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
      3) View logs and charts
      4) View and acknowledge alarms
   g. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
   h. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

D. FMS GRAPHICS

1. Graphics templates shall be coordinated with UNCG staff and shall conform to standards developed in previous Niagara systems at UNCG. The Integrator will be responsible for creating web pages within the supplied system and in the FMS Niagara server, including home page(s), with new information, links, etc. as buildings or systems are added. It is the SI's responsibility to remain knowledgeable about UNCG's standard FMS procedures, web page style, and existing palette of components prior to bidding each project.

2. This template shall not include all of the various scenarios or equipment that may be present on every project rather it provides a general overview of how each system shall look and how the data shall be displayed. A pre-engineering meeting shall be arranged between the systems integrator and the Owner to discuss each project specifically before engineering and graphics development begin. The following are mandatory requirements for each site.
   a. Each graphics screen shall include the approved UNCG format and links across the top per the graphics template.
   b. The systems integrator is responsible for providing a link to the control drawings (.pdf format) for each associated piece of equipment. A button for control drawings shall be located on the UNCG frame navigation bar. On integration projects, where existing controls exist, UNCG shall be responsible for providing the control drawings to the systems integrator. On new projects the systems integrator shall be responsible for providing the as-built control drawings.
   c. The systems integrator is responsible for providing a link to the operating and maintenance manuals for each major piece of equipment (AHUs, Pumps, VFDs). This link shall be located on the graphic for each piece of equipment, per the template.
   d. All graphics shall have a resolution of 1024 by 768 pixels.
   e. All graphics shall be designed for viewing using the current web browser utilized by UNCG at the time of deployment.
   f. All graphics shall conform to the UNCG standard, including easy access to trends as implemented for the Nursing and Instructional Building.
   g. Any graphics work developed and provided by the Systems Integrator for any UNCG project shall become the property of UNCG.
   h. The systems integrator shall submit to UNCG two (2) copies of a graphical proposal. The graphical proposal shall include written and graphical representation of proposed Web-based, FMS navigational user interface including screen shots to be used for the proposed project. Software graphical proposals viewable with a browser, delivered on compact disc or available via the Internet are acceptable.

E. Control Units General:

Provide an adequate number of control units to achieve monitoring and control of all data points specified and necessary to satisfy the sequences of operation for all mechanical systems shown on the plans. Provide a minimum of one separate controller for each AHU or other major HVAC system. Multiple DDC controllers may control one system provided that all points associated with individual control loops are assigned to the same DDC controller. Points used for control loop reset such as outside air or space temperature are exempt from this requirement. Each of the following panel types shall meet the following requirements.

1. Controllers shall be suitable for the anticipated ambient conditions.
   a. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -40°F to 140°F and 5 to 95% RH, non-condensing.
   b. Controllers used in conditioned ambient space shall be mounted in dustproof enclosures and shall be rated for operation at 32°F to 122°F and 5 to 95% RH, non-condensing.
2. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Memory: The Control Units shall maintain all BIOS and programming information in the event of a power loss for at least seventy-two (72) hours.

4. Diagnostics: The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall assume a predetermined failure mode and generate an alarm notification.
5. Immunity to power and noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 ft.
6. Automatic staggered restart of field equipment after restoration of power and short cycle protection.

F. Network Controllers (NC)
1. The Network Controllers (NC) shall provide the interface between the LAN or WAN and the field control devices and provide global supervisory control functions over the control devices connected to the NC. It shall be capable of executing application control programs to provide:
   a. Calendar functions
   b. Scheduling
   c. Trending
   d. Alarm monitoring and routing
   e. Time synchronization by means of an Atomic Clock Internet site including automatic synchronization
   f. Integration of BACnet controller data
   g. Network Management functions for all BACnet-based devices
   h. Ethernet Ports – 100/1000 Mbps
   i. RS-232 ports
   j. RS-485 ports electrically isolated
   k. Power supply 24 VAC or 24 VDC
   l. Battery Backup
   m. Uninterruptible Power Supply (UPS) for 120 Volt AC
   n. Real-time clock
   o. Browser support for operator interface
   p. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 100 gigabyte storage capacity)
   q. Ram
2. The NC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NC shall be an ODBC compliant database or must provide an ODBC data access mechanism to read and write data stored within it.
3. The NC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 64 simultaneous users.
4. Event Alarm Notification and actions
   a. The NC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
   b. The NC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
   c. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
      1) To alarm
      2) Return to normal
      3) To fault

d. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
e. Provide timed (schedule) routing of alarms by class, object, group, or node.
f. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
g. Control equipment and network failures shall be treated as alarms and annunciated.
h. Alarms shall be annunciated in any of the following manners as defined by the user:
    1) Screen message text
    2) Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
        a) Day of week
        b) Time of day
        c) Recipient
    3) SMS Text Message or Email to mobile devices such as the "On Call Phone."
    4) Graphic with flashing alarm object(s)
    5) Printed message, routed directly to a dedicated alarm printer
i. The following shall be recorded by the NC for each alarm (at a minimum):
    1) Time and date.
    2) Location (building, floor, zone, office number, etc.).
    3) Equipment (air handler #, accessway, etc.).
    4) Detailed description of the alarm.
    5) Acknowledge time, date, and user who issued acknowledgement.
    6) Number of occurrences since last acknowledgement.
    7) Deletion protection/permanent archive per UNCG System Administrator.
j. Alarm actions may be initiated by user-defined programmable objects created for that purpose.
k. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
l. A log of all alarms shall be maintained by the NC and/or a server (if configured in the system) and shall be available for review by the user.
m. Provide a "query" feature to allow review of specific alarms by user-defined parameters.
n. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
o. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

5. Data Collection and Storage
    a. The NC shall have the ability to collect data for any property of any object and store this data for future use.
    b. The data collection shall be performed by log objects, resident in the NC that shall have, at a minimum, the following configurable properties:
        1) Designating the log as interval or deviation.
        2) For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
        3) For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
        4) For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.

5) Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

6. All log data shall be stored in a relational database in the NC and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.
7. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
8. All log data shall be available to the user in the following data formats:
   a. HTML
   b. XML
   c. Plain Text
   d. Comma or tab separated values
9. Systems that do not provide log data in HTML and XML formats at a minimum shall provide as an alternative Microsoft SQL Server, Oracle 8i or Express, Hyperion Solutions™ SQL Server.
10. The NC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NC on the network. Provide the ability to configure the following archiving properties, at a minimum:
    a. Archive on time of day
    b. Archive on user-defined number of data stores in the log (buffer size)
    c. Archive when log has reached its user-defined capacity of data stores
    d. Provide ability to clear logs once archived
11. AUDIT LOG
    a. Provide and maintain an Audit Log that tracks all activities performed on the NC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NC), to another NC on the network, or to a server. For each log entry, provide the following data:
       1) Time and date
       2) User ID
       3) Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.
12. DATABASE BACKUP AND STORAGE
    a. The NC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
    b. Copies of the current database and, at the most recently saved database shall be stored in the NC. The age of the most recently saved database is dependent on the user-defined database save interval.
    c. The NC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

G. Custom Application Control (CAC) Units:

Modular, comprising processor board with programmable, nonvolatile, RAM/EEPROM memory for custom control applications. CAC's shall be provided for Roof Top Units, Boiler Plant, Chiller Plant, and other applications as shown on drawings and shall have published BACnet application source code, device resource files and external interface definitions.

1. Units monitor or control each input/output point; process information; and at least 50 expressions for customized HVAC control including mathematical equations, boolean logic, PID control loops with anti-windup, sequencers, timers, interlocks, thermostats, enthalpy calculation, counters, interlocks, ramps, drivers, schedules, calendars, OSS, compare, limit, curve fit, and alarms.

2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
   a. Automatic communications loss detection to maintain normal control functionality regardless of available network communications.
   b. Discrete/digital, analog, and pulse input/outputs.
   c. Monitoring, controlling, or addressing data points.
   d. Local energy management control strategies.
   e. Incorporate internal customizable safeties and limits to prevent improper and unrealistic inputs to CAC's.
3. Local operator interface port provides for download from and connection to portable workstation.
4. Communication: The Custom Application Controller shall communicate via the Primary Controller Network between BMS Controllers and other BACnet devices. CAC's shall communicate with the Building Controller and ASC's at a baud rate of not less than 78.8K baud.

H. Portable Engineering Stations for BACnet Controllers
1. Provide Portable Engineering Station (PES) software and licenses, including Workbench software and licenses, for up to four (4) UNCG laptops/portable workstations, and interfaces to provide; uploading/downloading of Advanced Application Controller, Unitary Equipment Controller and Variable Air Volume Box Controller databases, monitoring of all BACnet Objects including but not limited to Analog and Digital Inputs/Outputs/Values. The PES shall be capable of monitoring and overriding all controller physical input/output points and editing of controller resident time schedules. PES connectivity shall be via digital wall sensor connected to controller, through MS/TP jack on controller, and via tunneling using Wi-Fi wireless connection.
2. The Portable Engineering Station shall be able to access any other controller on that segment of the local network.
3. Connection of a PES to the Advanced Application Controller, Unitary Controller or VAV Box Controller shall not interfere with normal network operation in anyway, prevent alarms from being transmitted, or centrally-initiated commands from being executed.
4. Functionality of the PES connected to any AAC, UEC or VAVDDC shall include:
   a. Uploads and downloads of AAC, UEC and VAVDDC Controller databases.
   b. Uploads and downloads of controller BACnet Objects.
   c. Editing of BACnet Object values for minor equipment operational parameters (including minimum on/off and delay times, changeover values, minimum position setpoints, etc.). All such mechanical equipment editable BACnet Objects shall contain internal Controller safety range limits to prevent accidental entry of out of range or invalid values.
   d. Monitoring and overrides of all controller physical input/output points including timed overrides that automatically revert back to their normal value.
   e. Display of digital sensor values including diagnostics and calibration.
   f. Editing of controller time/date.
   g. Editing and overrides of resident Controller time schedules.
   h. BACnet information including device ID, BACnet instance, and BACnet description.

I. Configuration, Commissioning and Diagnostic Tool (CCDT)
1. Provide a Configuration, Commissioning and Diagnostic Tool (CCDT) software and licenses, and interfaces to provide uploading/downloading of Advanced Application Controller (ACC), Unitary Equipment Controller (UEC) and VAV Box DDC Controller (VAVDDC), monitoring of all BACnet objects, all inputs, and outputs. CCDT

connectivity shall be via digital wall sensor connected to controller, MS/TP bus on controller, Ethernet via tunneling using Wi-Fi wireless connection.

2. Connection of a CCDT to the Advanced Application Controller, Unitary Equipment Controller or VAV Box DDC Controller shall not interfere with normal network operation in anyway, prevent alarms from being transmitted or centrally initiated commands from being executed.
3. If the CCDT cannot be used for the AAC, UEC and VAVDDC's provide, in addition to the CCDT, the separate color display personal computer(s), software, and interfaces required to provide full CCDT functionality for AAC's, UEC's and VAVDDC's.
4. Functionality of the CCDT connected to any AAC, UEC, or VAVDDC Controllers shall include:
    a. Uploads and downloads of Controller databases.
    b. Uploads and downloads of Controller's BACnet Objects values.
    c. Editing of BACnet values for minor equipment operational parameters (including minimum on/off and delay times, changeover values, minimum position setpoints, etc.). All such mechanical equipment editable BACnet values shall contain internal Controller safety range limits to prevent accidental entry of out of range or invalid values.
    d. Monitoring of all BACnet objects including display of all test overrides of inputs, outputs and BACnet objects.
    e. Monitoring and overrides of all controller physical input/output points including timed overrides that automatically revert back to their normal value.
    f. Display of digital sensor values including diagnostics and calibration.
    g. Editing of controller time/date.
    h. Editing and overrides of resident Controller time schedules.
    i. BACnet information including device ID, BACnet instance, and BACnet description. Coordinate BACnet device IDs with current/existing UNCG BACnet device IDs to avoid duplication and communication issues.
    j. Integration of BACnet controller data
    k. Network Management functions for all BACnet based devices

J. Advanced Application Controller (AAC):

Modular, comprising processor board with programmable, nonvolatile, RAM/EEPROM memory for custom control applications. AAC's shall be provided for large AHU's, Boiler Plant, Chiller Plant, and other applications as shown on drawings.

1. Units monitor or control each input/output point; process information; and at least 50 expressions for customized HVAC control including mathematical equations, Boolean logic, PID control loops with anti-windup, sequencers, timers, interlocks, thermostats, enthalpy calculation, counters, interlocks, ramps, drivers, schedules, calendars, OSS, compare, limit, curve fit, and alarms.
2. The Advanced Application Controller shall have the following point count as a minimum.
    a. 4 Digital Inputs.
        1) 10 pulses per second.
    b. 12 Universal Inputs
        1) 0-20mA
        2) 0-5 VDC
        3) Balco Sensors
        4) Platinum Sensor
        5) 10K thermistor
    c. 8 Universal Outputs

1) 0-20 mA
2) 12 VDC relay driver
3) Individually short circuit protected
4) LED indication

d. 8 Digital Outputs
1) Triacs
2) LED indication

3. The controller shall come with an on board regulated 20 VDC power supply rated at 100 mA.
4. The controller shall have removable terminals for:
a. 24 VAC Power inputs
b. MS/TP Communication terminals
5. Stand-alone mode control functions shall operate regardless of network status. Functions include the following:
a. Peer to peer primary network level communications supporting BACnet objects and services according to PIC and BIBBs statement.
b. Automatic communications loss detection to maintain normal control functionality regardless of available networks communications.
c. Discrete/digital, analog, and pulse input/outputs.
d. Monitoring, controlling, or addressing data points.
e. Local energy management control strategies
f. Incorporate internal customizable safeties and limits to prevent third party BACnet tools from providing improper and unrealistic inputs to AAC's.
6. Local operator interface port provides for download from and connection to portable workstation.
7. Communication:
a. The Advanced Application Controller shall communicate via the Primary Controller Network between BMS Controllers and other BACnet devices.
b. Communication shall be peer-peer.
c. AAC's shall communicate with and other BACnet devices at a baud rate selectable between 9.6 and 76.8 K baud using MS/TP communications protocol.
d. AAC shall communicate with the UNC using:
1) RS-485 trunk with a baud rate selectable between 9.6 and 76.8 K baud using MSTP communications protocol.
2) An Ethernet trunk 100/1000 Mbps using BACnet IP.

K. AAC Room Sensor
1. The AAC Sensor shall provide room temperature value and humidity to the controller.
2. Each AAC shall support a minimum of two sensors.
3. The AAC Sensor shall connect directly to the controller and shall not utilize any of the I/O points of the controller.
4. The AAC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive.
5. The AAC Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering.
6. The AAC Sensor shall allow for the customization of the color on the esthetic covering as a standard offering.
7. The AAC Sensor shall be supplied in the following manner:
a. LCD display for showing (typically) the current temperature.
b. Tenant override to allow timed override of unoccupied to occupied mode of operation.
c. LED indication of override state

d. Up/Down keys to allow adjustment of the current setpoint
e. User interface with the AAC Sensor shall be provided as a configurable function and shall offer password protection for access to network variable editing.
f. ASHRAE compliance (LCD display and sub-base functionality)
g. The room sensor shall provide access to additional diagnostic data from a sensor-user keypad request. This Diagnostic mode is displayed on the LCD screens and includes separate displays for the controllers:
    1) Subnet and Node Address
    2) Errors
    3) Alarms
    4) Temperature Offset

L. Unitary Equipment Controller (UEC) Units:

Single board construction comprising processor board with programmable, nonvolatile, RAM/EEPROM memory for custom control and unitary applications. ASCs shall be provided for Unit Ventilators, Fan Coils, Heat Pumps, Rooftop Units, and other applications as shown on the drawings. To assure complete interoperability, all UEC's firmware shall support all BACnet objects and services as called out in the PIC and BIBBs statement.

1. The Unitary Equipment Controller shall have the following point count as a minimum.
    a. 6 Universal Inputs
        1) 0-20mA
        2) 0-5 VDC
        3) Balco Sensors
        4) Platinum Sensor
        5) 10K thermistor
    b. 4 Analog Outputs
        1) 0-20 mA
        2) 0-5/10 VDC
        3) Individually short circuit protected
    c. 8 Digital Outputs
        1) Triacs
        2) LED indication
2. Units monitor or control each input/output point; process information; and download from the operator station.
3. The controller shall have removable terminals for:
    a. 24 VAC Power inputs
    b. MS/TP Communication terminals
4. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    a. Peer to peer primary network level communications with automatic communications loss detection to maintain normal control functionality regardless of available network communications.
    b. Discrete/digital, analog, and pulse input/output.
    c. Monitoring, controlling, or addressing data points.
    d. Appropriate BACnet Objects for specific unitary applications.
5. Local operator interface port located on UEC and UEC sensor provides for download from or upload to portable workstation. All bus devices shall be accessible from either port.
6. Communication: UEC’s shall communicate with the UNC and ACC at a baud rate selectable of 9.6-76.8 K baud utilizing MS/TP.
7. UEC units monitor or control each input/output point; process information; and at least 50 expressions for customized HVAC control including mathematical equations, Boolean

logic, PID control loops with anti-windup, sequencers, timers, interlocks, thermostats, counters, interlocks, compare, limit, and alarms.

8. All UEC Controller setpoints shall be digital display setpoints with dual setpoint limits (integral hard limits which the user cannot exceed above and below and independent soft limits which are hidden from the user). All digital setpoints shall be network retentive after power outages and after replacement of sensor.

M. UEC Room Sensor

1. The UEC Sensor shall provide room temperature value and humidity to the UEC.
2. Each UEC will support a minimum of two room sensors.
3. The UEC Sensor shall connect directly to the ASC and shall not utilize any of the I/O points of the controller.
4. The UEC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive.
5. There shall be one UEC Sensor per floor wired so that the communication jack will provide for a connection to the native BACnet RS-485 communication trunk to which the UEC controller is connected.
6. By connecting to this UEC Sensor, the connected controller, and all other devices on the native BACnet RS-485 bus shall be accessible by the Portable Engineering Station.
7. The UEC Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering.
8. The UEC Sensor shall allow for the customization of the color on the esthetic covering as a standard offering.
9. The ASC Sensor shall be supplied in the following manner:
    a. LCD display for showing (typically) the current temperature.
    b. Tenant override to allow timed override of unoccupied to occupied mode of operation.
    c. LED indication of override state
    d. Up/Down keys to allow adjustment of the current setpoint
    e. User interface with the UEC Sensor shall be provided as a configurable function and shall offer password protection for access to network variable editing.
    f. ASHRAE compliance (LCD display and sub-base functionality)
    g. The room sensor shall provide access to additional diagnostic data from a sensor-user keypad request. This Diagnostic mode is displayed on the LCD screens and includes separate displays for the controllers:
        1) Subnet and Node Address
        2) Errors
        3) Alarms
        4) Temperature Offset

N. VAV Controller Functionality (VAVDDC).

Controls shall be microprocessor based Pressure Independent Variable Air Volume Digital Controllers, as shown in the drawings. The VAVDDC shall be a single integrated package consisting of a microprocessor, power supply, damper actuator, differential pressure transducer, field terminations, and application software. All input/output signals shall be directly hardwired to the VAVDDC controller. The internal actuator shall employ a manual override that allows for powered or non-powered adjustment of the damper position. In all cases, the controller shall automatically resume proper operation following the return of power to, or control by the ASC.

Programming, configuring and/or troubleshooting of input/output signals shall be easily executed through the ASC sensor or GP tool connected at the wall sensor location.

1. Shall provide BACnet object and service support to provide BAS integration and optimum use of network bandwidth,
2. The VAVDDC control algorithms shall be designed to limit the frequency of damper repositioning, to assure a minimum 10-year life from all components. The VAVDDC shall provide internal differential pressure transducer for pressure independent applications with an accuracy of ± 5 %. VAVDDC and transducer shall be able to deliver accurate measurement and control for a minimum pressure of .004 in wc. Flow through transducers requiring filter maintenance are not acceptable.
3. The VAVDDC shall provide positive hardware feedback of the damper position. Damper position calculated on actual flow versus maximum flow is not acceptable. Damper position shall be capable of being easily displayed on VAV box graphic at either the UNC or Workstation.
4. The VAVDDC shall provide zone control accuracy equal to or better than +/- 1 degree F. Systems providing control accuracies greater than +/- 1 degree F are not acceptable. With the submittal package, Contractor shall provide performance data that verifies control accuracy of the VAVDDC.
5. All input/output signals shall be directly hardwired to the VAVDDC. A minimum of three input points of the VAVDDC shall employ a universal configuration that allows for flexibility in application ranging from dry contact, resistive, to voltage/current sourced inputs. If three universal points are not available, a minimum of three input points (each) of the dry contact, resistive and analog voltage/current types must be Triac and universal analog form. All digital outputs shall be Triac type. Devices utilizing non-relay outputs shall provide an interface relay for all points. All analog outputs shall be programmable for their start points and span to accommodate the control devices. Configuration of all I/O points shall be accomplished without physical hardware jumpers, switches, or settings. Troubleshooting of input/output signals shall be easily executed with the Graphical Programming tool or a volt-ohm meter (VOM). All I/O points shall be utilized by the local ASC or shall be available as I/O points for other controllers throughout the network.
6. The FMCS contractor shall provide VAVDDC to the VAV box manufacturer, for factory mounting. The VAV terminal unit supplier shall include in its price all costs for mounting of VAVDDC controller, connection of actuator to damper shaft, wiring of device power, wiring of VAVDDC to fan (fan powered terminal) and wiring to electric reheat coils or reheat valve actuator as specified on drawing.
7. The VAV terminal manufacturer shall provide a multi-point, averaging, differential pressure sensor mounted on the inlet to each VAV box. The VAV terminal unit manufacturer shall supply a line to low voltage transformer, of sufficient capacity, to power the VAVDDC plus all reheat valves and/or contactors and fan circuits associated with the VAV terminal and actuator assemblies. The FMCS contractor shall provide all reheat control valves to the mechanical contractor for mounting and piping. The FMCS contractor shall provide and install all wiring between the valve and VAVDDC controller and between the room sensor and the VAVDDC controller.

O. VAV Box Room Sensor

1. The VAV Box Room Sensor shall provide room temperature value to the controller.
2. The VAV Box Room Sensor shall connect directly to the controller Box and shall not utilize any of the I/O points of the controller.
3. The VAV Box Room Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive.

4. There shall be one VAV Box Room Sensor per floor wired so that the communication jack will provide for a connection to the communication trunk to which the VAV controller is connected.
5. By connecting to this VAV Box Room Sensor, the connected controller, and all other devices on the native BACnet RS-485 bus shall be accessible by the Portable Engineering Station.
6. The VAV Box Room Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering.
7. The VAV Box Room Sensor shall allow for the customization of the color on the esthetic covering as a standard offering.
8. The VAV Box Room Sensor shall be supplied in the following manner:
    a. LCD display for showing (typically) the current temperature.
    b. Tenant override to allow timed override of unoccupied to occupied mode of operation.
    c. LED indication of override state
    d. Up/Down keys to allow adjustment of the current setpoint
    e. User interface with the VAV Box Sensor shall be provided as a configurable function and shall offer password protection for access to network variable editing.
    f. ASHRAE compliance (LCD display and sub-base functionality)
    g. The VAV Box Room Sensor shall provide access to additional diagnostic data from a sensor-user keypad request. This Diagnostic mode is displayed on the LCD screens and includes separate displays for the controllers:
        1) Subnet and Node Address
        2) Errors
        3) Alarms
        4) Temperature Offset

P. VAVDDC –Air Balancing.

Through the BACnet Portable Engineering Station or the Configuration Commissioning Diagnostic Tool, the VAVDDC shall support a fully prompted Air Balance sequence. The BPES or CCDT shall, when connected through the wall sensor on the Ethernet network or through a Wi-Fi connection access the VAVDDC unit. The air balance sequence shall step the balancing contractor through the checkout and calibration of the VAVDDC. Upon completion of the balancing sequence, the flow values presented by the VAVDDC shall match those observed by the balancing contractor's measurement equipment. Additionally, upon completion of the air balance, the balance settings shall be archived for future in the VAVDDC. The CCDT shall be able to access these balance settings at any time and generate a report. The balance settings can be uploaded by either the BPES or CCDT for use if the VAVDDC requires replacement. Systems not able to provide a formatted air balance Graphical Programming Tool shall provide an individual full time during the Air-balancing process to assure full balance compliance.

Q. Application Specific Control Units:

Single board construction comprising processor board with programmable, nonvolatile, RAM/EEPROM memory for custom control and unitary applications. ASCs shall be provided for Unit Ventilators, Fan Coils, Heat Pumps, Rooftop Units, and other applications as shown on the drawings. To assure complete interoperability, all ASCs firmware shall support all BACnet options and be BTL Certified.

1. Units monitor or control each input/output point; process information; and download from the operator station.

2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
   a. Peer to peer primary network level communications with automatic communications loss detection to maintain normal control functionality regardless of available network communications.
   b. Discrete/digital, analog, and pulse input/output.
   c. Monitoring, controlling, or addressing data points.
   d. Internal customizable safeties and limits to prevent improper and unrealistic inputs to ASC's.
3. Local operator interface port located on ASC and ASC sensor provides for download from or upload to portable workstation. All bus devices shall be accessible from either port.
4. Communication: ASC's shall communicate with the Building Controller and CAC's at a baud rate of not less than 78.8 K baud.
5. ASC units monitor or control each input/output point; process information; and at least 50 expressions for customized HVAC control including mathematical equations, boolean logic, PID control loops with anti-windup, sequencers, timers, interlocks, thermostats, counters, interlocks, compare, limit, and alarms.
6. All ASC Controller setpoints shall be digital display setpoints with dual setpoint limits (integral hard limits which the user cannot exceed above and below and independent soft limits which are hidden from the user). All digital setpoints shall be network retentive after power outages and after replacement of sensor.

R. ASC Room Sensor
1. The ASC Sensor shall provide room temperature value and humidity to the ASC.
2. The ASC Sensor shall connect directly to the ASC and shall not utilize any of the I/O points of the controller.
3. The ASC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive.
4. There shall be one ASC Sensor per floor wired so that the communication jack will provide for a connection to the communication trunk to which the ASC controller is connected.
5. By connecting to this ASC Sensor, the connected controller, and all other devices on the local bus shall be accessible by the Portable Engineering Station.
6. The ASC Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering.
7. The ASC Sensor shall allow for the customization of the color on the esthetic covering as a standard offering.
8. The ASC Sensor shall be supplied in the following manner:
   a. LCD display for viewing up to four possible displays, each showing a current value in the ASC or on the network.
   b. Tenant override to allow timed override of unoccupied to occupied mode of operation.
   c. LED indication of override state
   d. Icons shall be utilized to represent sensor and controller function status, affording independence from a single language for use interface.
   e. User interface with the ASC Sensor shall be provided as a configurable function and shall offer password protection for access to network variable editing.
   f. Six buttons to provide the following functions:
      1) Selection and adjustment of up to four setpoints (Setpoint Key)
      2) Selection of up to two HVAC modes (Mode Key)
      3) Selection of up to two fan modes (Fan Key)
   g. ASHRAE compliance (LCD display and sub-base functionality)

h. The room sensor shall provide access to additional diagnostic data from a sensor-user keypad request. This Diagnostic mode is displayed on the LCD screens and includes separate displays for the controllers:
   1) Subnet and Node Address
   2) Errors
   3) Alarms
   4) Temperature Offset

S. ASC – VAV Controller Functionality.

Controls shall be microprocessor based Pressure Independent Variable Air Volume Digital Controllers, as shown in the drawings. The VAV ASC shall be a single integrated package consisting of a microprocessor, power supply, damper actuator, differential pressure transducer, field terminations, and application software. An alternate model shall be offered that allows for direct connectivity to an external actuator for those applications that employ a non-butterfly style damper configuration. All input/output signals shall be directly hardwired to the VAV ASC controller. The internal actuator shall employ a manual override that allows for powered or non-powered adjustment of the damper position. In all cases, the controller shall automatically resume proper operation following the return of power to, or control by the ASC. Programming, configuring and/or troubleshooting of input/output signals shall be easily executed through the ASC sensor or GP tool connected at the wall sensor location.

1. The VAV ASC control algorithms shall be designed to limit the frequency of damper repositioning, to assure a minimum 10-year life from all components. The VAV ASC shall provide internal differential pressure transducer for pressure independent applications with an accuracy of ± 5 %. Flow through transducers requiring filter maintenance are not acceptable. The VAV ASC shall provide zone control accuracy equal to or better than +/- 1 degree F. Systems providing control accuracies greater than +/- 1 degree F are not acceptable. With the submittal package, Contractor shall provide performance data that verifies control accuracy of the VAV ASC.
2. All input/output signals shall be directly hardwired to the VAV ASC. A minimum of one input point of the VAV ASC shall employ a universal configuration that allows for flexibility in application ranging from dry contact, resistive, to voltage/current sourced inputs. If a universal point is not available, a minimum of one input point (each) of the dry contact, resistive and analog voltage/current types must be provided on every controller. The outputs of the ASC shall be of the relay and universal analog form. All digital outputs shall be relay type. ASC devices utilizing non-relay outputs shall provide an interface relay for all points. All analog outputs shall be programmable for their start points and span to accommodate the control devices. Configuration of all I/O points shall be accomplished without physical hardware jumpers, switches, or settings. Troubleshooting of input/output signals shall be easily executed with the Graphical Programming tool or a volt-ohm meter (VOM). All I/O points shall be utilized by the local ASC or shall be available as I/O points for other controllers throughout the network.
3. The FMCS contractor shall provide VAV ASC to the VAV box manufacturer, for factory mounting. The VAV terminal unit supplier shall include in its price all costs for mounting of VAV ASC controller, connection of actuator to damper shaft, wiring of device power, wiring of VAV ASC to fan (fan powered terminal) and wiring to electric reheat coils or reheat valve actuator as specified on drawing.
4. The VAV terminal manufacturer shall provide a multi-point, averaging, differential pressure sensor mounted on the inlet to each VAV box. The VAV terminal unit manufacturer shall supply a line to low voltage transformer, of sufficient capacity, to power the VAV ASC plus all reheat valves and/or contactors and fan circuits associated with the VAV terminal and actuator assemblies. The FMCS contractor shall provide all reheat

control valves to the mechanical contractor for mounting and piping. The FMCS contractor shall provide and install all wiring between the valve and VAV ASC controller and between the room sensor and the VAV ASC controller.

5. A minimum of two input points of the VAV ASC shall employ a universal configuration that allows for flexibility in application ranging from dry contact, resistive, to voltage/current sourced inputs. If these universal points are not available, a minimum of two input point (each) of the dry contact, resistive and analog voltage/current types must be provided on every controller.

T. VAV Box Room Sensor

1. The VAV Box Room Sensor shall provide room temperature value and humidity to the controller.
2. The VAV Box Room Sensor shall connect directly to the controller Box and shall not utilize any of the I/O points of the controller.
3. The VAV Box Room Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive.
4. There shall be one VAV Box Room Sensor per floor wired so that the communication jack will provide for a connection to the communication trunk to which the VAV controller is connected.
5. By connecting to this VAV Box Room Sensor, the connected controller, and all other devices on the local bus shall be accessible by the Portable Engineering Station.
6. The VAV Box Room Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering.
7. The VAV Box Room Sensor shall allow for the customization of the color on the esthetic covering as a standard offering.
8. The VAV Box Room Sensor shall be supplied in the following manner:
   a. LCD display for viewing up to four possible displays, each showing a current value in the VAV Box or on the network.
   b. Tenant override to allow timed override of unoccupied to occupied mode of operation.
   c. LED indication of override state
   d. Icons shall be utilized to represent sensor and controller function status, affording independence from a single language for use interface.
   e. User interface with the VAV Box Room Sensor shall be provided as a configurable function and shall offer password protection for access to network variable editing.
   f. Six buttons to provide the following functions:
      1) Selection and adjustment of up to four setpoints (Setpoint Key)
      2) Selection of up to two HVAC modes (Mode Key)
      3) Selection of up to two fan modes (Fan Key)
   g. ASHRAE compliance (LCD display and sub-base functionality)
   h. The VAV Box Room Sensor shall provide access to additional diagnostic data from a sensor-user keypad request. This Diagnostic mode is displayed on the LCD screens and includes separate displays for the controllers:
      1) Subnet and Node Address
      2) Errors
      3) Alarms
      4) Temperature Offset

U. ASC VAV –Air Balancing.

Through the Portable Engineering Station, the VAV ASC shall support a fully prompted Air Balance sequence. The Portable Engineering Station shall, when connected through the wall

sensor, access the connected VAV ASC unit. The air balance sequence shall step the balancing contractor through the checkout and calibration of the VAV ASC. Upon completion of the balancing sequence, the flow values presented by the VAV ASC shall match those observed by the balancing contractor's measurement equipment. Additionally, upon completion of the air balance, the balance settings shall be archived for future use if the controller were to require replacement. Systems not able to provide a formatted air balance Graphical Programming Tool shall provide an individual full time during the Air-balancing process to assure full balance compliance.

V. ASC – Fan Coil Unit, Unit Ventilator, Heat Pump, or Packaged Rooftop Controller Functionality.

Controls shall be microprocessor based as shown in the drawings or indicated in the sequence of operations. The ASC shall be a single integrated package consisting of a microprocessor, power supply, field terminations, and application software. The units shall be started and stopped from the BMS. A low limit protection thermostat in the mixed air section of the unit shall close down the outdoor air damper, open coil valves, and alarm the BMS when a temperature below 38°F (adjustable) is sensed. All input/output signals shall be directly hardwired to the ASC controller. In all cases, the controller shall automatically resume proper operation following the return of power to, or control by the ASC.

1. All ASCs must have an operating temperature range -40°F to 140°F and 5 to 95% RH, non-condensing. because they are located in the proximity of extreme temperatures (hot water/steam pipes or the outdoor air).
2. All ASCs shall have capability for both ASHRAE Cycle II and ASHRAE Cycle III fully tested and validated. Bidder shall provide application documentation for ASC ASHRAE cycle II and III compliance including sequence of operation, controller program, and available SNVT's. The control program shall also be fully customizable in the field to accommodate any local or project specific requirements that may be required.
3. All duct averaging sensors for ASCs must be true continuous averaging units that sense the mean temperature over the complete length of the sensor end to end. Sensors that provide four or nine sensing points, which may be accurate due to air temperature stratifications, are not acceptable.
4. All ASCs shall be easily replaceable for ease of future maintenance and to minimize downtime.

W. The outputs of the ASC shall be of the relay Form C and universal analog form. All digital outputs shall be relay type Form C. ASC devices utilizing non-relay outputs shall provide an interface relay for all points.

X. LANs:

Capacity for a minimum of 64 client workstations connected to multi-user, multitasking environment with concurrent capability to access DDC network or control units.

1. Enterprise Network LAN
   a. Media: Ethernet (IEEE 802.3), peer-to-peer CSMA/CD, operating at 100/1000 Mbps, cable 10 Base-T, UTP-8 wire, category 5 or later.
2. Primary Controller Network LAN
   a. Media: BACnet BTL Certified.
3. Secondary Network LAN (If Required)
   a. Media: BACnet BTL Certified.
4. Remote Connection

a. Provide ability for remote connection to Network Controller (NC).

Y. Software:
1. Controller and System HVAC Applications
a. Update to latest version of software at Project completion. Include and implement the following capabilities from the control units if documented by the specified sequence of operations:
1) Load Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, occupied/unoccupied setback/setup, DDC with PID, and trend logging.
2) HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy/economizer switchover.
3) Chiller Control Programs: Chilled water plant optimization with condenser water reset, chilled-water reset, chiller and pump equipment selection and sequencing.
4) Boiler Control Programs: Boiler plant optimization with hot water supply reset, boiler and pump equipment selection and sequencing.
5) Programming Application Features: Include trend point, alarm reporting, alarm lockout, weekly scheduling, staggered start, sequencing, anti-short cycling, and calculated point.
2. Controller and Network Setup Software
1) Network management tools for the ANSI / ASHRAE Standard 135 BACnet protocol shall be provided including a network learn function, winks, and diagnostics.

2.3 CONTROL PANELS

A. Local Control Panels: Unitized NEMA 1 cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.
1. Fabricate panels of 0.06-inch thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.
2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gages.
4. Provide ON/OFF power switch with over-current protection for control power sources to each local panel.
5. Install heat generating devices at the top of the control panel and provide adequate venting of heat.

2.4 CONTROL CABLE

A. Electronic and Fiber-Optic Cable for Control Wiring: As specified in Division 26.

2.5 EXAMINATION

A. Verify that conditioned power supply is available to control units.

B. Verify that duct, pipe, and equipment mounted devices and wiring are installed before proceeding with installation.

2.6 INSTALLATION

A. Install equipment level and plumb.

B. Install software in control units and operator workstation. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

C. Connect and configure equipment and software to achieve sequence of operation specified.

D. Verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Locate all 48 inches above the floor.
1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

E. Install guards or tamper-proof enclosures on thermostats in the following locations:
1. Entrances.
2. Public areas.
3. Where indicated.

F. Install automatic dampers according to Division 23.

G. Install damper actuators on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

H. Install labels and nameplates to identify control components according to Division 23 Section "Basic Mechanical Materials and Methods."

I. Install labels and nameplates to identify control components according to Division 23 Section "Mechanical Identification."

J. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

K. Install steam and condensate instrument wells, valves, and other accessories according to Division 23 Section "Steam and Condensate Piping."

L. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

M. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

N. Install electronic and fiber-optic cables according to Division 26 Section "Control/Signal Transmission Media."

2.7 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26.

B. Install building wire and cable according to Division 26.

C. Install signal and communication cable according to Division 26.
1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install all input/output, signal, and communication cable in conduit.
3. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
4. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

2.8 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
1. Install piping adjacent to machine to allow service and maintenance.

B. Ground equipment.
1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

2.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
1. Leak Test: After installation, fill system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
4. Pressure test control for air piping:
   a. Pressure test control air piping at 30 psig. or 1.5 times the operating pressure for 24 hours, with maximum 5 psig. loss.
   b. Pressure test high-pressure control air piping at 150 psig. and low-pressure control air piping at 30 psig. for 2 hours, with maximum 1 psig
5. Calibration and test electric/electronic thermostats by disconnecting input sensors and stimulating operation with compatible signal generator.

B. Replace damaged or malfunctioning controls and equipment.
1. Start, test, and adjust control systems.
2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.

3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

C. Verify DDC as follows:
1. Verify software including automatic restart, control sequences, scheduling, reset controls, and occupied/unoccupied cycles.
2. Verify operation of operator workstation.
3. Verify local control units including self-diagnostics.

2.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain control systems and components.
1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs. Include a minimum of twenty-four (24) hours dedicated instructor time on-site.
3. Review data in maintenance manuals.
4. Schedule training with Owner, through Architect, with at least seven (7) days' advance notice.

2.11 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one (1) year of date of Substantial Completion, provide up to three (3) Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

2.12 TRAINING

A. Provide a minimum of twenty-four (24) hours of on-site or classroom training throughout the contract period PRIOR TO PROJECT SUBSTANTIAL COMPLETION or PROJECT TURNOVER for personnel designated by the Owner. Each session shall be a minimum of four (4) hours in length and must be coordinated with the building Owner. Train the designated staff of Owner’s Representative and Owner to enable them to:
1. Proficiently operate the system
2. Understand control system architecture and configuration
3. Understand DDC system components
4. Understand system operation, including DDC system control and optimizing routines (algorithms)
5. Operate the workstation and peripherals
6. Log on and off the system
7. Access graphics, point reports, and logs
8. Adjust and change system set points, time schedules, and holiday schedules
9. Recognize malfunctions of the system by observation of alarms and graphical visual signals
10. Understand system drawings, and Operation and Maintenance manual
11. Understand the job layout and location of control components

12. Access data from DDC controllers
13. Operate portable operators terminals

END OF SECTION 230923 – DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC