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15001. GENERAL INFORMATION

Updated: December 18, 2014

On July 31, 2013, the University adopted *Getting to Zero: The UNCG Climate Action Plan* (see <http://fac sustainability.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 1-1/2" 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, 1/2" 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.