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ALL THE ABOVE SECTIONS HAVE A DATE OF FEBRUARY 2018

IT IS THE RESPONSIBILITY OF THE DESIGN TEAM TO REFER TO EACH
INDIVIDUAL SPECIFICATION SECTION FOR ANY NEW REVISIONS

University of North Carolina at Charlotte Design and Construction Manual
REVISIONS (after February 2018)

List of Revisions

Revision

Revision #

Date

February 2018 | UNC CHARLOTTE

Note: Any version prior to February 2018 should be replaced with this updated version (February 2018). Thereafter, revised pages in the Design and Construction Manual shall be indicated with blue headers and footers. Revision # will be associated with the revision.

Whole Sections/Divisions, when added, will have the section noted on the "List of Revisions" sheet as "New" and will be black text with blue header and footer. Revision # will be on the first page of added Section/Division.

INTRODUCTION

Introduction to UNC Charlotte's Design and Construction Manual

This manual, consisting of two separate documents – design guidelines and construction guidelines – are intended to guide future design and construction projects at UNC Charlotte. The manual is structured to be of use to all members of the design team. The first section sets design guidelines for University buildings and open space, paying careful consideration to the means in which an individual project can be woven into the campus fabric. The second section of this manual, consisting of construction guidelines, follows the organization of a typical specification manual in order to provide detailed guidance for campus construction projects.

Together, the design guidelines and construction guidelines offer a universal starting point for all UNC Charlotte projects. This document is intended as a resource; the University fully expects the design team to employ their professional expertise and analysis on campus projects. As well, the design team should consult applicable state requirements (including the State Construction Manual). For successful projects, designers are encouraged to review the contents of the manual and discuss implementation and alternatives with the University Project Manager (UPM). Should any variance from these documents occur, the designer is expected to bring this to the attention of the University Project Manager (UPM). The University's approval of design submittals does not constitute authorization of any variance from this manual. Ultimately, compliance with this manual is the Designer's responsibility.

SECTION 3
ANNEX A
LEED CHECKLIST

University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex A – LEED Checklist



LEED for New Construction and Major Renovation 2009
Project Scorecard

Project Name:
 Project Address:

Yes	?	No			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sustainable Sites	26	Points

<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prereq 1 Construction Activity Pollution Prevention	Required
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1 Site Selection	1
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 2 Development Density & Community Connectivity	5
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 3 Brownfield Redevelopment	1
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.1 Alternative Transportation , Public Transportation Access	6
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.2 Alternative Transportation , Bicycle Storage & Changing Rooms	1
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.3 Alternative Transportation , Low-Emitting & Fuel-Efficient Vehicles	3
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.4 Alternative Transportation , Parking Capacity	2
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 5.1 Site Development , Protect or Restore Habitat	1
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 5.2 Site Development , Maximize Open Space	1
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 6.1 Stormwater Design , Quantity Control	1
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 6.2 Stormwater Design , Quality Control	1
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 7.1 Heat Island Effect , Non-Roof	1
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 7.2 Heat Island Effect , Roof	1
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 8 Light Pollution Reduction	1

Yes	?	No			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Water Efficiency	10	Points

<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prereq 1 Water Use Reduction , 20% Reduction	Required
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.1 Water Efficient Landscaping , Reduce by 50%	2
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.2 Water Efficient Landscaping , No Potable Use or No Irrigation	2
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 2 Innovative Wastewater Technologies	2
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 3 Water Use Reduction	2 to 4
			30% Reduction	2
			35% Reduction	3
			40% Reduction	4

Yes	?	No			
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Energy & Atmosphere	35	Points

<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prereq 1 Fundamental Commissioning of the Building Energy Systems	Required
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prereq 2 Minimum Energy Performance : 10% New Bldgs or 5% Existing Bldg Renovations	Required
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prereq 3 Fundamental Refrigerant Management	Required
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1 Optimize Energy Performance	1 to 19
			12% New Buildings or 8% Existing Building Renovations	1
			14% New Buildings or 10% Existing Building Renovations	2
			18% New Buildings or 12% Existing Building Renovations	3
			18% New Buildings or 14% Existing Building Renovations	4
			20% New Buildings or 18% Existing Building Renovations	5
			22% New Buildings or 18% Existing Building Renovations	6
			24% New Buildings or 20% Existing Building Renovations	7
			26% New Buildings or 22% Existing Building Renovations	8
			28% New Buildings or 24% Existing Building Renovations	9
			30% New Buildings or 28% Existing Building Renovations	10
			32% New Buildings or 28% Existing Building Renovations	11
			34% New Buildings or 30% Existing Building Renovations	12
			36% New Buildings or 32% Existing Building Renovations	13
			38% New Buildings or 34% Existing Building Renovations	14
			40% New Buildings or 38% Existing Building Renovations	15
			42% New Buildings or 38% Existing Building Renovations	16
			44% New Buildings or 40% Existing Building Renovations	17
			48% New Buildings or 42% Existing Building Renovations	18
			48% New Buildings or 44% Existing Building Renovations	19
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 2 On-Site Renewable Energy	1 to 7
			1% Renewable Energy	1
			3% Renewable Energy	2
			5% Renewable Energy	3
			7% Renewable Energy	4
			9% Renewable Energy	5
			11% Renewable Energy	6
			13% Renewable Energy	7
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 3 Enhanced Commissioning	2
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4 Enhanced Refrigerant Management	2
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 5 Measurement & Verification	3
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 6 Green Power	2

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Section 3, Annex A – LEED Checklist



LEED for New Construction and Major Renovation 2009
Project Scorecard

Project Name:
 Project Address:

Yes	?	No		14	Points
			Materials & Resources		
<input checked="" type="checkbox"/>			Prereq 1 Storage & Collection of Recyclables	Required	
<input checked="" type="checkbox"/>			Credit 1 Building Reuse	1 to 3	
			Credit 1.1 Building Reuse , Maintain 55% of Existing Walls, Floors & Roof	1	
			Credit 1.2 Building Reuse , Maintain 75% of Existing Walls, Floors & Roof	2	
			Credit 1.3 Building Reuse , Maintain 95% of Existing Walls, Floors & Roof	3	
			Credit 1.4 Building Reuse , Maintain 50% of Interior Non-Structural Elements	1	
			Credit 2.1 Construction Waste Management , Divert 50% from Disposal	1	
			Credit 2.2 Construction Waste Management , Divert 75% from Disposal	1	
			Credit 3.1 Materials Reuse , 5%	1	
			Credit 3.2 Materials Reuse , 10%	1	
			Credit 4.1 Recycled Content , 10% (post-consumer + 1/2 pre-consumer)	1	
			Credit 4.2 Recycled Content , 20% (post-consumer + 1/2 pre-consumer)	1	
			Credit 5.1 Regional Materials , 10% Extracted, Processed & Manufactured Regionally	1	
			Credit 5.2 Regional Materials , 20% Extracted, Processed & Manufactured Regionally	1	
			Credit 6 Rapidly Renewable Materials	1	
			Credit 7 Certified Wood	1	
			Indoor Environmental Quality	15	Points
<input checked="" type="checkbox"/>			Prereq 1 Minimum IAQ Performance	Required	
<input checked="" type="checkbox"/>			Prereq 2 Environmental Tobacco Smoke (ETS) Control	Required	
			Credit 1 Outdoor Air Delivery Monitoring	1	
			Credit 2 Increased Ventilation	1	
			Credit 3.1 Construction IAQ Management Plan , During Construction	1	
			Credit 3.2 Construction IAQ Management Plan , Before Occupancy	1	
			Credit 4.1 Low-Emitting Materials , Adhesives & Sealants	1	
			Credit 4.2 Low-Emitting Materials , Paints & Coatings	1	
			Credit 4.3 Low-Emitting Materials , Flooring Systems	1	
			Credit 4.4 Low-Emitting Materials , Composite Wood & Agrifiber Products	1	
			Credit 5 Indoor Chemical & Pollutant Source Control	1	
			Credit 6.1 Controllability of Systems , Lighting	1	
			Credit 6.2 Controllability of Systems , Thermal Comfort	1	
			Credit 7.1 Thermal Comfort , Design	1	
			Credit 7.2 Thermal Comfort , Verification	1	
			Credit 8.1 Daylight & Views , Daylight 75% of Spaces	1	
			Credit 8.2 Daylight & Views , Views for 90% of Spaces	1	
			Innovation & Design Process	6	Points
			Credit 1.1 Innovation in Design : Provide Specific Title	1	
			Credit 1.2 Innovation in Design : Provide Specific Title	1	
			Credit 1.3 Innovation in Design : Provide Specific Title	1	
			Credit 1.4 Innovation in Design : Provide Specific Title	1	
			Credit 1.5 Innovation in Design : Provide Specific Title	1	
			Credit 2 LEED® Accredited Professional	1	
			Regional Priority Credits	4	Points
			Credit 1.1 Regional Priority Credit : Region Defined	1	
			Credit 1.2 Regional Priority Credit : Region Defined	1	
			Credit 1.3 Regional Priority Credit : Region Defined	1	
			Credit 1.4 Regional Priority Credit : Region Defined	1	
			Project Totals (Certification Estimates)	110	Points
Not Certified			Certified: 40-49 points Silver: 50-59 points Gold: 60-79 points Platinum: 80+ points		

SECTION 1:
DESIGN GUIDELINES

SECTION 1
DIVISION 01
GENERAL PRINCIPLES

University of North Carolina at Charlotte Design and Construction Manual
Section 1, Division 01 – General Principles

PART 1 - GENERAL PRINCIPLES

ARCHITECTURAL GUIDELINES

The design guidelines that follow provide a cohesive set of standards applicable to the UNC Charlotte campus. The guidelines are not intended to prescribe solutions nor limit creativity but rather to establish a flexible framework that respects UNC Charlotte's past, adequately addresses its present needs, and retains innovation for future projects.

The guidelines present design principles common to all buildings and sites within the University, addressing topics such as building typologies, massing, materials, and fenestration. The guidelines also specify treatments for open space connections. All new buildings and site improvements should be consistent with these principles or carry the burden of showing how they improve upon the proposed recommendations. The guidelines also address specific functional design considerations applicable to building projects. These considerations include topics such as building access, crime prevention, service and loading access, and sustainability.

A related document to this manual is the UNC Charlotte Campus Master Plan, completed in 2010. Designers are expected to adhere to the intent of the current UNC Charlotte Campus Master Plan and this Design Manual.

The Master Plan can be found at: <http://facilities.uncc.edu/>

CAMPUS IDENTITY

While accommodating program needs, new construction should respect the scale of its context to establish a campus of related building forms that is welcoming and highly identifiable. The design of new buildings should take into account the campus vernacular, especially of those buildings adjacent to the site. By incorporating the architectural character of the existing campus into the design of new buildings, the University will build an interesting and varied collection of visually related buildings, as opposed to a collection of "carbon-copied" buildings.

BUILT ENVIRONMENT

Respect for the carrying capacity of the land is critical. As often as possible, new construction should be infill projects, promoting the best and highest use of the land. In multiple locations, the Master Plan indicates that UNC Charlotte should continue consolidating surface parking into parking structures around the campus perimeter. The Plan recommends new campus buildings, recreation fields, or general open space for the existing parking lots closer to the interior of campus.

Decisions about how campus land is used will have direct implications for the University's transportation networks. Access to a site, via road, foot, or bike will be considered when determining a building site. Certain land uses will create a reciprocal need for additional roads and parking. The Master Plan tested multiple scenarios to ensure that proposed uses created a minimal burden to the University's transportation system. The University can further minimize the impact by incorporating creative, alternative means of access to the campus, which will reduce the need for personal vehicles. New construction will include improvements to the sidewalks surrounding the building. As well, buildings will connect to the existing circulation network of paths, bike lanes, and roads. Appropriate bicycle parking, as outlined by LEED, will be provided in new projects. New buildings will also be mindful of orientation, shading, and the effect on adjacent buildings and spaces

ECOLOGY AND HYDROLOGY

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UNC Charlotte will act to connect habitat, stream, and river corridors within its campus grounds. Habitat fragmentation will be evaluated by the University during new construction projects. The University will not disturb steep slopes, and new construction will utilize buildings as retaining walls to work with the natural topography of campus. Disruption to wooded areas will be kept to a minimum. The University will also support connections to the larger region through greenway trails and waterway protection of Toby and Mallard Creeks.

The massing of new buildings will allow daylight to reach active outdoor spaces, as well as natural daylight into indoor areas to the extent possible. New landscape projects on campus will work with a palette of native species. Over time, labor- and resource-intensive lawns will be supplanted with native grasses that require less irrigation, chemical-inputs, and general maintenance. This will occur in areas identified by the Master Plan.

Toby Creek, Mallard Creek, and two unnamed tributaries run through parts of campus. Toby Creek is most prominent, as it bisects the campus into eastern and western halves. Therefore, the University is invested in the health of its waterways on campus, as well as aware of the ways in which its treatment of these resources affects those further downstream. As part of the Campus Master Plan, a campus-wide onsite storm water management plan addresses both the quantity and quality of run-off. This plan identifies opportunities to cleanse, calm, and treat storm water. The University will look inward to supply some of its water needs by collecting rainwater for reuse in buildings and irrigation. Ultimately, the University would like to use landscape design to create healthy and ecologically appropriate spaces, provide pleasant outdoor environments, minimize storm water runoff, and reduce the “heat island” effect.

LANDSCAPE AND OPEN SPACE DESIGN CONSIDERATIONS

The Master Plan recommends several treatments to enhance existing open spaces, develop future spaces, and better connect the two. Strong axial sight lines, appropriate brick paving, benches, distinctive lighting, seat walls, and architecturally integrated handicap ramps will all contribute to an inviting campus setting. The sighting of buildings to frame quadrangles, courtyards, and other pedestrian spaces will keep new construction projects consistent with the design intent of the Campus Master Plan and the 1997 Sidewalk Master Plan (Section 2).

The UNC Charlotte campus is nearly 1000 acres; yet, it maintains a highly identifiable campus core. Future construction projects should respect the pedestrian scale of the campus core and create intimate, memorable spaces such as courtyards, pocket parks, and small plazas. The introduction of plantings, seat walls, water elements, and public artwork to frame these areas will enhance their sense of intimacy. Seating, so that members of the campus community can enjoy, study, and congregate in these areas, should be included in the plans.

To further enrich the quality and interest of the University’s open spaces, the design guidelines and Master Plan identify three types of open spaces on the campus to be cultivated throughout campus: manicured open spaces, working landscapes, and natural landscapes.

Manicured open spaces are the formal quads used to organize the campus’s buildings. Manicured open spaces may consist of formalized landscaping that includes plantings, shrubs, trees, and turf grass; or, they may consist of formal “hardscaping,” that includes materials such as brick, wood, and pre-cast pavers. Formal plantings are often incorporated into the hardscaping design.

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In certain settings, the University may choose to implement “*working landscapes*”: landscaped settings that perform dual purposes of visual interest and stormwater management function. Please consult the appendix of the Master Plan for a full description of opportunities for working landscapes.

Natural landscapes on campus are open space areas in which native species grow “freely.” Native grasses and flowers replace non-native turf grass areas along the campus’s edges and streams. Natural landscapes require less maintenance and chemical inputs for their care and upkeep. Again, the Master Plan identifies areas for natural landscapes to be cultivated, as they are not appropriate for all areas of campus. Natural landscapes will create greater bio-diversity on campus and strengthen UNC Charlotte’s connection to its unique region, climate, and ecology.

ENERGY

Energy can be the single greatest operating expense for a university and the single greatest source of carbon emissions. Reducing energy consumption provides benefits on both fronts. UNC Charlotte will explore the use of natural resources such as solar (for heating and hot water), wind (for ventilation and cooling), and geothermal (for heating), and will not prohibit the incorporation of these features into a building’s design. However, the University retains final approval to ensure life cycle cost savings.

The University will also reduce energy requirements of buildings through design, equipment selection, and use/operations guidelines. Building systems will strive to be closed loop, so that waste heat and other process byproducts can be recycled for other building functions. As new technologies become available and affordable, the University will evaluate and, as appropriate, implement these practices.

Building design will minimize maintenance and operating costs by employing whole-systems lifecycle evaluation and by integrating innovative building engineering solutions at project inception. Building design should also adopt monitoring, measuring, and feedback systems to establish baselines of energy usage and building performance, against which the University can evaluate improvements and set goals for future projects

SUSTAINABILITY

To create a campus that improves the quality of life and environment for its students, faculty, and staff, the University addresses issues of sustainability as a continuous process affecting environmental and fiscal concerns. The design guidelines encourage sustainability at the “campus scale” by addressing goals within four broad categories: ecology and hydrology, energy, built environments, and public education through learning landscapes.

The University is committed to environmental sustainability and stewardship of the physical environment and is committed to procedures and products that both sustain the environment and produce savings for the University over time.

It is the goal of the University of North Carolina at Charlotte that new buildings be designed to meet a minimum standard of “LEED¹ Certified” criteria. For additional information about these criteria, please consult Annex A. The University Project Manager (UPM) will advise the designer whether s/he should pursue Green Building Council certification on a project-by-project basis.

BUILDING TYPOLOGIES

¹ LEED: Leadership in Energy and Environmental Design

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A building can be described by its program, size, form, location on campus, and the way it is used to define an exterior space. Campuses are composed of collections of buildings with similar programs representing academic, residential, athletic, and student life uses. The program contained in a building often dictates the building's size and location. Groupings of similar uses frequently occur because of the desire to maximize functional adjacencies and congregate similar typologies.

Intuitively, a building should portray its use with characteristics embodied in the building envelope, mass, and detailing. For example, numerous windows, well-detailed entries, a relatively narrow width to length footprint, and connections to pedestrian pathways and open space will characterize residence halls. The Master Plan identifies areas suitable for new residential housing in the South, East, and North Villages.

Large expanses of glass, tall floor-to-floor heights to accommodate interstitial utility distribution, roof treatments to conceal fume hood exhaust stacks, and wide width to length proportions to satisfy classrooms, lecture halls, and lab module requirements will characterize academic buildings.

BUILDING PLACEMENT

Campus buildings generally define two types of areas: streets and open spaces. In some cases, buildings will define both. On UNC Charlotte's core campus, like other traditional campus cores, buildings most frequently define open spaces, forming the edges of campus quads. Regardless of the space a building frames, it should be designed as "edge definer," actively shaping the spaces around it with public interfaces at the street level that relate to existing adjacent buildings.

To define outdoor space, build-to lines are established as part of the guidelines. These build-to lines are not set-back requirements, but space-making edges that the buildings should adhere to.

- Buildings shall remain parallel and perpendicular to adjoining streets and spaces. This geometry reinforces view corridors, street edges, wayfinding, and entry locations.
- Buildings shall retain a minimum of *60 percent* of their frontage along the build-to line. This recognizes that buildings are designed with setbacks and variations in mass and height to balance proportions and create visual interest.
- Buildings shall meet build-to lines on more than one façade when sited on a corner condition. The intent is for a building in this condition to present a strong visual presence in multiple directions when facing a street, quad, or major pedestrian path.

Each project should take responsibility for improving adjacent streets and pedestrian ways by including funds in its budget to bring these areas up to campus standards. Siting and design of new structures should result in areas that are lively and secure through twenty-four hour use. Designers are encouraged to use the campus palette of building and landscape materials, walkways, lighting, signage, and street furniture to create both active gathering and contemplative spaces. These types of spaces should reinforce linkages and gateways within the campus and at its edge.

DEFINED QUADS AND HIERARCHY

Due to prominent locations and/or specialized civic uses, certain buildings on campus will need to be designed as iconic, or "hero" buildings. Robinson Hall is an example of building with a civic programming component and high visibility from University City Boulevard. Its design and presence is iconic and elegant, befitting of the functions it contains. However, not all buildings on campus need to have iconic status. Several buildings on UNC Charlotte's existing campus serve successfully as "soldier" or background buildings. The design of "soldier" buildings should still be exceptional, but toned down so as not to compete for attention with the hero buildings, like the Fretwell Building. This approach establishes

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a hierarchy among campus buildings that allows visitors to intuitively understand the arrangement and function of the buildings.

Campus Axes and Landmarks

Landmarks or Heroes should be determined by location (such as terminating an axis, creating a gateway, or anchoring an entrance) or uses (library, art museum, performing arts, administration) which develop a legible hierarchy on campus.

Soldier Buildings are well crafted unique buildings which form the edges of spaces, maintain rhythm and massing of the context, and allow the hero buildings to act as landmarks.

BUILDING MASSING

The massing of a building is defined by several key elements including: building height, geometry of plan (length and width), and roof form. Most of the older buildings on campus are one to two stories in height and rectangular in plan geometry. Newer buildings are typically three to four stories.

Architectural scale is important because it helps to define the overall character of a campus. This is accomplished by how the features of buildings, particularly at the ground level, relate to the scale of the human body. It is further reinforced by how buildings relate to each other and the surrounding open space.

Much like the campus, buildings are composed of many different elements such as door treatments, window types, columns, arches, cupolas, chimneys, and cornices. How these elements are applied often gives intuitive visual clues as to the programmatic use of the building. Future buildings must reflect the intimacy of the existing campus's scale in their details. This respect will allow a wide range of architectural styles to coexist in an elegant and cohesive manner.

Wings, setbacks, and porticos will also reduce the overall size and scale of a building. It is imperative that future buildings maintain these characteristics so that the campus aesthetic remains consistent. The potential mass of a new building will be dictated by topography, site area, build-to setbacks, and the height of adjacent buildings.

The difference in scale between the main campus and the CRI campus is visually evident. This difference is not necessary contradictory; it represents the difference in place and function between the two campuses. Future projects on each campus should be responsive to its individual context and be relatable to the human user of the building.

Buildings placed along streets and paths should be spaced at a regular rhythm.

- Buildings should be no longer than 125-250ft in length
- Longer buildings should have massing that reduces their scale
- Pedestrian portals should be created to allow for functional campus circulation

Building heights should maintain consistency along the entire connection.

- Building height should match that of existing buildings along the connection
- Building height for new connections should be consistent
- Taller buildings should be recessed at the limit line
- Stories above the limit line should be distinct from the façade below
- Material, color, and pattern of upper stories should help to reduce their visual impact

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FAÇADE RHYTHM

There are several features comprising a building's façade that, when employed correctly, will reduce a large scale into a more human scale. Arranging a façade into three major vertical pieces is a principal approach to accomplishing this. The three vertical pieces include:

- A base of cast stone or brick. The height of the base will be proportional to the height of the building.
- A middle portion of brick generally with pre-cast accents.
- A top or roof that caps the project rather than a condition in which there is no defined top edge to the building.

Base

Cast stone bases are encouraged for all buildings fronting quads, principal streets, or major pedestrian spines in order to distinguish the building at street level. The stone should be predominately light in color and should be of a height proportionate to the overall building size. Articulation of the surface is encouraged. Brick is also an acceptable material for bases, particularly when detailed to differentiate the base from the upper levels.

Middle

The primary material of the walls above the base should consist of standard sized Boren "Special Morrocroft" #02-79-1 (Now Hanson Brick) brick, traditionally associated with UNC Charlotte's architecture. Other brick sizes may be used for decorative purposes and/or on secondary walls internal to the site. Consideration should be given to the compatibility of brick and stone colors of adjacent and opposite buildings. This should not, however, discourage visual richness on the campus. Window frames and mullions, sun screens, metal elements, and railings may be used to introduce color into building façades when appropriate.

Top

The manner in which a building 'meets the sky' also contributes to its sense of scale. Articulating a building's roofline provides visual termination to a façade and further minimizes one's perception of its scale. Future buildings should incorporate treatments into their design that will accomplish this goal. A change in plane and/or a change in material will create shadow, texture, and visual interest. Unless incorporated into a building's design, mechanical equipment should be screened from view and placed away from main pedestrian circulation paths.

The standard for vertical division is to maintain symmetry with respect to the primary entry and to express a sense of order and repose elsewhere along the same facade. Expression of rhythm via cast stone banding, brick reveals, brick projections, or other elements is desirable.

Consistent vertical expression and rhythm of facades

MATERIALS AND COLORS

UNC Charlotte has already established a detailed materials palette for the campus, as outlined below. By respecting this palette, new building designs will foster a sense of architectural continuity with existing buildings across the campus. Other approved materials may be employed to highlight particular features of the façade, and the University encourages architects and designers to use these accent materials in a way that explores and expands upon the basic vocabulary of the campus building. The interplay of

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materials and textures with the traditional campus building palette is one way to respect the campus' historic building styles while creating an aesthetic that is modern.

Standard materials and colors should generally reflect those of Robinson Hall: (For more specific information, refer to the Design and Construction manual, Section 2,):

ENTRANCES

Articulation of the main public entry on the façade of a building is crucial for promoting clear visual and intuitive access to campus buildings. The primary building entrance should be articulated through architectural elements that instill a sense of hierarchical importance. Canopies, loggias, change in vertical plane, change in grade, change in material, and placement of signage can all help to highlight and distinguish a building entry. Vestibules, to limit heat and cooling loss, should be predominately glass to provide unobstructed visual access into the interior of buildings.

Secondary entrances should also be clearly defined using a combination of brick and pre-cast stone material. All entrances should be covered to protect building users from inclement weather. Secondary entrances should be recessed from the building face or covered using a canopy.

Building entrances should contribute to the life and activity of the streets and walks surrounding the building. Well-lit and glass entries will enhance security in the areas adjacent to the building. Building entrances are frequently the meeting and gathering places of those using the buildings, and they should be designed to encourage interaction.

Main entrances should be accessible for individuals with disabilities. Accessible pathways to buildings within the immediate vicinity as well as major walkways to other parts of campus shall be integrated into the design of the building.

Entries should be clear and pronounced.

- Entries should be distinct in massing, scale, and material from other façade elements
- Entries should have exterior and interior spaces that reinforce arrival and interaction

WINDOW EXPRESSION

Window openings should be vertically oriented (or articulated as such by use of frames and mullions), and should generally consist of masonry or stone heads and sills. Ample fenestration at the base of a building will maximize visual connections between the building's 'public' ground level and the street or open space on which it is located.

Recessed window openings which emphasize depth and shadow lines are recommended. A minimum depth of two inches is recommended from the face of the facade to the face of the window frame. Design of "curtain walls" is not desired except in special circumstance where they are subordinated to the solidity and massing of the facade.

The academic activities of the University, so far as they are compatible, should be visible to passers-by. Windows should be placed to light and provide views to internal spaces, and also to give walks and streets the security and richness that derives from the visibility of adjacent activity.

ROOFSCAPES

Rooftop terraces, garden areas, or other designed roofscape elements are desirable. The topography of campus is such that one often has a view looking down upon the roofs of buildings at lower elevations.

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Roofscapes should be designed with this in mind. No highly reflective materials, such as metallic materials or mirrors, may be used on the surfaces of roofs. By painting or using materials light in color, roofs can deflect heat from the sun and lessen cooling costs for the building. Sustainable green roofs are encouraged when appropriate as the “fifth façade” of buildings.

Mechanical equipment located on building roofs shall be adequately screened with structures integrated into the building design so as not to be visible from the ground level or from windows of adjacent buildings.

Glazing, such as clerestories or skylights, should appear as recessed openings.

PARKING DECKS

The designer should apply the University’s architectural guidelines to new decks, specifically those regarding setbacks, massing, façade rhythm, and scale. New decks will define streets and open spaces on campus. They should align with streets, courtyards, and view corridors. Additionally, decks should have at least one façade that addresses the street and respond to the character and organization of the space it faces.

Decks should be designed to have a clear distinction of vehicular and pedestrian entrances. Most visitors to campus go directly to a parking deck, as their first destination on campus. Therefore, the design of should attempt to make the transfer to foot, shuttle, or bike as efficient and safe as possible. Special consideration should be given to pedestrian paths when they intersect with vehicular routes. Using specialized pavers or simply changing the paving material from asphalt will visually enforce pedestrian crossing. The design should also consider opportunities that facilitate bus and bicycle usage, such as sheltered shuttle stops and bicycle storage on site.

The University would like to encourage a mix of functions within its parking decks, when possible. Parking deck ‘wrappers’ literally wrap around the exterior of decks and house multiple uses such as commercial, residential, office, or a combination of the three. This creates a true mixed-use space that enhances pedestrian movements and encourages activity on the street well beyond parking hours. The Master Plan recommends deck wrappers at certain locations, and these should be designed following the University’s architectural design guidelines.

The University expects that new parking decks will respect the UNC Charlotte’s commitment to environmental sustainability. Although LEED certification for parking garages is not applicable, the garages shall be designed to minimize impact on the ecology and environment of the campus.

CAMPUS SIGNAGE

With the Campus Master Plan and these design guidelines, the University strives to strengthen its identity and brand. This is accomplished through many means, from the cohesiveness of the campus’s architectural character to the scale and intimacy of its open spaces, from its presence on abutting city roadways to the use of native, regional plant species. The most obvious, and perhaps basic, means of accomplishing a strong campus identity is through campus signage, particularly signage that appears on campus buildings. The University has created and adopted Campus Signage Standards that should be followed by all construction projects.

Specifically, the name of all buildings must be permanently attached to, or architecturally integrated into, the facade of the building. As a general guide, the building name should be integrated in the design of the primary entrances. The font and size shall conform to the Campus Signage Standards (Section 2,

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Annex D). If a formal name has not been designated, the design should include an integrated position of pre-cast stone for future building name signage. Such position should be designated in the construction documents for future installation.

The University may decide to supply/install the building signage by separate contract. The UPM should be consulted to determine the delivery method.

FUNCTIONAL DESIGN CONSIDERATIONS

Whereas the architectural guidelines of the previous section provide a set of practices to affect the physical appearance of the campus, its buildings, and its open spaces, the functional design considerations outlined within this section are intended to ensure that the campus operates in a seamless, safe, and secure manner.

CRIME PREVENTION

Of primary importance to the University is the health and safety of its students. Crime prevention is one factor contributing to the safety of students. As designers approach new projects, they should consider the implications a new building or open space will have on safety and security. Construction projects should include plans for well-lit pedestrian paths, particularly in areas on the edge of campus. Designers should ensure that potential problem areas in general are well-lit; examples of such areas include stairwells, entrances and exits of buildings, parking areas, ATMs, public telephones (including security phones), bus stops, recreation fields and courts, storage areas, and recycling areas. Building windows should provide views of activities occurring outside the building, including views of parking lots. Entrances and edges of campus should have multiple surveillance points from adjacent buildings. Where appropriate, campus police sub-stations may be included in the building design. Features that may allow criminal activity to go unnoticed – fencing that obscures views, heavy foliage or shrubbery along pathways or building entrances, spaces that cannot be seen from adjacent buildings and pathways – should be avoided. In general, the University prefers ATMs to be located in the interior of buildings.

During construction, the Electrical Contractor must provide adequate temporary security lighting within the limits of construction site.

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PART 2 - PROJECT DEVELOPMENT PROCESS

2.1 GENERAL

A. INFORMATION AVAILABLE FROM THE UNIVERSITY

1. Campus Map in AutoCAD format
2. Master Plan
3. Signage Standards (Section 2, Annex D)
4. Designer access to University Facilities Drawings & Records File

2.2 UNIVERSITY PROJECT MANAGER (UPM)

- A. Design contracts are with the State of North Carolina through the University of North Carolina at Charlotte, to be administered by the Facilities Management Department. The University will appoint a single University Project Manager (UPM) for each design effort. The UPM is the primary contact for the Designer. The University Project Manager may rely on other University personnel for support. The University may change the project manager during any phase of a project.
- B. All official correspondence and coordination will be with the UPM. Direct communication with other University officials may be necessary to execute design and construction responsibilities; however, such involvement shall be orchestrated by the UPM. During the construction phase a construction manager will also be assigned by the University to monitor the quality and schedule of the project.
- C. All invoices are to be mailed to the attention of the UPM. Failure to do so will unnecessarily delay the processing of an invoice. All matters pertaining to the Designer's Contract shall be directed to the UPM as well.

2.3 DESIGNER'S PROJECT MANAGER AND CONSTRUCTION ADMINISTRATOR

The Designer shall designate in writing a Design Project Manager and a Construction Administrator for all formal communications with the University.

2.4 DRAWING REQUIREMENTS

Designers shall follow the drawing requirements as detailed in Section 3, Annex G.

2.5 PREPARATION OF MEETING MINUTES

Minutes of each design and construction meeting shall be prepared by the Designer. Copies of the minutes will be made available for all officials at the meetings. The Designer can deliver copies to each official's office or deliver a set to the University Project Manager who will then distribute them on campus. Minutes should be provided to the UPM for review within five working days after the meeting.

2.6 NORTH CAROLINA CONSTRUCTION MANUAL

All design work shall comply with the procedures outlined in the North Carolina State Construction Manual prepared by the North Carolina Department of Administration's State Construction Office (NCDOA/SCO). Designers should familiarize themselves with the NC State Construction Office's policies. The intent of the UNC Charlotte manual is to help designers understand the particular needs and desires of the University. This manual does not supersede any requirement in the North Carolina State Construction Manual.

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PART 3 - PROJECT DEVELOPMENT SEQUENCE

3.1 PRECONSTRUCTION CONFERENCE

The Designer shall conduct a preconstruction conference according to SCO requirements. A standard agenda is provided at the NC State Construction Website: <http://www.nc-sco.com/forms.aspx>

3.2 MONTHLY PROGRESS MEETINGS

- A. The Designer shall conduct monthly progress meetings as described in the NCDOA/SCO Blue Book. The meetings shall be conducted by the Designer's Project Manager.
- B. The agenda shall include the following elements (at a minimum):
1. Distribution of a written agenda
 2. Recognition of new personnel assigned to project
 3. Confirm attendance by all contractors (circulate attendance sheet)
 4. Review minutes of previous meeting for corrections or omissions
 5. Changes in Project personnel telephone numbers or pager numbers
 6. Short Term Schedule Projections (by each contractor)
 7. Progress Report (percentage complete by each contractor)
 8. Report on HUB percentage participation on the project; calculated by dividing the contractor's HUB commitment (value) by the contractor's total contract
 9. Long Term Schedule Projections (by each contractor)
 10. Review of weather-related delays for previous month
 11. RFI's in progress
 12. Review of Bulletin Drawing Log
 13. Change Orders in Progress (Execution)
 14. Potential Change Orders
 15. Accidents
 16. UNC Charlotte Project Manager's Comments
 17. State Construction Office Representative's Comments
 18. Schedule Next Monthly Progress Meeting

3.3 BIDDING/CONTRACTING

The Designer will administer the bidding and construction phase unless specified otherwise in the Design Contract.

3.4 REQUIRED BID ALTERNATES

If the following types of materials are specified for the project, the product brands listed below shall be included in the bid document as bid alternates as authorized by NC General Statute 133-3. A public meeting is required for submission of proprietary materials:

19. Schlage Locksets (see UNCC Std. Spec S08710)
20. Simplex Fire Detection Systems
21. Lenel Card Access System
22. Boren Brick "Special Morrocroft" #02-79-1
23. Brick Pavers – English Edge by Pinehall Brick
24. Door Hardware (see Section 2.8)
 - a. Interior cylinders are to be Schlage 6 Pin Everest D

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- b. Exterior cylinders are to be Schlage Primus
- c. Locks are to be Schlage Lever D Series RHO 626; Best; or Sargent Lever 10 Line LNL 260.
- d. Exterior cylinders are to be Schlage Primus
- e. Locks are to be Schlage Lever D Series RHO 626; Best; or Sargent Lever 10 Line LNL 260.
- d. Exit/Panic devices are to be Von Duprin 99-98-55-STC; Sargent 80 Series; or Precision.
- e. Smoke Activated Closers are to be LCN; Morton; Corbin-Ruswin; or Rixson Firemark.
- f. Overhead Closers are to be LCN 4011, Sargent 281; or Corbin-Ruswin

3.5 CHANGE ORDERS (C.O.)

All change orders will use the change order form obtained from the NC State Construction Website. The change order "Requesting Party" will be determined by the State Construction Office Representative or UPM (for informal projects). The change order "Title" should be six words or less.

3.6 24 HOUR EMERGENCY CELL PHONE

The Designer shall provide the University Project Manager (or his/her designee) with a continuously operable cell phone which may be called by the University at any time there is an emergency at the Project. The person carrying the cell phone shall be knowledgeable of the Project and have the ability to immediately contact the contractor's key personnel. The University may occasionally make test calls to ensure the cell phone is operational.

3.7 CONSTRUCTION SIGNS

Construction signs are required on all capital construction projects unless exempted by the University Project Manager. No other signs or contractor logos are authorized on construction sites at UNC Charlotte.

3.8 SCHEDULING OF SERVICE OUTAGES

Required outages of existing service shall be scheduled by the University at dates and times least disruptive to the University community. Requests shall be submitted in writing to the Designer's Project Manager and the UPM at least thirty days prior to the planned outage. The Designer shall review the outage plan to assist in determining the plan with the least disruption to the University.

SECTION 2:
CONSTRUCTION GUIDELINES

SECTION 2
DIVISION 01A
CAPITAL PROJECT GUIDELINES (FORMAL)

DIVISION 01A – Capital Project Guidelines (Formal)

ADD THE FOLLOWING INFORMATION TO THE GENERAL REQUIREMENTS SECTION OF THE SPECIFICATION. Omitted sections and paragraphs are not used. (Modifications may be necessary for this document to be project-specific)

PART 1 - SITE ACCESS AND USE OF PREMISES

1.1 CONTRACTOR USE OF PREMISES

- A. THE CONTRACTOR shall use only the following roads on campus: Toby Creek Road from W.T. Harris Boulevard to Cameron Blvd. to Craver Rd., Cameron Blvd. from University City Blvd. to Craver Road, Craver Road from Cameron Blvd. to the construction entrance. (Modify for specific project.)
1. Each Contractor must coordinate materials deliveries to the project site without recourse to University staff assistance. Shipping documents must contain complete delivery instructions to include a site location, Contractor name, and telephone number for the delivery truck driver's use. In case of fire, medical, ambulance or safety concern dial 911.
 2. Each Contractor using a yard hydrant, wall hydrant or hose bib must use the proper key or handle. A key or handle may be borrowed from Facilities Management. Damage from misuse or abuse will be billed to the offending Contractor. Fire hydrants will not be used for water supply (case-by-case exceptions may be made by Facilities Management if no other water is available).
 3. The Contractor shall take reasonable effort to protect existing surfaces, roadways/haul routes, parking lots, finishes, and adjacent facilities from damage during construction. Prior to construction, the Contractor may initiate a Pre-Construction meeting with the Designated Representative to perform an inspection to record damaged existing conditions. Each Contractor will ensure that vehicles and equipment are not loaded beyond their rated Gross Vehicle Weight, or other load restrictions. Vehicles operating on the Campus must comply with all State weight and axle restrictions. Contractors will be held responsible for repair of damage caused by their vehicles. When hauling material consisting of any form of stone, rock, dirt, debris or concrete the material shall not be piled or placed any higher than the sides of the hauling vehicle without written authorization of the University Project Manager.
 4. If a Contractor intends to install a physical security alarm system, prior coordination must be accomplished with Public Safety.
 5. Explosive blasting generally is not allowed. In extreme rock conditions the blasting alternative may be considered. If blasting is approved, a comprehensive plan will be coordinated with UNC Charlotte staff prior to execution.
 6. All equipment must be secured when Contractor staff is not on-site. Each contractor must accept responsibility for physical security of tools, equipment, materials and other property on-site. The construction fence must be maintained and signed to prevent casual entry into the site.
 7. Contractors are allowed to work 24 hrs per day, 7 days per week, except on Saturday during spring and winter commencements, provided the general contractor's superintendent is on site. Other restrictions apply near housing areas.
 8. Each Contractor is responsible for employee conduct and behavior on Campus. Harassment, verbal abuse, and other such behavior toward students, faculty, staff, or the

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- general public will not be tolerated. Radios and other sound sources are not allowed on the project. All employees are required to wear shirts.
9. Each Contractor (and all Contractor employees) must comply with University Traffic Regulations and Emergency Procedures Manual. All North Carolina motor vehicle laws apply on Campus, including registration and inspection requirements. The University reserves the right to direct the route of all hauling on University property. There shall be no additional payment related to the route being selected or modified by the University. Factors such as traffic disruption, soiling of street, and detriment of pavement will be considered.
 10. All materials, equipment, vehicles and employee vehicles must be contained within the limits of construction. Parking is extremely limited on Campus. Vehicles shall be parked in assigned areas to be arranged with the UPM. Vehicles must display temporary parking permits which will be provided by the UPM. Vehicle operators shall comply with all traffic and parking signs. Parking on sidewalks or lawns for loading and unloading may be arranged on an individual basis, but only after coordination with the UPM or University Construction Manager.
 11. Prior to initial occupation of the site, coordinate with Facilities Management and check in at the Facilities Management office.
 12. Weapons are prohibited on Campus.
 13. Prior to any excavation at any location by any Contractor, the Contractor must coordinate with Facilities Management to establish utilities locations. A University representative in company with the Contractor's representative will locate and mark location of utilities on the ground. The Contractor remains responsible for protecting existing utilities from damage.
 14. Contractors will maintain safe pedestrian ways around the project site. Walkways and roads will not be blocked.
 15. To the extent herein described there is no charge to Contractors for University provided utilities except telephone service. Current telephone charges will be provided upon request. The University will provide power at no cost for office trailer and small tools. The University will identify utility sources and the contractor will be responsible for all costs associated with tie-in, metering, and distribution. Hot and cold water for HVAC equipment, if available, shall be metered by the contractor. Contractor will be invoiced monthly at the current rate.
 16. Utilities outages must be coordinated with Facilities Management at least 30 days prior to the period of the outage. For some critical circuits, longer lead times may be necessary.
 17. All Contractors must provide all labor, materials, tools and equipment required to accomplish the work. The University will not furnish or loan anything except where contract documents so indicate. No Contractor shall use any facility beyond the limits of construction.
 18. Attachment: Contractor's Safety Guide
 19. Added items to be provided to the Contractors by the University:
 - a. Campus Telephone List
 - b. Facilities Management Telephone List
 - c. Campus Map
 - d. UNCC Emergency Procedures Manual
 - e. UNCC Traffic Regulations
 20. The Contract Documents may specifically identify certain existing materials and items which are to be delivered to the Owner. For any other materials removed in the course of the Work, the Contractor shall first offer them to the Owner; if not accepted, the Contractor shall remove them from the Project. Any materials which are paid for under the Contract, but not incorporated into the Work due to Change Orders or for other reasons, shall be similarly offered to the Owner.

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PART 2 - SAFETY

2.1 CONTRACTOR'S SAFETY GUIDE

- A. General: It is University policy to provide a working, teaching, and learning environment as free as possible of recognized hazards to the safety and health of students, faculty, staff and visitors. All Contractors are required to comply with that policy. All safety, health, and fire protection rules, regulations, policies and procedures that apply to UNC Charlotte personnel shall also apply to Contractors and their employees. Prior to initiating any contractual operations, the Contractor's on-site supervisors shall become thoroughly familiar with UNC Charlotte safety rules, procedures, emergency and disaster instructions plus all applicable state and federal safety and health regulations. Contractor shall establish and maintain a functioning safety program including safety meetings and site inspections for the purpose of controlling unsafe acts and conditions at the work site.
- B. Please refer to webpage for contract safety program: <http://safety.uncc.edu/contractors>

2.2 UNIVERSITY SAFETY OFFICE REQUIREMENTS

- A. The following requirements have been established by the University Safety Officer:
 - 1. In case of fire, medical, ambulance, or safety concern dial 911 (off campus line 704-687-2200).
 - 2. Hazard Communication notifications will be made to extension 2200.
 - 3. Notify UNC Charlotte of any hazardous or unusual operation.
 - 4. Notify UNC Charlotte of any impairment of fire protection.
 - 5. Barricades must be erected a safe distance (at least 6 feet) from perimeter of construction areas.
 - 6. A chemical spill prevention plan must be in effect.
 - 7. Accomplish regular removal of scrap and debris.
 - 8. All welding, cutting, or hot work must comply with appropriate safety standards.
 - 9. No parking on sidewalks except as necessary during a specific task.
 - 10. Designate a safety and health coordinator for the project, or assign that responsibility to the on-site superintendent.
 - 11. Comply with UNC Charlotte posted "No Smoking" rules.

2.3 FACILITIES MANAGEMENT DEPARTMENT SAFETY REQUIREMENTS

- A. Care shall be taken to protect all persons in the vicinity from injury and undue inconvenience. Contractor shall provide & maintain pedestrian and vehicular barricades as necessary for the situation.
- B. Pedestrian barricades shall be constructed of continuous temporary fencing completely containing the work area.
- C. Fencing shall be erected with sturdy bracing and shall extend from the ground to a minimum of 48" high and shall meet all ADA requirements for barricading for the visually impaired.
- D. Continuous, plastic mesh, orange safety fencing is acceptable. If the barricade blocks an existing pedestrian sidewalk, the contractor shall properly mark an alternate route by installing and maintaining neat legible signs. "Alternate Route" signs may be required at locations outside the Construction Limits
- E. All workers and traffic control personnel shall wear "safety orange" vests or shirts while performing work in streets, parking lots, or other areas where there may be vehicular traffic.

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2.4 QUANTITY OF GENERAL SITE ROCK EXCAVATION:

- A. The following quantity of rock excavation shall be included in the Base Bid and considered as part of the Contract as follows:
 - 1. General Construction Contract: ? cubic yards
 - 2. THE UNIT PRICE QUOTED ON THE FORM OF PROPOSAL shall apply for adding to and deducting from the above quantity in accordance with the method used.

2.5 QUANTITY OF TRENCH ROCK EXCAVATION:

- A. The following quantity of rock excavation shall be included in the Base Bid and considered as part of the Contract as follows:
 - 1. General Construction:
 - 2. Plumbing: cubic yards
 - 3. HVAC: cubic yards
 - 4. Electrical: cubic yards

2.6 THE UNIT PRICE QUOTED ON THE FORM OF PROPOSAL shall apply for adding to and deducting from the above quantity in accordance with the method used.

2.7 QUANTITY OF GENERAL UNSUITABLE SOILS EXCAVATION:

- A. The following quantity of unsuitable soils excavation and removal offsite and replacement of shall be included in the base bid and considered as part of the contract as follows:
 - 1. General Construction Contract: cubic yards

2.8 THE UNIT PRICE QUOTED ON THE FORM OF PROPOSAL shall apply for adding to and deduction from the above quantity in accordance with the method used.

2.9 QUANTITY OF GENERAL SOILS EXCAVATION AND RECOMPACTION:

- A. The following quantity of soil excavation and re-compaction shall be included in the base bid and considered as part of the contract as follows:
 - 1. General Construction Contract: cubic yards.

PART 3 - ALLOWANCES (NOT USED)

PART 4 - ALTERNATES

4.1 The contractor shall review all addenda, drawings, and specifications to fully appraise the extent of each alternate.

PART 5 - MODIFICATION PROCEDURES

5.1 CUTTING, PATCHING, AND FINISHING:

- A. See General Conditions, Article 39. The repair of all damages made by cutting shall include restoring those surfaces to a state of finish equal to that when construction began, including such things as surface texture, design, and color, unless in remodeled work new finishes are called for. All such repairs shall be performed by persons trained and proficient in the particular trades involved; for example, plaster repairs by plasterers, masonry repairs by masons, tile

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repairs by tile setters, painting by painters, and the like. It is the intent of the Contract Documents that all areas requiring repairs shall be restored to a completely finished condition acceptable to the Architect and the Owner.

5.2 CUTTING AND PATCHING:

- A. All cutting required to perform the work, and install the products specified under a particular Contract or Subcontract, shall be performed under that particular Contract or Subcontract, and all patching work resulting from this cutting shall be performed under that particular Contract or Subcontract unless completely new products have been scheduled or called for. All patching work shall be by craftsmen skilled in the required work and who may already be engaged on the Project. Cutting shall be held to the minimum.

5.3 PAINTING FOR PATCHING:

- A. All patching work within previously painted areas shall be painted by that Contract or Subcontract, which caused the need for this painting, unless completely new finish or finishes have been scheduled or called for. All painting shall be by skilled painters who may already be engaged on the Project.

5.4 CUTTING OF STRUCTURAL MEMBERS:

- A. Shall not be performed without review by the Architect.

PART 6 - ELECTRICAL AND MECHANICAL WORK AND CONNECTIONS

6.1 GENERAL

- A. ALL ELECTRICAL WORK shall be in accordance with Division 16 and applicable codes.
- B. ALL HEATING, VENTILATING, AND AIR-CONDITIONING WORK shall be in accordance with the HVAC Sections of Division 15 and applicable codes.
- C. ALL PLUMBING WORK shall be in accordance with the Plumbing Sections of Division 22 and applicable codes.
- D. PLUMBING WORK also includes work of Div. 2 specification Section _____.

PART 7 - TESTING LABORATORIES LISTING

7.1

- A. ALL CUSTOM FABRICATED ASSEMBLIES of electrically operated equipment provided under this Contract shall be listed by a nationally recognized testing laboratory, such as Underwriters' Laboratories, Inc. This requirement shall apply in every case where such listings have been established for the particular type of materials or devices in question.
- B. ALL STANDARD MANUFACTURED ITEMS of electrically operated equipment shall be listed by a nationally recognized testing laboratory such as Underwriters' Laboratories, Inc. This requirement shall apply in every case where such listings have been established for the particular item in question.

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PART 8 - OVERALL PROJECT COORDINATION

8.1 GENERAL

- A. The contractor shall coordinate all work of his contract to produce the required finished project in accordance with the contract documents. Special attention shall be given to the submission of shop drawings, product data, samples, color charts, and requests for substitution within the specified time; furnishing the proper shop drawings to subcontractors, products suppliers, and separate prime contractors for divided contracts, whose work and equipment is affected by and related thereto; and the furnishing of all information concerning locations, type, and size of built-in equipment and products and equipment utilities. This coordination is in addition to all other coordination requirements called for in the technical sections of the project manual and on the drawings.
- B. COORDINATION DRAWINGS are required for all portions of the project. These drawings shall be developed by the HVAC Mechanical Contractor and shall show the sizes, elevations, and locations of all duct work, mechanical piping larger than 1-1/2" diameter, motors, pumps, and other mechanical equipment, in relation to the structure, walls and ceilings.
1. Drawings shall be of minimum scale of 1/4" equal; 1'-0", contain a block in the upper right corner for sign off by the Contractors and Subcontractors, and be forwarded to the Plumbing Contractor through the General Contractor and shall be in the form of reproducible mylars or other acceptable medium.
 2. The Plumbing Contractor shall receive these drawings and show in the color red, the sizes, elevations, and locations of all equipment and piping larger than 1-1/2" diameter, except that fire protection piping and equipment shall be shown in the color green.
 3. The Plumbing Contractor shall sign each drawing thus indicating coordination, or if coordination has not been attained, shall notify the General Contractor of the need for effective coordination efforts to resolve. Issues and items requiring further coordination shall then be resolved between the Contractors, the results shall be included on the coordination drawings, and the Plumbing Contractor shall sign each drawing thus indicating coordination. Signed coordination drawings shall then be forwarded to the Electrical Contractor through the General Contractor.
 4. The Electrical Contractor shall receive and similarly mark in the color blue; equipment, conduit larger than 1-1/2" diameter, panels, and any light fixtures which may conflict with work of other Contractors or Subcontractors.
 5. Upon completion of this process, these drawings shall then be circulated through the General Contractor for General Contractor coordination. The General Contractor shall distribute to each of the Contractors sepia of final coordination drawings that each can make prints as necessary for field use.
 6. Copies of completed coordination drawings shall be forwarded to the Architect, for information only, and not as shop drawings, prior to the installation of the work.
- C. WORK INSTALLED in advance of the completion of the process required by Paragraph 4.09.01, which must be relocated to effect coordination, shall be relocated as part of the work. Such relocation shall not be basis of entitlement for additional time or money.

THE PROCESS of coordination may require the addition of sleeves and reinforced penetrations not specifically shown by the documents. Such sleeves and reinforced penetrations of the structure are a part of the work and shall be provided by the Contractor needing the sleeve or penetration. Penetrations through concrete shall be effected by forms or sleeves. Penetrations shall not be cored, drilled or chopped through structural elements unless specifically engineered by the Contractor and submitted for review in accordance with procedures for submittal of shop drawings. Penetrations through structural steel members shall be reinforced with pipe sleeves full penetration welded to the webs or flanges of the members or shall be fully reinforced with plates, shapes, and angles. Reinforcement details for penetrations through structural steel will be provided by the structural engineer upon request by the Contractor.

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- 8.2 THE GENERAL CONTRACTOR shall conduct all necessary coordination meetings with the contractors to fully and effectively attain this coordination and to develop these coordination drawings.
- 8.3 COORDINATION DRAWINGS shall be revised, to reflect as-built conditions, by the general contractor, and reproducible mylars of these shall be given to the architect at the time of request for certificate of substantial completion.
- 8.4 COORDINATION OF GRADES: tops of access points to underground systems in unpaved area shall be adjusted as necessary to be 2" higher than surrounding finish elevations.
- 8.5 GENERAL INSTALLATION REQUIREMENTS
- A. INSPECTION OF CONDITIONS: The Contractor shall require the installer of each component to inspect both the substrate to which it is to be installed and the conditions under which the work is to be performed. Do not proceed with the installation until unsatisfactory conditions have been corrected to meet the requirements of the component and its manufacturer.
 - B. INSTALLATION INSTRUCTIONS: The Contractor shall perform the installation work in accordance with the Contract Documents and the manufacturer's installation instructions and recommendations, the more explicit or more stringent requirements governing.
 - C. THE CONTRACTOR shall inspect materials and equipment immediately upon delivery and again prior to installation. Damaged and defective items shall be rejected and removed from the Project.
 - D. THE CONTRACTOR shall provide attachment and connection devices and methods necessary for installing the work in a secure condition. Install work true to required line and levelness. Allow for expansion and building movement.
 - E. VISUAL EFFECTS: The Contractor shall provide uniform joint widths in exposed work of the same material. Joints shall be arranged in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for a final decision.
 - F. CONTRACTOR shall recheck measurements and dimensions before starting each installation.
 - G. THE CONTRACTOR shall install each component during weather conditions and Project status that will insure the best possible results. Isolate each part of the completed construction from incompatible material to prevent deterioration.
 - H. THE CONTRACTOR shall coordinate the installation of temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction work for inspection and testing.
- 8.6 MOUNTING HEIGHTS: Where mounting heights are not indicated or specified, install individual components at the standard mounting heights recognized within the industry and governing code for the particular application. Refer questionable mounting height decisions to the architect for a final decision.
- 8.7 CLEANING AND PROTECTION: See supplementary general conditions. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply a

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non-damaging protective covering where required to insure protection of work from damage or deterioration until owner's acceptance of project.

- 8.8 MAINTENANCE OF EXISTING SERVICES: Conduct construction operations so that heat, air conditioning, ventilation, electrical, telephone, gas, water, sanitary, storm sewer, and any other service required for the building operations, to the existing building are maintained at all times during normal working hours. Any shutdowns or interruptions shall be coordinated with and approved by the owner.
- 8.9 PROTECTION OF INSTALLED WATERPROOFING MATERIALS
- A. ALL TRADES REQUIRING WORK to be done on installed waterproofing materials shall provide means for protecting the waterproofing materials and the General Contractor shall act as coordinator to insure that the protection is provided. Protection for storage of materials, walking areas, and working areas shall be by sheets of 19 mm (3/4") thick plywood or an equal approved by the Architect. Protection from solvents, petroleum products, and other substances detrimental to the waterproofing membrane as listed by the membrane manufacturer shall be by drain buckets, properly wrapped unbroken containers, drop cloths, and plywood. Protection shall be afforded to all work areas and materials transportation and workmen access lanes to the work areas. In no case shall equipment, materials, and substances detrimental to the waterproofing membrane be stored on or allowed to come in contact with the installed waterproofing materials.
- B. THIS PROTECTION shall be provided for:
1. Roofing
 2. Waterproofing
- C. To assure proper and accurate fit, all dimensions of existing facilities are to be considered approximate and installation dimensions shall be taken by the Contractor prior to ordering materials or initiating work.

PART 9 - PROTECTION OF EXISTING WORK

- 9.1 SEE GENERAL CONDITIONS, ARTICLE 11.
- 9.2 ALL CONTRACTORS are hereby reminded and cautioned that extreme care shall be exercised to protect the existing facilities from damage during the progress of the work. Any damage that occurs shall be repaired or damaged areas removed and replaced with new materials equal to the existing and to the owner's satisfaction without additional cost.
- 9.3 The lawn in the material storage areas and elsewhere as affected by the contract shall be protected from unnecessary digging, trenching and rutting, and after completion of the work all holes, trenches, ruts, and other damage shall be filled in, graded, and made ready to receive new grassing. If grassing is included in the project, these areas shall be grassed in accordance

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with the requirements of section 02930. If grassing is not included in the project, these areas shall be grassed to match existing as close as possible.

PART 10 - OTHER REQUIREMENTS

- 10.1 PROVIDE dielectronic isolation between dissimilar metals, such as, but not limited to, between mild steel and aluminum.
- 10.2 ALL WELDING to the structure shall be performed to the same requirements as are described by specification sections 05120 and 05121.
- 10.3 VARIOUS ITEMS will be mounted within rated assemblies such as walls and floors. The contractor providing any such items shall also provide the work necessary to maintain the rating of the assembly.
- 10.4 CEILING SUSPENSION SYSTEMS: Each piece of equipment supported by the ceiling suspension system, particularly in acoustical ceilings, shall have at least 2 safety wires attached to each piece of equipment.
- A. Each piece of equipment in a "narrow face" acoustical ceiling suspension system shall be fully independently supported by wires or straps and NOT supported by the suspension system. "Narrow face" suspension systems have flanges too narrow to effectively support equipment, particularly should there be some movement in the system
- B. All safety wires and all fully supporting wires and straps shall be provided by the installer of the equipment.
- 10.5 CONTRACTOR QUESTIONS: Questions contractors may have of the architect shall be submitted through the project expeditor using the "request for information" form which is attached to the beginning of this division. Answers shall be returned from the architect through the project expeditor. The project expeditor shall assign a number to each question and shall assure that question which is forwarded to the architect includes related inquiries of all contractors. The project expeditor shall assure that answers to questions are included in the work of all contractors. The project expeditor shall maintain a log including the number of each question, a brief description of each question, the dates forwarded to and returned from the architect, and other pertinent information. A current copy of this log shall be given to the on-site representative of the architect 7 calendar days prior to each monthly progress conference.
- 10.6 UTILITY STANDARDS: All underground piping and utilities (both metallic and non-metallic), except copper pipe, shall have a separate copper tracer wire and non-metallic warning tape installed above the utility line.
- A. The tracer wire shall be traced for continuity prior to backfill, immediately upon completion of backfill and compaction and once again during final utility location/as-built at the end of the project. This also will include landscape irrigation mains to the points of the valves. All above ground utility features such as vaults, manholes, valves, handholds, etc to be properly labeled. Contractor shall provide an inventory of all installed outdoor utility features including type and model.
- B. IDENTIFICATION TAPE: The 1st stage of identification shall be a buried warning tape. This tape shall provide an early warning at shallow depth excavation. The tape shall be 6" wide, and

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buried approximately 18" to 30" above the service pipe, but a minimum of 10" below finished grade. It shall consist of multiple layers of polyethylene with an overall thickness of 3 to 5 mils. It shall be installed continuous from valve box to valve box or manhole to manhole, and shall terminate just outside of valve box or manhole wall. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to APWA color code standards. The lettering on the tape should name the utility it is protecting (i.e. Caution buried sewer line below).

- C. TRACER WIRE: The 2nd stage of identification shall be a buried tracer wire. This tracer wire shall provide pipeline identification, be fully detectable from above grade utility locators, and be able to provide a depth reference point to top of pipe.
 - D. All pipe, including lawn irrigation lines, and metallic pipe with compression gasket fittings installed underground shall have a tracer wire installed along the length of the pipe. The wire shall be taped to the top of the pipe at a maximum of 10' intervals and not allowed to "float freely" within the backfill.
 - E. Tracer wire shall be single-conductor, 12 gauge minimum, copper single-conductor wire with type "UF" (Underground Feeder) insulation, and shall be continuous along the pipeline passing through the inside of each valve box. A #12 AWG or heavier (smaller AWG number), solid, insulated (RHW, THW, or polyethylene insulation is recommended); copper wire shall be taped to pipe at 10 foot intervals. Do not wrap wire around pipe. The wire must be one continuous, unbroken length. Coil tracer wire at meter location and street end with enough wire to extend a minimum of two feet above grade.
 - F. TRACER Wire boxes
 - 1. Plastic gas and water longer than 1000 feet in length from curb valve to meter riser must have tracer wire boxes installed in accordance with UNC Charlotte standards.
- 10.7 FINAL AS-BUILT SITE UTILITY SURVEY: Prior to project completion the Design Engineer shall have the as-built survey finalized by a licensed land surveyor and locating company satisfactory to the University. The locator will locate all utilities using approved methods, where the locator shall connect to the trace wire. Any problems found in the survey shall be documented to the owner and designer. The final as-built survey shall locate and inventory all utilities and also survey the existing conditions. The survey of the site shall also include 1' contours, pipe size, and depth of utility, manhole elevations, inverts, building footprint, and all aspects of the site.
- A. Preparation: Prior to utilities being buried and at completion the site utilities shall be surveyed by a survey and location company registered in North Carolina and satisfactory to the Owner.
 - 1. Progress as-built surveys are to be done as needed.
 - 2. Survey shall be tied to the North Carolina State Plane Coordinate System (a.k.a. N.C. Grid).
 - 3. Surveys shall meet NC Standards for Positional Accuracy.
 - 4. Surveys shall include the following:
 - a. Provide X, Y, and Z coordinates for all newly installed utilities.
 - b. Where new utility installation occurs adjacent to or crosses exposed existing utilities, provide X, Y, Z coordinates and description of existing utilities.
 - c. Gravity Piping (storm water & sanitary sewer):
 - 1) Locate centerline of all manhole and inlet covers and grates.
 - 2) Locate all piping inverts in and out of structures, including headwall and pipe outlet structures.
 - 3) Pipe location is not necessary for gravity piping with the exception of any tee or wye connections.
 - d. Pressure Piping (water, fire, hot & chilled, and gas):

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- 1) Provide pipe locations at fifty-foot intervals along the top centerline of pipes, at all valves, tees, branches, and changes in direction.
 - e. Duct Banks:
 - 1) Provide X, Y, Z locations on top edge, both sides, of the duct bank at fifty-foot intervals, all structural connections and all changes in directions.
 - 2) Note duct bank thickness on drawings.
 - f. Telecom/Electrical Manholes:
 - 1) Dimensions to include structure width, length and depth.
 - 2) Include elevations at top and bottom of vault, top of manhole entrance and at all conduit entering and exiting the manhole.
 - B. Format: Digital files to be issued through the Construction Manager to the Architect and Engineers of Record for review of compliance with specification requirements.
 - 1. Digital files shall be provided as a CAD (*.dwg) file in GIS format.
 - 2. The CAD file shall be based on the NC GRID.
 - 3. NAD 1983 (tie to the North Carolina State Plane Coordinate System) shall be the projection delivery format.
 - 4. All survey points shall be clearly labeled with X, Y, and Z coordinates.
 - 5. All progress surveys for each utility type shall be merged into one file.
 - 6. If all utility types are merged into one file they shall be separated by layer.
 - 7. Record Survey(s) shall be submitted within 15 days of Final Acceptance.
 - C. If required by the University Project Manager the utilities may be surveyed before they are buried. If this is the case the trace wire and locator tape must still be installed to University standard. The trace wire shall be tested prior to project punch list.
- 10.8 FIELD ENGINEERING
- A. OWNER'S SURVEY: Based on the Owner's Survey, the Contractor shall verify all existing grades and conditions, and verify dimensions of existing construction and report any errors and inconsistencies in writing to the Architect before work is performed in the areas where errors and inconsistencies exist.
- 10.9 PROJECT MEETINGS (ALSO SEE GENERAL AND SUPPLEMENTAL CONDITIONS)
- A. The Contractor and each of his Prime Subcontractors or each Prime Contractor, as the case may be, shall present a written progress report for his contract work and shall recommend any constructive measures as may be appropriate.
 - B. Pre-Roofing Conference - See roofing specification Section
 - C. The Designer shall conduct a preconstruction conference according to SCO requirements. A standard agenda is provided at the NC State Construction Website: <http://www.nc-sco.com/forms.aspx>
 - D. The Designer shall conduct Monthly Progress Meetings as described in Section 111 of the NCDOA/SCO Blue Book. The meetings shall be conducted by the Designer's Project Manager. The agenda shall include the following elements (at a minimum):
 - 1. Distribution of a written agenda
 - 2. Recognition of new personnel assigned to project
 - 3. Confirm attendance by all contractors (circulate attendance sheet)
 - 4. Review minutes of previous meeting for corrections or omissions
 - 5. Changes in Project personnel telephone numbers or pager numbers
 - 6. Short Term Schedule Projections (by each contractor)
 - 7. Progress Report (percentage complete by each contractor)

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8. Report on HUB percentage participation on the project; calculated by dividing the contractor's HUB commitment (value) by the contractor's total contract
 9. Long Term Schedule Projections (by each contractor)
 10. Review of weather-related delays for previous month
 11. RFI's in progress
 12. Review of Bulletin Drawing Log
 13. Change Orders in Progress (Execution)
 14. Potential Change Orders
 15. Accidents
 16. UNC Charlotte Project Manager's Comments
 17. State Construction Office Representative's Comments
 18. Schedule Next Monthly Progress Meeting
- E. The Designer shall distribute written minutes of the monthly meetings within one week of the meeting. In general, the format of the minutes should include the topics listed in the agenda. Any revisions reported to the Designer, shall be entered and copies redistributed by the Designer no later than the following monthly meeting.
- F. Copies of the minutes will be made for all officials at the meetings. The Designer can deliver copies to each official's office or deliver a set to the University Project Manager who will then distribute them on campus. Minutes should be provided to the UPM for review within five working days after the meeting.
- G. Waste management goals and reporting will be discussed at:
1. Pre Bid Meeting
 2. Pre Bid Meeting
 3. Pre-Construction Meeting
 4. Regular Job site Meetings
 5. See Section 3, Annex B for other supporting documentation in relation to the above.
- 10.10 SUBMITTALS
- A. SEE GENERAL CONDITIONS and SUPPLEMENTS THERETO, the Specification Sections, and TABULATION OF SPECIFICATION SUBMITTALS AND SPECIAL REQUIREMENTS for required submittals
- B. PHOTOGRAPHS OF THE SITE: The General Contractor shall make photographs of the site showing site conditions as existing prior to the starting of any work. Two prints of each photograph shall be made, 1 for the Architect and 1 for the Contractor. Prints shall be 203 mm by 254 mm (8" by 10") in size, glossy prints. A minimum of 2 photographs shall be made of the overall site and additional photographs shall be made of any unusual site conditions that will affect the work. Photographs shall clearly show the existing site condition.
- 10.11 QUALITY CONTROL (ALSO SEE ARTICLE 8 OF THE GENERAL CONDITIONS)
- A. TESTING LABORATORY SERVICES: A TESTING LABORATORY will be employed and paid directly by the Owner. Whenever any retesting and re-monitoring is made necessary because work performed by the Contractor is not in accordance with the requirements of the Contract Documents, the Contractor shall reimburse the Owner for the cost of this retesting and re-monitoring. Testing and monitoring shall be required for:
1. Verification of foundation subsoil conditions in accordance with Division 2.
 2. Testing of soil compaction as specified in Division 2.
 3. Testing of concrete cylinders as specified in Division 3.
 4. Inspection of structural steel as specified in Section 5.
 5. Mortar testing required by Division 4.

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6. Floor finishes tolerance measurements required by Division 3.

10.12 QUALITY CONTROL PLAN

- A. The Contractor is responsible for quality control and shall establish and maintain an effective quality control system. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The site project superintendent will be held responsible for the quality of work on the job and is subject to removal for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the owner, and shall be responsible for all construction and construction related activities at the site.
- B. The Contractor shall furnish for review by the designer, not later than 20 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract. The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The owner will consider an interim plan for the first 20 days of operation. The first application for payment will be processed only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started. The second application for payment will not be processed until acceptance of the contractors CQC Plan.
- C. The Contractor shall have a Qualified and Competent Supervisor present whenever workers are performing work. The Supervisor shall notify the Designated Designer's Representative of the work schedule for each day prior to initiating work.

10.13 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS (SEE GENERAL CONDITIONS AND SUPPLEMENTS THERETO, ARTICLE 40.)

- A. FIRE PROTECTION: The General Contractor and each Prime Contractor or Prime Subcontractor shall establish and maintain a Project fire protection program and procedure to be followed in the event of fire.
- B. TEMPORARY SANITARY FACILITIES: The General Contractor shall provide and maintain self-contained, chemically-treated, temporary toilets adequate for the accommodation of all persons engaged on the work. Temporary toilets shall be enclosed and weatherproof and shall be kept in sanitary condition at all times. As soon as conditions of work will allow, a temporary toilet within building shall be provided. This toilet shall be equipped with a temporary water closet fixture and connections to sewer. All temporary toilets shall be in accordance with the regulations of the authorities having jurisdiction.
- C. TEMPORARY TELEPHONE SERVICE: All long-distance and toll calls shall be paid for by party making call. Telephone service is available from the Owner. Each Contractor may arrange for connection to this service, as part of the work.
- D. BARRIERS: Shall be provided by the General Contractor.
- E. TEMPORARY CONSTRUCTION FENCE: A metal 2438 mm (8') high fence with locked vehicle gates and locked pedestrian gates shall be erected as indicated and maintained. Vehicle gates shall be located as close as possible to any required permanent vehicle entry to the area. Before Project final review, this temporary fence and its foundations and appurtenances shall be

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removed from the site, and all resulting post holes and damage and disfiguration to the site repaired to the satisfaction of the Owner and any other parties involved.

1. Fencing shall be chain link fabric with posts and top rails of pipe sections and a bottom wire. Fabric shall contain a dark green mesh for screening.
- F. TREE AND PLANT PROTECTION: Contractors are hereby reminded and cautioned that care shall be exercised to protect trees and plants which are to remain during the progress of the Project. Suitable barriers shall be provided around all trees and plants that are to remain and which are in the construction area and product handling area. All damage to such trees and plants shall be repaired; broken limbs properly and neatly pruned and painted with pruning paint; all trunk damage neatly dressed and painted with pruning paint. Any trees and plants which are excessively damaged shall be replaced in like, kind, size, and species by the Contractor at no additional cost. All work shall be by a recognized and approved nursery.
1. All grading around trees and plants to remain shall be such that the root system shall not be disturbed. Earth shall not be temporarily piled around trees and plants, nor shall earth be graded to the trees and plants above the natural root depth for that particular species.
 2. Established trees and plants, which are in the way of construction and which are in the material handling areas, shall be removed and stored for future replanting. The services of a recognized and approved nursery shall be employed to remove the trees and plants and prepare them for storage. Removed trees and plants shall be properly balled and burlapped in accordance with their size. During the time of storage, they shall be properly watered and cared for in accordance with the instructions from the nursery. After the construction work is completed, the stored trees and plants shall be replanted, and those trees and plants not replanted shall be disposed of as directed by the Owner.
- G. PROVIDE AND MAINTAIN SUITABLE TEMPORARY sidewalks, closed passageways, fences, or other structures required by law so as not to obstruct or interfere with traffic in public streets, alley ways, or private right-of-way. Leave an unobstructed way along public and private places for pedestrians and vehicles.
- H. PROVIDE WALKS over and around all obstructions in public places. Maintain from the beginning of twilight, through the whole of every night, sufficient light and guards to protect persons from injury.
- I. LEAVE ACCESS TO FIRE HYDRANTS. Should these hydrants be susceptible to damage caused by the operations of this Contract, they shall be protected by means approved by the governing authority.
- J. TEMPORARY PARTITIONS: Provide temporary partitions between occupiable areas and the work. Locate as required to facilitate Owner's continued occupancy. Construct of minimum 25 ga. metal stud with 5/8 inch gypsum board panel each side tight to adjoining construction. Provide sound and thermal insulation. Construct temporary partition in accordance with applicable fire-separation requirements of authorities having jurisdiction. Where required, provide acceptable lockable doors in temporary partitions.
- K. TEMPORARY EGRESS: Provide emergency egress from existing occupied areas at all times as required by authorities having jurisdiction. Maintain egress path in compliance with requirements of North Carolina State Building Code requirements.
- 10.14 SECURITY:
- A. Each contractor shall be responsible for security and protection to his equipment and the site-stored and installed products under his jurisdiction, at all times whether paid for by the owner or not, until the owner accepts the project.
 - B. CONDUCT CONSTRUCTION WORK so that the owner's existing building can be locked securely at all times when it is not normally opened. All temporary outside walls and barriers shall be constructed so they will be reasonably tamperproof.

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- C. CONTRACTORS shall provide identification for their vehicles and all employees on this project. Identification methods shall be approved by the owner. The contractor shall be held responsible for each of his employees wearing the identification while on the project.
- D. THE GENERAL CONTRACTOR, AS COORDINATOR FOR THE PROJECT, shall establish a color code for the hard hats to differentiate between the various trades and visitors. Twelve (12) hard hats for Owner's and Architect's representatives shall be furnished by the Contractor and kept in clean condition.
- E. Except for communication devices, no radios or other sound-emitting devices not directly associated with the work will be operated by the workers at the job site. All workers will behave in a polite manner and all workers will wear shirts and shoes when on campus. Workers are not to make any comments or gestures to any University personnel, students or guests. Workers are permitted to smoke in designated smoking areas. Workers not complying with these requirements will not be allowed to work and may be instructed to vacate the work site. If workers are restricted from working, such restriction(s) shall not alter the terms of the contract.

10.15 ACCESS ROADS AND PARKING AREAS:

- A. THE GENERAL CONTRACTOR shall provide and maintain for the duration of the Contract, a graded and graveled site access road for the use of himself, his Subcontractors, his product suppliers, and Prime Contractors as the case may be. Additional access ways shall be furnished and maintained to the product storage areas and the work itself. All access roads and ways shall be properly maintained for passage during all weather conditions while work is being performed.
- B. ADDITIONAL ACCESS ROADS AND PARKING AREAS shall be furnished and maintained during all weather conditions for the use of the Owner, Owner's visitors, and other persons and services having proper business at the Project until permanent roads and parking areas are provided.
- C. SHOULD ACCESS ROADS not be located for permanent roads, they shall be removed, prepared for grassing, and grassed. Otherwise, they shall be prepared for permanent roads.

10.16 TEMPORARY CONTROLS:

- A. WATER CONTROL: THE CONTRACTOR OR EACH PRIME CONTRACTOR, AS THE CASE MAY BE, SHALL PROVIDE THIS WATER CONTROL FOR ALL WORK PERFORMED UNDER THE CONTRACT OF THE CONTRACTOR OR EACH PRIME CONTRACTOR. Furnish all labor and necessary equipment and provide all necessary products for the temporary control of surface water and seepage water during construction. Furnish and operate pumps and other equipment required to keep all excavations, pits, and trenches free from water at all times. Dikes and ditches shall be constructed around excavations and elsewhere as necessary to prevent surface water from flooding the excavations or standing in areas adjacent to excavations, in work areas or in product storage areas. The Contractor shall take all necessary precautions to protect adjacent areas and properties from damage. He shall not divert water onto adjacent areas and properties at points other than that which would be considered the natural flow, prior to construction, without the expressed consent of the Owner in writing with a copy to Architect. He shall take steps to prevent the erosion of soil, earth and other material and the conduction of the eroded materials onto adjacent properties, and shall be responsible for the removal of such materials, the restoration of adjacent areas to their original condition, and at the proper time, the removal of all water control means and methods.

10.17 EROSION CONTROL:

- A. Temporary erosion control is specified in Division 2 and on the drawings.

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10.18 FIELD OFFICES AND SHEDS:

- A. LOCATION of all temporary offices and storage sheds shall be approved by the Architect and owner.
- B. STORAGE SHEDS shall be provided and maintained by the Contractor in accordance with the requirements of the Contract Documents.

10.19 CONFERENCE AREA:

- A. The General Contractor shall provide and maintain, as part of the Contract, in a weather tight condition a separate conference area for his use and for the use of periodic Project conferences and other related conferences for the duration of the Project. This area shall be at least 22 square meters (230 square feet) in size, insulated, heated in cold weather, air conditioned in hot weather, and ventilated during other times when heat and air conditioning is not required. Conference area shall be illuminated by at least four 610 mm by 1219 mm (2' by 4') light fixtures each containing four 40 watt fluorescent lamps. Conference area shall contain four 762 mm by 1524 mm (30" by 60") tables and 30 stacking side chairs. Adjacent to the conference area shall be an illuminated and ventilated toilet room containing 1 water closet, 1 lavatory with mirror, 1 waste basket, and a supply of toilet tissue, paper towels, and liquid hand soap. All utilities, supplies, cleaning, and maintenance shall be by the Contractor as part of the Work and at no additional cost.

10.20 CONTRACTOR'S FIELD OFFICE:

- A. The General Contractor shall provide and maintain, as part of the Contract, a weather tight office for his daily use and the use of the Architect and his representatives when a separate office for the Architect's representative is not called for. Office shall be properly illuminated, heated during cold weather, and shall have operating windows with locks, doors with locks, tables, chairs, and drawing racks. Office shall have an illuminated and ventilated toilet room containing 1 water closet, 1 lavatory with mirror and a supply of toilet tissue, paper towels and liquid hand soap. All utilities, supplies, cleaning, and maintenance shall be by the Contractor as part of the Work and at no additional cost. Provide telephone service as called for hereinbefore. **All temporary offices and conference areas shall be smoke free.**

10.21 CONSTRUCTION CLEANING:

- A. This requirement shall be strictly enforced. The site in general and all areas in and around the Project construction shall be clear of waste at all times in order to present a clean and orderly appearance and prevent hazards to safety and health.

10.22 WASTE: The general contractor shall be responsible for the collection and removal of waste on a daily basis and in a lawful manner. Burying and burning of waste on the property shall not be permitted. Washing waste down sewers or into waterways shall not be permitted. Waste shall not be allowed to accumulate and shall not be allowed to become hazards to safety and health.

- A. The General Contractor shall furnish rodent proof containers in each construction area for the workmen to deposit their garbage and similar waste. This waste shall be kept separate from all other waste and shall be so identified in order that it can be disposed of as required by local regulations. Upon evidence of pest infestation, the General Contractor shall provide extermination services as a part of the work.
- B. Hazardous and dangerous waste, as listed by the EPA, shall be kept separate from all other waste. The trade responsible for this waste shall be solely responsible for the handling, removal, and disposing, in accordance with the regulations pertaining to such waste, on a daily basis.

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- C. The General Contractor shall be responsible for furnishing means and methods for preventing mud being brought into the building or onto the construction by workmen.
- 10.23 PUBLIC STREETS AND PRIVATE WAYS:
- A. All public streets adjacent to the site and all private ways at the site shall be kept clear of waste, spilled materials and products, and wet and dry earth at all times and shall be cleaned at the end of each working day. When wet earth is encountered, it shall be cleaned from the vehicles before they leave the site and enter the streets and private ways. All by the general contractor
 - B. THE REQUIREMENTS of this Article 9 do not prevent the General Contractor from entering into an agreement between him and the other Prime Contractors for the General Contractor to remove their waste.
- 10.24 CLEANING PRIOR TO INSTALLING FINISHES:
- A. The General Contractor shall remove all debris and soot, smudges, dust, and other deposits from the walls, ceilings, floors, and other exposed surfaces prior to installing finishes. Do not perform any finishing work until such surfaces are properly clean.
- 10.25 FIRST AID KITS:
- A. Each Prime Contractor and each Prime Subcontractor shall provide adequate provisioned first aid kits on the Project site for personnel employed by him and for the convenience of workmen employed by their Sub-subcontractors.
- 10.26 MATERIAL AND EQUIPMENT (SEE GENERAL CONDITIONS, ARTICLE 8).
- A. NEITHER THE OWNER NOR THE ARCHITECT WILL BE RESPONSIBLE FOR ANY ORAL INSTRUCTIONS BY OR ANY WRITTEN CONFIRMATIONS OF ANY ORAL INSTRUCTIONS FROM THE CONTRACTOR, SUBCONTRACTOR, PRODUCT SUPPLIERS, ETC.
- 10.27 PRODUCT SUBSTITUTIONS:
- A. Products and systems specified are the absolute minimum quality standard and substitutions of lesser quality are not acceptable.
 - B. REQUEST FOR SUBSTITUTION will not be considered verbally nor will approval be issued verbally. All requests for substitution shall be in written form as hereinafter stated and shall be transmitted through the bidding contractor with his concurrence.
 - C. REQUESTS FOR SUBSTITUTION of products by, manufacturers other than those listed in or performance requirements specified in the sections of the specifications, addenda, and on the drawings, will be considered by the architect if received not later than 10 working days prior to the date for receipt of bids, not including any bid date extension, so as to allow a reasonable time for the evaluation of requests for substitution and the notification, by addendum, of all bidding contractors as to the approved and accepted substitutions.
 - D. REQUEST FOR SUBSTITUTION:
 - 1. After Contract(s) is (are) signed, no substitutions will be evaluated by the Architect without compensation from the requesting Contractor to the Owner for cost of evaluation charged the Owner by the Architect.
 - E. ANY REQUEST FOR SUBSTITUTION which does not clearly show equality, to the architect's satisfaction, will be rejected. The burden of proof that the proposed substitution is equal to and meets the requirements specified and shown in the project documents including type, design, quality, operation, function, use, size, appearance, capability, electrical requirements,

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mechanical requirements, and manufacture shall be solely the responsibility of the bidding contractor through which the substitution was transmitted and thereby concurred with the substitution.

- F. REQUEST FOR SUBSTITUTION for a system and for each separate product item shall include: reason for substitution request; cost of both specified item and proposed substitution item; laboratory test reports; catalogs and drawings showing capacities, operations, functions, dimensions, construction details and methods of assembly; connections; and installation to the work. If a proposed substitution of products, equipment, or systems have different dimensions or configuration than that which is specified and required, then the contractor proposing the substitution shall furnish full drawings and details verifying the suitability of the proposed substitution with respect to space provided, functional operation (including maintenance accessibility), and aesthetic values, as a condition precedent to acceptance of the substitution. If the proposed substitution is accepted by the owner, after architect's review, the contract sum will be adjusted by change order reflecting extras or credits involved. Should the request for a substitution be accepted, shop drawings and samples shall be submitted in accordance with the general conditions and supplements thereto. Substitutions of a minor nature not involving a change in the contract sum or the contract time may be approved by the architect, without referral to the owner, in accordance with general conditions of the contract, form oc-15, North Carolina Department of Administration; article 21.
- G. MANUFACTURER'S LITERATURE which is readily available to the architect will not be acceptable for establishing proof of equality. Laboratory test reports shall have been performed by a nationally recognized independent testing laboratory which is known for its testing expertise. The laboratory test shall include type of materials used in the product including their thickness and strength, and a direct comparison to that specified for capacities, capabilities, coating, functions, life cycle usage, and operations. Where products will be exposed, and where systems will be used, no change in the architect's design and engineering intent will be allowed.
- H. IF PROPOSED SUBSTITUTIONS are accepted by the Owner, after Architect's review, the bidding Contractor's price may include prices reflected by the substitutions so indicated by Addendum.
- I. AFTER THE TIME FOR REQUESTING SUBSTITUTIONS has expired, requests for substitutions will be reconsidered, after signing of Contract, should circumstances arise that will be detrimental to the Project with respect to the time of completion and quality of performance as required by the Contract Documents. These circumstances shall be limited to strikes and other conditions beyond the Contractor's control. Request for reconsideration will be judged on the merit of each individual request.
- J. PRODUCTS PROPOSED FOR USE IN PROJECT: Within 20 consecutive calendar days after the Notice to Proceed, the Contractor shall furnish to the Architect for review, a complete list of products with manufacturers and suppliers of each that the Contractor will provide in the Project. This list shall be broken down into the Sections of the Project Manual. If an item is to be substituted, it shall be so noted and the request for substitution shall be submitted as hereinbefore called for. If an item is not listed and a request for substitution is not offered, then the Architect for expedience will select colors and finishes when preparing the color schedule and the Contractor shall match these colors. All materials installed by the Contractor shall be new. All materials shall meet NC State Building Codes and should there be any discrepancies between design and code, the more stringent requirement shall apply. All materials shall be in compliance with standards (or approved products) of the NC State Construction Office. Unless specified otherwise, NO PRODUCT CONTAINING ANY AMOUNT OF ANY FORM OF ASBESTOS SHALL BE INSTALLED AT UNC CHARLOTTE. ASBESTOS MEANS ASBESTIFORM VARIETIES OF CHRYSOTILE, CROCIDOLITE, AMOSITE, ANTHOPLYLLITE, TREMOLITE OR ACTINOLITE. BY DEFINITION, INSTALLATION OF ASBESTOS MATERIALS WILL BE CONSIDERED CONTRACTOR'S NEGLIGENCE AND THE

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CONTRACTOR SHALL PERFORM ALL NECESSARY WORK TO REMOVE THE ASBESTOS AND RESTORE THE SITE TO THE "POST-CONTRACT" CONDITION.

- K. ALL REVISIONS resulting directly or indirectly from equipment, products, and systems to be provided, which have different characteristics from that which the Project was designed for, shall be the financial responsibility of the Contractor or Subcontractor providing the equipment, products, and system which caused the revision. For example: Should a unit of equipment require a utility supply of larger capacity, such increase required in the supply system and its related components, back to a point where an increase will not be required, shall be paid for by the Contractor or Subcontractor providing that unit of equipment.

10.28 STORAGE AND PROTECTION:

- A. All products both stored and installed, shall be properly stored and protected from damage in accordance with the type of product and its manufacturer's recommendations. See Specification Sections for any special storage and protection requirements.
- B. PRODUCTS THAT CAN BE DAMAGED by weather, dampness and sunlight shall be stored in a weatherproof building or similar enclosure. On-site yard storage on pallets under a canvas or plastic sheet or the like is NOT a substitution for a weatherproof building or similar enclosure. Products that will not be damaged by weather, dampness, and sunlight and that can be stored outside a weatherproof building or similar enclosure shall be stored off the ground and shall be protected from dirt, grime, mud, etc., with particular attention being given to those products that will be exposed to view in the finished work. Products that can also be damaged by high and/or low temperatures shall be stored in weatherproof building or similar enclosure where the proper storage temperature can be maintained as required by the product being stored. Stored products, when installed, shall be in a new, undamaged, and factory finished condition.
- C. NO FINISHING PRODUCT OR FINISHED PRODUCT shall be stored in the Project or installed in the Project until the Project is fully enclosed; is heated to the minimum temperature required by the product; and the humidity can be controlled to that required by the product. Coordinate with all finishing trades involved, in order that the required environmental conditions can be furnished and maintained prior to, during, and after the time of storage or installation of finishing products and finished products.

PART 11 - FACILITY START UP/COMMISSIONING

- 11.1 STARTING OF SYSTEMS: SEE SPECIFICATION SECTIONS for requirements to be performed under each particular section.
- 11.2 TESTING, ADJUSTING, AND BALANCING OF SYSTEMS: SEE SPECIFICATION SECTIONS for requirements to be performed under each particular section.

PART 12 - CONTRACT CLOSEOUT

- 12.1 See general conditions and supplements thereto and specification sections for document submittals, demonstrations, written instructions, personnel instructions, and any other special requirements.
- A. PROJECT RECORD DRAWINGS: Shall be furnished to the Architect with each application for payment and at time of closeout. Project record drawings shall meet North Carolina Department of Administration Standards of the most current North Carolina Construction Manual.

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- B. THE GENERAL CONTRACTOR shall file one (1) complete set of Contract Drawings in his field office. Each Prime Contractor and each Prime Subcontractor, as the case may be, shall fully and accurately note in red on this set any and all changes and deviations in the Project from that originally indicated on the drawings, as required by change orders, bulletin drawings, addenda, alternates, products, equipment, and methods of construction. All utility services and other concealed work which are built into walls, floor slabs, roof slabs, below slabs on grade, and in general unexposed shall be accurately located to avoid damage to them in case a change or renovation takes place at some future date. All changes in dimensions, elevations, location of building components and equipment, and the location of any existing work which are different from that originally shown shall be indicated on these drawings. A copy of these, showing the work for which payment is requested shall be provided with each application for payment.
- C. UPON COMPLETION of construction, the Contractors shall each furnish a copy of surveys by a N.C. Registered Land Surveyor showing the final and accurate location of all new underground utilities each has installed giving spot elevations of the utilities at 30'-0" intervals maximum. All encountered existing underground utilities shall also be noted on the site plan if their location, type, or elevation is different from that indicated on the Contract Drawings or if the utility is not indicate don the Contract Drawings. Further, the survey provided by the General Contractor shall accurately locate the building and shall give as built contours of the site.
- D. AT THE CONCLUSION OF THE PROJECT, the Contractors shall turn over to the University all equipment, files, logs, drawings or submittals, etc., belonging to the Owner.
- E. AT THE CONCLUSION OF THE PROJECT, Contractors shall provide receipts signed by the Owner for all required items of the attic stock. The Project Expeditor shall submit a listing (specification section, type of material, and quantity) of all required attic stock items for review by the owner and designer prior to the preliminary final inspection.
- F. AT THE CONCLUSION OF THE PROJECT Contractors shall provide one copy of all packing slips, instruction sheets, Owner's guides, etc., that were packed with items of equipment and materials incorporated into the project.
- G. AT THE CONCLUSION OF THE PROJECT each Contractor shall provide a comprehensive listing of subcontractors and suppliers showing the generic name of materials, work or equipment provided, trade or brand name, name, address, telephone number and contract person, and a reference to the drawings or specification.
- H. AT THE CONCLUSION OF THE PROJECT Shop Drawings, Fire Sprinkler and Fire Alarm Drawings shall be sent in AutoCAD and PDF formats. Other General shop drawings, not specific to UNC Charlotte may be sent in PDF format.
- I. AT THE CONCLUSION OF THE PROJECT Design manuals, warranty information, and paper documentation provided to the owner be in a digital format to facilitate storage. Acceptable file types are pdf, doc, xls, tiff, jpg, and dwg.

PART 13 - FINAL CLEANING UP

13.1 SEE GENERAL CONDITIONS, ARTICLE 41.

- A. BEFORE THE DATE OF THE PRELIMINARY REVIEW, the Work and the site shall be cleaned of all debris, boxes, cartons, crates, wrappings, etc. Only such cleaning materials and equipment absolutely required shall be allowed on the Project at this time. If approved beforehand by the Architect, other materials may be stored on the Site in designated areas in a neat and orderly manner. Clean up shall include removal of all dirt and construction debris from the roof structure.

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- B. BEFORE THE DATE THE FINAL REVIEW is made to determine completion of the Project, in accordance with the Contract Documents, all of the Contractor's products and equipment shall be removed from the site, the Project given a thorough cleaning, such as: Glass cleaning, carpets vacuumed, building surfaces and equipment washed as required, resilient tile waxed and buffed as required, paint splatter removed, general dusting, debris removed, resilient wall bases buffed, etc., and the Project made 100 percent complete and ready for the Owner's occupancy and use as intended. All other cleaning and preparation shall be in accordance with the specification sections.
- C. PERMANENT BUILDING POWER AND UTILITIES: These services shall remain the responsibility of the Contractors during all reviews up to and including the day of Project acceptance.
- D. **ASBESTOS AND POLYCHLORINATED BIPHENYL (PCB) REQUIREMENTS** (See GENERAL CONDITIONS, Article 48.)
- E. DURING THE WORK PROCESS, should the Contractor encounter any material identified as asbestos and/or PCB, or be suspect of containing asbestos and/or PCB, he shall immediately initiate the required procedures of the Environmental Protection Agency (EPA), and/or state or local agencies having jurisdiction, which include, but are not necessarily limited to, the following:
1. INITIATE PROCEDURES for the protection of any and all persons exposed to the affected areas or adjacent areas affected thereby.
 2. ON BEHALF OF THE OWNER the Contractor shall: Secure quotations for the Owner's approval to engage the services of a licensed industrial hygienist to perform an asbestos and PCB identification survey, the purpose of which is to
 - a. verify presence of asbestos and PCB
 - b. determine the type of asbestos and PCB
 - c. make asbestos and PCB exposure assessments
 - d. make any other tests required to comply with EPA requirements not specifically noted herein
 - e. determine the scope of the Project required to be corrected
 - f. make recommendations with respect to possible corrective actions which the Owner may take, i.e., encapsulation and/or removal and disposal, as may be required
 3. Upon consultation with the Owner and the Architect, and upon determination of corrective actions to be taken, instruct the hygienist to prepare a specification in sufficient detail to outline the procedures required by EPA, for encapsulation, and/or removal and disposal, as the case may be, so as to furnish the Contractor with sufficient information to bid competitively the remedial work by specialty Contractors engaged in the encapsulation or elimination of asbestos and PCB material, based on an identified scope of work.
 4. During the corrective process, require the hygienist to review the Contractor's procedures for compliance with EPA, state and local requirements, make such test as may be required and, at the conclusion of the work, certify that the area is free and clear of asbestos and/or PCB materials and particles in the air.
 5. Secure quotations, for approval by the Owner, from specialty Contractors to perform the corrective work determined by the hygienist. The quotations shall include both time required and cost. In addition to the above, the Contractor shall submit itemized quotations for the replacement of any insulation or other asbestos and/or PCB containing materials removed, with insulation or other materials selected by the Architect, together with any other associated cost for replacement of materials and finishes necessarily removed to accommodate removal of asbestos and/or PCB materials, and time extensions allowed by the specifications.
- F. OWNER-APPROVED QUOTATIONS for the hygienist and for corrective work to be performed will be incorporated into the Contract by Change Order.
- G. NORTH CAROLINA AND FEDERAL ASBESTOS REGULATIONS INFORMATION:

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1. The Environmental Protection Agency's (EPA's) National Emission Standards for Hazardous Air Pollutants (NESHAP) require an asbestos inspection and a ten (10) working day notification prior to demolition and renovation of all commercial, institutional, or industrial facilities. This excludes residential buildings with four (4) or fewer dwelling units. NESHAP also applies to the demolition of all residences which are being demolished for commercial, institutional, or industrial purposes. Notification of all demolitions is required whether or not the structures are found to contain asbestos.
2. If an inspection, conducted by a North Carolina accredited asbestos inspector, confirms that a facility contains at least 160 square feet, 260 linear feet, or 35 cubic feet, of Regulated Asbestos Containing Materials (RACM), then these materials are to be removed prior to starting the renovation or demolition activity. When removal of RACM is required, a notification and a removal fee shall be submitted as part of the notification process. The notification and the removal fee, when applicable, shall be submitted to the Asbestos Hazard Management Branch. The removal of RACM shall be conducted by North Carolina asbestos accredited individuals.
3. Please note that Forsyth, Buncombe/Haywood, and Mecklenburg Counties have local NESHAP programs and should be contacted directly for local requirements.

PART 14 – BIM

14.1 Design Manual:

Designers are expected to adhere to the standards explained in the “University’s Design and Construction Manual” and “Space Standards” that can be found at the following link: <http://facilities.uncc.edu/our-services/business-related-services/facilities-planning/design-and-construction-manual>

Deviations can only be authorized by the University’s Capital Project Manager. Also refer to Annex J.

A. VDC/BIM Requirement:

The University’s VDC/BIM requirements were developed as a planning service for creating a VDC to IWMS vision. It is to assist the entire AEC/O Team during new construction and renovation projects through all 5 phases of a projects Lifecycle to achieve that VDC to IWMS workflow vision.

The BIM, VDC Workflows and Metadata will serve as the “live” data source used throughout the life of the project. It is important that there be a balance of structured information to support both design and constructability as well as building maintenance and operations, but not so much as to become burdensome to the AEC Team. The University is not attempting to track more metadata than can be practically use or update, all of which is further described in the VDC/BIM Requirements Implementation Plan.

14.2 Use of Document

The Implementation Plan provides guidance around the scope of VDC/BIM modeling and metadata required by the Architects, Engineers, Contractors and Sub-Partners for the University of North Carolina at Charlotte. Guidance on BIM use and Asset Naming by the Architects and Engineers during the design phases as well as defining the Contractors scope of work during construction for those assets and the required deliverables during construction and at project close-out. Further review and explanations of the process can be reviewed at Design and Construction Project Kick-Off meetings.

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A Referenced Documents

Designers and contractors shall adhere to the requirements as listed in the “University of North Carolina at Charlotte Design and Construction Manual; Section 3, Annex J – UNC Charlotte VDC/BIM Requirements Implementation Plan”

<http://facilities.uncc.edu/sites/facilities.uncc.edu/files/media/Planning/design-manual-current/49sec3-annex-j-ilm.pdf>

B. Functional Requirements

1. The Design Team shall submit to UNC Charlotte their Design BEP (BEP-D) before the start of schematic design or within thirty [30] days of contract being awarded, outlining the strategy and schedule for utilizing BIM to execute design related activities and project coordination. Further review and collaboration around VDC workflows will need to be reviewed once the Construction BEP (BEP-C) has been issued. For further details see the VDC/BIM Requirements Implementation Plan.
2. The Construction Team shall submit to UNC Charlotte their Construction BEP (BEP-C) within thirty [30] days of contract being award, outlining the strategy and schedule for utilizing BIM and VDC Technology to execute construction related activities and project coordination. TO make this a collaborative process the Construction Team needs to involve the Design Team in their VDC workflow when creating their BEP-C. For further details see the VDC/BIM Requirements Implementation Plan.

C. Equipment Metadata Requirements

The metadata requirements during the BIM/VDC workflow can be found in the Appendix sections of the VDC/BIM Requirements Implementation Plan. The document itself explains the processes and workflows that UNC Charlotte has put in place internally for managing this process. This document should sever as a road map for helping create the BEP-D and BEP-C for a project Familiarity with the process is recommended and additional data points are in the body of the document as well, not everything can be correctly executed just by relying on the Appendix documents.

D. Deliverable Documents

The University of North Carolina at Charlotte will provide the AEC Team with a template folder file structure to populate all Documentation for the life of the project. This folder structure has a direct relationship to the Digital Management Exchange Guidelines found in the Implementation Plan.

E. Deviations

Changes or deviations can only be authorized by the University’s Capital Project Manager in conjunction of Facilities Operations. Deviations or changes will need to be submitted in writing or highlighted in the BEP-D or BEP-C for the University to review and approve.

14.3 Construction Routes:

Designers and contractors shall adhere to the requirements as listed in the “University of North Carolina at Charlotte Design and Construction Manual Section 2, Division 01A – Capital Project Guidelines (Formal); PART 1 - SITE ACCESS AND USE OF PREMISES.”

<http://facilities.uncc.edu/sites/facilities.uncc.edu/files/media/Planning/07sec2div1aa-project.pdf>

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However, for some projects additional/ different requirements (including route maps) shall be provided by the University's Capital Project Manager. An overview of routes can be accessed on the "5-year Capital Plan Projects Map" by selecting the "Show/ Hide Construction Routes" icon on the time lapse slider.

<http://capitalconstructionplan.uncc.edu/5-year-capital-plan-rojects-map>

Deviations can only be authorized by the University's Capital Project Manager.

14.4 Deliverables:

Designers and contractors shall adhere to the requirements as listed in the "University of North Carolina at Charlotte Design and Construction Manual; Section 3, Annex J – UNC Charlotte VDC/BIM Requirements Implementation Plan"

<http://facilities.uncc.edu/sites/facilities.uncc.edu/files/media/Planning/design-manual-current/49sec3-annex-j-ilm.pdf>

SECTION 2, DIVISION 1B
CAPITAL PROJECTS SUPPLEMENTAL GENERAL
CONDITIONS

SUPPLEMENTAL GENERAL CONDITIONS

The following modify the January 2013, 24rd Edition of the GENERAL CONDITIONS OF THE CONTRACT, STATE OF NORTH CAROLINA FORM OC-15 and supersedes them only whenever they are in conflict. Unaltered provisions of the General Conditions shall remain in effect. These modifications shall be incorporated into all Contract Forms.

1.1 ARTICLE 1 - DEFINITIONS

- A. Add to the end of the paragraph "The Geotechnical Technical Report does not constitute a part of the Contract Documents, but is included for reference."
- B. The "Owner" is the State of North Carolina through the University of North Carolina at Charlotte.
- C. The "Designer" referred to herein, shall mean (designer to insert design firm name and address).
- S. "Equal To" or "Approved Equal" Add: "substitute products by manufacturers other than those specified in the Project Manual, Addenda, and on the drawings and which may be incorporated in the Work after review and concurrence by the Architect and acceptance by the Owner. This review shall be in accordance with the General Requirements".
- U. "Provide." Shall mean furnish and install complete in place, and ready for use.
- V. "Indicated" and "Shown." Shall mean as detailed, scheduled, or called for in the Contract Documents.
- CC. "Latest Edition." Shall mean the current printed document issued up to 30 calendar days prior to date of receipt of bids, unless specified otherwise.
- DD. "Quality." Shall mean the meticulous attention to the detail of installation and workmanship necessary to the assemblage of products in the highest grade of excellence by skilled craftsmen of the trade.
- EE. "Drawings" or "Plans" mean the drawings enumerated in the Contract (including all information in the Detail Manual).
- FF. "Specifications" mean this Project Manual and Addenda thereto, and this term shall include such pages as are enumerated in the Contract as applicable to the work involved.
- GG. "Supplementary Conditions", as referred to in other parts of the Project Manual, shall be the same as "Supplementary General Conditions."
- HH. Project Identification: All correspondence, reports, schedules, applications for payment, fax items, etc., shall contain formal title of project, code and item numbers, and SCO ID numbers.

1.2 ARTICLE 2 - INTENT AND EXECUTION OF DOCUMENTS

- A. ADD to paragraph a:

All work shall be in accordance with the Contract Documents. No change therefrom shall be made without a review by the Designer. Where more detailed information is needed, or when an interpretation of the Contract Documents is needed, the Contractor, before proceeding with the work, shall refer the matter to the Designer who will furnish information or interpretation in the form of a Field Order or other written forms or drawings. If any errors, inconsistencies, or

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omissions in the Contract Documents are recognized by the Contractor or any member of his organization, the Contractor shall notify the Designer in writing of such error, inconsistency, or omission before proceeding with the work.

Where compliance with two or more requirements, material or equipment, are specified and the requirements, materials or equipment, establish conflicting specifications or quality levels, the contractor is to comply with the most stringent or higher quality specification. The Designer shall be the authority for determining the highest quality specification.

Should the specifications and drawings fail to particularly describe the material or kind of goods to be used in any place, then it shall be the duty of the Contractor to make inquiry of the Designer for what is best suited. The material that would normally be used in this place to produce first quality finished work shall be considered a part of the Contract.

Shop drawings shall be legible and suitable for producing legible reproductions.

1.3 ARTICLE 3 - CLARIFICATION AND DETAIL DRAWINGS

A. ADD to paragraph a:

If, in the opinion of the Contractor work is indicated or is specified in such manner as will make it impossible to produce a first-class piece of work, or should discrepancies appear within the Contract Documents, he shall refer same to the Designer for interpretation before proceeding with work. If the Contractor fails to make such reference, no excuse will thereafter be entertained for failure to carry out work in satisfactory manner. Where only part of the work is indicated, similar parts shall be considered repetition. Where any detail is shown and the components therefore are fully described, similar details shall be construed to require equal materials and construction.

1.4 ARTICLE 4 - COPIES OF DRAWINGS AND SPECIFICATIONS

A. ADD to paragraph:

e. Cost of additional drawings and specification shall be as follows:

Drawings: The Designer shall offer printing of additional copies of documents at direct material cost plus 10% for handling.

1.5 ARTICLE 5 - SHOP DRAWINGS, SUBMITTALS, SAMPLES, DATA

A. ADD to paragraph a:

This schedule shall be an excerpt from the CPM schedule described by the Supplementary General Conditions. This Schedule shall indicate the items, relevant specification sections, other related submittals, the date when such item will be furnished to the Architect, and the date by which Architect's review is necessary to maintain Construction Schedule. This schedule shall take into consideration the resubmission of shop drawings required to achieve acceptance of the Designer and Owner.

B. ADD to paragraph c:

The following shop drawings will take longer than 20 calendar days for review and return to the Contractor:

1. Structural Steel
2. Mechanical Systems

C. ADD to paragraph d:

All shop drawings, submittals, samples, and data shall be submitted to the Designer for review according to accepted CPM schedule from Article 5 (a). After these items have been reviewed by the Designer they will be returned to the Contractor or Project Expediter. Samples and shop

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drawings required for evaluation of a substitution shall be submitted with the request for substitution. Shop drawings, submittals, samples, and data will not be considered by the Designer unless the submission clearly indicates that they have been checked, coordinated between Prime Subcontractors, and stamped approved by the Contractor and Fabricator or Contractor, Subcontractor, and Fabricator as the case may be. All shop drawings and catalog cuts submitted shall each receive the following stamp completed and dated by the Contractor or submitting Prime Contractor. Samples shall have the stamp affixed to a tag attached to each sample.

**Submitted in accordance with Section
No.**

**and paragraph
No.**

_____ **of the specification**

FOR SINGLE CONTRACT, AS FOLLOWS

_____ We have checked and approved this submittal. We find it to be in accordance with the Contract Documents.

Subcontractor	Signature	Date
---------------	-----------	------

_____ We have reviewed this submittal and find it is coordinated with the other parts of the Project.

Subcontractor	Signature	Date
---------------	-----------	------

D. ADD paragraph e:

No extension of construction time will be allowed for delay in checking shop drawings, submittals, samples or data because of the Contractor's, Subcontractor's, or Fabricator's failure to check shop drawings before submitting them to the Designer. All shop drawings shall be prepared to show how the material relates specifically to the conditions of the Project. Standard manufacturer's drawings that do not show how and where the material is to be used will not be considered. Shop drawings shall not be reproductions or portions of reproductions of the Contract documents. Coordinated shop drawings at the same scale indicating all mechanical, electrical, and plumbing shall be required between all trades. The Prime Subcontractor in a given area, as determined by the Contractor, shall submit their drawings to the other involved Subcontractors through the Prime Contractor.

E. ADD paragraph f:

The Contractor will furnish and deliver to the Owner 1 copy of each shop drawing, submittal, sample, and data which has been reviewed by the Designer and which has received a "NO EXCEPTIONS TAKEN" or a "TO BE CORRECTED AS NOTED" evaluation. The Contractor or each Prime Contractor shall deliver these to the Owner within 14 calendar days of receiving each reviewed item from the Contractor following review by the Designer, or in the case where 1 copy of a sample was submitted, within 14 calendar days of receiving advice that the sample is "NO EXCEPTIONS TAKEN" or "TO BE CORRECTED AS NOTED." Coordinate delivery with the owner's project manager. The owner shall have the option of accepting submittal copies during construction or at closeout in which case the project expeditor shall neatly store all items by division in "banker type" storage boxes or a separate file cabinet in the contractor's office facility. All stored submittals and samples shall be accessible to owner at any time during normal working hours.

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F. ADD paragraph g:

After the Plumbing, HVAC, and Electrical shop drawing submittals have received a favorable review, the Contractor shall submit to the Designer for the Owner, complete operating and maintenance manuals as called for in Divisions 22, 23, and 26. These manuals shall be submitted not later than 14 calendar days before occupancy.

1. Only Contract Documents, approved Change Orders, approved Contractor submittals to the extent they are in accordance with the Contract Documents, Designer bulletin drawings, and references specifically incorporated into Contract Documents constitute authoritative description of the Work. No other documents, including Contractor generated drawings, shall be considered authoritative.

1.6

1.7 ARTICLE 8 - MATERIALS, EQUIPMENT, EMPLOYEES

A. ADD

Also see - GENERAL REQUIREMENTS.

B. ADD to paragraph d:

These substitutions shall be made only by the Contractor and not by subcontractors or material suppliers. Necessary or required substitutions can be made after contract award per usual procedure, but only under unusual or extenuating circumstances.

1.8 ARTICLE 10 - PERMITS, INSPECTIONS, FEES, REGULATIONS

A. ADD paragraph f:

The Contractor shall perform the Work in accordance with The University of North Carolina at Charlotte regulations and the Preconstruction Conference Checklist (if such checklist is furnished).

1.9 ARTICLE 11 - PROTECTION OF WORK, PROPERTY AND THE PUBLIC

A. ADD:

Also see - GENERAL REQUIREMENTS.

1.10 ARTICLE 13 - INSPECTION OF THE WORK

A. ADD to paragraph c:

The Contractor shall also serve the same notice to the Owner for all such inspections or testing.

1.11 ARTICLE 14 - CONSTRUCTION SUPERVISION AND SCHEDULE

A. ADD to paragraph a:

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The Contractor and each of his Prime Subcontractors shall keep a Superintendent on the Project during the progress of the Work, for purposes of coordination with other Prime Subcontractors, and if required by the Owner, regardless of whether said Contractor or Prime Subcontractor has work currently in progress. Contractors are allowed to work any day of the year, except at times when the Owner may have special events which would be disrupted by Contractor's activities.

B. ADD to paragraph f:

"Unless designated otherwise, The General Contractor shall be the 'Project Expeditor'."

The Project Expeditor shall prepare daily and have available for inspection by the Designer, State, and Owner daily project reports. Project daily reports shall be prepared for every day of the project beginning with the date of the notice to proceed and terminating with project completion. Daily reports must also be completed for all weekends and holidays. The daily reports are to include the following items (at a minimum): Superintendents name and signature; day and date; morning and afternoon temperature; weather (clear, cloudy, rain and duration of rain); site conditions; other applicable weather conditions; crew sizes for all contractors and subcontractors on site; and major work accomplished for that day.

C. ADD to paragraph g:

Provide CPM CONSTRUCTION SCHEDULE as stated below:

1. The Construction Schedule shall show the date when the work of each Specification Section is to begin and is to be completed, its total dollar value percent to be completed each month, and total dollar value to be completed each month. The initial schedule and subsequent updates shall be signed by the general contractor.
2. The Construction Schedule shall be a schedule in time scaled logic network in the Critical Path Method and shall depict sequence of operations mutually agreeable to the Owner, designer, and each of the Prime Sub-Contractors.
3. The dates of commencement and completion of each of the various stages of the work (including lead time activities, drawing and sample submissions, bidding, awarding subcontracts, manufacturing and shipping); delivery dates for material and equipment by separate contract in detail satisfactory to the Designer. Such Schedule shall show a complete itemized breakdown of the work, and shall include networks for all phases of the work including networks for all work to be performed by the Contractor or all Prime Sub- Contractors.
4. The schedule and all other constructions schedules shall include 1 and only 1 critical path and this critical path shall be clearly identified. The Construction Schedule shall include the early and late start dates and early and late finish dates of all activities.
5. The Contractor shall also submit a separate progress schedule listing all submittals required under the contract and when it is anticipated that each submittal will be submitted allowing 20 days for the designer's review. The separate progress schedule shall be an excerpt from the above described construction schedule.
6. The schedule shall not indicate any on-site construction activity longer than 21 consecutive calendar days or any other activity longer than 28 consecutive calendar days. Any activity with an anticipated longer duration must therefore be broken into component activities, each of which has duration of no longer than 28 calendar days. The initial schedule and subsequent updates shall be submitted in 24" X 36" color plots using a font size acceptable to the owner. Additionally, one 11" X 17" copy shall be submitted with each color plot.
7. The Construction Schedule shall anticipate all weather delays which may be predicted from analysis of weather reports for the last 5 years and allowances for rock and unsuitable soil removal. The schedule shall also include all major milestones and all anticipated inspection, shutdowns/outages for electrical, water, natural gas, and steam tie-ins if applicable.

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As a separate document, the Contractor shall submit progress report, with each Application for Payment, which shall consist of a checklist showing the date of commencement of each activity on the Construction Schedule then commenced the date of completion of those activities completed, and the approximate percentage of completion of each activity.

The Contractor shall receive the permission of the Owner to make changes to the schedule. Notwithstanding any other provisions here of to the contrary, the time of completion may be extended only by a written change order.

Whenever the Schedule of Work changes, the Construction Schedule, which is a different document from the progress report, shall be revised by the Contractor to include the Schedule revisions of all the Prime Sub-Contractors and other sub-contractors and submitted with the next Application for Payment. This revised schedule shall include all information required of the schedule prior to revisions and shall provide for completion on the Contract Completion Date.

The Contractor shall advise in advance, at least 24 hours on a weekday and at least 48 hours on weekends and legal holidays, of all schedule changes, so that any Owner inspections can be arranged. If no revised Construction Schedule is included with an Application for Payment, this lack of inclusion shall constitute a certification by each and all the Contractors that no changes in the Construction Schedule have occurred.

Ownership of float and purpose of Schedule

1. All schedule float, slacktime, or contingency within the schedule jointly belongs to the Owner and Contractor. The Owner shall be entitled to require early completion and clean-up of certain portions of the Work. (i.e. the difference in time between the projects early completion and the required completion date and total float within the overall schedule, is not the exclusive use of either the owner or the Contractor, but is jointly owned by each and is a resource available to and shared by each of the parties as needed to meet contract milestones and the contract completion dates with the owner receiving initial benefit. The Contractor shall not sequester shared float through such strategies as extending activity duration estimates to consume available float, using preferential logic or using extensive crew/resource sequencing etc. since float time within the schedule is jointly owned, no time extensions will be granted until a delay occurs which extends the work beyond the contract completion date. Since float time within the construction schedule is jointly owned, it is acknowledged that owner caused delays on the project may be offset by Owner caused time savings (i.e., critical path submittals returned in less time than allowed by the contract, approval of substitution requests which result in a savings of time to the Contractor. In such an event, the Contractor shall not be entitled to receive a time extension until all owner caused time savings are exceeded and the contract completion date is also exceeded.

The submittal of a fully revised and acceptable construction schedule shall be a condition precedent to the processing of the second monthly payment application. As such, each of the prime Sub-Contractors have a specific obligation to each of the other Prime-Sub Contractors and to the owner to provide all necessary information and to fully cooperate with the Contractor in the development of this and all other construction schedules, including monthly updated construction schedules. All updated construction schedules shall include an updated submittal process schedule excerpted from the construction schedule.

Regardless of which submittal method the Contractor elects to use in formulating the construction schedule, an updated schedule shall be submitted to the owner 5 days prior to submittal of any monthly payment request. The submittal of the updated construction schedule, which satisfies the requirement of this article accurately reflects the status of the work, and incorporates all changes into the schedule, shall be a condition precedent to the processing of the monthly payment application. Updated schedules shall also be submitted at such other times as the Owner may direct. Upon approval of a change order or issuance of a directive to

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proceed with a change the approved change order shall be reflected in the next schedule update submitted by the Contractor or other update submittal approved by the Owner.

If completion of any part of the work, the delivery of equipment or materials, or submittal of any of the submittals is behind the updated construction schedule and will impact the end date of the work past the contract completion date, the Contractor, shall submit in writing, a plan acceptable to the owner for completing the work on or before the current completion date.

No extensions of time shall be granted unless the delay can be clearly demonstrated by the Contractor, on the basis of the updated construction schedule current as of the month the change is issued on the delay occurred and which delay cannot be mitigated, offset, or eliminated through such actions as revising the intended sequence of work or other means. It is recognized that any such delay which is the direct result of, and only the direct result of an owner directed change may entitle the Contractor to added compensation for efforts to maintain the schedule or for costs related to extending the schedule as a result of the owner directed change which cannot be accommodated by owner caused time savings.

As a precedent to the release of retained funds, the Contractor shall, after completion of the work has been achieved, submit a final construction schedule which accurately reflects the manner in which the project was constructed and includes actual start and completion dates for all work activities on the construction schedule.

Should the Contractor fail or refuse to complete any portion of the work in accordance with the Construction Schedule, the Owner may perform or cause to be performed the work necessary to cause such completion, and all costs incurred by Owner and Designer shall be deducted from any monies which otherwise may become due the Contractor. Should such costs exceed monies due, the Contractor shall reimburse the Owner within 30 days of the Owner documenting the costs to the Contractor. Schedule shall be prepared by a third party scheduling consultant.

The Contractor shall anticipate that the Owner may require various changes to the work. Only those changes which also change the duration of the critical path shall entitle the Contractor to present a claim for schedule impact, acceleration, or deceleration, only to the extent of the change in the duration of the critical path. Beyond compensation given in resolution of such a claim for acceleration or deceleration.

The purpose of the Construction Schedule, and monthly updates as hereinbefore described, or as may be otherwise submitted and approved, shall be to furnish the Owner and Designer with information to indicate that the Contractor has planned the Project in sufficient detail for the Contractor to insure that its construction can be accomplished in an orderly manner and on the Contract completion date. The dollar value estimates to be included on the schedule are to assist the Owner in cash flow planning so that funds will be readily available to pay the Applications for Payment. Monthly progress reports and updates are to furnish the Owner with current status of any changes required in the original schedule which will assist the Owner in scheduling delivery and installation of any products, furnishings, etc., necessary for the operation of the facility for its intended purpose. The responsibility for construction planning and the effective efficient implementation of such, or the converse, to meet the Contract completion date, or authorized appropriate extensions therefore, are the total responsibility of the Contractor, and such responsibility shall not transfer to the Owner/Designer. Preview of the original Construction Schedule, and subsequent modifications thereto, by the Owner and/or the Designer shall be limited to the general purposes set out above. Such approval shall not operate to imply the agreement of the Owner/Designer to the Contractor's planned procedures, coordination, critical path scheduling, etc., as being appropriate or reasonable.

Contractor shall assign manpower loading for each activity of the schedule by applying the total man-hours required to complete each activity to a resource identified as "man-hours" on each activity."

If the Contractor submits an early completion baseline schedule that shows contract completion

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in less than 85 percent of the working days specified in these special provisions, the baseline schedule shall be supplemented with resource allocations for every task activity and include time-scaled resource histograms. The resource allocations shall be shown to a level of detail that facilitates report generation based on labor crafts and equipment classes for the Contractor and subcontractors. The Contractor shall use average composite crews to display the labor loading of on-site construction activities. The Contractor shall optimize and level labor to reflect a reasonable plan for accomplishing the work of the contract and to assure that resources are not duplicated in concurrent activities. The time-scaled resource histograms shall show labor crafts and equipment classes to be utilized on the contract. The Engineer may review the baseline schedule activity resource allocations using Means Productivity Standards or equivalent to determine if the schedule is practicable."

D. ADD paragraph m:

Prior to and during the execution of the Work, the Contractor shall immediately report any error, discrepancies, conflicts, and omissions found therein to the Designer in writing and shall have the same explained or corrected by the Designer before proceeding with the Work. Any necessary changes shall be adjusted as required thereafter by Article 19 - Changes in the Work. Any work done by the Contractor or after these Conditions have been discovered, and before the Designer has either explained or made corrections, shall be corrected at the Contractor's expense. The Contractor shall coordinate all work of his Contract to produce the required finished Project in accordance with the Contract Documents. Special attention shall be given to the submission of shop drawings, samples, color charts, and requests for substitution within the specified time; furnishing the proper shop drawings to Subcontractors, and material suppliers, whose work and equipment is affected by and related thereto; and the furnishing of all information concerning location, type, and size of built-in equipment and materials and equipment utilities. This coordination is in addition to all other coordination requirements called for in the technical sections of the Project Manual.

E. ADD paragraph n:

The Contractor shall post a sign indicating firearms are prohibited on the job site.

F. ADD paragraph o:

Prior to issuing the 2nd Application and Certificate for Payment, the contractor shall provide in graphic format the Baseline Anticipated Cost based on both early and late start dates for the duration of the project. On a monthly basis and as part of each subsequent Application and Certificate for Payment, the contractor shall submit the Baseline Anticipated Cost graph to include the actual earned value along with an explanation of any schedule variance.

1.12 ARTICLE 15 - SEPARATE CONTRACTS AND CONTRACTOR RELATIONSHIPS

A. ADD:

Also see DIVISION 1 - GENERAL REQUIREMENTS

B. ADD paragraph g:

The Contractor shall provide all required Site Utilities Work, including but not limited to: Site Storm Sewer, Site Sanitary Sewer, Water and Steam Lines, Natural Gas, and Electrical. Final connection from building to site utilities shall be by the Contractor.

1.13 ARTICLE 17 - CONTRACTORS AND SUBCONTRACTOR RELATIONSHIPS

A. ADD:

The Contractor has the responsibility to insure that all product suppliers, and Prime Subcontractors, their agents and employees, adhere to the Contract Documents and that they provide all products on time.

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1.14 ARTICLE 19 - CHANGE IN THE WORK

A. ADD to paragraph c.1:

Unit prices include all time, costs, and overhead of each unit.

B. ADD to paragraph d:

Overhead shall include all Conditions of the Contract and all general requirements such as Project management, scheduling, home office expense, layout, reproduction of Drawings and Specifications, testing and inspection, shop drawings and sample coordination, shop drawing preparation, proposal request estimating, supervision (including general and nonworking foremen) small tools and expendable items, taxes, temporary facilities and services, including access and safety provisions, "as-built" drawings, estimating general and administrative overhead, and profit. Pricing of proposal requests need to be accomplished within 20 calendar days minimum following receipt by the contractor. Upon request, the contractor shall provide the designer with documentation to substantiate labor rates.

In the event of additions and deletions of items of direct labor and/or material, the item quantities shall be algebraically summed prior to the incorporation of applicable prices, Unit Prices, and/or the overhead and profit percentage applicable.

1.15 ARTICLE 21 - MINOR CHANGES IN THE WORK.

A. Revise the first sentence by adding after "The Designer..."

"with consultation with the Owner."

1.16 ARTICLE 23 - TIME OF COMPLETION, DELAYS, EXTENSIONS OF TIME

A. Substitute the following as paragraph b:

The CM shall commence work to be performed under this Agreement on the issued Notice to Proceed, and shall fully complete all work hereunder by (ADD DATE). After the execution of the contract, if the contract completion date is later, a no cost change order will be executed immediately to reduce the number of days in the contract so that the contract completion date is (ADD DATE).

All Contractors are responsible for "on-time" performance and shall be responsible for identifying and appropriately coordinating long lead materials and equipment to maintain the project schedule.

For each day in excess of the contract duration, the CM shall pay to the Owner, the sum of Two Thousand Five Hundred Dollars (\$2,500.00) per calendar day until (ADD DATE) and the sum of One Hundred Dollars (\$100.00) per calendar day per bed after (ADD DATE) the work is delayed beyond the completion date or authorized extension thereof, as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the Owner by reason of failure of said CM to complete the work within the time specified, such time being of the essence of this contract and a material consideration thereof.

B. ADD to paragraph c:

After the contract completion date, the Designer shall deduct from all contractor pay applications, the liquidated damages in the amount of the daily liquidated damage rate times the number of calendar days after the contract completion date minus any previously assessed liquidated damages.

C. Add to paragraph d:

The "5-year average of precipitation" shall be determined only by applying daily amounts greater than one-tenth (0.10) of an inch. Only amounts exceeding 0.10 inch shall be applied in determining the actual number of "rain days" for a given month.

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The Contractor shall maintain, on site, a hard bound log book to record daily precipitation data from the UNC Charlotte Weather Center alongside daily NOAA readings from the Fire Station #27 – Ken Hoffman Drive, Charlotte. The Log shall also record any corresponding impacts to activities on the critical path. The Log shall be maintained on a daily basis and made available for inspection by the Designer or Owner at any time. If for some reason the UNC Charlotte Weather Center is out of service, Fire Station #27 data shall be applied for that time period, but only if the UNC Charlotte Weather data is not available.

Saturdays, Sundays, and holidays are available to recover lost time due to weather. Time extensions for weather related delays which affect the critical path and exceed the NOAA 5-year average for a particular month, will only be granted provided the contractor makes an effort to make-up work on weekends or holidays following the rain event. Exceptions to this requirement may be granted in cases where rain occurs on a make-up day.

The effect of "rain days" may impact Critical Path work activities for a period more than the average rain days for any period, such as dewatering, cleanup, etc. which would follow a rain event. The Contractor shall include in the Project Schedule, sufficient days to accommodate weather related delays which will result from the 5-year average precipitation for each month. It is the responsibility of the Contractor to maintain such a log and to obtain the verification and initials of the Designer's representative on a monthly routine basis. The Contractor shall transmit logs and 5 year weather data averages to the Designer monthly. The Designer shall make weather delay determinations by comparing verified Contractor's logs with the 5 year averages over the duration of the Project. All approved weather delays shall be reported to the Contractor or Project Expediter and to the Owner and shall be accumulated and granted in 1 or more Change Orders. Contract time shall not be shortened by weather conditions which are more advantageous than had been predicted.

D. ADD paragraph h:

Time:

1. The Contractor shall commence work to be performed under this agreement on a date to be specified in a written order from the designer and shall fully complete all work within *(designer to insert appropriate project construction time)* consecutive calendar days from, and including said date. For each day in excess of the above number of days, the Contractor shall pay to the Owner the sum of *(designer to insert liquidated damages [words and numbers] as established by the University)* as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the Owner by reason of failure of said Contractor to complete the work within the time specified, such time being in the essence of this contract and a material consideration thereof.
2. The Contractor agrees that said work shall be prosecuted regularly, diligently, and uninterruptedly at such rate or progress as will insure full completion thereof within the time specified.

1.17 ARTICLE 24 - PARTIAL UTILIZATION: BENEFICIAL OCCUPANCY.

A. ADD paragraph e:

Unless training requirements are included in the specifications, prior to issuance of Date of Acceptance, the Contractor shall have his/her authorized representatives visit the Project and give full instructions to the Owner's designated operating and maintenance, care, and adjustment of all equipment and special construction elements."

1.18 ARTICLE 31 - REQUEST FOR PAYMENT

A. ADD:

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After the award of the Contract, the contractor shall promptly submit to the Designer for review and Owner approval a complete schedule of values of the various parts of the work listed in the numerical order of the specifications. The schedule shall be dated and signed by the Contractor and shall include a description of the work, quantities, labor, materials, and total Contract amount for each item. Upon Owner approval of this schedule of values, the schedule shall be used as the basis for determining monthly payments and, therefore, is needed in advance of the Contractor submitting the first application and certification for payment. Plumbing, Electrical, and HVAC Prime Sub-Contracts shall be broken down in accordance with the Table of Contents for each such work. Values shall generally be of the same order of magnitude and generally shall be between \$10,000.00 and \$100,000.00. Should the schedule of values include any value for mobilization, the schedule of values shall include an equal value for demobilization.

The Request for Payment shall be on forms described by North Carolina State Construction Manual Section 323 and similar to AIA Document G703, latest edition. The Request for Payment shall list materials and labor separately for each Section of the Project Manual. When Request for Payment includes (1) materials stored other than on the Owner's property, or, (2) if allowed by the Owner, other than within the boundaries of the State of North Carolina, request for Payment will not be considered and another Request for Payment shall be made. Contractor or each Prime Contractor shall also attach to the application all receipts and vouchers required to verify the requested payments for stored materials. No payment made to the Contractor by the Owner shall constitute acceptance of any work or materials not in accordance with the true intent of the Contract.

The Contractor shall additionally include on each monthly Application for Payment the following statement: "We certify that the Surety for this Project has been duly notified of the amount of this request." Unless exception to pay is made by the Surety to the Designer within 4 calendar days following the date of request, it will be assumed that the Surety concurs in the payment of this application.

American Institute of Architects Document G703, if used, may generally be obtained at office supply firms or directly from the American Institute of Architects, 1735 New York Avenue, Washington, D. C. 20036.

1.19 ARTICLE 32 – CERTIFICATES OF PAYMENT AND FINAL PAYMENT

- A. ADD to paragraph f:
- B. THE FINAL PAYMENT of retained amount due to the Contractor on account of the Contract shall not become due until the Contractor has furnished to the Owner, through the Designer, Guarantees as set forth in the General and Supplementary General Conditions including other Guarantees required by specific Sections of the Project Manual. In addition to the above, all other submissions required by other Articles and Sections of the Project Manual must be in the hands of the Designer before approval of final payment.

1.20 ARTICLE 34 - MINIMUM INSURANCE REQUIREMENTS

- A. ADD to opening paragraph:

The Designer shall be named as additional insured party on all insurance policies supplied by the Contractor. Final payment will not be made until these "As-Built Drawings" are turned over to the Designer of record and reviewed and deemed complete in writing by the Designer.

1.21 ARTICLE 38 - USE OF PREMISES.

- A. Add paragraph e:

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Should the Owner allow material storage outside the construction limits, the following conditions shall apply:

1. Staging of the Contractors: Site office trailer, equipment, materials, etc. shall be inside the construction fence or where there is no fence, inside the construction limits. No open trailers or flat beds are permitted, unless otherwise authorized. All material shall be stored in an enclosed and securable vehicle. Put name of project, company name, and company phone number on all storage vehicles stored off construction site.
2. As space is available, the Owner may allow parking of construction workers' vehicles on its property at no cost to the contractor. Vehicles found parked outside the designated area will be towed away at the contractor's expense.
3. Contractor personnel must wear ID badges at all times when they are working at UNC Charlotte. The ID badge can either be the Contractor's ID badge or clothing indicating which contractor or subcontractor they are directly employed by.

1.22 ARTICLE 39 - CUTTING, PATCHING, AND DIGGING

A. ADD:

Also see DIVISION 1 - GENERAL REQUIREMENTS

1.23 ARTICLE 40 - UTILITIES, STRUCTURES, SIGNS

A. ADD to paragraph j:

The University will provide the Contractor with access to electrical power for operating small tools, for construction lighting, for elevator testing, and for field office operations. The University will not charge the Contractor for power so consumed. The Contractor will bear all costs related to connecting to, transforming, and distributing power from the connection point. The Contractor will bear all costs related to connecting to, transforming, distributing and maintaining temporary power from the connection point.

The Contractor shall allocate power equitably. Welding equipment and other high power users must have self-contained power sources. Power outages shall be coordinated by the Contractor with the University 30 days in advance.

At the start of construction, the contractor shall enter into a Service Agreement with Piedmont Natural Gas and pay all gas utility costs until owner occupancy at which time said Service Agreement will be transferred to the owner.

:

B. ADD to item I:

A shop drawing of the project identification sign must be approved by the University prior to fabrication. No directional signs will be permitted without the University's permission. Contractors are not permitted to install any sign, anywhere on the site, off the site on University property, or on any equipment on the site, without explicit written approval of the Owner. See enclosed University project sign detail.

Location of any sign shall be approved by the Owner. Should any sign be moved from its initial location, the new location shall be approved by the Owner. All signs shall be maintained by the project expeditor in first class condition throughout the Contract by repainting, repairing, and re-erecting as necessary and as required. Sign shall be fabricated as indicated on the Drawings.

1.24 ARTICLE 41 - CLEANING UP

A. ADD:

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Also see DIVISION 1 - GENERAL REQUIREMENTS

1.25 ARTICLE 42 - GUARANTEE

A. ADD paragraph e:

ALL GUARANTEES SHALL INCLUDE LABOR AND PRODUCTS AND SHALL BE SIGNED BY THE MANUFACTURER OR SUBCONTRACTOR, AS THE CASE MAY BE, AND COUNTERSIGNED BY THE CONTRACTOR. ALL GUARANTEES SHALL BE IN ADDITION TO, AND NOT IN LIEU OF, ALL LEGISLATED GUARANTEES. ALL GUARANTEES SHALL BE ADDRESSED TO THE OWNER AND DELIVERED TO THE DESIGNER UPON COMPLETION OF THE PROJECT AND BEFORE OR WITH THE SUBMISSION OF REQUEST FOR FINAL PAYMENT.

B. ADD to paragraph f:

In the event that the Owner considers it impractical, because of unsuitable test conditions, or some other factors, to execute simultaneous final acceptance of all equipment, portions of the installation may be certified by the Designer for the Owner's final acceptance when that portion of the system is complete and ready for operation. The decision to accept only portions of the Project rests entirely with the Owner and may only be executed by the Owner.

C. ADD to paragraph g:

The Contractor shall also guarantee for a period of 24 months, unless a longer guarantee time is specifically called for in the Specification Sections, that the work covered by this Contract will be watertight and leak-proof at every point and in every area affected by this Contract, except where leaks can be attributed to damage by forces beyond his control. He shall, immediately upon notification by the Owner of water penetration, determine the source of water penetration and, at his own expense, do any work necessary to make the work covered by this Contract watertight. He shall also, at his own expense, repair or replace any other damaged material, finishes, equipment, and furnishings, damaged as a result of this water penetration to return the building to its original accepted condition.

D. ADD paragraph h:

The Contractor signing a Contract with the Owner, shall obtain and forward to the Owner any and all guarantees issued by the manufacturers specifically for certain products and systems covered under his Contract. In the event the manufacturer does not have a suitable "preprinted" warranty form" to fully cover the guarantee requirements as set forth in the Specification Section, he shall produce a warranty form patterned after those contained hereinafter which shall fully document the guarantee as set forth in the Specification Section.

E. ADD paragraph i:

In addition to the foregoing stipulations, the Contractor shall comply with all other guarantees referred to in any portion of the Contract Documents, the more stringent requirements governing.

F. ADD paragraph j:

If for any reason the Contractor cannot guarantee any part of his work using materials or construction methods which have been specified or indicated he shall notify the Designer in typewritten form before Contracts are signed, giving reasons together with the names of products and data or substitution he can guarantee. Should the Contractor fail to so notify the Designer prior to the Signing of Contract, he will he held to have agreed to guarantee all work specified or indicated.

1.26 ARTICLE 45 - TAXES.

A. ADD to paragraph e:

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Contractors shall submit monthly with their request for payment, a signed statement containing the amount of sales and use tax paid by the Contractor for that particular billing period."

1.27 ARTICLE 48 – ASBESTOS CONTAINING MATERIALS (ACM).

A. ADD the following:

No asbestos containing material may be installed in this facility, including but not limited to, sprayed-on insulation, pipe insulation, floor tile, mastic adhesive, patch materials, wiring insulation, or acoustical treatment.

END OF SECTION 01 – 02 SUPPLAMENTAL GENERAL CONDITIONS

SECTION 2
DIVISION 01C
DESIGN SERVICES PROJECT GUIDELINES (INFORMAL)

University of North Carolina at Charlotte Design and Construction Manual
Section 2. Division 01C – Design Services Project Guidelines (Informal)

PART 1 - PROJECT TITLE PAGE

February 8, 2018
Project No.



PROJECT NAME

University of North Carolina at Charlotte Design and Construction Manual
Section 2. Division 01C – Design Services Project Guidelines (Informal)

PART 2 - PROJECT GUIDELINES

2.1 BIDDERS/CONTRACTORS SHOULD CHECK THEIR CONTRACT DOCUMENT SET TO VERIFY THAT THE FOLLOWING INFORMATION IS INCLUDED.

A. PART

1. Project Title Page
2. Project Guidelines
3. List of Drawings
4. List of Standard Details
5. Instructions to Bidders
6. General Requirements
7. General Safety Requirements
8. General Guarantee Requirements
9. Summary

B. These are the required list of specifications that shall be included as part of the project. Delete sections that are not required and add others that may be required.

1. SPECIFICATIONS

- | | |
|-------------------------------------|--|
| 01730 Moving Services | 08400 Hollow Metal Doors & Frames |
| 02001 Asbestos Floor Mastic Removal | 08710 Finish Hardware |
| 02220 Earthwork | 08720 Pneumatic Door Openers |
| 02510 Concrete Sidewalk | 08721 Electro-Mechanical Door Openers |
| 02511 Structural Concrete Repair | 08810 Glass & Glazing |
| 02515 Brick Pavers | 08811 Mirrors |
| 02522 Asphalt Surfacing | 08820 Storefront System |
| 02830 Fence | 09110 GWB Ceiling & Soffits |
| 02930 Lawns & Grasses | 09120 Fiberglass Reinforced GWB Column |

2. COVERS

- | | |
|--|---------------------------------------|
| 02950 Landscape Planting | 09260 Gypsum Drywall |
| 03200 Concrete Reinforcing | 09300 Ceramic Tile |
| 03300 Cast-In-Place Concrete | 09545 Suspended Ceiling |
| 04210 Brick Masonry | 09550 Wood Floor Refinishing |
| 04220 Concrete Masonry Unit Construction | 09650 Vinyl Composition Tile Flooring |
| 04270 Glass Masonry Unit | 09651 Resilient Rubber Tile Floor |
| 05400 Metal Stud Framing | 09680 Carpet |
| 05500 Metal Fabrication | 09700 Epoxy Floor Reseal |
| 05505 Aluminum Metal Fabrication | 09701 Quality Composition Flooring |
| 05520 Steel Railings | 09900 Painting |
| 07310 Fiberglass Shingle Roof | 09901 Pavement Marking |
| 07410 Metal Roofing | 09950 Wall Covering |
| 07420 Architectural Panels | 10190 Drapery |
| 07460 Vinyl & Aluminum Siding | 10200 Architectural Louvers |
| 07500 Roofing System | 10505 Lockers & Benches |
| 07610 Flashing & Sheet Metal | 10536 Exterior Awning |
| 07720 Roof Scuttles | 13125 Aluminum Benches |
| 08110 Steel Doors & Metal Frames | 16010 Electrical |
| 08120 Hollow Metal Storefront | 16720 Fire Detection System |
| 08210 Wood Doors | 16725 Security System |
| 08330 Rolling Counter Fire Door | 16740 Telecommunications |

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Section 2. Division 01C – Design Services Project Guidelines (Informal)

SECTION 02 00015 – LIST OF DRAWINGS

PART 3 - LIST OF DRAWINGS

3.1 The following drawings are included in these specifications:

A.	<u>NUMBER</u>	<u>TITLE</u>	<u>DATE</u>
	SKETCH	VICINITY LOCATION PLAN	01/12/00

SECTION 02 00016 – LIST OF STANDARD DETAILS

PART 4 - LIST OF STANDARD DETAILS

4.1 Bidders/contractors should check the list of details in the index at the front of the document to ensure all details are included in this set.

A. NONE INCLUDED IN THIS SPECIFICATION

SECTION 2 00200 – INSTRUCTIONS TO BIDDERS

PART 5 - INSTRUCTIONS TO BIDDERS

5.1 INSTRUCTIONS TO BIDDERS

- A. All bidders are encouraged to personally inspect the job site to assure themselves of the entire job conditions and requirements. The UNC Charlotte Purchasing Department will provide further instructions in the "Request for Proposal". Questions concerning bid procedures should be addressed to the Purchasing Department (704.687.2227). When calling with questions, be prepared to give the Quotation Number shown on the Bid Document.
- B. Any requested material or process exceptions or substitutions to these specifications shall be submitted in writing.

When several products or manufacturers are specified as being equally acceptable, the Contractor has the option of using any product and manufacturer combination listed. HOWEVER, THE CONTRACTOR SHALL BE AWARE THAT THE CITED EXAMPLES ARE USED ONLY TO DENOTE THE QUALITY STANDARD OF PRODUCT DESIRED AND THAT THEY DO NOT RESTRICT BIDDERS TO A SPECIFIC BRAND, MAKE, MANUFACTURER OR SPECIFIC NAME; THAT THEY ARE USED ONLY TO SET FORTH AND CONVEY TO BIDDERS THE GENERAL STYLE, TYPE, CHARACTER AND QUALITY OF PRODUCT DESIRED; AND THAT EQUIVALENT PRODUCTS WILL BE ACCEPTABLE. SUBSTITUTION OF MATERIALS, ITEMS OR EQUIPMENT OF EQUAL OR EQUIVALENT DESIGN SHALL BE SUBMITTED TO THE ARCHITECT OR ENGINEER FOR APPROVAL OR DISAPPROVAL (14 days prior to the bid opening date). SUCH APPROVAL OR DISAPPROVAL SHALL BE MADE BY THE ARCHITECT OR ENGINEER PRIOR TO THE OPENING OF BIDS.

Any work the bidder expects of the Owner which is not herein described shall also be noted in writing with the bid; otherwise the Contractor shall provide complete work as intended.

- C. The Contractor shall be experienced in the specified type of work and during the bid review may be requested to furnish a list of similar work completed at other locations within the past two years. Such a list, if requested, is to include date of contract, name and address of Owner, telephone number and their representative who is familiar with the work provided.

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- D. All measurements shall be confirmed by the bidders to verify measurements shown on the drawings and listed in the specification.
- E. All invoicing should be forwarded to the Facilities Management Project Coordinator for approval. Unless otherwise noted, payment will be made upon completion of all work described in this specification and the attached drawings. If partial payments are approved, the Owner reserves the right to hold retainage of an amount not to exceed 15% of the completed work value.
- F. If these specifications or the drawings refer to Physical Plant Standard Details or other specification articles which are not presented in the Bid Documents, Bidders should immediately notify the Purchasing Department and request copies.

SECTION 02 00700-1 – GENERAL REQUIREMENTS

PART 6 - GENERAL REQUIREMENTS

6.1 GENERAL REQUIREMENTS

- A. All COMMUNICATION CONCERNING DESIGN INTERPRETATION AND/OR SCHEDULING, OR CONTRACT SCOPE SHALL ONLY BE WITH THE OWNER'S DESIGNATED REPRESENTATIVES NAMED IN ARTICLE: SUMMARY, B3. Unless advised otherwise. The Contractor will cooperate with Campus Police and University Safety Officials as appropriate for impromptu situations.
- B. The Contractor shall have a Qualified and Competent Supervisor present whenever workers are performing work. The supervisor shall notify a Designated Representative of the work schedule for each day prior to initiating work.
- C. To assure proper and accurate fit, all dimensions of existing facilities are to be considered approximate and installation dimensions shall be taken by the Contractor prior to ordering materials or initiating work.
- D. Unless otherwise noted, the Contractor shall furnish all material and labor required for the work outlined in these specifications. Unless authorized in writing by the Owner, the Contractor may not subcontract this work to any other company. All work shall be performed by workers who are employees of the Contractor.
- E. All work shall be performed in a first-class professional manner and in every respect comply with all sections of the current North Carolina Building Code. If there is a discrepancy between specified work and the North Carolina Building Code, the more stringent requirement shall apply.
- F. Except for communication devices, no radios or other sound emitting devices not directly associated with the work will be operated by the workers at the job site. All workers will behave in a polite manner and all workers will wear shirts and shoes when on campus. Workers are not to make any inflammatory comments or gestures to any University personnel, students or guests. Workers are not permitted to smoke in University buildings. Workers not complying with these requirements will not be allowed to work and may be instructed to vacate the work site. If workers are restricted from working, such restriction(s) shall not alter the terms of the contract.
- G. Vehicles shall be parked in assigned areas to be arranged with the Physical Plant representative. Vehicles must display temporary parking permits which will be provided to the project supervisor by the Physical Plant representative. Vehicle operators shall comply with all traffic and parking signs. Parking on sidewalks or lawns for loading and unloading may be arranged on an individual basis, but only after coordination with one of the Designated Representatives.
- H. CONSTRUCTION AND DEMOLITION DEBRIS
 - 1. The contractors shall keep the building and surrounding area reasonably free from rubbish at all times, and shall remove debris from the site from time to time or when directed to do so by the designer. Before final inspection and acceptance of the building, each contractor shall clean his portion of the work, including glass, hardware, fixtures, masonry, tile and marble (using no acid), clean and wax all floors as specified, and completely prepare the building for use by the owner, with no cleaning required by the owner.

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2. The Contractor is responsible for all construction and demolition debris resulting from the project.
3. The Contractor shall not dispose of any debris or trash in any University dumpster or receptacle.
4. The Contractor shall not allow debris or trash to collect overnight unless specifically authorized in writing after special written and specific request is formally received by the University Project Coordinator from the Contractor's Project Manager.
5. The Contractor is encouraged to dispose of reusable and recyclable materials at an approved recycling facility. The Contractor shall dispose of all non-recyclable materials at a regulated Construction / Demolition Landfill; a municipal solid waste landfill shall not be used.
6. The Contractor shall meet with the University Waste Reduction and Recycling Representative to review and execute the Waste Removal Form included with the specifications.
 - a. The University's Office of Waste Reduction and Recycling requires information on the waste generated during this project. This requirement is for your company as well as all subcontractors working for you on this project. Please notify your subcontractors of this requirement.
 - b. The Waste Removal Form indicates the materials you plan to dispose of and the method you plan to use for disposal.
 - c. The Waste Removal Form shall be completed and signed as part of your agreement with the University to accept this project.
 - d. If you have any questions or concerns about this agreement, please contact the Office of Waste Reduction and Recycling. Please visit our web site for waste haulers servicing the University area.
 - e. The Contractor shall provide the University Waste Reduction and Recycling Representative with the weights and contents of specific recyclable materials disposed of at a recycling facility, or salvaged for donation or reuse by the contractor in significant quantities.
 - f. Office of Waste Reduction and Recycling
9201 University City Boulevard, Charlotte, NC 28223
Phone (704) 687-3890
<http://facilities.uncc.edu/recycling>
7. The Contractor shall provide the University Waste Reduction and Recycling Representative with the names and locations of recycling and reuse sites used.
8. Upon completion of the Project, the Contractor shall promptly remove all evidence of his occupation of the site (equipment, surplus materials, trash and debris) and shall clean the construction site.
9. Release of final payment is contingent on the above waste reporting requirements
- I. Upon completion of the contracted work, the Contractor shall promptly remove all evidence (equipment, surplus materials, and debris) of his occupation of the site, except completed work as specified.
- J. All materials installed by the Contractor shall be new. All materials shall meet N.C. State Building Codes and should there be any discrepancies between design and code, the more stringent requirement shall apply. All materials shall be in compliance with standards (or approved products) of the N.C. Office of State Construction. Unless specified otherwise, NO PRODUCT CONTAINING ANY AMOUNT OF ANY FORM OF ASBESTOS SHALL BE INSTALLED WITHIN THIS PROJECT. ASBESTOS MEANS ASBESTIFORM VARIETIES OF CHRYSOTILE, CROCIDOLITE, AMOSITE, ANTHOPLYLLITE, TREMOLITE OR ACTINOLITE. BY DEFINITION, INSTALLATION OF ASBESTOS MATERIALS WILL BE CONSIDERED CONTRACTOR'S NEGLIGENCE AND THE CONTRACTOR SHALL PERFORM ALL NECESSARY WORK TO REMOVE THE ASBESTOS AND RESTORE THE SITE TO THE "POST-CONTRACT" CONDITION.
- K. The Contractor shall take reasonable effort to protect existing surfaces, finishes, and adjacent facilities from damage during construction. Any damage shall be repaired by Contractor at the Contractor's expense prior to completion of the job. Prior to construction, the Contractor may initiate a Pre-Construction meeting with the Designated Representative to perform an inspection to record damaged existing conditions.
- L. Throughout these specifications, the term "Drawings" is used to refer to the complete set of design drawings attached to the specifications. It is intended that the drawings and specifications be

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technically consistent, however if discrepancies are noted, they should be brought to the attention of one of the Designated Representatives for resolution.

- M. If, during the progress of the work or during the period of guarantee, the contractor fails to prosecute the work properly or to perform any provision of the contract, the owner, after fifteen (15) days' written notice sent by certified mail, return receipt requested, to the contractor from the owner, may perform or have performed that portion of the work. The cost of the work may be deducted from any amounts due or to become due to the contractor, such action and cost of same having been first approved by the owner. Should the cost of such action of the owner exceed the amount due or to become due the contractor, then the contractor or his surety, or both, shall be liable for and shall pay to the owner the amount of said excess.

SECTION 02 00700-2 – GENERAL SAFETY REQUIREMENTS

PART 7 - GENERAL SAFETY REQUIREMENTS

- 7.1 This information shall be provided to the competent supervisor by the contractor prior to initiating any work.
- A. **UNIVERSITY SAFETY OFFICE REQUIREMENTS**
- B. Please refer to webpage for contract safety program: <http://safety.uncc.edu/contractors>
1. No parking on sidewalks except as necessary during a specific task.
 2. Designate a safety and health coordinator for the project, or assign that responsibility to the on-site supervisor.
 3. Comply with UNC CHARLOTTE posted "No Smoking" rules.
- C. **FACILITIES MANAGEMENT DEPARTMENT SAFETY REQUIREMENTS**
1. Care shall be taken to protect all persons in the vicinity from injury and undue inconvenience.
 2. Contractor shall provide & maintain pedestrian and vehicular barricades as necessary for the situation. Pedestrian barricades shall be constructed of continuous temporary fencing completely containing the work area. Fencing shall extend from the ground to a minimum of 8' high with top rail and shall meet all ADA requirements for barricading for the visually impaired. Continuous, plastic mesh, orange safety fencing is acceptable. If the barricade blocks an existing pedestrian sidewalk, the Contractor shall properly mark an alternate route.
 3. All workers shall wear "safety orange" vests or shirts while performing work in streets, parking lots, or other areas where there may be vehicular traffic.

SECTION 02 00700-3 – GENERAL GUARANTEE

PART 8 - GENERAL GUARANTEE

- 8.1 Unless stated otherwise in the specific requirements section, the contractor shall guarantee all installed work and materials for one year as described below:
- A. Upon completion of work, Contractor shall guarantee all work and materials against defects for a period of three hundred, sixty-five days following Owner's acceptance of work. Any and all material necessary to correct defects will be provided and executed promptly by the Contractor at the Contractor's expense. Such guarantee is a condition of this contract and will commence on the date of Owner's acceptance of all the completed work.
- B. The required guarantee described in this article, or any article of the specification, does not exempt the Contractor from having to correct at any time any defective work installed which is not in compliance with the contract documents.

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SECTION 02 01100 - SUMMARY

PART 9 - SUMMARY This contract is for:

- A. BASE BID
- B. ALTERNATES
- C. OWNER'S DESIGNATED REPRESENTATIVES
 - 1. The Owner's Designated Representatives referenced throughout these specifications
 - 2. Mac Fake
 - 3. Project Coordinator Name
- D. SCHEDULE
 - 1. The Contractor shall complete the work within
 - 2. The work is to be sequenced with other construction work. Therefore, it will be necessary to coordinate the installation with the Designated Representative.

SECTION 2
DIVISION 02
EXISTING CONDITIONS

DIVISION 2 – EXISTING CONDITIONS

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s Contract Documents.

SECTION 02 4116 – BUILDING DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of buildings and site improvements
 - 2. Removing below-grade construction
 - 3. Disconnecting, capping or sealing, and site utilities
 - 4. Salvaging items for reuse by Owner

1.2 SUMMARY

- A. Demolish: Completely remove and legally dispose of off-site.
- B. Recycle: Recovery of demolition waster for subsequent processing in preparation for reuse.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Division 31 Section “Earth Moving.”

PART 3 - EXECUTION

3.1 STRUCTURE REMOVAL

- A. In open areas, foundations of structures shall be removed entirely. Where new structures will replace existing structures, indicate extent of foundation removal on the drawings.

3.2 RELOCATED EQUIPMENT

- A. 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: disconnection and moving, restoration and capping or utilities, recording existing piping arrangements to facilitate reinstallation, and replacing unsalvageable utilities/extensions required to complete reinstallation.

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3.3 BLASTING

- A. Blasting is strongly discouraged. If blasting is authorized by the UPM, a blasting plan and schedule must be submitted by the Contractor to the Designer's geotechnical engineer for approval. Blasting plan will include at a minimum: seismograph monitoring locations and dust, traffic, and noise control contingencies. Contractor is responsible for documenting conditions of adjacent structures when collateral damage is possible. Contractor is responsible for collateral damage to existing conditions.
- B. Contractor is required to obtain necessary permits and for hiring a UNC Charlotte approved inspector.

3.4 REUSE OF MATERIALS

- A. Efforts shall be made to reclaim and reuse materials resulting from demolition. Reclaimed materials shall be: reused in new construction, separated and sent to appropriate recycling centers, or sent to the local C & D landfill as appropriate. A minimum of 50% of all construction waste shall be diverted from landfill. (Refer to Section 3, Annex B for Construction Waste Plan.)

3.5 ASBESTOS ABATEMENT

- A. Demolition, renovation, or remodeling projects are likely to involve some asbestos abatement. Designers are required to have a qualified asbestos consultant on the Design Team. The University will provide available information on identified asbestos on any site, but the Designer may encounter questionable material which may contain asbestos. Designer will perform an on-site visual survey and will have testing conducted on questionable material involved with/interfere with the project. Designer will provide the UPM with a copy of the report.
- B. The Designer shall provide a design for asbestos removal, if required, as part of the Design Contract as per the State Construction Manual.
- C. 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 Mecklenburg County Department of Environment, Health, and Natural Resources, Asbestos Hazardous Management Branch.
- D. Certified hazardous material abatement contractors must be contracted with to remove the asbestos; certified hazardous materials transported must be used to transport material to a certified landfill. The limit of liability required by these contractors for Hazardous Materials is no less than \$10,000,000 per occurrence. UNC Charlotte must be named as additional insured on all policies.

SECTION 2
DIVISION 03
CONCRETE

DIVISION 3 - CONCRETE

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer's Contract Documents.

SECTION 03 3000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work specified in this Section consists of furnishing the equipment, labor, materials, and incidentals required for the construction of all Portland Cement, cast-in-place, and precast concrete items.

1.2 REFERENCE DOCUMENTS

- A. American Concrete Institute (ACI)
- B. American Society for Testing and Materials (ASTM)
- C. Portland Cement Association (PCA)
- D. American Association of State Highway and Transportation Officials (AASHTO).

1.3 QUALITY ASSURANCE

- A. Properties of Concrete:
 - 1. General Requirements
 - a. Design mixes to produce concrete of proper workability, durability, compressive strength, maximum density, and minimum shrinkage and permeability.
 - b. Design mixes to have a minimum water-cement ratio, the largest permissible maximum size specified coarse aggregate, and an optimum percentage of fine aggregate.
 - c. Use maximum size of coarse aggregate in accordance with ACI Committee 613 Report, Recommended Practice for Selecting Proportions for Concrete.
 - 2. Durability: For durability purposes, use a water-cement ratio in accordance with either. ACI Committee Report 613, Table 4 as determined by the type of structure and exposure conditions or 0.50 by weight whichever is the lesser.
 - 3. Workability: Use approved chemical or air-entraining admixtures, or suitable combinations thereof in accordance with ASTM C260 to improve workability, as well as to reduce water and cement contents, and minimize shrinkage and permeability of concrete, provided that these admixtures do not adversely affect other required properties of concrete.
 - 4. Strength:
 - a. Design the mix for each class and type of concrete of a specified compressive strength based on the required overdesign factor according to ASTM C94.
 - b. For working stress method of design each class of concrete shall be designed so that not more than 20 percent of the compressive strength tests will have values less than the specified compressive strength, and the average of six consecutive strength tests will be equal to or greater than the specified compressive strength.

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5. Method of Proportioning:
 - a. For proportioning mixes use methods as described in ACI Report 613.
 - b. Do not vary the proportions of the ingredients of the approved mixes without the written approval of the Structural Engineer.

- B. Mock up: A sample panel for exposed concrete may be required at the site prior to beginning production. The panel shall show all 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 design 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. Adequate cover over reinforcing steel
 2. Sealing and waterproofing
 3. Proper drainage
 4. Joints and connections
 5. Proper dimension and sizing for embedded items
 6. Coordination of the electrical and mechanical requirements for penetrations and across expansion joints
 7. Protection of in-place work during construction (against vandalism)

1.4 SUBMITTALS

- A. Sample
 1. Membrane-forming curing compound: Two one-pint samples, each type.

- B. Design Mixes:
 1. At least 30 days prior to start of placing concrete submit design mixes for each class and type of concrete, indicating that the concrete ingredients and proportions will result in a concrete mix meeting the requirements specified.
 2. Include for each class and type of concrete as many mix designs as there are combinations of different ingredients, or type of ingredients, anticipated to cover the requirements of the contract work.
 3. Compressive test cylinders for each design mix shall be made at the Contractor's expense by an independent testing laboratory approved by the Engineer and tested in accordance with the ACI Code and "Method of Test for Compressive Strength of Molded Concrete Cylinders (ASTM C39)" three cylinders will be required for each design mix.
 4. Furnish two (2) copies of each report to the Structural Engineer/Designer. Concrete mix design, which does not meet the Specifications, will be rejected.
 5. Establish the mix designs and have them tested through the laboratory.
 6. Submit cylinder test results for the various mix designs showing compressive strength at 2, 7, and 28 days

- C. Proposed Method of Temperature Control

- D. Certificates:
 1. Ingredients:
 - a. Submit with the mix design laboratory test reports and mill or manufacturer's certificates attesting to the conformance of ingredients with these specifications. Use ingredients in the design mix, which are representative samples of the materials to be used in the contract work.
 - b. In case the source, brand or characteristic properties of the ingredients need to be varied during the term of the contract, submit revised laboratory mix report, in conformance with the above procedures.
 2. For Certificate of Compliance:
 - a. Certificates of compliance shall be submitted for the following items:
 - 1) Waterstops

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- 2) Floor hardener
- 3) Chemical curing compounds
- 4) Admixtures
- 5) Non-shrink grout
- 6) Epoxy bonding compound
- 7) Reinforcing steel

1.5 PACKAGE RELATED WORK

- A. Concrete Reinforcement, Section 03010.
- B. Forms and Formwork, Section 03030.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Package Cement:
 1. Deliver to the project site in original sealed packages labeled with the weight, name of the manufacturer, brand, and type specified.
 2. Store packages in a watertight building.
 3. Do not use cement, which has been reclaimed by cleaning bags.
 4. Do not use cement, which has been damaged by exposure or over-stocking.
 5. Do not deliver packages varying more than three percent from the specified weight.
 6. Packaged cement will be subject to test at any time.
- B. Bulk Cement:
 1. Store bulk cement separately from other cement and protect from deterioration from exposure to moisture and intrusion of foreign matter.
 2. Provide facilities to maintain separation of cement meeting the requirements of these specifications from other cement.
 3. Provide in cement manufacturer's plant, facilities for sampling of cement at the weighing hopper or in the feed line immediately before entering the hopper.
 4. Do not use different brands of cement or the same brand of cement from different sources without approval.

1.7 CONCRETE ADMIXTURE

- A. Storage and handling
 1. Store materials protected from exposure to harmful weather conditions and at a temperature above 40° Fahrenheit.

1.8 GUARANTEE

- A. In addition to the 365-day warranty specified in Article G3, the Contractor shall warranty the concrete surface against spalling or aggregate exposure for a period of two years following the date of acceptance. Any and all material necessary to correct defects will be provided and executed promptly by the Contractor at the Contractor's expense. Such guarantee is a condition of this Contract and will commence on the date of Owner's acceptance of all the completed work

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C150 Type I or II

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- B. Admixtures - Approved brands: Chlorides may be present in admixtures provided the total chloride in the proposed concrete mixture including chloride ions contributed by the admixture or admixtures, aggregates and mixing water is not in excess of 150 ppm.
- C. Burlap Sheet shall comply with Engineer's recommendations.
- D. Water requirements:
 - 1. Containing no impurities, suspended particles, algae or dissolved natural salts in quantities that will cause:
 - a. Corrosion of reinforcing steel.
 - b. Volume change that will increase shrinkage cracking.
 - c. Efflorescence.
 - d. Excessive air entraining.
 - 2. The pH to be not less than 6.5 or greater than 7.5.
 - 3. When tested in accordance with AASHTO T26, standard mortar briquette tests to show no indication of unsoundness, change in time-of-setting not in excess of 30 minutes, or reduction in strength not more than ten percent.
- E. Concrete Aggregate shall comply with Engineer's recommendations.
 - 1. Aggregate shall be free from injurious amounts of organic impurities. Should material fail to pass test for organic impurities in sand for concrete, retest in accordance with Engineer's recommendations. If the fine aggregate shows by the colorimetric test a darker color than that of the sample originally approved for work, stop using the aggregate until tests satisfactory to the University Project Manager have been made to determine whether the change in color is indicative of an injurious amount of deleterious
- F. Waterstops:
 - 1. Elastomer Waterstops:
 - a. Elastomer waterstops shall be made of natural or synthetic rubber or polyvinyl chloride shall be dense, homogeneous, free from porosity and other imperfections, and symmetrical in shape. Materials shall be resistant to chemical action with portland cement, acids and alkalis, and not affected by fungi. They shall show no effect when immersed for 10 days at room temperature in 10 percent solutions of sulphuric acid, hydrochloric acid, and sodium chloride, and a saturated lime solution. Resistance to fungi shall be determined by Engineer's recommendations. Material shall not be adversely affected when subjected to tests for low temperature brittleness (-35 degrees F), in accordance with ASTM D 1329, and for water absorption (maximum 5 percent by weight). Waterstops not indicated otherwise shall be 6 inches by 3/8-inch.
- G. Materials for Curing Concrete:
 - 1. Polyethylene Sheeting:
 - a. Polyethylene sheeting shall be natural color and shall have a normal thickness of 0.004 inch. The loss of moisture when determined in accordance with Engineer's recommendations and shall not exceed 0.055 gram per square centimeter of surface.
 - 2. Polyethylene-Coated Burlap:
 - a. Polyethylene-coated burlap shall be 4 mils thick white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard and shall conform to Fed. Spec. CCC-C-467. The loss of moisture when determined in accordance with ASTM C 156 shall not exceed 0.055 gram per square centimeter of surface.
 - 3. Liquid Chemical Compound Curing:
 - a. Liquid chemical compound curing shall be accomplished by the application of a suitable sealer-hardener designed for sealing and hardening in addition to curing of the concrete, applied by the method and at the rate recommended by the manufacturer. It shall not reduce the adhesion of paint, waterproofing or other material to be applied to the concrete. The chemical compound shall be free of

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petroleum resins or waxes. The loss of moisture when determined in accordance with Engineer's recommendations shall not exceed 0.055 gram per square centimeter of surface. The abrasion loss shall not exceed 80 percent of that of the same concrete, untreated, when tested in accordance with Engineer's recommendations at age 28 days. The adhesion to the treated concrete shall be at least 90 percent of the adhesion to the same concrete, untreated. The test for adhesion will consist of forming mortar or concrete slabs, three moisture cured and three liquid chemical cured for each type of covering to be applied. After curing for 28 days, the slabs shall be permitted to dry in air. The covering shall be adhered to the troweled face of the slabs with the adhesive to be used in the work. After the adhesion has set, cuts one inch apart and 6 to 10 inches long shall be made through the adhered covering, forming strips to one end of which a calibrated spring type balance or other device shall be attached. The strips shall be peeled off at a rate of 2 to 100 inches per minute. The pull required to peel the covering from the slabs shall be the average of three specimens.

- H. Chemical Floor Hardener:
 - 1. Chemical Floor Hardener: All concrete floor slabs, both interior and exterior, not having an additional applied finish, University Project Manager may require a liquid concrete hardener applied in accordance with the manufacturer's recommendations. Acceptable hardeners are:
 - a. Sonneborn Lapidolith
 - b. Chem-Masters Sciolith
 - c. W.R. meadows Pena-lith
 - d. Protex Lithoplate
- I. Joint-Sealing Materials:
 - 1. Joint-sealing materials shall conform to Engineer's recommendations.
 - 2. Expansion Joint Filler:
 - a. Expansion joint filler shall be preformed type conforming to Engineer's recommendations.
 - 3. Accessories
 - a. Black "house sheathing" material is not acceptable.
- J. Slots and Inserts for Masonry Anchors:
 - 1. Dovetail Anchor Slots:
 - a. Dovetail anchor slots shall be formed of zinc-coated sheet steel, U.S. 24 minimum gage, provided in concrete faced with or abutting masonry.
 - 2. Inserts:
 - a. Inserts shall be formed of 9 minimum gauge zinc-coated steel wire, engaged between a two-piece half-round wood core, and having loops for embedding in concrete.
- K. Epoxy Bonding Compound:
 - 1. Epoxy bonding compound shall conform to Engineer's recommendations.
- L. Vapor Barrier:
 - 1. Vapor barrier shall be polyethylene sheet .006 inch (6 mil) thickness of widest practicable widths. See Construction Drawings for locations.

2.2 STEEL REINFORCEMENT

- H. Unless specified otherwise on drawings, all reinforcing steel shall be ASTM A-615, Grade 60 and shall be fabricated and placed in accordance with ACI 301. All continuous rebar reinforcing shall be lapped as shown on the drawings.
- I. If wire fabric is required, it shall be welded cold-drawn steel wire fabric, ASTM A-185.

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PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Air Entrainment:
 - 1. Determine the air content of concrete in accordance with the Engineer's recommendations.
- B. Testing of Concrete:
 - 1. General requirements:
 - a. Compression test cylinders for all concrete pours shall be made at the Contractor's expense by an independent testing laboratory approved by the Project Manager and tested in accordance with the ACI Code and "Method of Test for Compressive Strength of Molded Concrete Cylinders (ASTM C39)" three cylinders will be required for the first 5 cubic yards and four for each 50 cubic yards thereafter for each day's pour.
 - b. Furnish two (2) copies of each report to the Project Manager and one copy to local government building department, if required and structural engineer. Concrete, which does not meet the Specifications, will be required to be removed and replaced at the Contractor's expense or may be subjected to a load test, also at Contractor's expense.
 - c. For each work shift, when concrete is delivered, at least one set of specimens will be made. A set of test specimens will consist of at least four standard cylinders from a batch. At least one specimen of the set will be tested for 2-day, 7-day, and 28-day compressive strength. The tests for 2-day compressive strength, approximately 25 percent of the 28-day compressive strength, will be used to aid in the determination of form, falsework and centering removal. The tests for 7-day compressive strength, approximately 60 percent of the 28-day compressive strength, will be likewise used.
 - d. Slump tests, yield tests, and air content tests will be performed by the laboratory with no less frequently than that of casting strength specimen sets; however, the Project Manager reserves the right to have the concrete tested as often as he deems necessary.
 - e. Submit a delivery ticket from the concrete supplier to the Project Manager before unloading at the site for each batch delivered to the site setting forth the following information:
 - 1) Name of supplier
 - 2) Name of batching plant and location
 - 3) Serial number of ticket
 - 4) Date
 - 5) Truck number
 - 6) Specific job designation (contract number and location)
 - 7) The volume of concrete (cubic yards)
 - 8) Specific class and type of concrete (in conformance with the specification requirement)
 - 9) Time loaded
 - 10) Type and brand of cement
 - 11) Weight of cement
 - 12) Maximum size of aggregates
 - 13) Weights of coarse and fine aggregates, respectively
 - 14) Maximum amount of water to be added and amount of water added at the site, if any
 - 15) Kind and amount of admixtures
 - 2. Concrete Strengths:
 - a. Determine compressive strengths from standard test specimens taken by the laboratory according to ASTM C31 and ASTM C172, and cured and tested in

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- accordance with ASTM C39. Core drilling and testing will be in accordance with ASTM C94.
- b. Compute and evaluate in accordance with Engineer's recommendations.
3. Air content:
 - a. Determine in accordance with Engineer's recommendations.
 4. Cement factor:
 - a. Determine in accordance with Engineer's recommendations.
 5. Modulus of elasticity:
 - a. Determine the modulus of elasticity and Poisson's Ratio in accordance with ASTM C469 as directed by the Structural Engineer.
 6. Slump:
 - a. Determine in accordance with Engineer's recommendations.
 7. Unit Weight:
 - a. Determine the unit weight in accordance as directed by the Structural Engineer.
- C. Design Mix:
1. Specified 28 days compressive strength of concrete shall be as follows:
 - a. $f'c = 4000$ psi for all structurally reinforced concrete work.
 - b. $f'c = 3000$ psi concrete for exterior work and all flatwork underfoot, such as walks, steps, ramps, drives, and porch floors: Also use for pipe thrust blocking and masonry cell fill.
 - c. Concrete exposed to weather shall have a maximum of 5-1/2 gal. of water per sack of cement and a minimum of 6-1/4 sacks of cement per cubic yard.
 - 1) $f'c = 3000$ psi concrete for mud mats, limited site voids, soil boring voids, and for under foundations where excavated to excessive depth.
 - 2) $f'c = 3000$ psi concrete for grout with maximum size coarse aggregate not exceeding 3/8 inch.
- D. Classes of Concrete:
1. Classes of concrete are designated by numerals corresponding to their specified 28-day compressive strengths in pounds per square inch as determined by Engineer's recommendations.
 2. When class is not indicated use 3,000 psi concrete.
 3. Each class of concrete may comprise one or more mixes determined by the maximum size of aggregate, cement factor and types of admixtures used.
- E. Minimum Cement Factor:
1. Observe the minimum cement factor for the various classes of concrete as follows:
 - a. Classes of Concrete Minimum Cement Factor (in psi) (Bags per cu yd of Concrete)
 - 1) 5,000 ~ 6.5
 - 2) 3,500 - 4,000 ~ 6.25
 - 3) 3,000 - 3,400 ~ 5.75
 - 4) Less than 3,000 ~ 4.5
- 3.2 MATERIAL PREPARATION
- A. Concrete Production:
1. Ready Mix Concrete:
 - a. Ready-mixed concrete shall be batched, mixed and transported in accordance with Engineer's recommendations. Plant equipment and facilities shall conform to "Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association."
 2. On-site Batching:
 - a. Concrete produced by on-site volumetric batching and continuous mixing shall be batched and mixed in accordance with and shall conform to all requirements of Engineer's recommendations.
- B. Admixtures:

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1. Air entraining admixture:
 - a. Use for concrete exposed to weathering or in contact with rock or moist soil.
 2. Chemical admixtures:
 - a. Use water reducing admixtures in concrete areas below grade in contact with rock, earth, or fill.
 - b. Employ admixtures without interfering with the specified air content dosage of air-entrained concrete.
 - c. Except as specified, use water reducing, set retarding or set accelerating admixtures only with Project Manager's approval.
 - d. If the introduction of certain admixtures to improve concrete strength is permitted by the Engineer, do not reduce the cement content below the minimum amounts specified.
 3. Use calcium chloride only as specifically authorized in writing by the Project Manager. Do not use calcium chloride in prestressed concrete, underground structures, reinforced concrete, or in concrete used to encase or in contact with structural steel or cast iron.
- C. Consistency:
1. Slump shall not exceed 2-inches above design mix slump as approved by the Engineer, and shall be kept at a practical minimum for the point of placement.
- D. Construction Joints:
1. Joints not shown on the Construction Drawings shall be made and located so as to not impair the strength of the structure and shall be subject to approval of the Engineer. In general, construction joints must be placed such that no vertical pour may exceed 10 to 15 feet and no horizontal pour may exceed 20 to 30 feet. Horizontal joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the top of footings of grade slabs. Joints shall be perpendicular to the main reinforcement.
 2. Reinforcement in Construction Joints: All reinforcing steel and welded wire fabric shall be continued across joints. Keys and inclined dowels shall be provided as indicated. Longitudinal keys at least 1-1/2 inches deep shall be provided in all joints in walls and between walls and slabs or footings.
 3. Preparation of Surface: The surface of the concrete at all joints shall be thoroughly cleaned and all laitance removed.
 4. Bonding:
 - a. When a bonded construction joint is required, bond shall be obtained by one of the following methods.
 - b. The use of a bonding compound for concrete, conforming to Mil. Spec. MIL-B-19235.
 - c. The use of suitable chemical retardant which delays but does not prevent setting of the surface mortar. Retarded mortar shall be removed within 24 hours after placing to produce a clean exposed aggregate bonding surface.
 - d. By roughening the surface of the concrete in proper manner which will expose the aggregate uniformly and damaged concrete at the surface.
- E. Expansion Joints, Cleavage Joints, Waterstops and Embedded Items:
1. Expansion Joints and Cleavage Joints:
 - a. Expansion joints shall be provided in any structure having a dimension of 120 feet in any principal direction. Desirable maximum spacing is 50 to 60 feet. Reinforcement shall stop 2 inches from the face of an expansion joint. Expansion joints and cleavage joints shall not be less than 1/2-inch wide except as indicated otherwise. Expansion joints not exposed to weather shall be filled completely with preformed joint material conforming to Engineer's recommendations. Expansion joints exposed to weather and cleavage joints between vertical masonry surfaces and floor slabs laid on earth shall be filled to a depth of one-inch from the surface or face of the concrete width deep space above the preformed material conforming to Engineer's recommendations. The one-inch deep space above the preformed material shall be cleaned after the concrete has been cured, and when dry, filled

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flushed with joint sealing material. Reinforcement or other embedded metal items bonded to the concrete, except dowels in floors bonded on only one side of joint, shall not be permitted to extend continuously through any expansion joint.

F. Waterstops:

1. All horizontal and vertical construction and expansion joints providing for fluid containment in a wet space as well as joints located in exterior walls below grade shall have placed in the joint a waterstop to develop effective watertightness. Wet space shall include tanks, channels, chambers, etc. used to store, convey or contain fluids or solids containing fluids.
2. The material, design, and location of waterstops in construction joints and expansion joints shall be as indicated or as specified herein. Each piece of pre-molded waterstop shall be maximum practicable length in order that the number of end joints will be held to a minimum. Joints at intersections and at ends of pieces shall be made in the manner most appropriate to the material being used. Joints shall develop effective watertightness fully equal to that of the continuous waterstop material and shall permanently develop not less than 50 percent of the mechanical strength of the parent section and shall permanently retain its flexibility.

G. Other Embedded Items:

1. All sleeves, inserts, anchors, and embedded items required for adjoining work or for its support are placed prior to concreting. All sub-contractors, whose work is related to the concrete or must be supported by it, shall be given ample notice and opportunity to introduce or furnish embedded items before the concrete is placed. All ferrous metal sleeves, insets, anchors, and other embedded ferrous items exposed to the weather or where rust would impair the appearance or finish of the structure shall be galvanized.
2. Placing Embedded Items:
 - a. Expansion joint material, waterstops, and embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids. Aluminum shall not be embedded in concrete except where aluminum is protected from direct contact with the concrete.

H. Reinforcing Bars:

1. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items, but not so as to impair design strengths of the members. If bars are moved more than one bar diameter, the resulting arrangement of bars shall be subject to the approval of the Project Engineer.

3.3 CONVEYING

A. General Requirements:

1. Convey concrete from the point of delivery with a continuous flow of concrete to the point of placement without segregation.
2. Provide an arrangement at the discharge end of a conveyor to prevent segregation.

B. Chutes and Troughs:

1. Use only ferrous metal or approved plastic or rubber lined chutes and open troughs. Where steep slopes are required, discharge the concrete into a hopper. Keep chutes or open troughs clean of hardened concrete by thoroughly flushing with water after each use.
2. Discharge the water used for cleaning outside the lines of the structure.

C. Adjustable Length Pipes (Elephant Trunks):

1. Use flexible pipes only of ferrous metal, rubber or plastic, six-inch minimum diameter and use in a manner that will not cause segregation of the concrete.

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2. Locate chutes or flexible pipes so that concrete is delivered in a continuous flow to points not more than five feet horizontally and five feet vertically from its final location.
3. Thoroughly clean flexible pipes or elephant trunks after each use.

D. Buggies:

1. Construct runaways on which buggies will operate such that they will not come in contact with or be supported by the reinforcing steel of the structure.

E. Pumping Equipment:

1. Use pumping equipment, designed to handle the types, classes and volumes of concrete to be conveyed without segregation.
2. Operate the pump equipment so that a continuous stream of concrete without air pockets is conveyed. Position the discharge end of the line as near the final position of the concrete as possible.

3.4 WARRANTY FOR SLAB WATERPROOFING & ADMIXTURE

- A. Project warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. The manufacturer's standard warranty document executed by the authorized company official. The manufacturer's warranty is in addition to, and not a limitation of, other rights the owner may have under provisions of the contract documents.
 1. Warranty period: Five years commencing on the date of acceptance of the project by the Owner or Notice of Completion.
 2. Warranty terms: Terms to include moisture related failure, including all finish floor materials and labor.

3.5 PREPARATION FOR PLACEMENT

- A. Do not place concrete until all formwork, steel reinforcement, installation of embedded parts, preparations for finishing unformed areas, scaffolding, lighting, power and methods and procedures for placing concrete have been approved. All surfaces of forms and embedded materials shall be cleaned of dried mortar or grout from previous pours. Poorly consolidated concrete at construction joints and all loose material shall be removed. Surfaces of concrete and embedded materials shall be cleaned of laitance, or oil and other bond destroying agents.
- B. Surfaces against which concrete is to be placed shall be clean and free of running water, mud, loose material, oil, debris, frost and ice. Rock surfaces shall be free of semidetached and unsound fragments. Absorptive foundation surfaces shall be moistened thoroughly or otherwise treated so that moisture will not be drawn from freshly placed concrete.
- C. Coat faces of removable concrete forms with form oil approved by the University Project Manager.

3.6 PLACEMENT

A. General Requirements:

1. Place concrete continuously and as soon as possible after mixing. Do not use vibrators for shifting the mass of fresh concrete.
2. Place concrete in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. Cover each layer of concrete with fresh concrete within 45 minutes.
3. Do not place concrete which has attained its initial set or concrete which has contained its mix water for more than 90 minutes.
4. Notify the Project Manager at least 24 hours in advance of the start of concrete placing.

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5. Placing will not be permitted when, in the opinion of the Project Manager, the sun, heat, wind or limitations of facilities furnished prevent proper finishing and curing.
6. Control concrete temperature at time of placement:
 - a. To be not less than 45° F
 - b. To be not more than 90° F
7. Unless approved by the University Project Manager, do not start concreting when descending natural air temperature falls lower than 40° F.
8. Start placement of structural concrete on/or next to a construction joint with a 3inch thick layer of oversanded mix with 3/4-inch maximum aggregate, an extra sack of cement per cubic yard, and a five-inch slump.
9. Deposit concrete as nearly as practicable directly in its final position so that the lateral movement will not result in segregation of the coarse aggregate, mortar, or water from the concrete mass. Do not use methods and equipment in depositing concrete in forms which result in clusters or groups of coarse aggregate being separated from the concrete mass. When concrete is placed through a dropchute, use one or more vibrators where concrete is falling to prevent stacking and separation
10. Place formed concrete, in continuous, approximate horizontal layers, the depth of which generally shall not exceed 24-inches. Lesser depths may be required where necessary to ensure that each new layer can be made monolithic with the previous layer.

B. Compaction:

1. Consolidate all concrete by vibration to the maximum practicable density, so that it is free from pockets of coarse aggregate and entrapped air, and filled tightly against, all formed surfaces and embedded materials. In consolidating each layer of concrete operate the vibrator at regular and frequent intervals, and in a near vertical position. Allow the vibrating head to penetrate and revibrate concrete in the upper zone of the underlying layers.
2. Re-vibrate the top layer of each placement systematically at the latest time the concrete can be made plastic by means of vibration. Do not place layers of concrete until the layers previously placed have been vibrated thoroughly as specified.
3. Consolidate concrete by electric or pneumatic drive vibrators of sufficient power and capacity to consolidate the concrete effectively and quickly. Operate concrete vibrators at speeds of at least 7,000 rpm when immersed in the concrete. Have standby vibrators in good condition readily available if needed during concrete placement. Use equipment capable of obtaining results and operating reliably and effectively with a concrete mix that is not excessively oversanded or high in slump and may occasionally be of lower slump than intended.

3.7 CURING AND PROTECTING

A. General Requirements:

1. Protect freshly placed concrete from excessive hot or cold temperatures. Maintain concrete surfaces without drying for the period of time necessary for the hydration of the cement and the proper hardening of the concrete.
2. Cure newly placed concrete for a cumulative period of seven days at an air temperature in excess of 55o F.
3. During the curing period keep steel and wood forms set. If forms are removed during curing use one of the following methods of curing immediately and continue for the remainder of the curing period.

B. Normal Curing And Protection:

1. (Use any one of the methods specified below)
 - a. Use ponding on horizontal surfaces providing the surface is submerged at all time for the required curing period.
 - b. Apply continuous sprinkling with nozzle or nozzles which, during the first 24 hours, atomizes the follow of water providing a mist and not a spray.

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- c. Do not apply the moisture under pressure directly upon the concrete and avoid flowing or washing on the surfaces while susceptible to erosion.
 - d. Cover the entire surface of the concrete with double thickness burlap sheet, laid directly on the concrete and kept wet at all times. Maintain in good condition.
 - e. Sprinkle, as specified above, for at least 18 hours and then immediately cover the concrete surface with water proof curing sheets, free from holes or tears. Hold in position in such manner that the entire surface of the concrete being cured is fully covered at all times.
 - f. Do not damage burlap or waterproof sheet or concrete surfaces.
2. Membrane-Forming Curing Compound:
- a. Use a curing compound when authorized for circumstances where the application of moisture is impracticable and where such compounds will not jeopardize the appearance of the concrete. Except as otherwise specified, use Type 1 compound, uniformly applied over the surface at the thickness recommended by the manufacturer. Thoroughly mix compound and apply within one hour after mixing.
 - b. Where the surfaces are subjected to sunlight, apply Type 2 White compound.
3. Do not apply wax-resin type curing compounds to a surface where bond is required for additional concrete or where a bonded surface coating such as paint, tile, dampproofing, waterproofing, or roofing is to be applied.
 4. Warm the curing compound if required for satisfactory application in accordance with the manufacturer's recommendations. If the film of the compound is damaged before the expiration of the curing period, repair immediately with additional compound.
 5. Give surfaces the required surface finish prior to the application of the curing compound. Do not use curing compound on construction joints.
 6. Apply curing compound in two coats, apply the first coat immediately after stripping of forms and acceptance of the concrete finish.
 7. If the surface is dry, thoroughly wet the concrete with water and apply the curing compound just as the surface film of water disappears. Apply the second coat after the first coat has set.
 8. Protect the coating against damage for a period of at least 10 days after application. Apply an additional coating to coatings which are damaged.

3.8 WEATHER PROTECTION

- A. Concrete shall not be placed during rain or freezing weather unless approved measures are taken to prevent damage to concrete. Concrete placed during periods of high winds, low humidity, high temperatures, and other conditions causing rapid drying shall be initially cured with a fine fog spray of water applied immediately after finishing and maintained until final curing operations are started. Under hot weather conditions, steps shall be taken to reduce concrete temperature and water evaporation by proper attention to ingredients, production methods, handling, placing, protection, and curing. Subject to approval, applicable preventive measures shall be taken for placing concrete during hot and cold weather in conformance with ACI Reports 305 R-77 and 306R, dated May 1978, respectively entitled, "Hot Weather Concreting", and "Cold Weather Concreting".

3.9 DEFECTIVE CONCRETE

- A. Concrete will be considered defective if it is structurally unsound, not watertight, improperly finished, or not within the tolerances specified herein.
 1. Concrete will be considered defective if the concrete cylinder tests fail to meet the specified strength requirements at any location of the work. In such cases, take drilled cores at locations specified by the University Project Manager. Core specimens will be tested by the laboratory in accordance with the requirements of ACI 301. If cored specimens do not indicate compliance with the compressive strength requirements, replace the defective portion of the structure.

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2. Windsor probe tests conducted in conformance with Engineer's recommendations may be conducted by the laboratory if approved by the Project Manager in lieu of taking and testing core specimens.
3. The University Project Manager, at his discretion, will require replacement of the defective portion of the structure in accordance with Engineer's recommendations. All strengthening or correction of defective concrete will be at no additional cost to the University.

3.10 DAMAGED WORK

- A. Before final acceptance of the work, damage to surfaces, corners of concrete and concrete finish, whether such damage shall have resulted from the action of the elements or damage from any cause whatsoever, shall be neatly repaired, as approved by the University Project Manager at no additional cost to the University.
- B. At damaged places where surface repairs are permitted, the concrete shall be chipped out and a concrete patch installed. The patch shall have a minimum thickness of two-inches, shall be dense and watertight to meet specification requirements, and shall have a smooth exposed surface matching the neat line of adjacent concrete.

3.11 TOLERANCE FOR CONCRETE CONSTRUCTION

- A. Permissible surface irregularities are defined as "finishes," and are to be distinguished from tolerances as described herein.
 1. Allowable tolerances are:
 - a. Structures:
 - 1) Departure from established alignment.....1 inch
 - 2) Departure from established grade1 inch
 - 3) Variation from the plumb in the lines and surfaces of columns, piers, and walls exposed,
 - a) in 10 ft.....1/2 inch
 - b) Backfilled, in 10 ft.....1 inch
 - 4) Variation in the level or from grades specified in slabs and beams exposed,
 - a) in 10 ft.....1/2 inch
 - b) Backfilled, in 10 ft.....1 inch
 - 5) Variation in cross-sectional dimensions of columns, piers, slabs, walls and beams,
 - a) minus.....1/4 inch
 - b) plus.....1/2 inch
 - 6) Variation in sizes and locations of slab and wall openings.....1/2 inch

SECTION 03 4500 – ARCHITECTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Precast manufacturing plants shall be certified by the Precast Concrete Institute's (PCI) Plant Certification Program. 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.
- B. Testing: Precast manufacturers shall employ their own testing services with the Designer specifying frequency of testing.

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PART 2 - PRODUCTS

2.1 SUSTAINABILITY

- A. UNC Charlotte recommends the use of cement substitutes and additives in the concrete design that promotes the use of recycled materials such as fly ash and slag.
- B. Concrete materials and products should be extracted, recovered and manufactured within 500 miles of UNC Charlotte.
- C. Approved manufacturers will be listed in the specifications.

2.2 CONCRETE MIX

- A. Antique White cement with crushed limestone aggregate.

END OF DIVISION

SECTION 2
DIVISION 04
MASONRY

DIVISION 4 - MASONRY

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer's contract documents.

SECTION 04 2000 – UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Masonry Mock-up: A masonry mockup for approval of colors and workmanship shall be built on site prior to beginning masonry work. This panel shall show workmanship and will include face and backup construction and all accessories specified for on this project. The panel shall be 4'-0" x 4'-0", unless specified otherwise. The panel shall be constructed at a location indicated by the Architect/Project Manager. The materials used shall be provided by the project supplier and shall represent the final product in all aspects. The panel shall be protected from construction operations, but shall remain in place and exposed to the elements until project completion. This mock-up will be used for approval of brick, mortar, joint material, flashing, weep holes and precast pieces to be used on the project. This panel shall show color range and texture of masonry units and mortar joints required on this project.
- B. Quality Standards: Perform work in accordance with ACI 530 and ACI 530.1.
- C. Masonry Subcontractor Qualifications: The work of this section shall be bid and performed by an experienced firm certified as a "North Carolina Masonry Contractors Association Certified Masonry Contractor" as described in the most current version of the NCMCA's "Guide to Masonry Contractor Certification." (North Carolina Masonry Contractors Association, PO Box 3463, Hickory, NC 28603-3463, [\(828\) 324-1564](tel:8283241564), information@ncmca.com)

The masonry subcontractor shall at all times when work is in progress, provide an experienced individual from its own staff designated by the North Carolina Masonry Contractors Association Masonry Contractor Certification Program as a "CMP-Certified Masonry Professional" or "CME - Certified Masonry Executive" (as described in the most current version of the NCMCA's "Guide to Masonry Contractor Certification") on-site to supervise work in progress.

1.2 DELIVERY AND HANDLING

- A. Contractor shall store all materials in manufacturer's original unopened bundles or containers with manufacturer's brand name and identification clearly marked thereon. All material shall be sorted in packs, on platforms or other supports above ground to prevent damage, deterioration or contamination.

PART 2 - PRODUCTS.

2.1 CMU

- A. Concrete masonry units shall be of modular dimensions and units shall be of the same appearance and shall be cured by the same process delivered to the project site in an air-dry condition. Units shall be made with semi-lightweight aggregate conforming to ASTM C 331 and meet or exceed the following requirements. Units shall be a cast minimum of 21 days old prior to delivery to the site.

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1. Load-Bearing Concrete Masonry Units: ASTM C 90, Type II.
2. Hollow Concrete Masonry Units: ASTM C 129, Type II.
3. Concrete Building Brick: ASTM C 145, Type II, Grade U.

2.2 BRICK

- A. Face brick shall be "Morrocroft Special" #02-79-1 manufactured by Forterra Brick at www.forterrabrick.com (one available source in Charlotte is Brick Yard Limited). Installation shall comply with UNCC Std. Spec S02515. Brick Pavers shall be 2-1/4"x4"x8"
- B. Use Basic Square Rowlock Corner units at corners and ends of masonry walls. After brick laying is complete, quartz sand or hard rock screenings shall be swept over the brick and repeated for a minimum total of three "wet/dry" applications. More applications may be required at no extra cost, if necessary to stabilize the pavers and fill voids between bricks.

2.3 STONE TRIM UNITS

Base material shall be quartz or hard rock screening as described by NCDOT Spec 1012.1C3. References UNCC Std. Detail G02.1A. Various site situations may require additional requirements. Mortar shall be color BY115 (available from Brick Yard Limited).

2.4 MORTAR AND GROUT

- A. Cement shall be Portland Cement, Type S, meeting Standard Specifications for Portland Cement (ASTM C 270). Below grade load bearing masonry work should be Type M (ASTM C270).
- B. Sand shall meet the requirements of Standard Specifications for aggregate for Masonry Mortar (ASTM C-144-81), with the gradation to satisfy paragraph 3, Grading, and with the omission of subparagraph 3.4.
- C. Hydrated lime shall meet the requirements of the Standard Specification for Hydrated Lime for Masonry Purposes (ASTM C-207), Type S.
- D. Hydraulic hydrated lime shall meet the requirements of the Standard Specification for Hydraulic Hydrated Lime for Structural Purposes (ASTM C-141).
- E. Water shall be potable.
- F. Admixture workability and air entraining admixtures, if specified, shall conform to ASTM C-260.
- G. Prepackaged mortar cements may not be used unless approved in writing by the designer.
- H. Grapevine Joint: All tooled joints for brick work shall be tooled 1/8"grapevine joints. Head joints to be struck first and then bed joints. The jointing tools shall be replaced as necessary to provide crisp, distinct grapevine joints.
- I. Mortar shall match Robinson Hall, Brick Yard Limited 115, or match previous projects on campus.

2.5 REINFORCEMENT

- A. Unless specified otherwise on the drawings, Reinforcement steel for lintel blocks, bond beams and other reinforced masonry work as required, shall conform to ASTM A 615, Grade 60, size as indicated or specified.

2.6 TIES AND ANCHORS

- A. Anchors and ties shall be wire ties of hot-dipped galvanized in accordance with ASTM A 153, Class B-2 (1.5 oz. /sq. ft.) of types as specified hereinafter.

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Section 2, Division 04 – Masonry

- B. Welded steel adjustable anchors for anchoring masonry shall be No. 359 anchor rodTies shall be as follows:
 - 1. Brick: No. VWT triangular ties sized such that they are imbedded at least 2" into bed of brick veneer.
 - 2. CMU: No. VWT triangular ties or No. 302W.

2.7 MISCELLANEOUS ACCESSORIES

- A. Control joint material for exterior walls shall be as specified by designer or approved equal. Width shall be as specified by the Architect.
- B. Horizontal Expansion Joint Material shall be prefabricated neoprene joint material, 1/4" thick by approximately 2-3/4" wide with an adhesive surface on one side. Neoprene material shall conform to ASTM D 1056, Class RE41.
- C. Vertical Expansion Joint Material shall be prefabricated neoprene joint material, 3/8" thick by approximately 3" wide. Neoprene material shall conform to ASTM D 1056, Class RE41.

2.8 INSULATION

Block wall insulation shall be masonry fill processed for purpose of insulating masonry walls. Block wall insulation shall have been tested for water repellency in accordance with procedures developed by the National Bureau of Standards (NBS-82).

2.9 MASONRY CLEANERS

- A. Exercise caution to keep the masonry and adjacent surfaces clean during the erection of masonry. Clean wall surfaces as the work progresses and to the extent practical, clean masonry on the same day in which it is laid.
- B. Clean brick or stone masonry with water and brushes with nonmetal bristles. Diluted detergents may be used if the water is containerized and pumped to the sanitary sewer. Repeated washings are preferred to fewer washings that are too abrasive or chemically laden. Acid content in washing solutions is forbidden. The Designer and Contractor are to make every effort to prevent infiltration of cleaning water into the storm sewer system during masonry cleaning. This is especially the case when very old masonry units or mortar joints are involved.
- C. All cleaning agents to be environmentally safe.

SECTION 04 7200 – CAST STONE MASONRY

PART 2 - PRODUCTS

2.1 GENERAL:

All head joints at coping stones and joints at column covers, cornices, platforms, soffits, window sills and in general, all stone sections with projecting profiles, exposed top joints or rigid suspension connections to the supporting structure should be 'soft' sealant joints.

2.2 SUSTAINABILITY

- A. UNC Charlotte recommends that masonry materials and products should be extracted, recovered and manufactured within 500 miles of UNC Charlotte.

SECTION 2
DIVISION 05
METALS

DIVISION 5 - METALS

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer's Contract Documents.

GENERAL DESIGN:

1.1 GENERAL REQUIREMENTS

- A. Structures shall be designed in accordance with the North Carolina Building Code.
- B. 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.
- C. Try to design column base plates for ease of installation; i.e. use anchor bolts with double nuts and 1 ½" space to grout after leveling.
- D. Specify that work be temporarily braced during construction until the structural system is adequate to brace itself.

1.2 GENERAL TESTING

Structural tests on welds, bolts, shear studs, etc. shall be performed by a qualified independent laboratory (conforming to American Society for Testing and Methods standards) selected and paid for by the Owner in accordance with the NC 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 Engineering and Construction Management during the design phase of the project to discuss testing frequency to be included in the specifications.

SECTION 05 5000 – METAL FABRICATIONS

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel:
 - 1. Steel Plates, Shapes, and Bars: ASTM A 36, pickled when exposed to view.
 - 2. Cold-Formed Steel Tubing: ASTM A 500, Grade B.
 - 3. Hot-Formed Steel Tubing: ASTM A 501.
 - 4. Hot-Rolled Carbon Steel Bars: ASTM A 575, Grade as selected by fabricator.
 - 5. Steel Plates to be Vent or Cold-Formed: ASTM A 283, Grade C.
 - 6. Hot-Rolled Carbon Steel Sheets & Strips: ASTM A 568 & A 569, pickled and oiled.
 - 7. Galvanized Carbon Steel Sheets: ASTM A 526, with ASTM A 525, G90 zinc-coating.
 - 8. Malleable Iron Castings: ASTM A 47, Grade as selected.
 - 9. Steel Pipe: ASTM A 53, type as selected, Grade A, black finish unless galvanizing is required; standard weight (Schedule 40), unless otherwise shown or specified.
 - 10. Steel Wire Rope: ASTM A 475, plastic covered zinc-coated steel wire strand, size and number wires shown. Proved "Common" grade with Class B zinc-coating unless otherwise shown or specified.

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11. Cold-Finished Steel Bars: ASTM A 108, Grade as selected by fabricator.

2.2 FASTENERS

- A. Provide zinc-coated fasteners, with galvanizing complying with ASTM A 153. Select fasteners for the type, grade and class required for the installation of miscellaneous metal items.
- B. Standard Bolts and Nuts: ASTM A 325, Grade A, regular hexagon head.
- C. Lag Bolts: FS FF-B-561, square head type.
- D. Machine Screws: FS FF-S-92, cadmium plated steel.
- E. Plain Washers: FS FF-W-92, round, general assembly grade carbon s steel.
- F. Lock Washers: FS FF-W-84, helical spring type carbon steel.

2.3 MISCELLANEOUS MATERIALS

- A. Steel Primer Paint: Tnemec 10-99G, Green, modified alkyd rush inhibitive primer exceeding the performance requirements of FS TT-P-86d, Types I and II or equal.
- B. Galvanizing Repair Paint: High zinc-dust content paint for re-galvanizing welds in galvanized steel, complying with Military Specifications Mil-P-21035 (ships).
- C. Anti-Slip Surfacing: 3M Company "Safety-Walk," Black color with adhesive recommended by manufacturer for substrates indicated.

2.4 FABRICATION

For the fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding or welding and grinding prior to cleaning, treating, and application of surface finishes and including zinc coatings.

2.5 ROUGH HARDWARE

Furnish custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes for framing and supporting and anchoring Project Work, unless specified to be provided under other Sections of the Specifications. Provide with hot-dipped galvanized finish unless otherwise noted.

2.6 MISCELLANEOUS STEEL TRIM

Provide shapes and sizes as required for the profiles shown. Except as otherwise noted, fabricate units from structural steel shapes and plates and steel bars with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cut outs, fittings, and anchorages as required for coordination of assembly and installation with other work.

2.7 GRATINGS

- A. Provide grating platforms, platform frames, hangers, connections, and fasteners as indicated and required. Provide all hangers, structural connections, and fasteners required for platforms and to supporting structure as indicated. Provide one shop coat PMS 349 modified alkyd rust-inhibitive primer as specified after fabrication.

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- B. Provide banded metal bar grating as shown on the Drawings, complying with the NAAMM “Metal Bar Grating Manual” and as specified herein.
- C. Grating shall be provided complete with angle frames where indicated on the Drawings. Frames and fastening devices shall be of same material and finish as grating being fastened.
- D. Notching of bearing bars at supports to maintain elevations will not be permitted.
- E. Provide miscellaneous structural steel framing and supports as required to complete the work.

2.8 STEEL AND IRON FINISHES

- A. All exterior ferrous metals shall be aluminum or hot-dip galvanized after fabrication. Field welds shall be ground and have cold galvanizing applied.
- B. 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. Shop Painting: Shop paint miscellaneous metal work, except those members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces, unless otherwise specified.
 - 2. Remove scale, rust and other deleterious materials before the shop coat of paint is applied. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2 “Hand Tool Cleaning.” Remove oil, grease and similar contaminants in accordance with SSPC SP-1 “Solvent Cleaning.”
 - 3. Apply one shop coat of metal primer paint to fabricated metal items, except apply two coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat.
 - 4. Brush or spray on metal primer paint at a rate to produce a uniform dry film thickness of 2.0 mils for each coat. Provide full coverage of joints, corners, edges, and all exposed surfaces.
 - 5. Touch-up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal.

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SECTION 05 7300 – ORNAMENTAL RAILINGS

PART 1 - GENERAL

1.1 CODES

All guardrails and handrails must be in compliance with the ADA Accessibility Guidelines and all governing codes.

1.2 STORAGE AND HANDLING

Store structural steel in a manner that will prevent damage from falling objects, etc. and soiling from mud, concrete and debris. Make proper repairs if damaged or replace items where damage is extensive. .

PART 2 - PRODUCTS

2.1 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.

2.2 EXTERIOR METAL RAILINGS AND GRILLWORK:

- A. Exterior railings at steps and ramps will comply with Campus standard details (Section 3, Annex F).
- B. Railings which are an integral part of the architecture should be similar to Campus standard details (Section 3, Annex F).
- C. All railings and grillwork of painted metal will dark green, Campus standard.

SECTION 2
DIVISION 06
WOOD, PLASTICS AND COMPOSITES

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s Contract Documents.

GENERAL DESIGN

1.1 GENERAL REQUIREMENTS:

- A. Campus buildings vary on the use of interior woodwork depending on their function. Therefore, the University only reviews specifications provided by the architectural consultant on a project by project basis.
- B. Since the University has used very little wood in the past, most specifications have been adequate. 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 moisture content greater than 19%.

SUSTAINABILITY

1.2 GENERAL REQUIREMENTS:

- A. Certified Wood: When available, lumber and boards shall be certified by the Forest Stewardship Council (FSC).
- B. Locally Available Wood: Specify wood-based materials and products harvested and manufactured within 500 miles of UNC Charlotte.
- C. Recycled Plastics: Specify plastic products made from the highest practical post-consumer and then post-industrial recycled content
- D. VOC Content for Installation Adhesives and Glues: Comply with the following limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Wood Glues: Not more than 30 g/L.
 - 2. Contact Adhesive: Not more than 250 g/L.
- E. Provide composite wood and agrifiber products with no added urea-formaldehyde.

SECTION 06 1063 – WOOD AND TIMBER CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and General Provisions of the contract, including General and Supplementary Conditions and Division 1 specifications sections, apply to work in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of timber construction is shown on drawings and as detailed in this manual.

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1.3 QUALITY ASSURANCE:

- A. All products and construction shall comply with all applicable codes and standards specified in the front of this manual.

PART 2 - PRODUCTS

A. ROUGH LUMBER TIMBERS:

- 1. All wood components shall be fabricated from Southern Yellow Pine. Dimensional members shall be No. 2 or better. All wood shall be surfaced on all sides, all edges, and ends shall have 1/8" radius.
- 2. Wood shall be taken from live trees, free of sweep, rot, loose knots, wane and compressed wood. Wood shall be smooth and relatively free of excessive splinters, checks and splits. Excessively rough, split or checked members shall be rejected.

B. PRESERVATIVE TREATMENT:

- 1. All wood components shall be pressure treated to a net retention of 0.40 lbs. per cubic foot except structural members in ground contact, timbers used as edging or borders, and/or retaining walls which shall be pressure treated to a net retention of 0.60 lbs. per cubic foot.

PART 3 - EXECUTION

3.1 TIMBER BORDERS:

- A. Construct as shown on details in this manual, on existing grade if possible. Hand dress bedding to uniform grade if required. Timbers shall be 8' or longer as much as possible. No section shall be less than 4' in length unless otherwise specified. Joints shall be lap joints as detailed in this manual.

3.2 TIMBER RETAINING WALLS:

- A. Construct as shown on details in this manual and described herein. Walls are to be constructed with tightly fitting timbers, 8' or longer where possible. No timber shall be less than 4' in length unless otherwise specified.
- B. Filter fabric, porous backfill and structural backfill shall be placed as wall goes up. Ties and deadmen shall be placed and surrounded by properly compacted fill as wall is constructed.
- C. Wall height shall not exceed 5'4" unless approved. Where cuts or fills exceed 5'4", a landing not less than 3" wide will be used between upper and lower walls, total maximum height of 11'-0".

SECTION 06 4023 – INTERIOR ARCHITECTURAL WOODWORK

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Standing and running trim, frames, closet and utility shelving, cabinetry and countertops. Comply with AWI Custom standards.

2.2 COUNTERTOPS:

- A. Countertops in restrooms to be solid surface material or stone.

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B. Countertops in areas other than restrooms can be solid surface, stone or plastic laminate.

2.3 WARDROBE SPECIALTIES:

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

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s Contract Documents.

SECTION 07 1000 – WATERPROOFING

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

Applicators: Submit a letter from the manufacturer of waterproofing materials stating that the applicator is approved by the manufacturer for application of the waterproofing system specified. Applicator shall have a minimum of five years experience in satisfactory application of the type(s) of system(s) specified.

1.2 WARRANTY

Guarantee: Guarantee membrane waterproofing for two years with the Contractor or waterproofing sub-contractor agreeing to repair or replace work which leaks or otherwise fails to perform as required due to failures of materials or workmanship. This shall include the removal and replacement of any work which conceals the membrane work.

PART 2 - PRODUCTS

2.1 LOCATION

- A. Provide membrane waterproofing at the following locations:
1. All exterior walls below-grade that enclose rooms and spaces.
 2. Walls of below grade elevator pits.
 3. Toilet rooms, housekeeping closets and all floors containing floor drains, except where located on slab on grade (slab on grade damp proofing is standard (6) mil reinforced polyethylene with all punctures/penetrations sealed).
 4. Floors (including penetrations) of all mechanical rooms above other areas.

PART 3 - EXECUTION

3.1 APPLICATION

Before applying waterproofing, surfaces shall be completely free of dirt and loose materials, concrete fins shall be chipped back, form ties removed and honey-combs, cracks, and other voids filled. Prime surfaces and otherwise prepare as recommended by the material manufacturer. Provide a layer of a suitable membrane protection material. Take care to avoid puncturing the membrane when backfilling against waterproofed foundation wall.

SECTION 07 2100 – BUILDING INSULATION

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PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. In addition to compliance with the State Energy Code, construction assemblies must have the following minimum R-values:
 - 1. Walls: 19
 - 2. Built Up Roofing: 25
 - 3. Attic Ceiling: 30

1.2 SUSTAINABILITY

- A. Batt insulation must be formaldehyde free
- B. Recycled Content: Provide glass-fiber insulation with recycled content so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 30%.

SECTION 07 3113 – ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUSTAINABILITY

- A. Where possible, provide roofing products that meet the following reflectivity standards:
 - 1. Solar Reflectivity/Emissivity: Energy Star.
Solar Reflectance Index (SRI):
 - a. Low sloped roof (less than or equal to 2:12): SRI of 78 or greater
 - b. Steep sloped roof (greater than 2:12): SRI of 29 or greater

PART 2 - PRODUCTS

2.1 ASPHALT SHINGLES

Federal Specifications SS-S-001534 Class A, Type 1 Self Sealing Fiberglass. Shingles shall meet the requirements of Underwriters Laboratories, Inc. for Class A, I-90, wind-resistant shingles, by equaling or exceeding the requirements of UL 55B, UL 790 and UL 997. Shingle bundle wrapping shall bear the label of Underwriters Laboratories, Inc. Shingles shall be square-butt strips of uniform thickness or of thick-butt style, with internal fiberglass matting, asphalt coating and ceramic surface granules. Size of shingles shall be approximately 12" x 36", 3-tab design; weight 205 lbs. per square.

2.2 UNDERLAYMENT

Roofing Felt: ASTM D 226, asphalt saturated, organic, non-perforated, 30 lb, Type II.

2.3 ACCESSORIES

- A. Roofing Nails
- B. Material Galvanized Steel
- C. Head Diameter 3/8"
- D. Length sufficient to penetrate roof sheathing.
- E. Shank 11 or 12 gauge.

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- F. STAPLES ARE NOT ACCEPTABLE
- G. Bituminous Plastic Cement FS-SS-C-153, Asphaltic Base, Type I.

SECTION 07 4113 – METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUSTAINABILITY

- A. Where possible, provide roofing products that meet the following reflectivity standards:
- B. Solar Reflectivity/Emissivity: Energy Star.
 - 1. Solar Reflectance Index (SRI):
 - a. Low sloped roof (less than or equal to 2:12): SRI of 78 or greater.
 - b. Steep sloped roof (greater than 2:12): SRI of 29 or greater.
- C. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 60 percent.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

Sheet Metal shall be Base and Counter Flashing SMACNA Plate as applicable or required, 26-gauge, Galvanized Metal.

2.2 ACCESSORIES

- A. Concealed Flashing: Concealed flashing shall be "Fiberweb 310" thru-wall flashing as manufactured by Fiberweb International Corp., "Cop-A-Bond" 202 weight as manufactured by AFCO, Duplex "Cop-R-Flash" as manufactured by Phoenix, "Cop-R-Tex Duplex" as manufactured by York Manufacturing or an approved equal.
- B. Gutters and Downspouts: Gutters and downspouts shall be 24 gauge; pre-finished aluminum in color as shown on the drawings. Provide all fasteners, elbows, screens, splashblocks and other accessories required for a complete installation of gutters and downspouts.
- C. Fasteners: All nails, screws, bolts, rivets and other fastenings for sheet metal, unless otherwise noted, shall be type 304 or 305 stainless steel of size and type suitable for intended use. Nails shall be minimum 12 gauge, flat head annular-thread type, and of sufficient length to penetrate backing at least 3/4". Galvanized steel is not acceptable.
- D. Solder: Solder shall conform to ASTM Designation B 32T, 60-40 or 80-20 percent block tin and pig lead.
- E. Flux: For tinning galvanized steel surfaces, use acid type flux designed especially for use in soldering galvanized steel. For re-tinted surfaces, use regular rosin type flux.

2.3 FINISHES

- A. When located in the academic core, they will be standing seam. The color will be gray to match the roof of the Barnhardt Student Activities Center. If located in the vicinity of the athletic fields, metal roofs will be dark green to match the Irwin Belk Track and Field Center.

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SECTION 07 4213 – METAL WALL PANELS

PART 1 - GENERAL

1.1 SUSTAINABILITY

Recycled Content of Steel Products: Provide products with an average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 60 percent.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL PANELS

- A. Refer to drawing C-017.10 for selection of architectural panels, size, seam location, and configuration.
- B. Acceptable architectural panel materials are:
 - 1. Manufacturer: Citadel
 - a. Type: glazeguard 1000
 - b. Size: 5'x12'x1" sheets with batten moldings to cap seams
 - c. Color: clear stock anodized
 - 2. Manufacturer: Greensteel
 - a. Type: typical 5-ply insulating panel
 - b. Size: 5'x12'x1" sheets with batten moldings to cap seams
 - c. Color: clear stock anodized
 - 3. Manufacturer: Laminators Incorporated
 - a. Type: System II
 - b. Size: 5'x12'x1" sheets with batten moldings to cap seams
 - c. Color: clear stock anodized.

SECTION 07 5000 – ROOFING SYSTEMS

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Design: Roof designs shall comply with the latest version of the State Construction Office's "Roofing Design Criteria."
- B. Re-roofing:
 - 1. The Designer shall have a core sample taken of each existing roof system to determine the materials contained in each existing system. The Designer shall not rely on previous construction documents or record documents for this information.
 - 2. Guarantee: Insert the following into the Supplementary General Conditions involving roofing of existing structures: "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."
- C. The Designer shall have a roofing analysis report made of the existing roof materials to determine the presence of asbestos. The Construction Documents shall include the complete report and interpretation.

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1.2 SUSTAINABILITY

- A. Where possible, provide roofing products that meet the following reflectivity standards:
- B. Solar Reflectivity/Emissivity: Energy Star.
 - 1. Solar Reflectance Index (SRI):
 - a. Low sloped roof (less than or equal to 2:12): SRI of 78 or greater
 - b. Steep sloped roof (greater than 2:12): SRI of 29 or greater
- C. Preference should be given to roofing systems that are able to be recycled.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. For low-sloped roofs, the top surface color shall be white: this may be achieved with a white roofing membrane or white smoothly rounded (river washed) stone ballast.
- B. Drainage: Extra slope to roof drains should be provided two feet around the drain. Prior to final inspection, the contractor shall conduct a flood test of the roof in the presence of the Designer and the Owner to verify drainage.
- C. Flat membrane roofs - will be white roofing materials only.

SECTION 07 6200 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

Specifications for products included in this Section and accessories shall meet the ANSI, SMACNA and ASTM criteria for each material. Use flashing recommended by manufacturer as part of roofing system where applicable.

1.2 SUSTAINABILITY

Recycled Content of Steel Products: Provide products with an average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 60 percent.

PART 2 - PRODUCTS

2.1 MATERIAL

Flashing to be either Stainless steel or copper, unless otherwise approved by UNC Charlotte

SECTION 07 7000 – ROOF ACCESSORIES

PART 2 - PRODUCTS

2.1 ROOF SCUTTLE

- A. Scuttle shall be Type 'S' by The Bilco Company, RSL-3036 by Naturalite Company, RD-1 by Milcor Limited Partnership or approved equal.

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1. Clear opening (inside of curb) shall be 2'-6" x 3'0".
2. Cover shall be 11 gauge aluminum with 3" neatly welded beaded flange, insulated with 1" fiberglass, fully covered and protected with an 18 gauge aluminum liner.
3. The roof curb shall be 12" in height and be constructed of 11 gauge aluminum. The curb shall be formed with an integral predrilled 3½" flange for securing to the roof deck.
4. The curb shall be equipped with an integral 11 gauge aluminum cap flashing, fully welded at the corners for weather tightness. All clips, rope packing, etc. required for a proper fit and installation as described by the scuttle manufacturer shall be provided and installed by the Contractor.
5. Insulate the side walls of the curb with 1" thick rigid fiber board insulation (provided attached to the curb by the Manufacturer).
6. Scuttle shall be completely assembled with heavy duty hinges, spring operators to assist opening, a positive snap latch with turn handles and padlock hasps inside, and thermoplastic rubber gasket.
7. The cover shall be equipped with an automatic hold-open arm with vinyl grip handle for easy release and one hand control of cover to its closed and latched position.

SECTION 07 9200 – JOINT SEALANTS

PART 1 - GENERAL

1.1 SUSTAINABILITY

Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

Joint Sealers Indicate that caulk selection by the designer shall **not** be limited to the manufacturer's standard list of colors.

SECTION 07 9500 – EXPANSION CONTROL

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

Building Expansion joint covers on interior floors shall be of color and texture that matches adjacent carpet or floor covering. Aluminum covered joints shall be avoided.

SECTION 2
DIVISION 08
OPENINGS

DIVISION 8 - OPENINGS

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s Contract Documents.

DOORS

1.1 GENERAL

- A. All entrance doors and all exterior doors shall be “hinge-type.” Sliding doors are not acceptable unless specifically requested by the University. Every new building shall have mechanically assisted door operators at primary entrances. The mechanical mechanisms shall be activated by plunger buttons located approximately 10’ to the side of the door to discourage unnecessary use of the automated systems.
- B. The plunger button shall be located 12” away from building corners, overhang trim, or stationary and permanent objects that prevent individuals from engaging the plunger.
- C. The doors at primary entranceways shall be of “human scale” and not exceed 84” height and 42” width unless there is a pragmatic reason to install larger doors. Variations shall be brought to the attention of the UPM.

SECTION 08 1113 – HOLLOW METAL DOORS AND FRAMES

1.2 QUALITY ASSURANCE

- A. All steel doors, door frames, miscellaneous frames, and transoms when required, which are specified in this Section, shall be by the same manufacturer.
- B. Fire-Resistance Classification:
 - 1. Wherever a fire-resistance classification is shown, scheduled or required, provide materials which have been tested and listed by building code rating authority for rating construction assembly.
 - 2. Wherever a fire-resistance classification is shown or scheduled for hollow metal work, label each fire door assembly, complete with type of fire door hardware to be used. Identify each fire door and frame individually with UL labels, indicating applicable fire rating of both door and frame.
 - 3. Construct and install assemblies to comply with NFPA Standard No. 80 and as herein specified.
 - 4. Hardware reinforcement of labeled doors and frames shall conform to requirements of labeling agency. In addition the doors and frames shall conform to applicable local codes and regulations of authorities having jurisdiction.

1.3 SUSTAINABILITY

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 60 percent.

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PART 2 - PRODUCTS

2.1 MATERIALS

- A. Doors shall be manufactured from cold rolled steel - ASTM A 366.
- B. Commercial quality, carbon steel sheets, free from scale, pitting, and surface defects. Gauges shall be U. S. Standard.
- C. Steel for face sheets of hollow metal doors, and for broad frame faces, shall be stretcher-leveled.
- D. Sheet steel for exposed surfaces of doors and frames for exterior openings shall be hot-dipped galvanized, phosphatized steel sheet with not less than light commercial zinc coating in accordance with ASTM A 526.

2.2 STANDARD HOLLOW METAL DOORS

- A. General:
 - 1. Doors shall be manufactured in accordance with ANSI/SDI Publication 100 and the documents referenced therein.
 - 2. Doors shall be of the types and sizes indicated and shall be strong, rigid, neat in appearance, free of defects, warps, and buckles, and with corner bends true, straight, and of minimum radius for the metal gauge used.
 - 3. Unless noted otherwise, doors shall be 1-3/4" thick.
- B. Exterior Doors:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty)
 - 2. 16 gauge minimum.
 - 3. Non-labeled exterior doors shall have foamed-in-place insulation which completely fills all areas except those areas to receive the specific schedule hardware. Fibrous type insulation shall not be used.
 - 4. Exterior doors shall have a flush end channel (closure) at top rail which shall be sealed against moisture entry. Openings shall be provided in bottom recessed end channel (closure) to permit drainage of any entrapped moisture.
 - 5. All exterior doors shall be provided with weatherstripping.
- C. Interior Doors:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty)
 - a. 16 gauge minimum.
 - 2. Interior Metal Doors shall have the following Sound Deadening Materials:
 - a. Non-Labeled Doors
Non-combustible mineral wool (minimum 3 lbs. per cu. ft. density), or other acceptable non-combustible sound deadening material. Provide 100% coverage.
 - b. Labeled Doors
- D. UL approved insulating materials for designated class.

2.3 STANDARD HOLLOW METAL FRAMES

- A. Frame Construction (All types):
 - 1. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
 - 2. 16 gauge minimum.
 - 3. Fully welded units with integral trim, conforming to gauges, sizes, and profiles noted, complete with cutouts and reinforcing in accordance with approved shop drawings.

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4. Head and jamb members of each frame shall be carefully butted, lapped, or mitered together with contact edges tightly closed and trim aligned to fit straight, true and level. Weld corner joints together accurately with welds on exposed surfaces ground smooth and flush and rendered inconspicuous.
5. Where frames are installed in masonry walls or indicated to be filled with grout, provide steel mortar guards over mortised hardware reinforcements.
6. Rubber silencers: Drill stops to receive three silencers on strike jambs of single-swing frames and four silencers on heads of double-swing frames. Install plastic plugs to keep holes clear during construction. Silencers to be installed after final paintings.
7. Spreaders: Furnish all frames with a temporary, removable steel spreader at bottom. Do not remove until frames are securely anchored in place, square, and plumb.
8. Properly cut frames for 4-inch strike plate; reference Standard Detail A01.1.
9. Provisions for Hardware: Prepare frames at factory for installation of hardware. Frames shall be mortised, reinforced, drilled and tapped to templates to receive mortised hardware; frames to receive surface-applied hardware shall be provided with reinforcing plates only.
10. Welded Frames:
 - a. Corner joints of frame and stops shall be mitered with contact edges closed tight and continuously welded. Joints shall not be visible. Exposed welding shall be ground smooth and flush with the surrounding surface making the welds invisible.
 - b. The use of "body putty" and other similar materials shall not be permitted. A temporary steel shipping bar shall be securely attached to the bottom of each frame. Welded frames shall be used for:
 - 1) All exterior hollow metal frames.
 - 2) Locations specifically noted on drawings.
 - 3) Where required by code as related to the fire rating of the wall.
11. Labeled Frames:
 - a. Fire resistance ratings in hours shall be as indicated. Frames shall have the testing facility label securely attached to the hinge jamb and in such a position it cannot be seen when the door is in the closed position.

2.4 FRAME ANCHORS

- A. Anchors:** Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, of gauge scheduled.
1. Anchors: Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, of gauge scheduled.
 - a. Jamb Anchors: Provide a minimum of 3 anchors for each jamb. Locate anchors opposite top and bottom hinges and midway between, with maximum spacing of 24" between anchors.
 - 1) Provide a minimum of 3 anchors per jamb for frames 7'0" high and under, and 1 additional anchor for each additional 30" or less of frame height. Position anchors at level of butts and locks, and as indicated. Jamb anchors shall permit passage of conduit as required by job conditions, except at rated frames and as noted.
 - 2) Masonry: Provide anchors of corrugated or perforated steel straps or 3/16" diameter steel wire, adjustable or T-shaped, minimum 10" length.

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- 3) Stud Partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to wood studs with nails, to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding.
- b. Floor Anchors: Provide floor anchors drilled for 3/8" anchor bolts at bottom of each jamb member.
- 2. Gauges for hollow metal work shall be U.S. Standard. The following are minimum gauges to be used:

Item	Gauge
a. Jamb anchors	16
b. Floor anchors	11
c. Structural reinforcing	12
d. Stirrups for adjustable anchors	14
e. Louver frames	18
f. Louver blades	20
g. Hardware reinforcement	
1) 1. Hinges, pivots, butts	3/16" plates
2) 2. All other	12

2.5 STOPS AND MOULDINGS

- A. Door Sight Glass: Provide moldings around glass panels. Provide non-removable moldings on the outside of exterior doors and on non-secure side of interior doors. Other moldings may be stationary or removable.
- B. Gauge of Removable glass stops, frame stops and beads: 18 gauge.

2.6 FABRICATION

- A. Doors:
 - 1. All welds on the exterior shall be ground smooth and flush with the surrounding surface making the welds invisible. The use of "body putty" and other similar materials shall not be permitted.
 - 2. Door faces shall be without concave areas and convex areas when viewed no closer than 5'0" at any angle.
- B. Coordinate the undercut of the door bottom on all exterior doors in order that the gap between the door bottom and the surface over which it stands in the closed position will be no greater than 1/4" and no less than 1/8".
- C. Hardware:
 - 1. Unless shown otherwise on the drawings, hardware mounting heights shall comply with Standard Detail A01.1. Pulls, Pull Plates, and Push Plates shall be mounted 42" AFF to center.
 - 2. Where "cylindrical" type locks, latches, deadbolts, night latches, etc., are to be installed, provide proper SDI cylindrical lock reinforcement for support of the latch bolt and deadbolt mechanism.
 - 3. Doors shall be manufactured for specific hardware to be provided and with "latch" and "push-pull" stiles properly beveled.

2.7 FINISHES

- A. Steel Priming shall be as follows: After fabrication and assembly, all steel products shall be cleaned, phosphate treated, and coated with a baked-on, rust-inhibitive primer, 2 mils thick dry minimum. Concealed surfaces in contact with masonry or concrete shall be coated with bitumastic paint conforming to SSPC No.

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- B. Shop Coating
 - 1. Primer: Manufacturer's standard rust-inhibitive baked primer over phosphatizing treatment.
 - 2. Zinc-Rich Primer: Equivalent to Red Oxide (Cat. No. 41820) as mfg. by Devoe Paint Div. of Celanese Coatings Co., or approved equal.

SECTION 08 1416 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUSTAINABILITY

- A. Certified Wood: When available, lumber and boards shall be certified by the Forest Stewardship Council (FSC).
- B. Locally Available Wood: Specify wood based materials and products harvested and manufactured within 500 miles of UNC Charlotte.
- C. VOC Content for Installation Adhesives and Glues: Comply with the following limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Wood Glues: Not more than 30 g/L.
 - 2. Contact Adhesive: Not more than 250 g/L.
- D. Provide composite wood and agrifiber products with no added urea-formaldehyde.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

Doors shall be flush type, solid core. Core, rails, and stiles shall be glued together to form solid slab. Doors shall be 1-3/4" thick and shall be width and height shown on DOOR SCHEDULE. Doors shall be equal to Weyerhaeuser "Marshfield Series" Core DPC-1 or approved equal.

2.2 FACE VENEER

Face Veneer shall be standard thickness, thoroughly dried, tapeless, spliced with Type II adhesive per CS 35, laid at right angles to cross banding. Species shall be premium grade, rotary cut birch or red oak veneer as specified.

2.3 CROSS BANDS

- A. Cross Bands shall be thoroughly oven-dried hardwoods, 1/16" minimum thickness extending the full width of the door and laid with the grain at right angles to the face veneer.
- B. Edge Bands: The stile edge bands shall be a two-ply edge band laminated to the core on four (4) sides with Type II highly water-resistant glue, using the high frequency method. The outer stile shall be of the same or compatible species as the face. Two-ply stiles of mill-option hardwoods shall be used. Stiles must measure a minimum of 1-1/4" after trimming, top and bottom rails, 1-1/8". Finger jointing in outer stiles shall not be permitted.

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2.4 ADHESIVES

Cross bands and faces shall be laminated to the cores with Type I, 100% waterproof Melamine Fortified Urea glue, by the hot plate process.

2.5 CORE

- A. Weyerhaeuser Timblend with average density of 28-32 lb. per cu. ft.
- B. Core shall comply with ANSI A208.1, Mat Formed Particleboard.

2.6 OPENINGS

Factory cut openings for glass. See drawings and Standard Details for dimensions. Provide fire rated metal lite beading for all openings.

2.7 FINISHING

Doors shall be prefit. All doors shall be job finished.

2.8 MANUFACTURER'S MARKINGS

Any manufacturer's markings such as colored pegs shall occur on the top hinge edges of the doors only.

SECTION 08 3323 – OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. All materials installed by the Contractor shall be approved by a certified testing agency approved by the North Carolina Department of Insurance. All materials shall meet N.C. State Building Codes, and should there be any discrepancies between design and code, the more stringent requirement shall apply.

1.2 SUSTAINABILITY

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIAL AND CONSTRUCTION – GENERAL

- A. All materials shall be new and shall be manufactured for the intended use. No manufacturer's or installer's logos or other decals or signs will be attached to the door or any part thereof without authorization of the owner.
- B. Provide perimeter gasketing on guides and bottom bars and field installed at the head of the opening. UL listed gasketing shall bear the label of an approved certified testing agency. It shall be installed to effectively close the perimeter gaps,

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but not so tight as to affect the automatic closing of the door under alarm or test conditions.

- C. Brackets shall be steel plates to support counterbalance assembly, form end closures and provide mounting surface for securing ends of hoods.

2.2 DOOR CURTAIN MATERIAL AND CONSTRUCTION – ROLLING DOORS

- A. Curtain to consist of interlocked flat-faced slate, 1/2" deep, #22 gauge primed steel. Furnish matching bottom bar angle complete with UL approved vinyl astragal smoke seal.
- B. Guides to be #12 gauge primed steel. Attach to jamb with 3/8" bolts, 18" maximum spacing. Provide trim to eliminate exposed fasteners.
- C. Equip door for latching by slide bolts.

2.3 DOOR CURTAIN MATERIAL AND CONSTRUCTION – COILING DOORS

- A. Fire door assemblies may be mounted on masonry walls of concrete, brick or filled concrete block (CMU) with expansion anchors. If the hollow CMU blocks are not concrete filled within 18" of the wall opening, the guides must be thru-bolted to hollow block walls with a crush plate on the opposite side of the wall. Guides mounted to soft brick walls must be thru-bolted with a 3" diameter flat washer on the opposite side of the wall.
- B. The guide assemblies may be mounted to structural steel jambs that are an integral part of the masonry wall. Only face mounted guide wall angles may be welded to structural steel jambs on masonry walls, provided the welding rod and welding procedure are as specified in the Manufacturer's installation instruction for rolling fire doors, and provided that the structural steel jamb is an integral part of the masonry wall and linked to the wall by rebar. Between jambs, mounted guide wall angles must be bolted to structural steel jambs on masonry walls.
- C. Guides shall be roll formed steel shapes on doors through to 12' wide, three structural steel angles between jamb mounts.
- D. Bottom bars are two structural steel angles. Sloping bottom bars are available for uneven floor conditions with a limit of 1/2" per foot of opening width. Bottom weather seals are optional.
- E. Curtains shall consist of interlocking curved or flat profile slats with end locks to maintain alignment. Slats shall be roll formed galvanized steel and receive a rust-inhibitive roll-coating process which includes bonderizing, baked-on prime paint, and baked-on polyester topcoat paint in gray or tan.
- F. Hoods and Accessories
 - 1. Hood shall be #24 gauge primed galvanized steel. Intermediate supports shall be provided as required to prevent excessive sag. The hood shall be equipped with a thermally controlled, internal, galvanized steel flame baffle, when required.
- G. Counterbalancing Mechanism
 - 1. Counterbalance shaft assembly shall consist of steel pipe capable of supporting curtain load with maximum deflection of 0.03" per foot of width and helical torsion spring assembly designed for proper balance of door to insure that effort to operate door will not exceed 15 pounds. Provide wheel for applying spring torque and for future adjustment located outside end bracket.

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2.4 MANUAL DOOR OPERATORS

- A. Operation shall be push-up.
- B. Rolling fire and counter fire door shall be equipped with a speed governor activated by melting of either of two (2) fusible links (one on each side of wall) and a closure system which will cause the door to close on a smoke/fire alarm signal. The safety edge will cause the door to stop upon meeting an obstruction and will cause the door to close when the obstruction is removed. Doors shall close at an average speed of not less than 6 inches per second and not more than 24" per second.

2.5 ELECTRIC DOOR OPERATORS

The time delay release device shall be UL listed; power loss, fail safe and FM approved for use in conjunction with the Manufacturer's rolling steel fire doors and counter fire doors, and meet all the latest UL 864 requirements. The device shall respond to emergency conditions through smoke and fire detection devices and alarm systems. The unit can be positioned for operation with the mechanism pulling to the side or downward with a hold/release rating of 40 lbs. and is vibration resistant. The device shall provide a 10-second delay on alarm signal and a 10-second delay on power loss to activate closure of the fire door.

2.6 FINISHES

Galvanized steel curtain slats to be phosphate treated and finished with a baked-on prime coat of paint. Galvanized steel hood and all other exposed ferrous surfaces shall be primed.

SECTION 08 4113 – ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 2 - PRODUCTS

2.1 FINISHES

- A. Exterior window frames shall have baked-on enamel paint finish. Color is to match University standards.
- B. Frames should be white baked-on enamel matching the color of the Fretwell Building.

SECTION 08 4413 – GLAZED ALUMINUM CURTAIN WALLS

PART 2 - PRODUCTS

2.1 FINISHES

- A. Exterior window frames shall have baked-on enamel paint finish. Color is to match University standards.
- B. Frames should be white baked-on enamel matching the color of the Fretwell Building.

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SECTION 08 5000 – WINDOWS

PART 2 - PRODUCTS

2.1 FINISHES

- A. Exterior window frames shall have baked-on enamel paint finish. Color is to match University standards.
- B. Frames should be white baked-on enamel matching the color of the Fretwell Building

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Testing Services: Testing and inspecting of representative areas to determine compliance of installed system with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
 - 1. Water Spray Test: AAMA 501.2 tests to be performed at 5%, 50% and 90% completion to show construction is watertight.

SECTION 08 7100 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes items known commercially as door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. Refer to the characteristics section for each product. The criteria listed in the specifications are based on one manufacturer. No substitution of product will be accepted unless that product meets all the characteristics listed under its respective section.
- C. This Section includes the following:
 - 1. Hinges
 - 2. Key control system
 - 3. Lock cylinders and keys
 - 4. Lock and latch sets
 - 5. Bolts
 - 6. Exit devices
 - 7. Push/pull units
 - 8. Closers
 - 9. Overhead holders
 - 10. Protection plates
 - 11. Weatherstripping for exterior doors
 - 12. Thresholds

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- D. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 08 1113 – Hollow Metal Doors and Frames
 2. Section 08 1416 – Flush Wood Doors
 3. Section 08 4113 – Aluminum – Framed Entrances and Storefronts
 4. Division 20 – Electrical

1.02 REFERENCES

- A. Standards of the following as referenced:
1. American National Standards Institute (ANSI)
 2. Door and Hardware Institute (DHI)
 3. Factory Mutual (FM)
 4. National Fire Protection Association (NFPA)
 5. Underwriters' Laboratories, Inc. (UL)
 6. Warnock Hersey
- B. Regulatory standards of the following as referenced:
1. Department of Justice, Office of the Attorney General, Americans with Disabilities Act, Public Law 101-336 (ADA).
 2. CABO/ANSI A117.1: Providing Accessibility and Usability for Physically Handicap People, 1992 edition.

1.03 SYSTEM DESCRIPTION

- A. Refer to applicable Headings for system description for electric hardware products.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.
- B. Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into vertical format "hardware sets" indicating complete designations of every item required for each door or opening. Use specification Heading numbers with any variations suffixed a, b, etc. Include the following information:
 - a. Type, style, function, size, and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.
 - i. Cross reference numbers used within schedule deviating from those specified.

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- 1) Column 1: State specified item and manufacturer.
 - 2) Column 2: State prior approved substituted item and its manufacturer.
2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
 3. Keying Schedule: Have three meetings with the customer and the UNC Charlotte Key Shop to design and finalize the Keying schedule; an initial meeting to explain the keying requirements and expectations, a second meeting to receive the customer's keying first draft and if required a third meeting to finalize the keying structure. Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled in the electronic format specified. The format will be provided to the designer electronically.
- D. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- E. Contract closeout submittals:
1. Operation and maintenance data: Complete information for installed door hardware.
 2. Warranty: Completed and executed warranty forms.

1.05 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, exit devices, closers, etc.) from a single manufacturer.
1. Refer to the characteristics section for each product. Manufacturers will be considered provided they meet all the performance criteria listed therein.
- B. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.

1.06 QUALITY CRITERIA

- A. Supplier Qualifications:
1. It is recommended that the finish hardware supplier be a factory authorized distributor with office and warehouse facilities within a 50 mile radius of Mecklenburg County, North Carolina.
 2. The finish hardware supplier shall have a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.
 3. The finish hardware supplier shall employ an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the work, for consultation.

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- B. The contractor must schedule a pre-installation conference with the hardware manufacturer's representative(s), a representative of the county planning and/or maintenance department, the contractor's installer and a representative of the hardware supplier to demonstrate product installation and adjustment in accordance with manufacturer's recommendations and Owner's requirements.
- C. The contractor must schedule a pre-construction coordination meeting with Owner's system integrator and electrical contractor for final card access system requirements and all low voltage hardware connection of power supplies, card readers, EL exit devices, electric strikes, power transfers and controllers.
- D. The Contractor must contact the hardware manufacturers' representative to schedule an inspection of the hardware installation to confirm that all products are installed and adjusted according to manufacturer's recommendations. A certificate of compliance shall be submitted with the project closeout documents.

NOTE: Failure to schedule and perform required meetings shall not be cause for additional costs to the Owner.

1.07 PRODUCT HANDLING

- A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).
- E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.08 WARRANTY

- A. Special warranties:
 - 1. Door Closers: Ten year period
 - 2. Exit Devices: Three year period
 - 3. Locks and Cylinders: Three year period
(Manufacturer's whose standard warranty does not equal, or exceed the requirements listed above must provide a letter for each project stating that they will extend their warranty to comply with the requirements of the specification.)

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1.09 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware. Warranty start and end date.

1.10 KEY SYSTEMS

- A. All access control systems to include panic buttons and licensing. Camera system to include licensing and storage and be included as part of the project.

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PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Hinges:

1. Manufacturer:
 - a. Ives
 - b. Stanley
 - c. Hager
 - d. McKinney
2. Characteristics:
 - a. Templates: Provide only template-produced units.
 - b. Screws: Provide Phillips flat-head screws complying with the following requirements:
 - 1) For metal doors and frames install machine screws into drilled and tapped holes.
 - 2) For wood doors and frames install threaded-to-the-head wood screws.
 - 3) For fire-rated wood doors install #12 x 1-1/4 inch, threaded-to-the-head steel wood screws.
 - 4) Finish screw heads to match surface of hinges or pivots.
 - c. Hinge pins: Except as otherwise indicated, provide hinge pins as follows:
 - 1) Interior Doors: Non-rising pins.
 - 2) Tips: Flat button and matching plug. Finished to match leafs.
 - d. Size: Where hinges are specified, unless otherwise noted, they shall be of the types and sizes as follows:
 - 1) EXTERIOR DOORS:
 - a) Use continuous hinges at all exterior doors.
 - 2) INTERIOR DOORS:
 - a) 1-3/4" thick - up to 3'0", 5BB1 -26D, 4-1/2"
 - b) 1-3/4" thick - over 3'0" wide, 5BB1HW -26D, 5"
 - 3) The width of hinges shall be sufficient to clear all trim.
 - e. Quantity: Furnish one pair of hinges for all doors up to 5'0" high. Furnish one additional hinge for each additional 2-1/2 feet or fraction thereof.

B. Continuous Hinges:

1. Acceptable manufacturers:
 - a. Ives*
 - b. Select Products
 - c. Markar
2. Characteristics
 - a. Continuous gear hinges to be manufactured of extruded 6063-T6 aluminum alloy with anodized finish or factory painted finish, as scheduled.
 - b. All hinges to be manufactured to template. Uncut hinges to be non-handed and to be a pinless assembly of three interlocking extrusions applied to the full height of the door and frame without mortising.
 - c. Vertical door loads to be carried on chemically lubricated polyacetal thrust bearings. The door and frame leaves to be continually geared together for the entire hinge length and secured with a full cover channel. Hinge to operate to a full 180 degrees.
 - d. Hinges to be milled, anodized and assembled in matching pairs. Fasteners to be steel, self-drilling, self-tapping 12-24 x 3/4" screws.

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- C. Keying and Key Control:
1. Manufacturer:
 - a. Schlage Lock Company
 2. Characteristics:
 - a. All building key systems shall conform to the Campus Keying structure.
 - 1) Schlage Everest D for Interior Keys
 - 2) Schlage Everest D for Campus Mechanical Keys
 - 3) Schlage Primus C for Campus Entry Keys
 - b. All keys shall be Blank Bow both sides
 - c. Supply 1 change key for each key symbol used
 - d. Provide no keys with the cylinders
 - e. Provide keyblanks to equal 3 blanks per cylinder
- D. Mortise Locksets (Exterior, Non-Storefront, as scheduled):
1. Characteristics:
 - a. Chassis: Cold-rolled steel, handing field-changeable without disassembly.
 - b. Latchbolts: 3/4-inch throw stainless steel anti-friction type.
 - c. Lever Trim: Through-bolted, accessible design, cast or solid rod lever as scheduled.
Spindles: Independent break-away.
 - d. Thumbturns: Accessible design not requiring pinching or twisting motions to operate.
 - e. Deadbolts: Stainless steel 1-inch throw.
 - f. Electric operation: Manufacturer-installed continuous duty solenoid.
 - g. Strikes: 16 gage curved stainless steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.
 - h. **Scheduled Lock Series and Design: Schlage L series, 06A design.**
 - i. Certifications:
 - 1) ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
 - 2) ANSI/ASTM F476-84 Grade 30 UL Listed.
- E. Extra Heavy Duty Cylindrical Locks and Latches (Interior): as scheduled, fastened with through-bolts, shall be used on all interior doors.
1. Characteristics:
 - a. All lock functions shall incorporate a Vandalguard function where the outside is disengaged when in the locked mode. Vandalguard locks shall carry a 7 Year Warranty.
 - b. All locks and shall be prepared to accept 6-pin Large Format Interchangeable Cores (LFIC).
 - c. Chassis: Cylindrical design, corrosion-resistant plated cold-rolled steel.
 - d. Locking Spindle: Stainless steel, interlocking design.
 - e. Latch Retractors: Forged steel. Balance of inner parts: Corrosion-resistant plated steel, or stainless steel.
 - f. Lever Trim: Accessible design, independent operation, spring-cage supported, minimum 2" clearance from lever mid-point to door face.
 - g. All lock functions: 7 year warranty, Vandalguard function outside lever is disengaged when in the locked mode.
 - h. Rosettes: Minimum 3-7/16" diameter for coverage of ANSI/DHI A115.18, 1994 door preparation, through-bolt lugs on both spring cages to fully engage this pattern.
 - i. Springs: Full compression type.
 - j. Strikes: 16 gage curved steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.
 - k. **Lock Series and Design: Schlage ND series, Rhodes design.**
 - l. Certifications:
 - 1) ANSI A156.2, 1994, Series 4000, Grade 1. Tested to exceed 3,000,000

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- cycles.
- 2) UL listed for A label single doors up to 4 ft x 8 ft.

F. Exit Devices:

1. **Manufacturer: Von Duprin, 98/99 Series – Owner Preferred**
2. Electronic access points shall be Von Duprin QEL98/99 electric panic hardware operated by Owner's existing electronic access control system.
 - a. EL devices shall use a 16 amp solenoid to activate a mechanical linkage to retract the latch.
 - b. Power supplies shall be Von Duprin PS900 Series.
3. Conduit and necessary wiring shall be provided under Section 01600. See Owner's standard detail in Electrical 01600.
4. Characteristics:
 - a. All exit devices shall be of one manufacturer.
 - b. All exit devices shall have US32D touchpads. All finished parts that are not US32D shall be US26D, to the standard architectural finishes. No painted finish shall be allowed.
 - c. All exit devices shall be flush mounted. Provide manufacturer's standard shim kit to accommodate moulding for glass and vision lites. Exit devices that are not flush mounted must provide a filler bar on those doors where conflict with moulding for glass vision lites is not an issue.
 - d. Exit devices shall be attached with sex nuts and bolts on all doors. Finish on all exposed fasteners shall match devices.
 - e. On exterior pairs of doors, provide keyed removable mullions. Refer to the drawings and door schedule for locations of keyed movable mullions.
 - f. Lever handle operating trim for exit devices shall be of heavy duty construction, incorporating cast or heavy solid forged escutcheons and levers. Where listed in the hardware sets, provide "breakaway" lever incorporating an internal clutch mechanism allowing the lever to break away and drop into a "down" position when more than 35 pounds of torque are applied. Lever shall be easily reset to its operating position by a simple uplift motion.
 - g. Exit devices shall be "UL" listed for life safety. All exit devices for fire rated openings shall have "UL" labels for "Fire Exit Hardware."
 - h. All exit devices mounted on labeled wood doors shall be mounted on the door per the door manufacturer's requirements. (OWNER PREFERS EXIT DEVICES TO BE THRU-BOLTED, EVEN ON NON-RATED DOORS.)
 - i. All trim shall be thru-bolted to the lock stile case. Lever design to match locksets.
 - j. All exit devices shall be made of brass, bronze, stainless steel, or aluminum material, plated or powder coated to the standard architectural finishes to match the balance of the door hardware. Painted finishes are not accepted.
 - k. Provide glass bead conversion kits to shim exit devices on doors with raised glass heads.
 - l. Dogging mechanism shall be "hook and eye" type. No plastic dogging cams or friction type dogging mechanism shall be allowed.
 - m. Equip rim exit devices with a roller strike.
 - n. All exit devices shall be non-handed.
 - o. Touchpad shall extend a minimum of 1/2 of the door width. Touchpad height shall exceed height of mechanism case or rail assembly to eliminate pinch points. If touchpad height does not exceed height of mechanism case/rail assembly provide factory installed insert/filler on top and bottom of touchpad along mechanism case/rail assembly to prevent pinch point. Plastic touchpads are not acceptable.
 - p. All latchbolts to be the deadlocking type. Latchbolts shall have a self-lubricating coating to reduce wear. Plated or plastic coated latchbolts are not acceptable.
 - q. Provide removable mullions controlled by a key cylinder under the masterkey system.

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- r. At specific locations, such as the Media Center, Auditorium, Administrative areas, etc. equip exit devices with a fluid dampening device to reduce noise associated with the operation of the exit device.
 - s. Exit devices to include impact resistant, flush mounted end cap design to avoid damage due to carts and other heavy objects passing through an opening. End cap shall be of heavy-duty metal alloy construction and provide horizontal adjustment to provide alignment with device cover plate. When exit device end cap is installed, no raised edges will protrude.
- G. Closers and Door Control Devices:
- 1. Manufacturer: LCN, 4040XP Series X Non-Metal Cover
 - 2. Characteristics:
 - a. Door closers shall be overhead type and have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.
 - b. Closers utilizing pressure relief valves (PRV) are not acceptable.
 - c. ALL CLOSERS TO BE ATTACHED USING HEX NUTS AND BOLTS ONLY.
 - d. All fire rated doors shall have closers. Closers shall not be installed on classroom doors unless required by Fire Marshal's office.
 - e. Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F (49 degrees C) to -30 degrees F (-35 degrees C).
 - f. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed and back check. Closers shall be sized in accordance with manufacturer's recommendation.
 - g. All closers shall have solid forged steel main arms (and forearms for parallel arm closers) and, where specified, shall have a cast-in solid stop on the closer shoe ("cush"). Where door travel on out-swing doors must be limited, use "cush" type closers. Auxiliary stops are not required when "cush" type closers are used. Tri-Pack arm assemblies are not acceptable. At exterior doors, EDA arms with Ives FS18S floor stop is preferred. Provide SCUSH arms where door does not swing to a wall or where a floor stop may create a tripping hazard.
 - h. All closers shall be certified to exceed ten million (10,000,000) full load cycles by a recognized independent testing laboratory. All closers (overhead, surface and concealed) shall be of one manufacturer and carry manufacturer's ten year warranty (electric closers to have two year warranty).
 - i. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped. Provide adjustable units complying with ADA and ANSI A-117.1 provisions for door opening force.
 - j. Closers to be installed to allow door swing as shown on plans. Doors swinging into exit corridors shall provide for corridor clear width as required by code. Where possible, mount closers inside rooms.
 - k. Provide powder coated finish, certified to exceed 100 hours salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification. Lacquer or painted finish on metal components is not acceptable.
 - l. Where indicated provide power for future ADA operators. Basis of design is LCN Senior Swing 9500 Series. Actuators are to be wired or wireless depending on the situation, with wireless being the fall back when wired is not possible.
- H. Overhead Door Holders:
- 1. Manufacturer: Glynn Johnson
 - 2. Characteristics:
 - a. Provide heavy duty door holders of stainless steel.
 - b. Holder to be installed with the jamb bracket mounted on the stop.

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3. Products by the following manufacturers will be considered, provided they meet all the characteristics listed above:
 - a. Rixson Firemark

- I. Floor Stops and Wall Bumpers:
 1. Manufacturer: Ives
 2. Characteristics: Refer to Headings.
 3. Products by the following manufacturers will be considered, provided they meet all the characteristics listed above:
 - a. Trimco
 - b. Rockwood Manufacturing
 4. At exterior doors, Ives FS18S floor stops are preferred. Provide LCN SCUSH closers where door does not swing to wall or where a floor stop may create a tripping hazard.

- J. Push Plates:
 1. Manufacturer: Ives
 2. Characteristics:
 - a. Exposed Fasteners: Provide manufacturers standard exposed fasteners.
 - b. Material to be stainless steel, per the hardware headings.
 - c. Provide plate size as shown in hardware headings.
 3. Products by the following manufacturers will be considered, provided they meet all the characteristics listed above:
 - a. Trimco
 - b. Rockwood Manufacturing

- K. Door Pulls & Pull Plates:
 1. Manufacturer: Ives
 2. Characteristics:
 - a. Provide concealed thru-bolted trim on back to back mounted pulls, but not for single units.
 - b. Material to be forged stainless steel.
 - c. Provide units sized as shown in hardware headings.
 3. Products by the following manufacturers will be considered, provided they meet all the characteristics listed above:
 - a. Trimco
 - b. Rockwood Manufacturing

- L. Protective Plates:
 1. Manufacturer: Ives
 2. Characteristics:
 - a. Provide manufacturers standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
 - b. Materials:
 - 1) Metal Plates: Stainless Steel, .050 inch (U.S. 18 gage).
 - c. Fabricate protection plates not more than 1-1/2 inches less than door width on push side and not more than 1/2 inch less than door width on pull side. Bevel all edges.
 - d. Heights:
 - 1) Kick plates to be 8 inches in height.
 - 2) Mop plates to be 8 inches in height.
 - 3) Armor plates to be 30 inches in height.
 3. Products by the following manufacturers will be considered, provided they meet all the characteristics listed above:
 - a. Trimco
 - b. Rockwood Manufacturing

- M. Thresholds:

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1. Acceptable manufacturers:
 - a. National Guard Products, Inc.*
 - b. Pemko Manufacturing Company
 - c. Zero Weatherstripping Co., Inc.
 2. Types: Indicated in hardware headings, and shown in sill details.
- N. Weatherstripping:
1. Acceptable manufacturers:
 - a. National Guard Products, Inc.*
 - b. Pemko Manufacturing Company
 - c. Zero Weatherstripping Co., Inc.
 2. Types: Silicone rubber seals as indicated in hardware headings.
- O. Silencers:
1. Acceptable manufacturers:
 - a. Hager
 - b. Ives
 - c. Rockwood Manufacturing*
 2. Three for each single doors; four for pairs of doors.
- P. Magnetic Door Holders:
1. Acceptable manufacturers:
 - a. LCN*
 - b. Rixson-Firemark
 - c. Edwards
 2. Wall mounted 24vdc units with finish to match door hardware
- Q. Key Cabinet and System:
1. Acceptable manufacturers:
 - a. Key Systems Inc. (32 Key Minimum)
 - b. GFMS Keybox – card access
 - c. Alladin
 2. Key cabinet shall be delivered directly to the Owner's representative.
 3. Need Power and Ethernet to the cabinet
 4. Add security camera, opposite cabinet with Ethernet connection.
- R. 49er Card Systems
1. Please see 03 – Annex K – 49er Card Systems, see Residence Halls.

2.02 MATERIALS AND FABRICATION

- A. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.
1. Manufacturer's identification will be permitted on rim of lock cylinders only.
- B. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

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- C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
 - 1. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.
 - 2. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
 - 3. USE THRU-BOLTS FOR INSTALLATION OF ALL EXIT DEVICES, CLOSERS AND SURFACE-MOUNTED OVERHEAD STOPS. COORDINATE WITH ALUMINUM DOORS AND FRAMES, WOOD DOORS AND HOLLOW METAL DOORS AND FRAMES. WHERE THRU-BOLTS ARE USED, PROVIDE SLEEVES FOR EACH THRU-BOLT AS A MEANS OF REINFORCING THE WORK OR USE SEX NUTS AND BOLTS.

2.03 HARDWARE FINISHES

- A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).
- B. Provide finishes that match those established by ANSI or, if none established, match the Architect's sample.
- C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- D. The designations used to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.
 - 1. Hinges (Interior wood doors): 652 (US26D) Satin Chrome Plated Steel
 - 2. Hinges (Interior metal doors): 600 (USP)
 - 3. Continuous Hinges (Exterior): 628 (US28) Clear Anodized Aluminum
 - 4. Locks, Mortise: 630 (US32D) Satin Stainless Steel
 - 5. Locks, Cylindrical : 626 (US26D) Satin Chrome
 - 6. Exit Devices: 626 (US26D), 630 (US32D), 628 (US28)
 - 7. Door Closers: 689 (Powder Coated)
 - 8. Push Plates: 630 (US32D) Satin Stainless Steel
 - 9. Pull Plates: 630 (US32D) Satin Stainless Steel
 - 10. Protective Plates: 630 (US32D) Satin Stainless Steel
 - 11. Door Stops: 630 (US32D) Satin Stainless Steel or 626 Satin Chrome Plated Brass/Bronze
 - 12. Overhead Holders: 630 (US32D) Satin Stainless Steel
 - 13. Thresholds: 627 (US27) Mill Finish Aluminum
 - 14. Weatherstrip: 628 (US28) Clear Anodized Aluminum

2.4 SLIDING DOOR HARDWARE

Automatic Sliding Doors: Automatic sliding doors are not acceptable unless specifically requested by the University Project Manager.

2.5 OPERATORS

- A. All visible materials shall match the existing storefront finish.
- B. All materials shall be new and shall be manufactured for the intended use. No manufacturer's or installer's logos or other decals or signs will be attached to the storefront without authorization of the Owner.

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- C. All materials installed by the Contractor shall be new and UL Approved. All materials shall meet N.C. State Building Codes, and should there be any discrepancies between design and code, the more stringent requirement shall apply.
- D. The operating device installed shall allow for manual operation for persons entering the building who do not use the activating button(s). Such manual operation shall be possible without noticeable additional force by the user (compared to the force necessary prior to the installation).
 - 1. Pneumatic Door Openers:
 - a. Control Boxes shall contain the system air pump, valve(s) and electronics. Each circuit shall control one automatic equalizer operator.
 - b. Operators shall be pneumatically powered for the automatic equalizer system. The unit shall contain a built-in over speed control to prevent excessive speeds as the result of improper field adjustments. The operator shall slowly open the door, hold it at 90°, and then apply full spring power to close the door. The operators shall meet ADA requirements, ANSI Standards A159.19 and A117.1, and have been tested to over one and a half million operating cycles.
 - c. The door controlling devices shall be constructed with two integral operating chambers, a pneumatic cylinder actuator and a hydraulic door closer cylinder. The actuator shall be two piston tandem constructions. Cylinders shall be of high strength cast iron construction, be fully hydraulic, and shall have rack and pinion action. The shaft diameter shall be a minimum of 11/16 of an inch (17 mm). Closers shall utilize full complement bearings on the pinion shaft, and pistons shall be hardened.
 - 2. Electro-Magnetic Operators:
 - a. Wall mounted card reader shall be BLACKBOARD 4200 Series for exterior entry and exit.2.4
 - b. Control Boxes shall contain the transformer, relays, rectifiers and other electronic components. Each circuit shall control one automatic operator.
 - c. Operators shall be electro-mechanically powered for the automatic swing door system. The unit shall contain a built-in over speed control to prevent excessive speeds as the result of improper field adjustments. The operator shall slowly open the door, hold it at 90°, and then apply full spring power to close the door. The operators shall meet ADA requirements, ANSI Standards A159.19 and A117.1, and have been tested to over one million operating cycles.
 - d. The door controlling devices shall be completely assembled and sealed unit which shall include helical gear-driven transmission, overriding clutch, (to provide easy manual operation, spring-close) mechanical spring and bearings, all located in cast aluminum housing and filled with special lubricant including necessary transformer, cant for extreme temperature conditions. Attached to transmission system shall be a DC shunt-would permanent magnet motor with sealed ball bearings. Motor shall operate from 115-volt supply and require less than 5 amps at full power stall. Complete unit shall be resilient mounted with provisions for easy replacement, without removing door from pivots or frame.
 - e. Mounting height for card readers shall be 36" AFF.
 - f. Mounting height for automatic door openers shall be 36" AFF and 24" away from an inside corner. Opening of door shall not require operator to back up as door opens. Doors at vestibule locations shall be coordinated as to means of operation.

2.6 MISCELLANEOUS

- A. At all new doors, Contractor shall install ½" diameter rubber silencers, (minimum 3 per door) Glynn Johnson #64 or equal. Products of equal design, finish, and functions as manufactured by Baldwin, Ives, Rockwood, Quality, or Trimco will be considered equal.
- B. All exterior screws and fasteners shall be Stainless Steel, preferably with "Phillips" heads.

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PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
 - 1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
 - a. On doors with glass lite kits, coordinate the mounting height of the exit devices so that the devices are not visible through the glass on the pull side of the door.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers."
- F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.02 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
 - 1. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Door Hardware Supplier's Field Service
 - 1. Inspect door hardware items for correct installation and adjustment after complete installation of door hardware.
 - 2. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.
 - 3. File written report of this inspection to Architect.

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3.03 HARDWARE SCHEDULE

A. HW SET:

DOOR NUMBER:

TYPICAL HOLLOW METAL DOOR EXTERIOR ENTRY PAIR – PREPPED FOR FUTURE ADA OPERATOR

EACH TO HAVE:

1	CONTINUOUS HINGE	224HD	IVE
1	CONTINUOUS HINGE	224HD CUT FOR EPT	IVE
1	POWER TRANSFER	EPT-10	VON
1	MULLION	KR4954	VON
1	EXIT DEVICE	99DT	VON
1	EXIT DEVICE	HD-EL99NL	VON
1	MORTISE CYLINDER	80-132	SCH
1	RIM CYLINDER	80-159	SCH
2	CYLINDER CORES	80-037	SCH
1	CARD READER	BY SYSTEMS INTEGRATOR	
1	POWER SUPPLY	PS914-2RS-BB	VON
2	DOOR POSITION SWITCHES	679-05 HM	SCE
2	SURFACE CLOSERS	4041 EDA MC	LCN
2	KICK PLATES	8400	IVE
2	FLOOR STOP	FS18S	IVE
1	THRESHOLD	425	NGP
1	SET SEALS	5050B	NGP
2	DOOR SWEEPS	C627A	NGP
1	MULLION SEAL	5100S	NGP
1	DRIP CAP	16A	NGP

COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEM WIRING FOR ALL ELECTRIC SECURITY ITEMS TO BE IN CONDUIT OR FLEX FROM FRAME CONNECTION TO ABOVE DROPPED CEILING.

PREP HEAD OF FRAME FOR 120VAC FOR FUTURE ADA OPERATOR.

B. HW SET:

DOOR NUMBER:

TYPICAL ALUMINUM DOOR EXTERIOR ENTRY PAIR

EACH TO HAVE:

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1	CONTINUOUS HINGE	112HD	IVE	
1	CONTINUOUS HINGE	112HD CUT FOR EPT	IVE	
1	POWER TRANSFER	EPT-10	VON	
1	MULLION	KR4954	VON	
1	EXIT DEVICE	99DT	VON	
1	EXIT DEVICE	HD-EL99NL	VON	
1	MORTISE CYLINDER	80-132 (FOR KR)	SCH	
1	RIM CYLINDER	80-159	SCH	
2	CYLINDER CORES	80-037	SCH	
1	CARD READER	BY SYSTEMS INTEGRATOR		
1	POWER SUPPLY	PS914-2RS-BB	VON	
2	DOOR POSITION SWITCHES		679-05	SCE
2	SURFACE CLOSERS	4041 EDA MC X 30/61	LCN	
2	FLOOR STOP	FS18S	IVE	
1	THRESHOLD	425	NGP	
1	SET SEALS	BY DOOR MANUFACTURER		
2	DOOR SWEEPS	BY DOOR MANUFACTURER		
1	MULLION SEAL	BY DOOR MANUFACTURER		
1	DRIP CAP	16A	NGP	

COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEM WIRING FOR ALL ELECTRIC SECURITY ITEMS TO BE IN CONDUIT OR FLEX FROM FRAME CONNECTION TO ABOVE DROPPED CEILING

C. HW SET:

DOOR NUMBER:

TYPICAL ALUMINUM DOOR EXTERIOR ENTRY PAIR – PREPPED FOR FUTURE ADA OPERATOR

EACH TO HAVE:

1	CONTINUOUS HINGE	112HD	IVE	
1	CONTINUOUS HINGE	112HD CUT FOR EPT	IVE	
1	POWER TRANSFER	EPT-10	VON	
1	MULLION	KR4954	VON	
1	EXIT DEVICE	99DT	VON	
1	EXIT DEVICE	HD-EL99NL	VON	
1	MORTISE CYLINDER	80-132 (FOR KR)	SCH	
1	RIM CYLINDER	80-159	SCH	
2	CYLINDER CORES	80-037	SCH	
1	CARD READER	BY SYSTEMS INTEGRATOR		
1	POWER SUPPLY	PS914-2RS-BB	VON	
2	DOOR POSITION SWITCHES		679-05	SCE
2	SURFACE CLOSERS	4041 EDA MC X 30/61	LCN	
2	FLOOR STOP	FS18S	IVE	
1	THRESHOLD	425	NGP	
1	SET SEALS	BY DOOR MANUFACTURER		
2	DOOR SWEEPS	BY DOOR MANUFACTURER		
1	MULLION SEAL	BY DOOR MANUFACTURER		
1	DRIP CAP	16A	NGP	

COORDINATE SECURITY HARDWARE WITH SECURITY AND ELECTRICAL SYSTEM

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WIRING FOR ALL ELECTRIC SECURITY ITEMS TO BE IN CONDUIT OR FLEX FROM
FRAME CONNECTION TO ABOVE DROPPED CEILING
PREP HEAD OF FRAME FOR 120VAC FOR FUTURE ADA OPERATOR.

- D. HW SET:
DOOR NUMBER:
TYPICAL CLASSROOM
EACH TO HAVE:
- | | | | |
|---|----------------|----------|-----|
| 3 | HINGES | 5BB1 | IVE |
| 1 | CLASSROOM LOCK | ND95HD | SCH |
| 2 | CYLINDER CORE | 80-037 | SCH |
| 1 | WALL STOP | WS407CCV | IVE |
| 1 | SET SEALS | 5050B | NGP |
- E. HW SET:
DOOR NUMBER:
TYPICAL OFFICE
EACH TO HAVE:
- | | | | |
|---|---------------|----------|-----|
| 3 | HINGES | 5BB1 | IVE |
| 1 | OFFICE LOCK | ND92HD | SCH |
| 1 | CYLINDER CORE | 80-037 | SCH |
| 1 | WALL STOP | WS407CCV | IVE |
| 1 | COAT HOOK | 571MB26D | IVE |
- F. HW SET:
DOOR NUMBER:
TYPICAL SINGLE TOILET
EACH TO HAVE:
- | | | | |
|---|-------------|----------|-----|
| 3 | HINGES | 5BB1 | IVE |
| 1 | PRIVACY SET | ND40 | SCH |
| 1 | WALL STOP | WS407CCV | IVE |
| 1 | SET SEALS | 5050B | NGP |
| 1 | COAT HOOK | 571MB26D | IVE |

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- G. HW SET:
DOOR NUMBER:
TYPICAL CROSS CORRIDOR PAIR OF DOORS ON MAGNETIC HOLD OPEN
EACH TO HAVE:

6	HINGES	5BB1HW	IVE
2	EXIT DEVICES	9927 L LBR	VON
2	RIM CYLINDER	80-159	SCH
2	CYLINDER CORE	80-037	SCH
2	SURFACE CLOSERS	4041 EDA MC	LCN
2	KICK PLATES	8400	IVE
2	MAGNETIC HOLD-OPENS	SEM 7850	LCN
1	SET SEALS	5050B	NGP

MAGNETIC HOLD-OPEN TO BE WIRED TO FIRE ALARM SYSTEM BY ELECTRICAL SECTION

- H. HW SET:
1 KEY CABINET TCA-334-S TEL

SECTION 08 8000 – GLAZING

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Manufacturer's Certification: Contractor shall provide a signed certification by the glass manufacturer that the completed glass and frame installation is in compliance with manufacturer's recommended procedure and that the glass manufacturer's warranty is valid. Prior to installations, Contractor shall notify the glass manufacturer of installation schedule to allow for manufacturer's inspection throughout installation.
- B. Etched Insignia: Every panel of glass shall have the manufacturer's insignia identifying the type of glass. Labels must be permanently etched and visible when project is complete. Wire glass is not required to have the etched insignia.
- C. Manufacturer's Labels: Labels showing strength, grade, thickness, type and quality will be required on each piece of glass. Labels must remain on glass until it has been set in inspection. In addition to Manufacturer's Labels wire glass must comply with the requirements of the Underwriter's Laboratories, Inc.

PART 2 - PRODUCTS

2.1 SEALANTS.

- A. Sustainable Requirements:
VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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2.2 MISCELLANEOUS ACCESSORIES

Spacer Blocks: Material sufficiently firm to hold glass in position and compatible with glazing sealant.

2.3 GLASS TYPES

- A. Glass will be clear. A slight tint is acceptable if it allows clear views into the building. The intent is for passersby to be able to see activity within the building.
- B. Wire glass requirements as listed below were deleted due to safety concerns relating to injury that occurs if when glass is broken.
- C. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
- D. Wire Glass is unacceptable.
- E. Insulating Glass:
 - 1. Made up of 1 panes of glass, with dehydrated air automatically sealed, and surrounded by metal channel.
 - 2. Designated as Type G-1 on Drawings: Interior panes shall be 1/4" thick clear tempered float glass.
 - 3. Designated as Type G-2 on Drawings: Interior panes shall be 1/4" thick wire glass.
- F. Tempered Glass (Designated as Type G-1 on Drawings): Tempered clear float glass. One of the following:
 - 1. Tempered Glass as mfd. by ASG Industries, Inc.
 - 2. Tuf-Flex as mfd. by LOF.
 - 3. Herculite as mfd. by PPG Industries, Inc.
 - 4. Or approved equal.
- G. Replacement Glass: Replacement glass must be installed with new resilient gaskets at locations where gaskets existed prior to replacement.

SECTION 08 8300 – MIRRORS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Must be of high quality providing maximum performance and durability.
- B. It must exceed federal specification #DO-M-00411C made from primary float (Type 1) clear (Class 1) glass in accordance with ASTM C1036-85 and federal specification DD 9-451 d with QZ quality.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. BMP 1,000 or equal.
- B. The backing must consist of a layer of copper electrolytically deposited directly over the silver surface with a single layer of protective mirror backing paint applied over the metal stratum.

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- C. The mirrors must comply with salt spray testing in accordance with ASTM B117 with quality in accordance to DDM-411C it must pass 1800 hours of salt spray and 1½ mm edge creep penetration.

2.2 SEALANTS

- A. Sustainable Requirements:
 - VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

SECTION 08 9000 – LOUVERS AND VENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Aluminum gable roof vents shall be provided and installed by the Contractor in accordance with industry standards.
- B. Each Bidder shall reference attached drawings for details of construction.
- C. The related details on the drawings are considered to be a part of specified job requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

Gable roof vents shall be "airolite" Aluminum Vents available from Kuester Sales Co., Inc., or approved equivalent. Bidders may submit alternate aluminum gable vents, but should provide proposed vent information and literature along with their bids for full consideration.

2.2 FINISHES

Gable vents shall have a dark brown baked enamel finish,

2.3 ACCESSORIES

- A. Insect screen and six square feet of free area each.
- B. All fasteners shall be manufactured for the intended use and shall be non-corrosive. All materials installed by the Contractor shall be new. All materials shall meet NC State Building Codes and should there be any discrepancies between design and code, the more stringent requirements shall apply.

PART 3 - EXECUTION

3.1 INSTALLATION INSTRUCTIONS

- A. The Contractor shall furnish all equipment, materials, and labor for the construction of the exterior roof outlined by the drawings and in this specification.
- B. The Contractor shall take all means necessary to protect existing roof surfaces, finishes, and adjacent walls from damage during the vent replacement by installation of vancas tarps and polyethylene.

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- C. All canvas tarps, polyethylene, tape, etc., shall be removed upon completion and the job site left in a clean condition. Any damage areas shall be repaired by Contractor at his expense prior to completion of the job.
- D. Existing gable vents, flashing, and rotted wood (including all blocking, siding, and trim boards) will be properly removed by the Contractor and replaced with new. New aluminum gable roof vents, blocking, siding, trim boards, flashing etc. will be installed in accordance with standard industry methods and shall provide a weatherproof fit.
- E. Contractor shall install step flashing at the joints between the sloping roof and the vertical wall (some lap siding may have to be removed and replaced with new siding to install the gable vents and step flashing properly).
- F. The Contractor shall adequately protect exposed roofs, attic space and buildings to prevent building or content damage by inclement weather conditions.
- G. For each building the Contractor shall have all necessary materials "on hand" prior to beginning work on any building.
- H. All greenery in the area such as trees, shrubs, grass, flowers, etc. shall be fully protected from damage. Any such damage shall be immediately corrected to the original condition by the Contractor. Prior to working on any building, the Contractor should bring "pre-existing" damage to the attention of the Owner's job representative.
- I. As each building is completed, the Contractor shall magnetically sweep the ground around each building for nails, and remove any nails found.

SECTION 2
DIVISION 09
FINISHES

DIVISION 9 - FINISHES

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s contract documents.

GENERAL

1.1 GENERAL:

- A. Maintenance stock for each color, type, pattern, etc. of the following materials shall be provided. Each shall be packaged, protected, identified, and stored per guidance of the owner’s representative.
1. Carpet – 2% of installed amount
 2. Paint – 1 gallon of each type and color.
 3. Wall Covering – 5 linear yards.
 4. Tile (floor, wall, ceiling, etc.) – 2% of installed amount.

1.2 COLORS

- A. A color board and color schedule shall be submitted to UPM during design for approval. These colors shall be noted in the construction documents as a general guide. Samples of materials and colors from the actual manufacturers to be used shall be obtained from the contractor and assembled by the designer into a final color board soon after construction begins. This board will be submitted to the UPM who will obtain approvals as necessary. Approvals will be provided in writing to the designer.
1. UNC Charlotte official colors:
 - a. Green (PMS 349) and white. Gold (PMS8005 or PMS 465) is used in Athletic Marks but is not an official school color.
 2. Exterior Signage
 - a. See “Campus Signage Standards” dtd Nov. 13, 1998. Annex D.
 3. Interior Signage
 - a. By ASI Sign Systems or approved equal.
 4. Exterior Windows and Trim:
 - a. White to match Fretwell Building
 5. Exterior equipment and fixtures such as posts, bicycle racks, railings, bollards, IT cabinets, traffic signal cabinets, HVAC equipment, generators, and other visible items.
 - a. Dark Green: ‘Black Green’.
Manufacturer: Matthews Paint Co.
Paint Code: MP21337 R91290 - Satin Finish
Satin Clear overcoat
 - b. Light Green: Campus Green
Manufacturer: Matthews Paint Co.
Paint Code: MP00457 R91290 - Satin Finish
Satin Clear overcoat
 - c. Gold: Campus Gold
Manufacturer: Matthews Paint Co.
Paint Code: 64600SP 42228SP – Satin Finish
Satin Clear overcoat
 - d. Verify with PM all exterior colors.
 6. Mechanical Room Colors:
 - a. Ceilings and walls – white
 - b. Floors – dark gray
 - c. Hand rails – dark gray

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- d. Air dryer, air receiver, & compressor – light blue
 - e. Blowdown separator & blow off tank – dark green
 - f. Boiler, Burner & combustion control – dark gray
 - g. Chemical feed – purple
 - h. Condensate receiver & polisher – medium blue
 - i. Deaerator – dark blue
 - j. Flash tank – medium green
 - k. Heat exchanger – light green
 - l. Oil pump – medium orange
 - m. Silencer – light orange
 - n. Softeners – medium blue
7. Piping color codes:
- a. Bottom blowout – dark green
 - b. Breeching – medium brown
 - c. Chemical feed – purple
 - d. Chilled water – lime
 - e. City water – light blue
 - f. Compressed air – white
 - g. Condensate – medium blue
 - h. Continuous blowdown – medium green
 - i. Drain lines – dark brown
 - j. Fire protection – red
 - k. Fuel oil – black
 - l. Gratings and platforms – medium gray
 - m. High pressure steam – light orange
 - n. Hot water – dark blue
 - o. Low pressure steam – yellow
 - p. Natural gas – turquoise
 - q. Treated water (feed water) – medium blue
 - r. Vents – light gray
8. Note: Stencil labels may be required when the 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.

1.3 ACOUSTICAL TREATMENT

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

SECTION 09 2216 – NON-LOAD-BEARING STEEL FRAMING

PART 1 - GENERAL

A. SUSTAINABILITY

- 1. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 60 percent

PART 2 - PRODUCTS:

2.1 GENERAL:

- A. For purposes of designating type and quality, this Section is based on products manufactured by United States Gypsum (or approved equal).

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- B. The stud and runner system shall be in compliance with ASTM C 645, including requirements for minimum thickness. Manufacturers include: Dale Industries, Dietrich Industries, (or approved equal).
- C. Ceiling and soffit framing system for furred and suspended gypsum board ceilings shall be USG (or approved equal) drywall ceiling system, designed for screw attachment of gypsum board, furnished with required fasteners and accessories for complete system.

2.2 FURRING CHANNELS SHALL BE AS FOLLOWS

- A. Furring channels for gypsum board applied to ceiling and soffit framing shall be hat-shaped USG (or approved equal) drywall furring channels, roll-formed from not less than 25 gauge galvanized steel, 2-3/4" wide by 7/8" deep with 1/2" minimum wing flanges and 1-3/8" minimum crown width for gypsum board attachment.
 - 1. Furring channels for dropped ceilings, soffits, and where indicated at expansion joints shall be C-shaped studs, formed from not less than 25 gauge galvanized steel sheets, and of size indicated on drawings.
 - 2. Main Runners shall not be less than 16 gauge USG (or approved equal) cold-rolled channels, 1-1/2" web width with 19/32" flange.
 - a. Tie Wire shall be not less than 16 gauge soft annealed wire.
 - b. Hanger Wire shall be 9 gauge galvanized hanger wire.
 - c. Clips shall be galvanized wire USG furring channel clips.
 - d. The Mechanical and/or Plumbing Contractor shall furnish to the General Contractor for installation into the wall and/or ceiling framing all access panels as required to allow for maintenance and operation of mechanical and plumbing items concealed in walls or ceiling areas.

SECTION 09 2400 – PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.1 STUCCO

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

SECTION 09 2900 – GYPSUM BOARD

PART 1 - GENERAL

1.1 SUSTAINABILITY

- A. Recycled Content - Gypsum: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 50 percent by weight.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrates.
 - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD: GYPSUM BOARD SHALL CONFORM TO THE FOLLOWING

- A. Water-Resistant gypsum board shall be "Sheetrock W/R Gypsum Wallboard" 5/8" tapered-edge with treated manila paper finish. Fire resistant partitions shall be W/R gypsum wallboard, 5/8" thick, Type X gypsum board in accordance with ASTM C 36. Use 5/8" water-resistant gypsum board for all high humidity areas including all ceilings in locker rooms, mechanical rooms, mop receptors, etc.
- B. Gypsum soffit board shall be 1/2" thick, "Dens-Glass Gold" exterior gypsum soffit board by Georgia-Pacific or equals manufactured by Domtar, U.S. Gypsum or National Gypsum. Provide gypsum soffit board at all bathroom and shower ceilings and at all exterior soffit locations.
- C. Provide standard 5/8" thick gypsum board for ceilings in offices and at walls for furring.
- D. FRP clad gypsum board (by NUDO or approved equal) is an option for wet areas including showers, locker rooms, and kitchens. Consult with UPM before specifying.

2.2 JOINT TREATMENT

- A. Reinforcing Tape and Joint Treatment (Interior)
 - 1. Tape shall be USG Standard, or approved equal.
 - 2. Compound for embedding and fill coat application shall be "Durabond Joint Compound", or approved equal.
 - 3. Compound for finishing shall be "topping Compound".

2.3 TRIM

- A. Metal Corner Beads and Trim
 - 1. Fabricate corner beads and metal trim from galvanized steel, not lighter than 0.02" nominal thickness, on following shapes and sizes.
 - 2. Corner beads for all external corners shall be No. 800 metal/corner reinforcement. Metal trim shall be USG 800 series, sized for wallboard thickness.

2.4 AUXILIARY MATERIALS

- A. Fasteners: Screws for attachment of board to metal ceiling shall be 7/8" or 1" USG Drywall Screw, Type S. All screws shall have bugle head.
- B. Caulking: Caulking Compound shall be Acoustical type sealant, finished by gypsum board products manufacturer.
- C. Sound batts: USG Thermafiber Sound Attention Fire Blankets, Product Code B1, 1½ inch thick and meet requirements of ASTM C518 and C177.

SECTION 09 3000 – TILING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

- A. Bathrooms and showers – ceramic tile
- B. Food Service Areas – Quarry Tile

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1.2 QUALITY ASSURANCE

- A. The design, specifications, materials, and installation method should adhere to all applicable ANSI and ASTM codes and standards, in addition to the Handbook for Ceramic Tile Installation, Tile Council of America (TCA).

PART 2 - PRODUCTS

2.1 TILE PRODUCTS

- A. Glazed Ceramic Wall Tile:
 - 1. Provide "Standard Grade" units complying with ANSI A 137.1, Section 5. Color and pattern of units shall be as shown on drawings.
- B. Unglazed Ceramic Floor Mosaic Tile:
 - 1. Provide "Standard Grade" units, complying with ANSI A 137.1, Section 6, or size, color and pattern as shown on drawings. Provide cushion edge units except where square edge units are indicated. Factory mount tile onto sheets with mesh, dot, net, or other backing methods which is to remain permanently, in the setting bed.
- C. Provide rounded external corners, and trim shapes at head, jamb and sills of opening, of same material and finish as ceramic wall tile.
- D. Sanitary cove units shall be 4" high.
- E. External Corners
- F. Provide nose shapes, with an inside radius of not less than 3/4", unless otherwise shown.
- G. Internal Corners shall be field-buttet square except use square corner, combination angle and stretcher type cap.

2.2 THRESHOLDS

Marble Threshold shall be Class "A" Tennessee Sterling Gray, unless shown otherwise.

2.3 MEMBRANES

- A. Waterproof at Ceramic Tile
 - 1. Waterproofing where required or as indicated shall be Laticrete System (9235 Waterproof Membrane, 4237 Latex Thinset Mortar and accessories) as manufactured by Laticrete International, Inc. or approved equal.

2.4 SETTING MATERIALS:

- A. Mortar and Grout Materials
 - 1. Portland Cement ASTM C 150, Type 1, white or gray.
 - 2. Hydrated Lime ASTM C 206, Type S, or ASTM 207, Type S.
 - 3. Sand ASTM C 144 washed clean and graded. Use fine sand passing 1/16" mesh screen when mixed for grouting; use white sand for white cement.
 - 4. Water Clean and potable.
 - 5. Dry Set Mortars ANSI A 118.1 Tile Council of America (TCA) Formula 763, White, L & M, Tech, or Upco. Mortar in swimming pool shall be Formula 759 Thinset.
 - 6. Organic Adhesives ANSI A 136.1 for walls in shower areas with waterproof joints (silicone rubber or latex) Type II, AD, 1200.
- B. Thin Set Mortar; Low Absorption Tile
 - 1. Mortar shall comply with requirements for ANSI Standard A 118. 1967 Specifications for Thin-Set Portland Cement Mortar.

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2. Mortar shall be pre-sanded, gray Portland Cement with additives, and for use with ceramic mosaic tile (TCA Formula 759), and one of the following
 - a. K-B as manufactured by C.E. Kaiser Company, Inc.
 - b. Laticrete "Dry Bond" thinset mortar.
 - c. Tile-Mate Sanded as manufactured by Upco Company.
 - C. Grout Materials (One of the following)
 1. K. B. Ceramic Floor tile grout as manufactured by C. E. Kaiser Company, Inc.
 2. L & M Ceramic Mosaic, manufactured by L & M Surco Manufacturing Company, Inc.
 3. Floor Tile Grout, manufactured by Upco Company.
- 2.5 MIXING MORTARS AND GROUT
- A. Bond Coat: Creamy paste made of Portland Cement.
 - B. Portland Cement Mortar Setting Bed; Floors 1 part Portland Cement to 6 parts damp sand, by volume. Add water to obtain consistency or workability to promote maximum density as evidenced by smooth, slickened appearance when stroked with trowel.
 - C. Thin-Set Mortar Mix in strict accordance with written instruction of mortar manufacturer.

SECTION 09 5113 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

Provide products, conditions, and installation methods that meet or exceed all applicable ASTM standards, and are UL approved.

1.2 PROJECT CONDITIONS:

- A. 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.
- B. Tile will be stocked in the room for 48 hours prior to installation to acclimatize.
- C. Access to all utilities shall be provided to the fullest extent possible regardless of ceiling type used.

1.3 SUSTAINABILITY

- A. Recycled Content: Provide acoustical panel products with average recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS

- A. Tile selection shall be based on standard types by national suppliers and costs of maintenance and replacement must be considered in the selection.

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B. Ceiling Tile Selection For Interior Air-Conditioned Spaces

Company	Size	Grid Color	Series	Space
Armstrong	5/8" x 24" x 24"	White	769A	Cortega Minaboard Work/ Instruct./ circ

Or approved equal

2.2 SUSPENSION SYSTEMS

- A. Two by two grid configurations are preferred.
- B. Concealed grid systems, such as tee-and-spline systems, which are not accessible are not authorized.
- C. The ceiling suspension system shall be the type using formed double web tee sections.
- D. Exposed surfaces below the acoustical material shall be white baked enamel either directly applied to the bottom flange or by a cap piece applied to the flange.
- E. The system shall be of the type that each section shall have a positive interlock to the other.
- F. Main beams shall be approximately 1" wide and 1½" high. Cross tees and bridging tees shall be of the same width as main beam and approximately 1 1/4" high.
- G. Provide wall angles and splices as required for complete installation.

2.3 EXTERIOR CEILING SYSTEMS

- A. For ceilings installed in exterior space or non-air conditioned space the T-bars, wall angles, etc. shall be Series 830 manufactured by Chicago Metallics, color: off-white, all aluminum. (or approved equal).
- B. Hanger wires shall be aluminum or stainless steel and shall be non-corrosive in every respect (galvanized steel is not acceptable). Hanger wire number and spacing per code.
- C. The ceiling panels shall be 24-inch x 48-inch "Vinylrock" manufactured by Capul Company, color to match the T-bar color. (or approved equal).

SECTION 09 6000 – FLOORING GENERAL

PART 1 - GENERAL

1.1 SUSTAINABILITY

- A. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
 - 2. Rubber Floor Adhesives: Not more than 60 g/L.
 - 3. Cove Base Adhesives: Not more than 50 g/L.

PART 2 - PRODUCTS

2.1 THE FOLLOWING MATERIALS ARE PREFERRED AT THE LOCATIONS INDICATED:

- A. High traffic areas such as lobbies and corridors – terrazzo or non-slip porcelain tile.

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- B. General Purpose rooms – Vinyl Composition Tile (VCT)
- C. Offices, conference rooms, auditorium aisles (with permanent seating), lounges, music or language listening rooms, etc. – carpet
- D. Bathrooms and showers – ceramic tile.
- E. Food service areas – quarry tile or anti-bacterial cement
- F. Laboratories – monolithic systems with no seams or cracks
- G. Mechanical, storage, and custodial rooms – sealed concrete with steel trowel finish.
- H. 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 in some other way).

SECTION 09 6500 - RESILIENT FLOORING

PART 1 - PRODUCTS

1.1 VCT

- A. Tile Selection
 - 1. As an alternate to the below materials, the Contractor may submit a bid on any approved equal tile. The University reserves the right to refuse alternates based on its desire to select specific patterns and colors. Request for alternates must be submitted in writing with the Bid.
 - a. Company TBD
 - b. Series TBD
 - 2. Cove Base Selection
 - a. Company TBD
 - b. Series TBD
 - 3. Base boards should be rubber at carpet and VCT areas.
- B. Size at Carpet: 1/8" x 4"

1.2 FLOORING ADHESIVE:

- A. S-515 Clear Thin-Spread Adhesive manufactured by Armstrong World Industries Inc.
- B. Parabond M-269 manufactured by Para-Chem Southern, Inc. (or approved equal).
- C. Material at site must be in manufacturer's labeled containers.
- D. Adhesive for direct glue down installation shall be non-toxic low odor and solvent free with no alcohol, glycol, and ammonia. Adhesive shall be antimicrobial with no hazardous vapors and contain no carcinogenic materials per OSHA regulation 29 CFR 1910-1200. Adhesive shall have a flame spread rating of 25 or less.

1.3 COVE BASE ADHESIVE:

- A. Parabond M-273 Acrylic Cove Base Adhesive or approved equal

SECTION 09 6810 – CARPET

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PART 1 - GENERAL

1.1 SUSTAINABILITY

- A. In addition to recycling waste, prefer the use carpets with:
 - 1. high recycled contents
 - 2. modular
 - 3. manufactured within a 500 mile radius of campus
 - 4. manufactured, transported, maintained and ultimately disposed of in manners reflective of the University's sustainability vision and initiatives.
 - 5.CRI Green Label Plus required
 - 6. High recyclability using current technology.

PART 2 - PRODUCTS

2.1 CARPET SELECTIONS:

- A. All carpet shall be selected from the North Carolina QPL (Qualified Products List) established by the State Purchasing Department and available from the UNC Charlotte Purchasing Director. Exceptions for special areas may be granted in writing by the University Project Manager provided the total of the exceptions does not exceed 10% of the carpeted floor area of the project.
- B. Carpet Pattern and Orientation:
 - 1. All carpet of the same pattern shall be installed in the same orientation throughout a floor unless the Designer provides in writing to the UPM specific reason for other orientation.
 - 2. The Designer shall not select carpet with tight repeating patterns where long views of the carpet would expose irregular installation.

2.2 CARPET COLOR AND CONSTRUCTION

- A. Color:
 - 1. The Designer shall not select solid color carpet; a mixed pattern with high soil and stain hiding capabilities is preferred.
 - 2. Construction:
 - 3. Needle Punch Construction.
 - 4. 100% Solution Dyed.
- B. Polypropylene Fiber.
- C. Minimum 37 ounces Face Weight.
- D. Natural & Synthetic Composite Rubber Backing.
- E. Seams Sealed Against Water Penetration into Adhesive.
- F. Stain Resistant Against Kool-Aid, Red Dye, Ink, Coffee, and Mustard.
- G. Manufactured with recycled content materials.
- H. Purchased from a company that will recycle the carpet when time to replace.
- I. Resistant to chemical damage from Bleach, Sodium Chloride, and Sodium Magnesium Acetate (Ice Melt).

2.3 INSTALLATION ACCESSORIES

- A. Carpet Adhesive:

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1. Health Tech Premium Adhesive 88 or Approved Premium Adhesive. Material at site must be in manufacturer's labeled containers. **VERY IMPORTANT: See Article G4.B in Bidding Instructions.**
2. Adhesive for direct glue down installation shall be non-toxic low odor and solvent free with no alcohol, glycol, or ammonia. Adhesive shall be antimicrobial with no hazardous vapors and contain no carcinogenic materials per OSHA regulation 29 CFR 1910-1200. Adhesive shall have a flame spread rating of 25 or less.

SECTION 09 7200 – WALL COVERINGS

PART 1 - PRODUCTS

1.1 GENERAL REQUIREMENTS

- A. Wall corners at locations such as elevator entrances shall have vinyl bumper guards attached to the baseboard molding. These bumper guards will prevent damage from delivery carts, etc. The guards are to be stained or of a color which matches the adjacent floor baseboard material.
- B. Wall coverings shall be durable, non-porous and easily cleaned. Carpet is not an acceptable wall covering material. Fabric coverings are not permitted as wall covering materials unless special requirements dictate and written acceptance is obtained through the UPM on a room by room basis.
- C. When special wall coverings are used, the University shall be provided with maintenance instructions.
- D. Use of vinyl wall covering is discouraged and must be limited to specially approved areas.

SECTION 09 9100 – PAINTING

PART 1 - GENERAL

1.1 DEFINITIONS

- A. The Term "Paint" as used herein includes emulsion, enamels, paints, varnishes, stains, oils, and other coatings used as prime, intermediate, or finish coats.

1.2 SUSTAINABILITY

- A. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 1. North Carolina's Executive Order #156 on State Government Environmental Sustainability, Reduction of Solid Waste, and Procurement of Environmentally Preferable Products, Section 3.a (signed July 20, 1999) directs all state agencies to seek opportunities to reduce environmental impacts associated with capital improvements through project planning, design, and construction.
 2. The University is dedicated to conserving materials and energy. The Designer shall consider the use of recycled materials "whenever economically practical" in conjunction with State Law SB58, Chapter 256. The Designer shall propose finish products that have recycled content such as floor tile, ceiling tile, paving materials, and carpet. The Designer should consider the recyclability of a material at the end of its life. The Designer should also consider the use of low-volatility non-toxic, organic-content paints, stains and other finishes.

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1.3 STORAGE

- A. Paints, enamels, lacquers, sealers, stains, varnish, paste fillers and similar materials shall be delivered in original sealed containers that plainly show designated name, formulas, or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer.
- B. Store all materials in single, heated space provided by General Contractor.
- C. Keep storage place neat and clean, and remove soiled or used rags, waste and trash from building every night to avoid danger of fire.

PART 3 - EXECUTION

3.1 PREPERATION

- A. Exterior painting shall not be performed when the temperature is below 50 degrees F., while the surface is damp, during cold, rains, or frosty weather, or when temperature is likely to drop to freezing within 24 hours. Avoid painting surfaces while they are exposed to hot sun.
- B. Before painting is started in any area, it shall be broom cleaned and dust shall be removed from all areas to be painted. After painting operations begin in a given area, room cleaning will not be allowed.
- C. Contractor to provide adequate illumination, such as temporary lighting in all areas where painting operations are in progress.
- D. Protect adjacent areas and installations by use of drop cloths or other approved precautionary measures. Use polyethylene sheeting to prevent spray drifting.
- E. Remove and protect hardware, accessories, device plates, lighting fixtures, factory finished work, and similar items; or provide ample in-place protection. Upon completion of each space, carefully replace all removed items.
- F. All painting work shall be performed only by skilled mechanics, using adequate tools for work to be provided.
- G. Protect plumbing fixtures and trim. Standing on fixtures shall be prohibited.
- H. Before starting any work, thoroughly examine surfaces to receive paint finish for defects and which might prevent satisfactory results. Do not proceed with work until such conditions are corrected. Commencing of work shall constitute acceptance of surfaces, and thereafter shall be fully responsible for satisfactory work.
- I. Paints shall be applied only to surfaces that are completely free of surface moisture as determined by sight or touch. In no case shall paint be applied to surfaces upon which there is visible frost or ice.
- J. Remove electrical panel box covers and doors before painting wall. Paint separately and reinstall after all paint is dry.
- K. Surface Prep:
 - 1. Wood: Sandpaper wood surfaces to smooth and even surface, then dust off. After priming coat has dried, apply shellac, four (4) pounds cut, to all knots, pitch and resinous sapwood. After priming coat has dried, putty all nail holes, cracks, open joints and other defects. Putty shall be colored to match stain or paint.
 - 2. Masonry: Masonry surfaces to be painted shall be prepared by removing efflorescence, chalk, dust, grease, oil, excessive mortar, and other material detrimental to painting. Surfaces shall be thoroughly dry, properly cured, and clean before application of paint.
 - 3. Ferrous Surfaces:
 - a. Surfaces that have not been shop-coated shall be solvent cleaned to remove oil and grease. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be mechanically cleaned by power wire brushing or sandblasting.

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- b. After cleaning, apply one coat of ferrous metal primer to all ferrous surfaces that are to receive paint other than asphalt varnish. Protect shop-coated metal from corrosion before and after installation by treating corroded areas immediately upon detection. Abraded or corroded spots on shop-coated surfaces shall be wire brushed and touched up with same materials as the shop coat. All edge of repair shall be carefully feathered out on exposed surfaces.
4. Galvanized surfaces: to be painted shall be solvent cleaned and treated in accordance with Paint Manufacturer's directions.

3.2 APPLICATION

- A. Application shall be as follows
 1. All interior paint shall be applied by brush or rollers in accordance with manufacturer's recommendations. Spray painting may be used only by permission of the Designated Representative.
 2. Allow sufficient time between successive coats to permit proper drying. Modify as necessary to suit adverse weather conditions.
 3. Coverage and hide shall be complete. Where color, stain, dirt, or undercoats show through final coat of paint, surface shall be covered by additional coats until paint film is of uniform finish, color, appearance, thickness, and coverage, at no additional cost to Owner.
 4. Rate of application shall not exceed average rate of coverage recommended by manufacturer for type of surface involved.
 5. Finished surfaces shall be free from runs, drops, ridges, waves, laps, sags, brush marks; and free of variations in color, texture and finish.
- B. Visible surfaces on interior of ducts behind louvers, diffusers, registers, and grills shall be primed and painted (typically flat black enamel).
- C. Painting of all insulating pipe shall be clearly put in the general construction specifications since this contract contains the majority of the painting.
- D. Items typically not to be painted: Ducts, conduit, and mechanical equipment where concealed from view and not susceptible to rusting, items completely finished at the factory, non-ferrous metals, pre-finished millwork and casework, and acoustical tile and grid system.

3.3 SCHEDULE

- A. Paint Sheen:
 1. Walls – satin
 2. Doors – gloss
 3. Door and Window trim – gloss
 4. Ceilings – flat
- B. Complete coverage of all exposed surfaces is intended. Without restricting the extent of the work to be performed, the work shall include, but is not limited to the following:
 1. Structural Steel - Remove any rust and touch-up after erection. Exposed steel shall be finished painted.
 2. Ferrous Metal: All exposed surfaces of all ferrous metal work, including both exterior and interior of building, which is not finished/painted under other Sections. This includes all hollow metal work, exposed metal flashing, handrails, and similar items.
 3. Masonry: Painting of all exposed concrete unit masonry.
 4. Gypsum Drywall: All exposed surfaces.
 5. Wood: Staining of all wood doors and wood lockers except that specified to be prefinished. If painted, prime with I.C.I. 1020 wood primer or app. Equal.
 6. Paint-grade woodwork shall be painted – not stained.
 7. Mechanical Grilles and Diffusers and Electrical Panels: Paint to match color of surface in which item is mounted.
 8. Fire Extinguisher Cabinets: Paint doors and trim to match wall surface mounted on.

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9. Concrete: Painting of all exposed surfaces except floors.
- C. Room Requirements:
1. Mechanical room walls – epoxy paint
 2. Mechanical room floors – multi-coat sealer adequate for wear and dust protection on concrete.
 3. High Traffic Areas such as corridors and stairwells – Enamel Paint
 4. Restroom Walls: For painted restroom walls, use high gloss enamel for a distance up to five feet above the floor.
 5. 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).Painting Schedule
- D. Exterior Painting Schedule (See Art. D for color selection)
1. Ferrous Metal
 - a. One (1) coat Rust Penetrating Metal Primer
 - b. Two (2) Coats Alkyd Enamel
 2. Galvanized Metal
 - a. One (1) Coat Galvanized Metal Primer
 - b. Two (2) Coats Acrylic Latex Flat
 3. Masonry Surfaces (Block)
 - a. One (1) Coat Block Filler Coat
 - b. (2) Coats Acrylic Masonry Coating
 4. Exterior Plywood Soffit Board
 - a. One (1) Coat Vinyl Latex Primer
 - b. Two (2) Coats Latex Satin
 - c. Interior Painting Schedule (See Art. D for color selection)
 5. Concrete Masonry Units
 - a. One (1) Coat Block Filler
 - b. Two (2) Coats Semi-Gloss Alkyd Enamel
 6. Ferrous Metal Work
 - a. One (1) Coat Rust Penetrating Metal Primer
 - b. Two (2) Coats Semi-Gloss Alkyd Enamel
 7. Gypsum Wallboard (Ceilings)
 - a. Spot prime all cemented and taped joints with Latex Vinyl Primer.
 - b. One (1) Coat Latex Vinyl Primer
 - c. Two (2) Coats Latex Flat
 8. Birch Veneer Doors (Natural Finish)
 - a. Prior to application of stain thoroughly wash all faces of doors with mineral spirits or alcohol.
 - b. One (1) Coat Wood Sealer
 - c. One (1) Coat Gloss Spar Varnish
 - d. Two (2) Coats Satin Varnish
 9. Birch Veneer Doors (Satin Finish)
 - a. Prior to application of stain thoroughly wash all faces of doors with mineral spirits or alcohol.
 - b. Stain as selected
 - c. Two (2) Coats Satin Varnish
 10. Wood (Natural Finish)
 - a. One (1) Coat Wood Sealer
 - b. One (1) Coat Gloss Spar Varnish
 - c. Two (2) Coats Satin Varnish
 11. Wood (Stain Finish)
 - a. Stain as selected
 - b. One (1) Coat Gloss Spar Varnish
 - c. Two (2) Coats Satin Varnish
 12. Wood (Painted)
 - a. One (1) Coat Enamel Undercoat

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- b. Two (2) Coats Alkyd Semi-Gloss Enamel
- 13. Epoxy Finish on Masonry
 - a. One (1) Coat Block Filler
 - b. Two (2) Coats Epoxy Gloss Coating
- E. Materials: For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by Duron, excepting as noted specifically otherwise. All materials used for work shall be types specified in this Section. Paint shall arrive at project site, ready-mixed, except for tinting of undercoats, and thinning, if directed by Manufacturer's printed instructions. Tinting materials shall be as recommended by Manufacturer for particular materials to be tinted.
- F. Colors for interior wall surfaces shall be as follows
 - 1. Final Coat Duron Antique White, No. 22-03111(or approved equal)

SECTION 2
DIVISION 10
SPECIALTIES

DIVISION10 - SPECIALTIES

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s Contract Documents.

SECTION 10 1100 – VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

- A. All classrooms should be provided with markerboards and / or chalkboards with required blocking.

SECTION 10 1400 – NON-ILLUMINATED EXTERIOR SIGNS

PART 1 - GENERAL

1.1 SUMMARY

- A. The University of North Carolina at Charlotte supports the goal of making wayfinding along campus roadway and pedestrian ways understandable and accessible and has developed guidelines in an effort to promote mandatory design conformance and compliance. This information and guidelines are structured in accordance with the North Carolina department of transportation (NCDOT) and the federal manual on uniform traffic control devices (NCDOT adopted 2003).

All Exterior Signage for Roadways, Parking Lots, Loading Docks, Building Identification, Safety or any other exterior sign application, must be approved through Facilities Management Design Services which is governed by University Policy Statement #17 as related to all signage as applied to State Property and Facilities.

UNC Charlotte has adopted standard signage policies and design features for all exterior signs erected on campus. For visual reference; refer to the drawings in Annex D for typical campus exterior signs and sign groups. Permanent signs required by a project but not referenced here shall be submitted to Facilities Services for approval. New Sign products shall be equal or exceed in quality to the signs currently in place on campus.

- B. Refer to Section 02 4116 for the requirements on labeling insulation to indicate the presence or the absence of asbestos.
Refer to Section 33 1150 for requirements relating to the identification of underground piping and utilities described in Division 2.
Refer to Section 10 1401 for interior signs.
Refer to Section 26 0100 for electrical identification.

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1.2 SIGN TYPES – DESCRIPTION

- A. Two sign types require additional feature boards across the top in keeping with Campus Logo identification on public road access. Please refer to Type A and B signage in the attached manual.
- B. This Section contains the identity and function of exterior signs types:
- TYPE A - LARGE ROAD DIRECTORIES -
MAIN ENTRANCE ROADS AND PERIMETER HIGHWAY DIRECTIONAL
- TYPE B - MEDIUM ROAD DIRECTORIES -
INTERIOR CAMPUS ROADWAYS AT INTERSECTIONS AND EXTENDED LENGTH ROADS
- TYPE C - SMALL ROAD DIRECTORIES -
PARKING DECK AND SERVICE ROAD ENTRANCE SIGNS (SEE SIZE FOR E)
- TYPE D.1 – 2 - ATTACHED PARKING DECK ID
- TYPE E - DETACHED BUILDING ID
- TYPE F.1 - .3 - ATTACHED BUILDING ID (SIGNS, METAL LETTERS, VINYL GRAPHICS)
- TYPE G - ATTACHED OVERHEAD VEHICULAR DIRECTIONAL PARKING DECKS
- TYPE H – H.1 - PEDESTRIAN DIRECTIONAL
- TYPE I – OVERHEAD PARKING CLEARANCE BARS/SIGNAGE AT ALL DECK AND COVERED ENTRANCES AS WELL AS ANY CHANGES IN CLEARANCE (LIKE WHERE UPPER DECK LEVEL CLEARANCE IS LESS THAN THE ADA LEVEL).

1.3 GRAPHIC STANDARDS

This section provides graphic standards for all Exterior Sign configurations. Standards for exterior ADA directional signs (entrance signs) shall be approved by Facilities Management Design Services with regard to the specific placement, content or layout.

A. COLOR:

1. Full Crown – Stand Alone
 - a. Gold – 04 or equal metallic vinyl 7 year
 - b. Background – Black Green (see Annex D for paint codes by MPC).
 - c. Crown Gold option - Paint to match if that is specified
2. Half Crown and Text
 - a. Gold – 04 or equal metallic vinyl 7 year
 - b. Background – Black Green (see Annex D for paint codes by MPC).
 - c. Crown Gold option - Paint to match if that is specified
 - d. Text – White (see Annex D for paint codes by MPC).

The color of the sign face is to match Matthews Paint Co. MP21337 R91290 or approved equal with Satin Finish and Satin Clear Coat to seal. The color of the 'band' whether as an attached feature (TYPE A and B) or as accent band for vinyl decal crown feature is to be PMS 349 Campus Green.

B. LETTERING:

1. The University of North Carolina at Charlotte Crown and Text logo on the sign is registered as a legally protected trademark of the University and shall be produced from authorized originals without being modified.

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2. Go to this link for reference and logo access.
<http://www.publicrelations.uncc.edu/logo/main-logo.html>
3. All copy shall be UTOPIA (True Type Version). A number of standard letter sizes have been established which should be appropriate for most signage needs (see Annex D for references). Lettering sizes will depend on distance readability and the surrounding area of placement. Speed and travel of vehicular and pedestrian traffic may also have influence on letter stroke and sizing. The final graphic and letter height selected shall be based on current sign placement content.

C. HEIGHT:

See Annex D for height descriptions. WBLAOCK CAD details may be provided upon request via FTP site.

1.4 FABRICATION:

Manufacturer will visit the University grounds to verify existing signage sizing and component structure; then provide working drawings for review prior to fabrication. Some environmental conditions may require alteration in order to provide maximum affect for the driver or pedestrian. These must be approved via drawing submittal prior to fabrication.

1.5 PLACEMENT:

Placement and location of all signs shall be approved by Associate Vice Chancellor for Facilities Management via a Design Services Project Manager.

Contractor or Vendor is responsible for all public utility locate requests and will provide schedule of utility locates that coincide with University Department utility locations. If placement falls within the 'no dig' area as stipulated by North Carolina One Call (NCOCC), then installer is required to hand dig without up-charge for installation of the sign.

For Utility Locate information: <http://www2.ncocc.org/ncocc/default.htm>

1.6 BUILDING NAMES:

Names will be provided by Facilities Management prior to fabrication. Submittal of Color elevation drawing approval required prior to finishes being applied to signage.

1.7 RESPONSIBILITIES:

- A. Capital construction projects shall provide funding to pay for all signs associated with each project.
- B. In Capital Construction projects, the General Contractor shall be responsible for contracting manufacture of and for placement of the signs on campus in compliance with the policies and specifications outlined in this document under the direction of Design Services.
- C. The Contractor shall be responsible for full replacement for defects in materials or workmanship for five years.
- D. Budget entities and auxiliaries shall be responsible for paying for the costs of requested signs for existing buildings. A Project request must be entered via Archibus for any fixed signage needed.

1.8 UPDATES:

If required, vendor will provide submittal drawing or outlined process to update graphics or failed sign features prior to a Purchase Order being released. If a sign requires removal, the Vendor

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must put in place a sign readable for the location that will continue to direct traffic and pedestrians without undue stress.

PART 2 - PRODUCTS

2.1 EXTERIOR:

All should be handled in accordance with the University's "Campus Signage Standards" Room Number Assignments:

- A. All spaces including custodial, mechanical, and closet spaces shall have assigned numbers. It is desirable that the construction numbering system be retained throughout the life of the facility. Numbering systems will be coordinated with University CAFM requirements. Please Refer to the Space Manual on: <http://cafм. facilities.uncc.edu/CAFM/data.htm> Following are general guidelines for space numbering in all buildings:
1. The Construction Documents for all design disciplines shall display the approved, permanent room number assignments.
 2. The numbering system shall use three-digit numbers with alpha suffixes, if necessary; four-digit numbers are not acceptable. Suites can be numbered with nested letters such as 243 A, 243 B, 243 C . . . etc.
 3. Number sequence shall progress continuously in a corridor. Using odd or even numbers on either side of the corridor is neither required nor desired. Where corridor configurations make it impossible for a continuous numerical progression, the Designer shall strive to achieve a logical numerical progression. Consult with the UPM.
 4. The numbering system shall provide spare numbers in the sequencing, especially in areas where there are large rooms or open spaces where future renovations could subdivide the space.
 5. All spaces are to be assigned room numbers (closets, elevators, janitorial rooms, lobbies, rest rooms, stair landings, vestibules, etc.). Lobbies will not have signage.
 6. The lowest floor with a primary entrance shall be assigned "100" series numbers. All other floors located below grade shall be assigned numbers with a "B" prefix, (B02, B03, etc.).
 7. Basement room numbers shall be three digits and begin with the letter "B".

2.2 FABRICATION:

- A. 1. Sign Types B.1, D, E, and F2 also have a photopolymer plaque with integral raised graphics applied to the backer.
2. Sign Type G - provide surface silk-screened header and surface silk-screened graphics.
- B. Exterior ADA signs, type A.EXT, for example, shall be "chemically etched zinc" it is for use in exterior applications as the photopolymer will biodegrade over time if subjected to the elements.

SECTION 10 1401 – NON-ILLUMINATED INTERIOR SIGNS

PART 1 - GENERAL

1.1 SUMMARY

The University of North Carolina at Charlotte supports the goal of making facilities accessible and has developed guidelines in an effort to promote mandatory compliance. This information and

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guidelines are structured on the Americans with Disabilities Act (ADA). The University has used extreme care and high standards to assure accuracy in interpretation of the law.

It is not the intent to convert entire buildings to the new Design Manual specification unless funding department is doing so to bring building into compliance with ADA and other governing bodies. There will be instances where the Manufacturer will be asked to match existing room and space identification in order to conserve funding for more critical safety projects. But for all project signage, a review is required by Facilities Management Design Services designate in accordance with University of North Carolina at Charlotte Policy Statement 17.2.c. that instructs us in Code Compliant actions required regarding State facilities that includes the correct action regarding *“addition, removal, or movement of signs”*.

Signage Guidelines are taken from the Department of Justice's final rules implementing Title III of the Americans with Disabilities Act, printed in the Federal Register, 28 CFR, Part 36, 26-July-2010.

- A. Section includes: Interior non-illuminated directional, control, and information surface mounted signage as complete assembled and fixed system.
- B. Related sections:
 - 1. Section 08 1113: Steel Doors and Frames.
 - 2. Section 08 1416: Wood Doors.
 - 3. Section 09 2900: Gypsum Board Systems.
 - 4. Section 09 5113: Acoustical Ceilings.
 - 5. Section 09 9100: Painting.
 - 6. Section 09 7200: Vinyl Wall Covering.
- C. Unit prices: Provide installed unit price for each type unit in designed system for extra possible required signage.
- D. Large projects will require Manufacturer to fabricate a minimum of two each of each small size for submittal review, and renderings of Wayfinding Map and Direction signage.

1.2 REFERENCES:

- A. Standards of the following as referenced:
 - 1. American National Standards Institute (ANSI).
- B. Industry standards:
 - 1. Department of Justice, Office of the Attorney General, "Americans with Disabilities Act", Public Law 101-336, (ADA).
 - 2. ANSI A117.1: Providing Accessibility and Usability for Physically Handicap People, 1986 edition.
 - 3. Federal Register Part III, Department of Justice, Office of the Attorney General, 28 CFR Part 36: Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities, Final Rule, July 26, 1991.
 - 4. Federal Register Part II, Architectural and Transportation Barriers Compliance Board, 36 CFR Part 1191: Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Amendment to Final Guidelines, July 23, 2010.

1.3 DEFINITIONS:

- A. Terms:
 - 1. Braille: Grade 2 Braille including 189 part-word or whole word contractions in addition to Grade 1 Braille 63 characters. Tactile is required whenever Braille is required; see SYSTEM DESCRIPTION Article below.

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2. Non-tactile: Letters and numbers on signs with width-to-height ratio between 3:5 and 1:1 and stroke width ratio between 1:5 and 1:10 using upper case "X" to calculate ratios. Use typestyles with medium weight; upper and lower case lettering is permitted; NO serif typestyles are permitted. See SYSTEM DESCRIPTION Article below.
3. Symbols: Symbol is required to be tactile AND equivalent verbal description is required\ both in tactile letters and Braille.
4. Tactile: 1/32" raised capital letters without serifs at least 5/8" height and not more than 2" height based on upper case "X". Braille is required whenever tactile is required; see SYSTEM DESCRIPTION Article below.

1.4 SYSTEM DESCRIPTION:

- A. Signage under this section is intended to include items for identification, direction, control, and information where installed from single manufacturer.
- B. ADA design requirements:
 1. Signage requiring tactile graphics:
 - a. Wall mounted signs designating permanent rooms and spaces such as, room numbers and restroom, department, office, accessibility designated space, and fire exit identifications.
 - b. **Individually applied characters are prohibited** for either tactile letters or pictograms.
 2. Signage not requiring tactile graphics but require compliance to other ADA requirements: All other signs providing direction to or information about function of space such as, directional signs (signs with arrow), informational signs (operating hours, policies, etc.), regulatory signs (no smoking, do not enter), and ceiling and projected wall mount signs.
 3. Excluded signage:
 - a. Exterior signs.
 - b. Building directories.
 - c. Menus.
 - d. Temporary signs include personnel signs and tenant identification; suite numbers are not considered temporary.
- C. ADA performance requirements:
 1. Tactile graphics signs mounting requirements:
 - a. Single doors: Mount 60" to sign centerline above finish floor and on wall adjacent to latch side of door.
 - b. Openings: Mount 60" to sign centerline above finish floor adjacent opening.
 - c. No wall space adjacent latch side of door, opening, or double doors: Mount 60" to sign centerline above finish floor on nearest adjacent wall.
 - d. **ADA Signs Type A, B, C, E.1, F, and J:** Signs constructed from a clear Photopolymer Sheet, graphics are integral to the sign, no etched or separately applied characters are permitted. Plaques are surface painted with automotive grade polyurethane and then the raised graphics are tipped in second color, do not tip Braille.

1.5 SUBMITTALS:

- A. Product data:
 1. Manufacturer's signed statement regarding compliance with QUALITY ASSURANCE Article.
 2. Manufacturer's product literature indicating units and designs selected.
 3. Manufacturer's signed statement regarding compliance with ADA Statutes and requirements.
- B. Shop drawings:

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1. Indicate materials, sizes, configurations, assembly diagram, installation details for mounting, and applicable substrate mountings.
2. Typography sample for copy and approval.
3. Signage schedule complete with location of each sign and required copy; include floor plans, if required.
4. Artwork for special graphics.

C. Samples and/or Submittals:

1. Full size samples for Sign, insert, and copy in colors specified.
2. Furnish samples in small size sign.

Note: Samples will not be returned for use in Project but will remain with the University as reference for future sign projects and demonstration of product requirements.

D. Contract closeout:

1. Furnish appropriate checklist for aiding in reordering after Date of Substantial Completion. Maintain computer schedule program for **FIVE** years for ordering new signage required by Owner.
2. Maintenance data and cleaning requirements for exterior surfaces.
3. Proper steps to remove signs for repairs or updated installation replacement.
4. Furnish accurate templates in PowerPoint or other Microsoft based application useful for creating replacement insertable information cards.

1.6 QUALITY ASSURANCE:

A. Qualifications:

1. Manufacturer:
 - a. Work required under this section from manufacturers regularly engaged in work of this magnitude and scope for minimum of five years.
 - b. Third party vendor must provide manufacturer information including Name, Contact, Location, and manufacturer must provide all within this Division outline as if they were the direct supplier and installer for the sign package.
 - c. Maintain computer link between schedule input and computerized typography production.

1.7 DELIVERY, STORAGE, AND HANDLING:

** USE EITHER A or B **

- A. Please refer to ANNEX D.1 indicated for Delivery, Storage, and Handling Section.
- B. Acceptance at site: Coordinate delivery of work to Project site under this section for immediate installation.

1.8 SEQUENCING AND SCHEDULING:

- A. Schedule system installation after related finishes have been completed.
- B. Provide timeline of installation.

PART 2 – PRODUCTS

2.1 MANUFACTURED UNITS:

A. Acceptable product:

1. APCO; 388 Grant Street SE, Atlanta, Georgia, 30312, USA. Phone; (404) 688-9000. Telex; 752098. Fax; (404) 577-3847.
2. Other manufacturer's products are acceptable if submitted in accord with Product Options and Substitutions section and are in strict compliance with these specified requirements.

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2.2 COMPONENTS:

COMPONENTS LISTED BELOW GIVE ONLY GENERAL INFORMATION. SCHEDULES ARTICLE REQUIRES COMPLETE SIGNAGE SCHEDULE DEVELOPED BY MANUFACTURER'S REPRESENTATIVE.

A. Plaque:

1. Face material:
Wall or vertical surface:
 - a. *1/4" - 5/16" thickness (*single etch versus assembly signage) clear non-glare, optically corrected, cast virgin acrylic sheet with second surface (backside) applied perimeter line and border graphics application leaving center see-through area for insert.
 - b. ADA tactile signs: Individual 1/32" high letter characters chemically etched into surface material; Braille portion chemically etched into surface material.Ceiling:

1/4" thickness expanded PVC with first surface applied perimeter line and background color; 20 mm applied die-cut vinyl graphics.
2. Thickness: 1/16".
3. Back: Black acrylic sheet; 1/8" thickness plastic. (N/A for Ceiling Mount Modules).
4. Insert: Die-cut vinyl; 20 mm thickness. (N/A for Ceiling Mound Modules).
5. Corners: Square. (see Annex D.1 Interior Signage)
6. Mounting:
 - a. MOUNTING PLAQUES TO SURFACE; SELECT TYPE OR TYPES:
 - 1) WALL MOUNTING:
 - a) VT; Double sided vinyl tape mounting.
 - b) SA; Silastic adhesive for mounting to irregular surfaces, vinyl tape is used in conjunction for holding sign in position during adhesive curing time.
 - c) "2-way close cell VHB foam tape" The FullView signs, type L.1, should indicate that they are also to be mounted with Mechanical Fasteners, they are too heavy to be securely mounted with tape only.
 - 2) CEILING MOUNT:
 - a) CM; grid track and clip system or cable and clip.
 - b) **Projection mounted signs or Ceiling mounted signs:** Projection mounting bracket to be constructed using two mating aluminum extrusions, whereby one extrusion can be mechanically mounted to the wall or ceiling and the corresponding extrusion can be mechanically fastened to the sign face or holder and the entire assembly can be joined to the mounting bracket by engaging the mating tracks from either the top or bottom and sliding the sign into position. Assembly to be secured via discreet locking set screws.
 - b. Wall or vertical surface: VT or SA as indicated in schedule.
 - c. Ceiling grid: Furnish manufacturer's standard track and clip system, or cable tie and hardware for suspension installation direct to ceiling grid as required.
7. Colors:
 - a. Perimeter line color: PMS 349 "Campus Green".
 - b. Border and insert colors:

PMS 349 "Campus Green is default standard (all other colors must receive approval from Facilities Management Design Services. A submittal drawing must be provided that will be approved by Design Services, or if required, the Associate Vice Chancellor for Facilities Management.
 - c. Other Colors currently used in the Campus Sign Package to date (11-01-10).

Putty – all backgrounds.

 - 1) PMS Green –
Kennedy, ROTC, Colvard,
 - 2) PMS Green Border with Black text –
King Building.

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- 3) Matte Black –
Fretwell, Cone Center (Academic Spaces), Reese 4th Floor.

(Colors Cont.)

- 4) Satin Silver –
Cameron Applied Research, Bioinformatics.
 - 5) Wine –
Rowe Arts
 - 6) Olive Green –
Denny Complex
 - 7) Windsor Blue –
Cone Center Main Color, Winningham
 - 8) Jade Blue –
Student Health Center
 - 9) Malaga Black Green –
Student Union
 - 10) Bronze Metallic –
Duke Centennial Hall
8. Interior Sign Group (may be expanded – check with Project Manager for current list):
- a. Wall Mounted:
 - 1) 7-1/4" by 7-1/4" -Type A
 - 2) 9" by 7-1/4" - Type B
 - 3) 9" by 7-1/4" - Type B
 - 4) 9" by 7-1/4" - Type B.1 - Insertable
 - 5) 9" by 7-1/4" - Type B.2
 - 6) 9" by 7-1/4" - Type B.3
 - 7) 9" by 7-1/4" - Type B.4
 - 8) 9" by 7-1/4" - Type B.5
 - 9) 7-1/2" by 7-1/2" - Type C - Insertable
 - 10) 7-1/2" by 7-1/2" - Type C.1
 - 11) 7-1/2" by 7-1/2" - Type C.2
 - 12) 9" by 9" - Type C.3
 - 13) 9" by 1-3/8" - Type D - Insertable
 - 14) 5-7/8" by 5-1/4" - Type E - Insertable
 - 15) 2-1/2" by 5-1/4" - Type E.1
 - 16) 3-1/2" by 7-1/4" - Type F
 - 17) 4-1/2" by 8-1/2" - Type F.1
 - 18) 15-1/2" by 8-1/2" - Type F.2 - Insertable
 - 19) 12" by 12" - Type G - Insertable
 - 20) 11-3/4" by 17-3/4" - Type H - Insertable
 - 21) 9-3/4" by 11-3/4" - Type I - Insertable
 - 22) 5-7/8" by 5-1/4" - Type J
 - 23) 4" by 4" – 4" by 3" - Type J.1 - Insertable
 - 24) 11-3/4" by 11-3/4" - Type K - Insertable
 - 25) 36-3/16" by 18-7/16" - Type L.1 - Insertable
 - 26) 8" by 24" (varied) - Type L.2 - Insertable - CM
 - 27) 12" by 36" - Type L.3 - Insertable - CM
 - 28) 6" by 6" - PM - Type PM.01
 - 29) 6" by 6" - PM - Type PM.02
 - 30) 6" by 6" - PM - Type PM.03
 - 31) 6" by 6" - PM - Type PM.04
 - 32) 6" by 6" - PM - Type PM.05
 - 33) 6" by 6" - PM - Type PM.06
 - 34) 8" by 8" - SM - Type SM.01
 - 35) 8" by 8" - SM - Type SM.02
 - 36) 8" by 8" - SM - Type SM.03

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Or - Indicated in SCHEDULES Article from manufacturer's standard sizes.

- b. Suspended Ceiling Wayfinding Directories:
 - 1) 8" by 24".
 - 2) 12" by 36".
 - 3) Or as Indicated in Drawings referencing manufacturer's standard sizes.
 - c. Wall suspended Wayfinding Directories:
 - 1) 36-3/16" by 18-7/16"
- B. GRAPHICS:
- 1. Type: Factory printing OR Manual.
 - 2. Factory printing:
 - a. Type style: **UTOPIA - Bold**. (may not always apply)
(Not to be used for Tactile Lettering applications.)
 - b. Type style: **INTERSTATE - Bold**. (may not always apply)
REMINDER: ADA REQUIRES ALL UPPERCASE FOR TACTILE;
UPPER/LOWER CASE FOR NON-TACTILE.
 - c. Type code: Uppercase. Initial caps. Combination.
Indicated in SCHEDULES Article.
 - d. Type size:
 - 1) HM: ** 3/16". ** 7/32". ** 1/4". ** 5/16". ** 3/8". ** 7/16". **
 - 2) CB: ** 1/2". ** 5/8". ** 3/4". ** 15/16". ** 1". ** 1-1/4". **
 - e. Color: ** PMS 349 Green ** Black ** White ** (alternate to be approved)
 - 3. Furnish Grade 2 Braille characters for tactile signs; same text as letter designations and symbol translation indicated in DEFINITIONS Article.
 - 4. Insertable signage – Manufacturer to provide Microsoft based templates (.docx; pptx) with dotted border trim line to meet all signage package templates for insertable room signs. Manufacturer to keep on hand, Large Wayfinding directory content for updates for a period minimum of 5 years. (see 1.5, c)

2.3 FABRICATION:

- A. Shop assembly: (check with Design Services for available submittals for reference)
 - 1. Fabricate units to configurations indicated on reviewed shop drawings.
 - a. Wall or vertical surface units:
 - 1) Apply border colors to second surface of face material using photographic screen printing process.
 - 2) Apply color to insert material matching face color.
 - 3) Laminate back to face material using manufacturer's standard procedure leaving space for insertable message unit.
 - b. Ceiling-mount units:
 - 1) Apply perimeter line color to plaque surface using photographic screen printing process.
 - 2) Apply background color to plaque material; both surfaces.
 - 3) Attach plaque to ceiling mount grid track and clip system.
 - 2. Furnish required copy indicated on reviewed shop drawings.
 - 3. Wrap each individual unit with polyethylene.
 - 4. Provide card stock for insertable message printing.
- B. **FullView Signs (Ceiling & Type L.1):** Low Profile Sign Frame/Holder assemblies shall be comprised of extruded aluminum and/or aluminum composite materials and shall feature an overall depth of 7/16" (12mm) or less. Inserts are clear matte acrylic constructed using a continuous extruded sheet acrylic with a consistent non-glare (matte) surface finish. Digital Print Inserts are Full Color printed on HP premium instant dry gloss photo paper.
- C. **Type SM Signs:** These are not chemically etched or photopolymer, it is a 1/8" thick continuous extruded sheet acrylic with surface silk-screened graphics.
- D. **Signs that accept paper inserts:** Sign consists of 1/8" thick continuous extruded sheet

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acrylic solid color backer with a clear 1/8" thick continuous extruded sheet acrylic with surface silk-screened rule line (borders) applied to the face of the backer with 2-way close cell VHB foam tape.

PART 3 – EXECUTION

3.1 EXAMINATION:

- A. Verification of conditions: ** Indicated in Coordination Section. ** OR **
 - 1. Examine areas to receive signage; notify Architect in writing of unacceptable substrate.
 - 2. Beginning work indicates acceptance of substrate.
 - 3. Subsequent modifications to substrate or signage becomes this section's complete responsibility.

3.2 INSTALLATION:

- A. Install holders in locations with mounting types indicated in accord with reviewed shop drawings; square, plumb, and level units.

3.3 CLEANING:

- A. Clean exposed surfaces not more than 48 hours prior to Date of Substantial Completion in accord with manufacturer's written cleaning instructions.

3.4 SCHEDULES:

- A. See attached sheet for Schedule.

3.5 REMOVAL AND REPAIRS:

- A. Verification of conditions: ** Indicated in Coordination Section. ** OR **
 - 1. Examine areas to remove existing signage; notify Architect in writing of areas that will be damaged and repaired.
 - 2. Beginning work indicates acceptance to repair wall conditions up to paint (to be provided by Facilities Management Zone group).

SECTION 10 2113 – TOILET PARTITIONS

PART 1 - PRODUCTS

1.1 TOILET COMPARTMENTS:

- A. All toilets, urinals and their respective partitions shall be wall hung.
- B. Solid (homogenous color, not coated or laminated) phenolic toilet and shower partitions are preferred over other materials such as steel or laminates.
- C. Provide stainless steel trim and hardware with self closing door hinges.
- D. Latches that do not depend on precision alignment of door and wall to operate are preferred.
- E. Provide coat hooks in toilet partitions.

SECTION 10 2800 – TOILET AND BATH ACCESSORIES

PART 1 - PRODUCTS *(TO BE VERIFIED WITH UNIVERSITY PROJECT MANAGER)*

1.1 TOILET PAPER DISPENSER

Will be supplied by the Owner and installed by the contractor.

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1.2 PAPER TOWEL DISPENSER

- A. Will be supplied by the Owner and installed by the contractor.
- B. Paper towel dispensers are generally preferred over electric hand dryers and should be designed for roll-type paper towels. Integral trash cans may be used for recessed or semi-recessed locations. Dispensers will have stainless steel finish and locking covers.
- C. Paper towel dispensers in academic/administrative building restrooms will be changed to VonDrehle Hands-Free Mechanical Roll Towel Dispenser (For 7 7/8" Towels), Model Number 886.

1.3 SANITARY PRODUCTS DISPENSER

Will be supplied by the Owner and installed by the contractor

1.4 SOAP DISPENSERS

Will be supplied by the Owner and installed by the contractor.

1.5 SOAP DISH

A built-in ceramic tile soap dish shall be installed with each shower or tub.

1.6 METAL SHELF

At lavatories, a metal shelf finished to match adjacent trim shall be provided.

1.7 WASTE RECEPTACLE

At minimum of one owner provided freestanding Rubbermaid type waste receptacle with a minimum 18 gallon capacity shall be provided for every two lavatories. Women's restroom stalls shall include sanitary napkin receptacles.

SECTION 10 4300 – EMERGENCY AID SPECIALTIES

PART 1 - GENERAL

1.1 OWNER PROVIDED, CONTRACTOR INSTALLED EQUIPMENT.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Automated External Defibrillator Basis of Design: Philip Heartstart FR2+ series
 - 1. Indoor cabinets: 19.25" height, 13" width, and 6" depth.

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PART 3 - EXECUTION

3.1 PLACEMENT

- A. Work with Project Manager in designing appropriate locations for Automated External Defibrillators.
 - 1. The American College of Occupational and Environmental Medicine (ACOEM), recommended that when practical, AEDs be placed in locations throughout a workplace that will allow initiation of resuscitation and use of the AEDs (the “drop-to-shock” interval) within 5 minutes of recognized cardiac arrest. Estimating time needed for transport and set up the AED for various work areas can help determine if a proposed location for AED placement is appropriate.

SECTION 10 4400 – FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 DESIGNERS

- A. Shall clearly identify locations for Fire Extinguishers and cabinets on the plans. Locations shall be planned with the intent to provide appropriate coverage, while having the least interference with the interior design concept.
- B. Shall specify in-wall Fire Extinguisher Cabinets and Fire Extinguishers according to the guidance of the University Safety Officer. The General Contractor shall install the specified extinguishers new, unused, and certified on the date of Beneficial Occupancy.

1.2 FINAL LAYOUT

Will be provided to the UPM and forwarded on to the University Safety Officer for review and approval.

1.3 FIRE EXTINGUISHERS

Shall be provided according to NFPA – 10 and shall be UL approved. All fire extinguisher cabinets shall comply with ADA height and sign criteria.

1.4 PROVIDE

Automated External Defibrillator as per information contained in Appendix A.

PART 2 - KNOX BOX

2.1 LOCATION

- A. The Knox box shall be externally mounted in a location where first responders will service the building in an emergency. Preferably in close proximity to the main fire alarm panel.

2.2 INSTALLATION

- A. The Knox box will be tied to the campus security system which is monitored by the campus police department.

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- B. The Knox box will have a 2 taper switches to which will be tied to the door if it is opened and the wall if the Knox box is removed.
- C. The Knox box will be through bolted and securely attached to an external wall. See manufactured for proper mounting instructions.
- D. The Knox box will contain a minimum 2 sets of keys to fire pumps, elevators, and rooms. If the building is over 5 stories the Knox box will require 5 sets of keys.

2.3 REQUIREMENTS

- A. The campus standard Knox box is 1300 series Knox box which is only surface mountable. For smaller buildings a 4100 series recess-able Knox box may be used.
- B. The Knox box must be dual keyed and the second key shall be keyed to the campus police department standard.

SECTION 10 5113 – METAL LOCKERS

PART 1 - GENERAL

1.1 SUSTAINABILITY

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre consumer recycled content is not less than 60 percent

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All similarly specified materials shall have matching finish and colors.
- B. All materials shall be new and shall be manufactured for the intended use. No manufacturer's or installer's logos or other decals or signs will be attached without authorization of the Owner.
- C. All materials shall meet N.C. State Building Codes, and should there be any discrepancies between design and code, the more stringent requirement shall apply.

2.2 LOCKERS

- A. The lockers shall have the following features unless specific changes are requested and approved by the University through the UPM. The Designer is responsible for ensuring that modifications to the following general requirements are not needed by the University:
 - 1. Height: 72" minimum
 - 2. Width: 15" on center
 - 3. Depth: 18"
 - 4. Sloped tops
 - 5. Colors:
 - a. Doors, dark green
 - b. All other parts, black
 - 6. Base: Approx. 4" height with 2" minimum horizontal "kick set back" under the front face.
 - 7. Interior
 - a. 3 hooks with one single hook on each side and one double hook on the back wall.
 - b. 2 shelves; one at top and one at bottom approximately 8 inches above the bottom.

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8. End face plates where a row of lockers do not abut a wall, face plates shall be equal, at each end of each row to center the lockers on the wall. Color will match other framework.
- B. Doors:
 1. 2 sections of louvers for air circulation, one at top and one at bottom. Louvers shall prevent visibility into locker
- C. Hardware:
 1. Numerical plates with first plate being numbered 49-1 followed by 49-2, 49-3, 49-4, etc. Each room shall have the first plate being 49-1.
 2. Name card holders to accommodate slide-in cards. (Minimum card size 1 inch height, 4 inch length)
 3. Hasp for standard pad lock.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The specified materials shall be provided and installed by the Contractor in accordance with the "best quality" industry standards. The installed materials shall be complete and operate safely and efficiently for the intended use.
- B. The Contractor will make final clean-up. All adjustments necessary to provide proper operation will be performed by the Contractor prior to leaving the site.
- C. The Contractor's installation shall include, but not be limited to, all parts, fasteners, finishes and whatever other materials and equipment are needed for a complete operating system. Prior to starting work, the Contractor shall have all needed materials at the site, so that installation will progress efficiently.
- D. The lockers shall be firmly attached to the adjacent walls and floor with non-corrosive fasteners.
- E. If the concrete floor is un-even, the Locker Contractor shall apply leveling grout.
- F. Locker doors shall be installed in a flat place with a tolerance of 1/8 inch.

SECTION 10 5500 – POSTAL SPECIALTIES

PART 1 - GENERAL

- 1.1 PROVIDE 1 MAILBOX PER LEASE, VERIFY WITH PROJECT MANAGER.

SECTION 10 7313 – AWNINGS

PART 1 - PRODUCTS

1.1 AWNING FABRICS

- A. Use a mildew resistant fabric with a solution dyed modacrylic.
- B. Woven fabric made of 100% self-extinguishing fibers. These are modacrylic solution-dyed fibers with a fluorocarbon finish.
- C. Fabric shall be approximately 9.25 oz. per square yard. The fibers shall be flame resistant to pass or exceed Test Procedure #801, Title 19, California State Fire Marshal's Test (Registration #F-368.01), National Fire Protection Association Test #701, and ASTM E-84-84 (flame spread

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and smoke density is Class A or Class 1). Conforms to virtually all local building codes. Fabric does not melt drip.

- D. Fabric shall be highly resistant to ultraviolet rays and color degradation.
- E. Fabric underside shall be same as top surface-both sides alike.
- F. Fabric shall be plain weave and have excellent breathability. Also, fabric shall be chemical resistant that is highly resistant to acids, alkalies and solvents. It shall also be water repellent.
- G. The sew ability shall be of soft draping properties; mean all measures to prevent excessive puckering and uneven.
- H. Fabric can be heat sealed using equipment in accordance with manufacturer's specifications.

1.2 AWNING FRAMING

- A. All aluminum frame tubing shall be painted to match the material color.
- B. Framing shall be designed and installed to be structurally sound, and meet all North Carolina construction codes and regulations. This includes material connections to framing.
- C. Front of awning shall have a 6" fascia overhang. Sides of awning shall be fully open.

SECTION 10 – BUILT-IN RECYCLING/TRASH CABINETS

PART 1 – GENERAL

1.1 SUMMARY

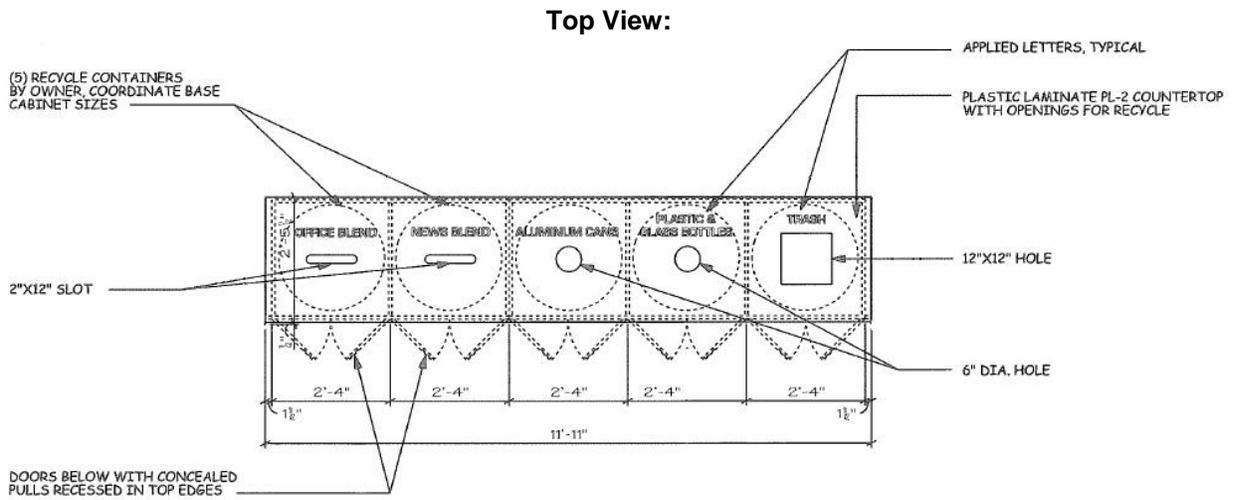
- A. As a State-funded institution, UNC Charlotte is required by NC General Statutes to provide recycling containers in all buildings. All new construction is to include built-in recycling/trash cabinets for use by the public. Built-in cabinets have the following advantages:
 - 1. Incorporated into building design, and can be built to match so that aesthetics do not become an issue.
 - 2. Allows recycling to be placed in easily accessible locations without blocking egress or creating Safety/Fire hazards.
 - 3. Ensure that recycling and trash containers are fixed in place, and cannot be moved around the building to other locations.
- B. Built-ins are to be located near vending areas and lobbies/entrances. Students should pass by at least one set of recycling bins between any given entrance and their classroom.

1.2 STANDARD DESIGN

- A. The standards for built-in recycling/trash cabinets are:
 - 1. 5-sections ("Office Blend", "News Blend", "Aluminum Cans", "Glass & Plastic Bottles", "Trash").
 - 2. Slant top with appropriately shaped/sized cut-outs for each section.
 - 3. Service doors on front of cabinets to be opened with concealed finger-holds rather than door pulls.
 - 4. Appropriately sized to fit rectangular 23-gallon container (20"W x 10"D x 30"H) or round 32-gallon container (24"Dia. x 28"H) (University will supply).
 - 5. A minimum of 8" should be left between one end of the built-in cabinet and continuing wall space to allow for collection of flattened cardboard boxes for recycling.
 - 6. Cabinet finish should be matched to interior building design. Laminate or paint finish may be used dependent on the other finishes in the area.
 - 7. Durable, engraved plastic or metal signage should be included on each section. Appropriate wording will be provided by the Office of Waste Reduction and Recycling.
 - 8. Design will incorporate ADA accessibility requirements.

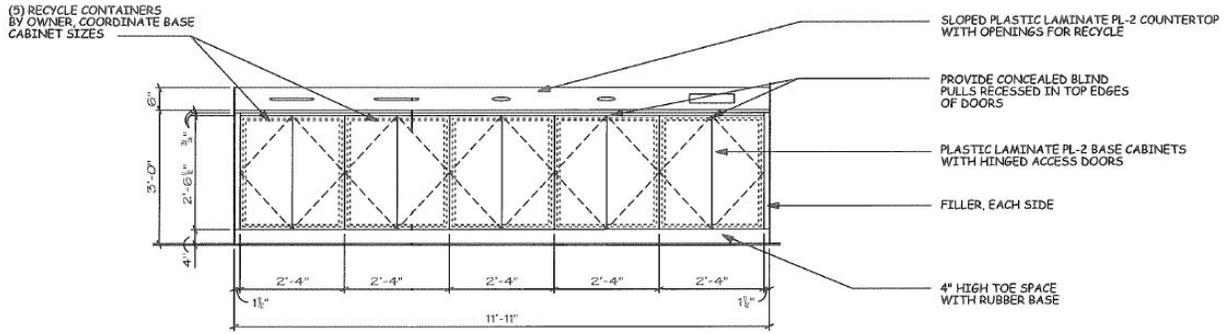
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B. Sample plan for built-in recycling cabinets for 32-gallon containers:

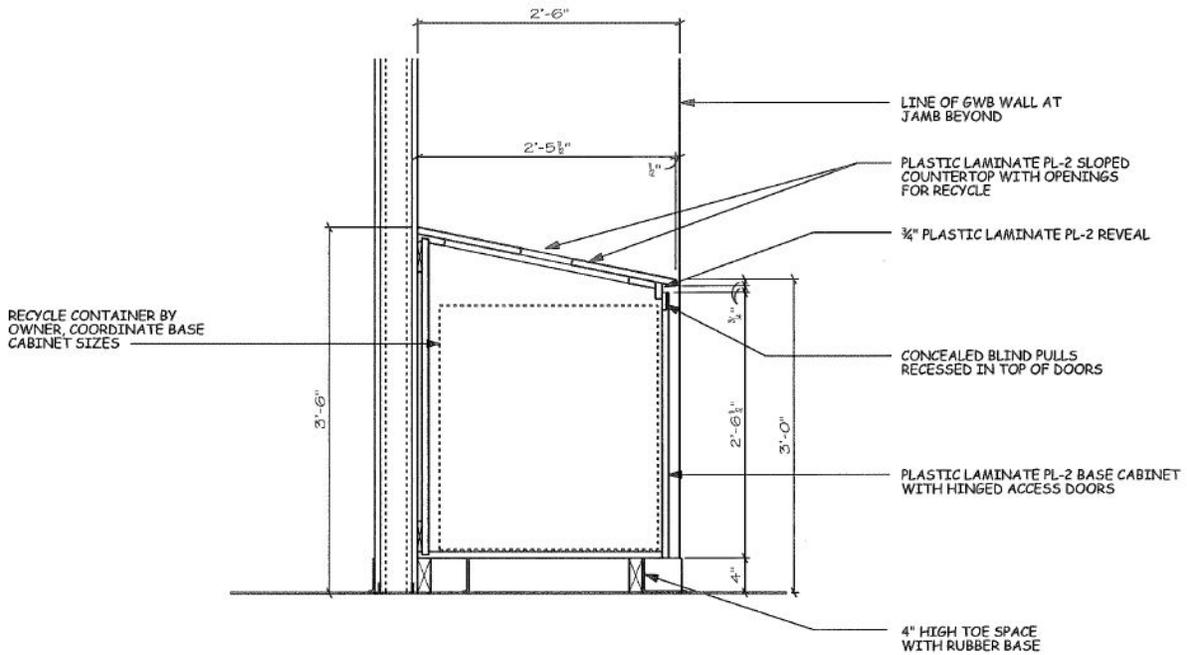


Front View:

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Side View:



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ANY DEVIATIONS FROM THE STANDARDS LISTED ABOVE MUST BE APPROVED BY OFFICE OF WASTE REDUCTION AND RECYCLING STAFF.

SECTION 2
DIVISION 11
EQUIPMENT

DIVISION 11 - EQUIPMENT

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s contract documents.

GENERAL PROVISIONS

- 1.1 CAPITAL IMPROVEMENT PROJECT EQUIPMENT IS IN ONE OF TWO CATEGORIES
- A. 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, or electrical systems. It is acquired through the construction contract and is in the project construction budget. This includes such items as shelving, food service equipment, unit kitchens, cabinets, laboratory work benches, fumes hoods, and fixed seating. The specifications shall clearly define which contractors have responsibilities relative to equipment receiving, inventory, and installation (including utility hook-ups).
 - B. Moveable Equipment is generally defined as equipment that does not have permanent attachment to the building’s systems. 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.
 - C. There may be a list of moveable equipment in the project’s program statement and the designer may be asked to help develop the final moveable equipment list as an additional service.
 - D. Allowances for all equipment need be considered during design. Some equipment may require connections to the project structure or utilities; therefore provisions for connections shall be in the project design (power, waste, water, natural gas, etc.). Both drawings and specifications shall clearly define who is responsible for receiving, installing, and connecting equipment.

VENDING EQUIPMENT

- 1.2 COORDINATION
- A. The owner’s representative will coordinate vending area requirements to be included in the design. Connection requirements of equipment (power, 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. Drink, sandwich, and candy require a 20 amp duplex receptacle.
 - 2. All water and electrical outlets should be 18 inches A.F.F.
 - 3. Floor finishes should be hard surface (ceramic tile, etc.).
- 1.3 VENDING MACHINES PROGRAM SPECIFICATIONS
- A. Purpose: To provide students, faculty and staff convenient access to snack and beverage vending machines whenever the facility is open for operation. Machines should be located inside the facility in an easily accessible location but visual presentation and minimization of noise transference is important. If the facility includes covered outside areas and patios, consideration should be given to locating additional vending machines in this location if it can be done tastefully. If workrooms, kitchenettes, or lounges are included in the program

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consideration should be given to locating vending machines in or near these areas also. Power and data outlets for vending machines shall be mounted at 78" AFF.

- B. Quantity Needed:
1. Faculty/Staff Office Building
 - a. Minimum: 1 snack and 1 beverage machine per building per 100-150 people.
 - b. Optimal: 1 snack and 2 beverage machines per building per 100-150 people.
 2. Combination of Classrooms & Office Building
 - a. Minimum: 1 snack and 2 beverage machines per building per 100-150 office people & 10 classrooms.
 - b. Optimal: 2 snack and 4 beverage machines per building per 100-150 office people & 10 classrooms.
- C. Design Factors
1. Typical Weight of Loaded Machine: @ 1000 lbs for bottle beverage Diagrams – (Attached?)
 2. Space Needed Per Machine:
 - a. Space for machine—79" high X 37" to 55" wide X 41" deep
 - b. Space need to service—37" from front of the machine
 - c. Spaced needed for facade—96" high; 2 end caps at 10" each
 - d. Space for convenient customer clearance—44 inches beyond the service space ideal.
 - e. Total Spaced needed per machine: 10.77 sq ft to 15.89 sq ft machine only
 - f. Total Space Recommended: 79 "high X 185 "wide X 78" deep - Space for typical vending set-up of 3 machines, 1 microwave, and 1trash/recycle. If a glass front bottle machine is used, add 5" to the width. If an "elevator" machine is used, add 15".
 3. Service Access
 - a. Type/Size of Access Needed for Installation and Servicing: Width and Height of door openings needed for machine clearance – 36" wide X 79" high
 - b. Preferred access without use of elevator or stairs: If elevator must be used to install, insure width, height and weight rating – 36" w X 79" h—weight empty: up to 680 lbs.
 - c. Spatial Relationship of Spaces and Access: Location of vending near fountains and bathrooms, high traffic areas (lounges, labs, concentration of classroom, or other high density utilization spaces), and/or high traffic entrances is optimal. Storage and access to loading dock or other outside unloading area is preferred both for installation and routing servicing.
 4. Utility Requirements
 - a. Power – Dedicated 20 amp/110 volt circuit for each beverage machine.
 - b. Snack machine can be plugged into outlet with beverage machine.
 - 1) 49er Card Access – Standard network connection
 - c. Sanitary Sewer drains in tiled areas to facilitate cleaning
 5. Special Considerations (Noise, Aesthetics, etc.):
 - a. Floor and Wall treatments – This will be a high use area. Tile floor is recommended around the machines to facilitate cleaning of spills; if carpet is utilized near machines color/pattern should be selected to hide stains.
 - b. Sheetrock wall corners should have bumpers or edge protectors to prevent damage during machine filling. Wall finish around machines should facilitate cleaning, i.e. gloss paint.
 - c. Noise – Machines should be located as to minimize noise transference to other areas of the facility. This may include placing machines in a room, alcove, or otherwise creating noise barriers.
 - d. Aesthetics - We would like as possible to integrate machines with facades so they appear planned versus just stuck together in a space. See Owner for facade approach. Although we would like the machines very accessible, they should be visually attractive. This may require some screening, etc.

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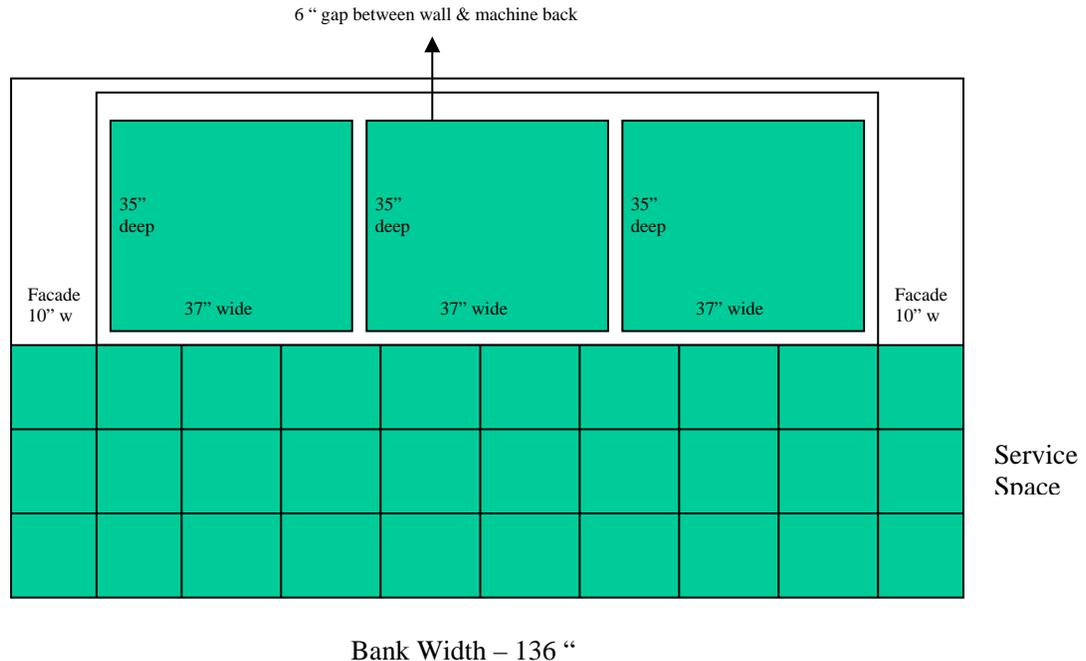
- 6. Trash
 - a. Large and attractive Trash and Recycling containers should be located near all vending areas and should be integrated into the wall lines as possible, i.e. not appear to be an afterthought, stuck in a hallway.
- D. Amenities
 - 1. As space permits the following items would be included with a central vending area, as possible in distributed location:
 - a. Space, utilities, and counter for a commercial grade Microwave.
 - b. Counters for patrons to set their materials/packs, etc on while they use the machine, or consume their purchase.
- E. Other Program Considerations:
 - 1. Avoid placing machines in locations in which usage will block hallway access. If staff workrooms/kitchenettes or staff and student lounges are included in the program, consideration should be given to locating vending machines in these locations also, i.e. one beverage and snack machine per workroom/lounge. Facility tenants/owners should be consulted before placing vending machines in these areas.

1.4 CAMPUS CONTACT

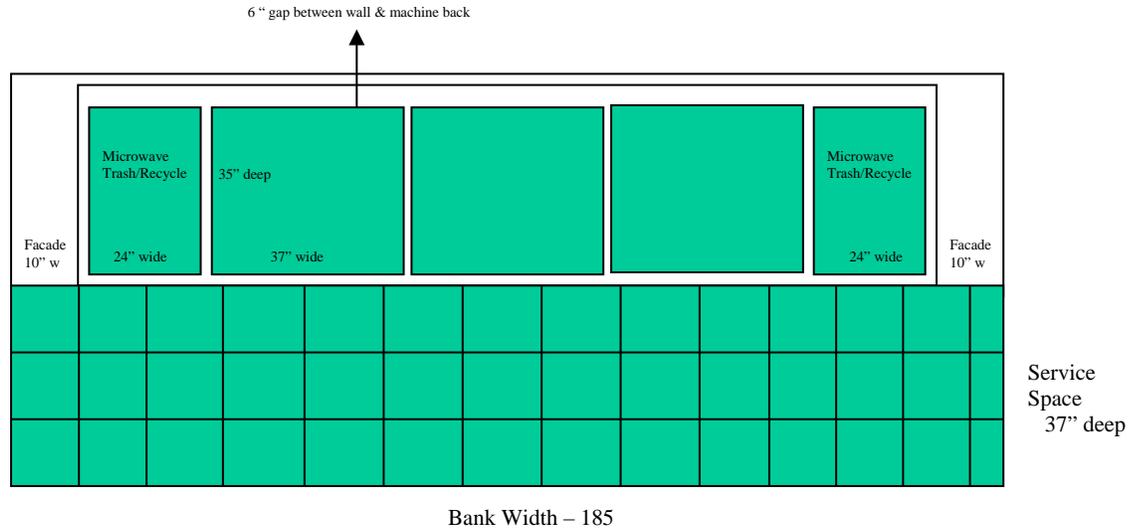
- A. For Additional Information and Design Review:

Name	Auxiliary Services
Address	Auxiliary Services Bldg. UNC Charlotte 9201 Univ. City Blvd. Charlotte, NC 28223-0001
Phone	704.687.2413
Fax	704.687.6828

1.5 SPACE DIAGRAMS



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COPY MACHINES PROGRAM SPECIFICATIONS

1.1 PURPOSE

- A. To provide students, faculty and staff convenient access to copiers whenever the facility is open for operation.
- B. Machines may be located in publicly accessible areas and inside departmental workrooms.
- C. Should a copier be located in a publicly accessible area presentation and adherence to safety codes is important. Also, most companies have guidelines or requirements for service work zones that need to be accommodated.
- D. Care should be taken to not place copiers too close to built-in cabinetry, as copier equipment is changed every 3-5 years and new equipment may vary in size from the initial machine.
- E. A small supply cabinet or small worktable is required close to the equipment. Office paper recycling system should also be located close to machine.

1.2 QUANTITY NEEDED

- A. Faculty/Staff Office Building
 - 1. Minimum: 1 publicly accessible copier per building
 - 2. Optimal: 1 copier per department with 1 publicly accessible copier per building.
- B. Combination of Classrooms & Office Building
 - 1. Minimum: 1 publicly accessible copier per floor
 - 2. Optimal: 1 copier per department with 1 publicly accessible copier every other floor

1.3 DESIGN FACTORS

- A. Typical Weight of Loaded Machine: @ 250 lbs
- B. Space Needed Per Machine:
 - 1. Space for machine: 42.5" high X 59" wide X 28" deep
 - 2. Space need to service
 - a. Front: 30"
 - b. Right Side: 10"

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- c. Left Side: 10"
 - d. Back: 7"
 - e. Height: 72" from floor
 - 3. Space for convenient customer clearance—44 inches beyond the service space ideal.
 - C. Total Spaced needed per machine: 36 sq ft of floor space for machine only
 - D. Total Space Recommended: 72 " high X 135 " wide X 65" deep - Space for copier with duplex and high capacity feeder/finisher attachment, adequate service space, 36" table/storage cabinet, and 2 10" wide office paper recycling bins.
 - E. Type/Size of Access Needed for Installation and Servicing:
 - 1. Width and Height of door openings needed for machine clearance – 32" wide; height not an issue
 - 2. Preferred access without use of stairs
 - 3. If elevator must be used to install, insure width and weight rating – 32"w—weight empty: up to 250 lbs not including personnel
 - F. Spatial Relationship of Spaces and Access:
 - 1. Location of publicly accessible copiers near high traffic areas (lounges, labs, concentration of classrooms, or other high density utilization spaces), and/or high traffic entrances is optimal.
 - 2. Location of departmental copiers near central office or in departmental workroom is optimal.
- 1.4 UTILITIES REQUIREMENTS
- A. Power: Dedicated 20 amp/115 volt circuit
 - B. 49er Card Access
- 1.5 ENVIRONMENTAL REQUIREMENTS:
- A. Temperature: Greater than 50 F and less than 90 F
 - B. Humidity: 10% RH minimum and 85% RH maximum
- 1.6 SPECIAL CONSIDERATIONS (NOISE, AESTHETICS, ETC)
- A. Built-in shelving/cabinetry – Care should be taken to not place copiers too close to built-in cabinetry, as copier equipment is changed every 3-5 years and new equipment may vary in size from the initial machine.
 - B. Heat – Copiers generate heat both at rest and during operation. Proper ventilation should exist to handle 612 BTU per hour when at rest and 2,407 BTU per hour when operating.
 - C. Noise – Machines should be located as to minimize noise transference to other areas of the facility. This may include placing machines in a room, alcove, or otherwise creating noise barriers.
 - D. Aesthetics - We would like as possible to integrate machines so they appear planned versus just stuck together in a space. We would like the machines very accessible and they should be visually attractive. This may require some screening, etc.
 - E. Trash – Small and attractive Trash and Recycling containers should be located near all copier areas and should be integrated into the wall lines as possible, i.e. not appear to be an afterthought, stuck in a hallway.
 - F. Amenities – As space permits the following items would be included with a copier area, as possible in distributed location.

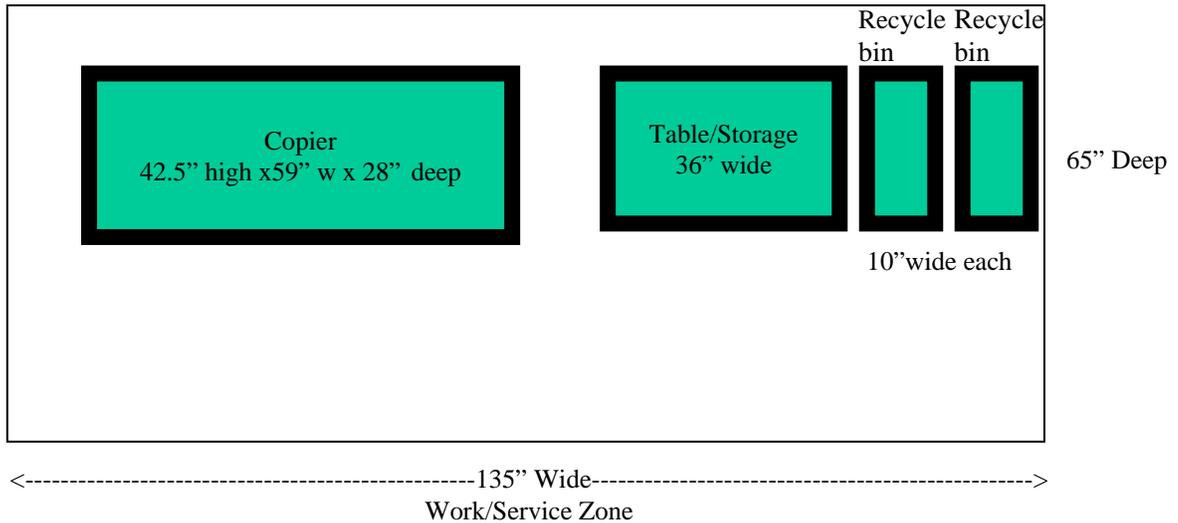
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- G. Table for patrons to set their materials/packs, etc on while they use the machine
- H. Other Program Considerations: Avoid placing machines in locations in which usage will block hallway access. If staff workrooms/kitchenettes or staff and student lounges are included in the program, consideration should be given to locating copier equipment in these locations also, e.g. one machine per workroom/lounge. Facility tenants/owners should be consulted before placing copiers in these areas.

1.7 **CAMPUS CONTACT FOR ADDITIONAL INFORMATION AND DESIGN REVIEW:**

Name Auxiliary Services
Address Auxiliary Services Bldg.
 UNC Charlotte
 9201 Univ. City Blvd.
 Charlotte, NC 28223-0001
Phone 704.687.2413
Fax 704.687.6828

1.8 **DIAGRAMS:**



PAY-FOR-PRINT PRINTING PROGRAM SPECIFICATIONS

1.1 **PURPOSE**

- A. To provide students, faculty and staff convenient access to printers whenever the public or departmental lab is open for operation. Machines may be located in publicly accessible areas and inside departmental labs. Care should be taken to not place printers in or too close to built-in cabinetry, as equipment is changed every 3-5 years and new equipment may vary in size from the initial machine. A small supply cabinet is required close to the equipment. Office paper recycling system should also be located close to machine.

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1.2 QUANTITY NEEDED

- A. Public Lab:
 - 1. Minimum: 1 publicly accessible printer per building
 - 2. Optimal: 1 printer per lab.
- B. Classroom/Departmental Lab:
 - 1. Minimum: 1 publicly accessible printer
 - 2. Optimal: 1 printer per lab

1.3 DESIGN FACTORS

- A. Typical Weight of Loaded Machine: @ 114 lbs (Printer) & @ 80 lbs (Computer)
- B. Space Needed Per Machine:
 - 1. Printer:
 - a. Space for machine—24.4" high X 18.7" wide X 24.6" deep
 - b. Space need to service
 - 1) Front: 30"
 - 2) Right Side: 10"
 - 3) Left Side: 10"
 - 4) Back: 7"
 - 5) Height: 72" from floor
 - 2. Print Release Station:
 - a. Space for machine—17" high X 29.5" wide X 27" deep
 - b. Space need to service
 - 1) Front: 30"
 - 2) Right Side: 10"
 - 3) Left Side: 10"
 - 4) Back: 7"
 - 5) Height: 72" from floor
- C. Space for convenient customer clearance—44 inches beyond the service space ideal.
- D. Total Spaced needed per machine: 36 sq ft of floor space for machine only.
- E. Total Space Recommended: 72 " high X 135 " wide X 67" deep - Space for printer with Pay-for Print Release Station, adequate service space, 36" table/storage cabinet, and 2 10" wide office paper recycling bins.
- F. Type/Size of Access Needed for Installation and Servicing:
 - 1. Width and Height of door openings needed for machine clearance – standard size interior door; height not an issue
 - 2. Preferred access without use of stairs
 - 3. If elevator must be used to install, insure width and weight rating 32" w—weight empty: up to 215 lbs not including personnel
- G. Spatial Relationship of Spaces and Access: Location of publicly accessible printers in or near public computer labs and departmental labs used as classrooms is optimal.

1.4 UTILITIES REQUIREMENTS:

- A. Power – Two (2) Dedicated 20 amp/115 volt circuit
- B. Network Line
 - 1. Two (2) campus network drops
 - 2. 49er Card Access --Twisted pair back to Telecommunications Room

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1.5 ENVIRONMENTAL REQUIREMENTS:

- A. Temperature: greater than 50 F and less than 90 F
- B. Humidity: 10% RH minimum and 85% RH maximum

1.6 SPECIAL CONSIDERATIONS (NOISE, AESTHETICS, ETC.):

- A. Built-in shelving/cabinetry – Care should be taken to not place printers in or too close to built-in cabinetry, as equipment is changed every 3-5 years and new equipment may vary in size from the initial machine.
- B. Heat/Mechanical Ozone – Printers generate some heat and mechanical ozone. Proper ventilation should exist to handle 612 BTU per hour.
- C. Noise – Machines should be located as to minimize noise transference to other areas of the facility.
- D. Aesthetics - We would like as possible to integrate machines so they appear planned versus just stuck together in a space. We would like the machines very accessible and they should be visually attractive.
- E. Trash – Small and attractive Trash and Recycling containers should be located near all printer areas and should be integrated into the wall lines as possible so that they appear to be planned for the space.
- F. Amenities – As space permits the following items would be included with a printer area, as possible in distributed location:
 - 1. Table for patrons to set their materials/packs, etc on while they use the machine
 - 2. Small storage area for paper and toner supplies

1.7 OTHER PROGRAM CONSIDERATIONS:

- A. Public labs are often open 24/7 and sometimes do not have attendants on duty. Allowances should be made to accommodate devices to secure the equipment to the tables/cabinets.

1.8 CAMPUS CONTACT FOR ADDITIONAL INFORMATION AND DESIGN REVIEW:

Name	Auxiliary Services
Address	Auxiliary Services Bldg. UNC Charlotte 9201 Univ. City Blvd. Charlotte, NC 28223-0001
Phone	704.687.2413
Fax	704.687.6828

CENTRALIZED MAIL ROOM PROGRAM SPECIFICATIONS

1.1 CENTRALIZED MAIL ROOM

- A. Location: Mail is moved about campus in bins transported with small pick-up trucks or cart vehicles. To facilitate pick-up and delivery centralized mail rooms should be located near or adjacent to the loading dock area, or be otherwise easily accessible from an exterior location by mail service personnel using campus motor vehicles. Additionally they must be easily accessible to departmental staff within the building.
 - 1. Door Access Control: The room must contain a secure door to be accessible only by mail delivery and designated faculty and staff of each department housed in the building. The

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access control mechanism should be a card reader system tied into the campus wide Lenell card access system per the approved University standard with accompanying master key accessible hardware.

2. Size: The scale 8'X 10' drawn above is a maximum size requirement, which will vary depending upon the number of departments occupying the building. Each room should have enough space to place outgoing bulk mail trays or tubs being sent from departments for processing. Shelving should be of such that will allow sorting of newspapers, flats and some small boxes. This design may be modified as space is allowed in each building and based on the number of departments/offices requiring mail services. Size and layout should be coordinated during schematic design with the Director of Mail Services.
3. Room finishes:
 - a. Shelving: A good working sample of the shelving is located in the College of Education building.
 - b. The floor should be finished with tile if possible
 - c. Lighting needs to be adequate to insure that users can see and read small print on mailing materials
 - d. Since the space will be accessed by building users it is preferable that the space be interior to the facility and conditioned (air and heat) versus requiring building users to be exposed to the outside elements.
4. The following existing mailrooms would serve as a good example of what is needed, again depending on the number and type of departments and individuals occupying the facility: College of Education Mailroom Woodward Hall Mailroom.
5. When the mail service area also functions as the recycling area for the department, the recycling area must be large enough to accommodate two paper containers (each 3 feet by 6 feet in plan).

RESTROOMS

1.1 FLOORS, WALLS, CEILINGS AND PARTITIONS SHALL BE EASY TO CLEAN, NON-POROUS, AND ACID RESISTANT. FLOORS SHALL BE A WATERPROOF, SLIP RESISTANT NO-WAX CERAMIC TILE.

1.2 ALL TOILETS, URINALS AND THEIR RESPECTIVE PARTITIONS SHALL BE WALL HUNG.

1.3 ONE HOSE SPIGOT SHALL BE PROVIDED UNDER THE LAVATORY COUNTERTOP FOR EACH RESTROOM.

1.4 EACH RESTROOM SHALL HAVE A MINIMUM OF ONE FLOOR DRAIN LOCATED AT THE LOW ELEVATION IN THE FLOOR, PREFERABLY AWAY FROM CIRCULATION SPACE.

1.5 TOILET PAPER, PAPER TOWEL AND SOAP DISPENSERS WILL BE SUPPLIED BY THE OWNER AND INSTALLED BY THE CONTRACTOR.

1.6 A WET HOUSEKEEPING CLOSET IS REQUIRED DIRECTLY ADJACENT TO EACH RESTROOM. THE CLOSET SHALL BE EASILY ACCESSED FROM A CORRIDOR OR OTHER PUBLIC CIRCULATION AREA. THERE SHALL BE NO SOFT FLOOR COVERINGS ALLOWED BETWEEN THE WET HOUSEKEEPING CLOSET AND THE RESTROOM(S) IT SERVES.

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1.7 EACH HOUSEKEEPING CLOSET SHALL BE A MINIMUM OF 6 FEET BY 8 FEET IN PLAN AND HAVE SHELVING FOR SUPPLY STORAGE AND WALL MOUNTED TOOL HOLDERS FOR MOPS AND BROOMS.

DESIGN GUIDELINES FOR CLASSROOM PLANNING AND DESIGN

1.1 PLEASE SEE APPENDIX A, DESIGN GUIDELINES CLASSROOM PLANNING AND DESIGN

SECTION 2
DIVISION 11
CAMPUS FOOD SERVICE APPENDIX A

DIVISION 11- CAMPUS FOOD SERVICE APPENDIX A

CAMPUS FOOD SERVICE OPERATIONS

FOOD OPERATION CONSTRUCTION AND RENOVATIONS

1.1 UNIVERSITY DEPARTMENT

- A. Business Services' Auxiliary Services Department shall review and approve any new food operations construction and renovation along with the appropriate Facilities Management Departments including preliminary program, design drawings, and construction drawings. Auxiliary Services Department administers all food related contracts with the University and outside vendors. Auxiliary Services Department shall be integrally involved in all aspects of construction including scheduling, construction progress, changes, and funding decisions.

1.2 PLAN REVIEW

- A. All new food operation construction and renovations shall be reviewed and approved by the North Carolina Department of Insurance.
- B. All new food operation construction and renovations shall be reviewed by the Mecklenburg County Health Department. Refer to web site under "Environment Health Plan Review"
<http://www.charmeck.nc.us/Departments/Health+Department/Environmental+Health/Food+and+Facilities+Sanitation/Programs+and+Services/Environmental+Health.htm>

1.3 RULE AND CODE COMPLIANCE

- A. All food operation construction and renovations shall comply with all Federal, State, and Local codes and guidelines.

1.4 SPECIFIC RULE AND CODE COMPLIANCE

- A. *Note: This is to bring special attention of rules and codes, other rules & codes may be required and govern new construction and renovations as appropriate.*
- B. All new food operation construction and renovations shall comply with administrative rules used by the North Carolina Department of Environment and Natural Resources. The rules are from "Title 15A, Subchapter 18A of the North Carolina Administrative Code".
- C. All new food operation construction and renovations shall require a site survey and review of all new equipment installed by the Mecklenburg County Health Department to insure that installation does follow the original approved plan review. This site survey and review will be scheduled and coordinated by the University's Food contractor as the health certificate shall be issued to the contractor, not the University.
- D. All new food operation construction and renovations shall be inspected at a later date by the Mecklenburg County Health Department to receive the require health rating certificate which will be posted at each food preparation site.
- E. All new food operation construction and renovations shall comply with the current National Electric Code NFPA 70.

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- F. All new food operation construction and renovations shall comply with the current State of North Carolina, Department of Administration, State Construction Office, Electrical Guidelines and Policies.
 - G. All new food operation construction and renovations shall comply with the Charlotte Mecklenburg Utility Department guidelines on requirements for sanitary sewer grease separators or interceptors. Refer to Mecklenburg County Code interpretation 1003.1 dated January 1, 2005.
 - H. All new food operation construction and renovations shall comply to the current North Carolina Building Code with respect of the use and requirement of exhaust hoods for use in food service operations. This includes North Carolina Mechanical Codes and guides for furnishing make up air required as part of an exhaust hood installation. All “Seismic Bracing” shall be installed as per guides and codes. Food exhaust duct shall have appropriate clean out access hatches for use during regular scheduled contracted duct cleaning.
 - I. All new food operation construction and renovations shall comply to the NFPA 17A and North Carolina Fire Codes concerning fire suppression systems with food exhaust hoods.
- 1.5 STANDARDS
- A. Flooring- Anti-bacterial ceramic tile shall be installed on all food preparation floors. This tile shall have slip preventative surface but allow for easy cleaning.
 - B. Ceiling- As per standard building codes, all ceilings shall be cleanable in food preparation areas.
 - C. Walls, Cabinets, Equipment- All services shall be easily cleanable.
 - D. Point of Sale
 1. All food locations require 49er card jacks.
 2. One Ethernet jack for credit card machine.
 3. Quad electrical box for each point of sale.
 4. The University will provide the point of sale equipment.
 - E. Beverage Machines
 1. The University’s contract food vendor arranges for the installation of beverage distribution stations, contractor must provide smooth chases for the installation of beverage lines from the distribution station to the “bag in the box” location and the CO2 propellant location.
 - F. Service Area & Loading Dock Design
 1. Service Area:
 - a. The service area shall be easily accessible to service vehicles and free from conflict with other vehicle and pedestrian traffic.
 - b. A recycling and trash holding room shall be located directly adjacent to the loading dock. The room size (minimum 100 square feet) shall vary dependent upon the building occupancy and function.
 - c. A housekeeping supply storage room (measuring at minimum 12 feet by 14 feet) shall be located adjacent to the loading dock.
 2. Loading Dock:
 - a. The loading dock shall be wide enough for two dumpsters sitting side by side with enough additional space for a delivery vehicle to back up to the loading dock and adequately open driver and passenger side doors.
 - b. Loading dock height shall be 60 inches.
 3. Loading Dock Driveway:
 - a. Loading dock driveways shall have 20 feet minimum radii (preferably larger).
 - b. Driveways and surrounding areas shall be designed to enable drivers to have a clear and unobstructed view while backing up to the loading dock.

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Section 2, Division 11 – Food Service Appendix A

- c. Provide appropriate parking locations and signage for service vehicles; such locations shall not block access for delivery and waste hauling trucks.
 - 4. Dumpster:
 - a. Provide space immediately adjacent to the building service area for two front loading type dumpsters, one for trash and one for cardboard.
 - b. Dumpsters should be located at the loading dock so that staff may place trash and cardboard directly into either dumpster from the dock.
- G. Grease Retention & Removal – Grease Interception & Containment
 - 1. Provide a complete and appropriate system for the retention and removal of grease resulting from cooking activities.
 - 2. Provide adequate space and systems for grease interception retention and containment. Provide the appropriate systems and mechanisms to prevent spillage during grease removal. Provide direct access to water to clean all adjacent areas.
- H. Can Wash
 - 1. All new food operation construction and renovations shall incorporate a can wash equipment and can wash area at an appropriate location with curbs.
- I. Hot Water Heaters
 - 1. Hot water heaters shall be installed to provide the required 140 degree water for dish washing and prep sinks.
 - 2. Mixing valves and/or additional hot water heater will be required to provide hot water for hand sinks in the food operation area as appropriate.
- J. Cameras
 - 1. All new food operation construction and renovations shall incorporate electronic cameras to monitor cash operations at point of sale areas.
 - 2. System to communicate and operate with the campus standard camera systems.
- K. Emergency Power
 - 1. All new food operation construction and renovations shall have all walk in coolers and freezers on secondary back up emergency power generator in the case of loss of house electrical power.
- L. Restrooms
 - 1. Although covered in the Mecklenburg County Health Department rules and codes, appropriate locations for restrooms shall be provided for both employees and customers including hot running water.
- M. Equipment
 - 1. All new food operation construction and renovations equipment shall be required to have the NSF (NSF International Inc.) and UL label.
- N. Utilities for Food Equipment
 - 1. General utilities shall be provided at each site by the general contractor for connection to Kitchen and Food Equipment.
 - 2. General contractor shall be required to make all hard utility connections to Kitchen and Food Equipment.

SECTION 2
DIVISION 12
FURNISHINGS

DIVISION 12 - FURNISHINGS

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s contract documents.

SECTION 12 2113 – HORIZONTAL LOUVER BLINDS

PART 1 - PRODUCTS

1.1 LOUVER BLINDS:

- A. If blinds are included in the project, they shall be of horizontal style and give a uniform appearance from the exterior. Vertical blinds shall be avoided.

SECTION 12 6100 – FIXED AUDIENCE SEATING

PART 1 - GENERAL

1.1 PROJECT CONDITION

Field Measurements: Coordinate actual dimensions of construction affecting fixed lecture room seating installation by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid delay of Work.

1.2 WARRANTY

- A. Manufacturer's Product Warranty: Submit manufacturer's standard warranty form for fixed lecture room chairs. This warranty is in addition to, and not a limitation of other rights Owner may have under Contract Documents.
 - 1. Warranty Period: One year from Date of Substantial Completion.
 - 2. Beneficiary: Issue warranty in legal name of project Owner.
 - 3. Warranty Acceptance: Owner is sole authority who will determine acceptance of warranty documents.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials (Flammability) shall satisfy applicable test, codes, standards, or requirements as follows:
 - 1. Polyethylene shall meet the Federal Motor Vehicle Safety Standard No. 302 which specifies a burning rate of less than 4 inches per minute.
 - 2. Upholstery materials shall meet requirements as set forth in the state of California Bureau of Home Furnishings Technical Bulletin 117.
 - 3. Fire-performance Characteristics of Seat Padding: Provide seating that complies with test method: California Technical Bulletin 117.
 - 4. Cushioning and padding shall be self extinguishing as defined in the requirements as set forth in the State of California Bureau of Home Furnishings Technical Bulletin 117.

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2.2 SEATING

- A. Fixed classroom seating shall be designed with manufactured, integral horizontal beams for future installation of data transmission cables. Unless directed otherwise, each seat shall be provided with oversized folding tablet-arm writing surface for placement of laptop computers. Tablet-arm support arms shall be heavy duty.
- B. Approximately 8% of tablet-arm shall be configured for comfortable use by left-handed persons.

2.3 SEATING FABRICATION

- A. Chair standards (legs and sides) shall be constructed of heavy duty cast iron.
- B. Backs of chairs shall be curved. Seats shall be upholstered unless directed otherwise.
- C. Structural Performance:
 - 1. Engineer, fabricate and install fixed audience seating to the following structural loads without exceeding allowable design working stresses of materials involved, including anchors and connection. Apply each load to produce maximum stress in each respective component of each audience seat unit.
- D. Manufacturer's System Design Criteria:
 - 1. Table Tops:
 - 2. Shall be nominal 1-1/4" thick, warp-resistant construction.
 - 3. Shall have core construction of 1-1/8" thick Novoply of 45 pcf density. Top surface shall have .040" high pressure laminate meeting NEMA 1999 standards, the bottom surface shall have .020" thick backing sheet.
 - 4. Glue shall be PVA applied under hot press.
 - 5. Edges shall be extruded 1-1/4" vinyl bullnose with T groove, inserted into a routed groove and secured every 12".
- E. Modesty Panels:
 - 1. Shall be nominal .810" thick, warp-resistant construction.
 - 2. Shall have core construction of .75" thick Novoply of 45 pcf density. Top surface shall have .040" high pressure laminate meeting NEMA 1999 standards, the bottom surface shall have .020" thick backing sheet.
 - 3. Glue shall be PVA applied under hot press.
 - 4. Edges shall be extruded 7/8" vinyl bullnose with T groove, inserted into a routed groove and secured every 8 inches.
- F. Frames:
 - 1. Table and seating frames shall be constructed of 1-1/2" x 2" x 11 gauge welded tube, configured into an integral unit for support of table and seat swing arm mechanism.
 - 2. Table mounting plate shall be 6" x 8" x 11 gauge formed plate for securing to floor with 3/8" expansion anchors.
 - 3. Swing arms shall be constructed from 1-1/2" x 2" x 11 gauge welded tube, hinged at the cantilever frame with copolymer thermoplastic bearings at 8 gauge junction box with spring activated return fully enclosed to prevent injury.
- G. Seat Modules:
 - 1. A two piece injection molded thermoplastic seat and backrest. The seats and backrests shall be joined by a maintenance free steel hinge with integral spring mechanism. The hinge is to be covered with a high-strength plastic bellows. Attachment to steel frame shall be through four molded-in sills on bottom of seat.
 - 2. Upholstered seats and back pads are required.
 - 3. Provide removable or swing-away chairs where wheelchair spaces are required.
- H. Power Modules:

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1. Integral power modules shall be 6-1/4" long x 3" wide x 2-1/2" high. Module shall be constructed of polycarbonate with textured finish, meeting UL-VO minimum requirements.
2. Each power module shall have one duplex receptacle (110 volts) and two data ports for data connections to meet AT&T standard connections. Data connectors to be provided by owner. The power module shall have a positive locking device in open position. Shall be constructed for use with eight wire harness.
3. Eight Wire Harness shall be constructed from flexible conduit to distribute power between power/data modules and the power in-feed. The wire harness shall be enclosed in a plastic trough with a metal divider to separate power and communication or data cables. The trough shall be .06 inch thick rigid pvc and attached to underside of table surfaces.

SECTION 12 9300 – SITE FURNISHINGS

PART 1 - PRODUCTS

1.1 SEATING

- I. Campus Memorial Benches:
 1. Campus benches are acquired by donations through the University Development Office. Location of benches will be provided through the UPM by the guidance of the Development Office and coordinated with the Facilities Management Planning Section.
 2. Bench Material and Style: Campus benches will be made of wood and metal as made by DuMor model #67-470, or approved equal, with clear heart redwood or fair-weather Transit series model T-2 with clear heart redwood or ipe wood. Legs will be made of metal, painted black, and be a "Gull Wing" design. (see Annex F, attached herewith).
 3. Bench Location Considerations:
 - a. The location of the bench shall be placed to create a pleasant and comfortable environment.
 - b. Orient benches to face landscaped areas when possible.
 - c. Avoid facing benches toward streets and parking areas.
 - d. Locate benches to attract students.
 - e. Benches made of ipe wood will not be placed in areas in close proximity to benches made of redwood.
 - f. Benches will be located to bring honor to those for whom they were dedicated. When large numbers of benches are donated, careful consideration must be given to the location to ensure the selected area will not be inundated with unnecessary seating.

1.2 COLUMNS AND WALLS

- A. Refer to the Design Guideline Illustrations. Placement of new columns and walls shall be reviewed with the University Landscape Architect. Seat Walls – Use "Basic Square Rowlock" corner blocks.

1.3 1.3 BICYCLE

- A. Racks
- B. Lockers, Fiberglass bike lockers shall be provided with observation window.
See Annex F, attached herewith.

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Section 2, Division 12 – Furnishings

1.4 TRASH RECEPTACLES

- A. Provide exterior trash and recycling containers. Trash cans shall be side loaded. (Consult UPM for appropriate number and orientation).
- B. See Annex/Appendix.
- C. See Annex E – Selection and Placement of Recycling & Trash Containers on Campus.

1.5 BOLLARDS

Pipe - Shall be 8" diameter, 36" high painted steel pipe set in 18" 3000 psi concrete.

1.6 SKATE STOPPERS

- A. Install skate board stopping.
- B. See Annex/Appendix.

1.7 ASH URNS

- A. Work with UPM to determine quantity and locations.
- B. See Annex/Appendix.

1.8 SIGNAGE

- A. See "CAMPUS SIGNAGE STANDARDS DOCUMENT".
- B. Signs, Roads Placement: (See Annex F, attached herewith).

SECTION 2
DIVISION 13
SPECIAL CONSTRUCTION

DIVISION 13 - SPECIAL CONSTRUCTION

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s contract documents.

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SECTION 2
DIVISION 14
CONVEYING EQUIPMENT SYSTEMS

DIVISION 14 – CONVEYING EQUIPMENT

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s contract documents.

SECTION 14 2000 – ELEVATORS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. The system must comply with ADA requirements; ASME/ANSI A17.1/A17.5; CSA & UL approved; and FCC Class A approved, and all applicable codes.
- B. Provide heat and smoke detector devices, and sprinkler heads as required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Elevator Equipment Room floors shall be a minimum of four feet in elevation above the bottom of the elevator shaft.

2.2 SYSTEMS AND COMPONENTS

- A. New Elevator Controls Modernization System.
 - 1. This system shall be a microprocessor-based network with improved performance over relay-based or conventional dispatching systems. The system shall have the capability of real time management and advance information processing to analyze building traffic patterns and evaluates estimated times of arrival (ETA) based on car position and hall call assignments for each car in the building. The system shall dispatch the car with the shortest ETA so passenger wait time is minimal.
 - 2. The system shall also improve ride quality by continually regulating the key elements which affect ride comfort, acceleration and deceleration, door opens, and floor to floor times.
 - 3. The system shall have modernization compatibility built in, such that it can work and function with existing peripherals such as door operators and signals.
 - 4. The system shall land elevators consistently at floor levels with greater accuracy. Cars shall not stop first, and then adjust to floor position. Actual floor heights are stored in memory and the system automatically adjusts to compensate for shifts in floor levels.
 - 5. The system shall be compatible with upgrading the elevator drive control to solid state DC or ACVF depending on the condition of the elevator system and the desired performance improvements.
 - 6. Each car shall have its own microprocessor so any car can act as the dispatcher. This redundant dispatching capability enables another car to assume master controller responsibilities in the event the master controller is taken out of service.

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Section 2, Division 14 – Conveying Equipment Systems

7. Phase I & II emergency fire service shall be provided in compliance with the ANSI A17.1 and NC State Building Code.
8. An emergency alarm bell shall be located on the car in conformance with ANSI A17.1 Code requirements, and connected to a plainly marked pushbutton in the car.
9. Elevators will return to ground floor and open doors in the event of a power failure. Provide emergency power as needed to accomplish this.
10. Elevator door emergency access keys shall be keyed to match the University Standard system and be placed in a Knox box on premises with a copy given to Campus Police Department.
11. Provide shunt-trip circuit as required.

2.3 OPERATION SYSTEMS (DUPLEX CAR AUTOMATIC, INDEPENDENT SERVICE FEATURE):

- A. Control of the elevator car shall be automatic in operation by means of a push button in the car marked for each of the two landing levels served and one button at each landing, wherein all stops registered by the momentary pressure of landing or car buttons shall be maintained until the car answers the call. An emergency stop switch shall be provided in the car push button station which, when in the off position, will render the elevator inoperative, and which will enable attendant or passenger to stop the car at any point during its travel. Opening of this switch shall not cancel registered calls, and when the switch is closed the care will continue to answer calls that have been registered. Each landing station shall contain a push button which shall become illuminated when pressed to indicate that a call has been registered to bring the car to that particular landing. A time delay, noninterference feature shall be incorporated in the control mechanism to allow ample time for opening and closing car and hoistway doors before it is again placed in motion.
- B. The operating buttons in the car and at the landings shall be vandal resistant fixtures and mounted in flush plates of a stainless steel finish. Fixtures shall be etched for illumination.
- C. An adjustable time delay (minimum 3-15 seconds) shall be provided so that after the car has stopped in response to a hall button, the entering passenger may register his car button before the car will reverse to answer calls in the opposite direction. The car stations hall contain an emergency switch for stopping the car at any point in its travel. Opening of this switch shall not cancel registered calls; when the switch is closed, the car shall continue to answer calls that have been registered. If the emergency switch is activated it shall be connected so as to sound the alarm bell located on the car top.
- D. The car station shall contain key switch (es) to operate the fan, lights and independent service operation. The independent service operation shall be capable of locking out each floor by use of key switch at each floor button location. Some floors will have restricted access and some floors will have limited access at certain times of the day. The independent service shall be such that it can be adaptable to add a card reader access system into the cab if necessary. A "door open" button shall be provided for stopping the closing motion of the doors, causing them to return automatically to their open position. The buttons in the car and hall stations shall be of the light-up type which will illuminate when the button is pressed, indicating that a call has been registered for that landing.
- E. Smoke detectors in the elevator machine room and each elevator lobby are on a separate zone. Only these detectors will affect the elevator. Should the first floor elevator lobby detector or elevator machine room detector be activated, the elevator is to park at the 2nd floor.
- F. Door Hold-Open Timer:
 1. The door hold-open timer shall be a modification to the elevator control circuitry combined with a solid state timer which is wired to the door open button in the elevator car. Pressing the door open button twice activates the timer and establishes an open door time which can be adjusted anywhere from 10 seconds to 2 minutes. After this time period has elapsed, the doors close and the car is restored to service automatically. The

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Section 2, Division 14 – Conveying Equipment Systems

pressing of a floor button in the car cancels the remaining time and permits immediate elevator service.

G. Corridor Hall Stations:

1. Hall station shall be surface mounted and have a modular design to allow for quick and easy installation of all components including key switches, etched instructions, and signage. Hall stations shall be made of anodized aluminum in stainless tones and mirror finished in frame. Mounting is with tamper resistant screws of a mirror finish. Hall stations must comply with ADA 4.10.3 and ANSI requirements.

2.4 DOOR OPENING DEVICES

A. New Door Operator:

1. New door rollers, interlocks, clutches, door tracks and spirator closures shall be retrofitted to existing elevator cars. Door operators shall provide smooth, quiet operation and outstanding reliability. Operators shall be easy to assemble and their configurations shall be field reversible and adjustable. Operators shall consist of a closed loop operation to provide smooth, steady motion at all times. Doors shall open and close without jerky movement or unnecessary noise.
2. Door operators shall feature solid state technology and strong, durable components. When maintenance is required all door operator elements shall be engineered for quick access and easy servicing.
3. Doors shall react instantaneously to safety sensors, and door closing speed and force shall be well within safety standards.
4. Elevator door safety edges to be Pana 40 continuous light beam.
5. Position adjustments shall be clearly identified and easily accessible from the top of the cab even when the door is in motion.
6. The system's service switch has open and close button on the control. This allows for easy selection of automatic or manual operation and means that adjustments can be performed quickly and easily. Door operators shall use a rigid door clutch design meeting code requirements.
7. Elevator Door Protection Device:
 - a. The elevator door safety system shall provide full opening protection; the screen shall fill the doorway from ground level to a height of six (6) feet. The system shall have no moving parts and can be set to tolerate damage keeping elevator in service.
 - b. The elevator door safety system shall protect passengers by setting up a harmless curtain of infrared beams. Block a single beam and the door reopens. The beams shall be controlled by ultra-reliable electronic circuitry. Elevator doors shall open and close automatically. They shall be provided with a reopening device that will stop and reopen the car door and hoistway door automatically if the door becomes obstructed by an object or person. The device shall be capable of completing these operations without requiring contact for an obstruction passing through the opening. The device shall be a non-reflective through beam system with a minimum of forty sensors per edge. It shall have a maximum sensor spacing of 1.8" or less. It shall incorporate a microprocessor controlled fail-safe system. It shall be capable of self adjustment to compensate for varying environmental conditions.

2.5 CAR ENCLOSURES

A. Removable Cab Wall Panels:

1. Panels to be covered in plastic laminate, using a standard design from either Nevamar or Formica product lines.
2. Reveal strip package and kick plate also in plastic laminate.

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- B. Elevator Ceiling Grid and Tile:
 - 1. Ceiling shall be elevator standard suspended ceiling. Three light metal frame with translucent diffusers.
 - 2. Use fluorescent lighting in the elevator cab – not reflector floods.
- C. Elevator Cab Flooring:
 - 1. Floor covering shall be 12" x 12" glue down vinyl composition tile flooring.
- D. Elevator Cab Fan:
 - 1. Elevator 2-speed cab fan shall be fitted for each car.
- E. Painting:
 - 1. All exposed metal work furnished by the elevator contractor under these specifications shall be properly painted after installation, except as otherwise specified.
 - 2. Minimum requirements shall include one coat of metal primer, and one coat of semi-gloss industrial grade enamel.
 - 3. All surfaces painted must be clean and free from rust, grease, etc., before painting.

2.6 SIGNAL EQUIPMENT

- A. All elevators shall contain flush mounted emergency telephones meeting University standards. Control wiring and conduit required from the elevator to the elevator equipment room shall be provided and installed by the prime contractor who installs the elevator. Conduit and wiring from the elevator equipment rooms to the facility termination point shall be installed by either the Electrical Contractor or the General Contractor. The University shall provide telephone cabling beyond the project termination point.
 - 1. Telephones in elevators shall be GAI-Tronics ADA Emergency telephone flush-mounted Model 287RP-AD.
- B. Car Position Indicator:
 - 1. An electrical position indicator shall be provided in the upper portion of the elevator cab. An audible signal shall sound prior to elevator arriving at or passing any landing.
 - 2. A digital readout type indicator may be substituted.
 - 3. Fixtures shall be vandal resistant and shall be stainless steel.
- C. Car Riding Lantern with Gong:
 - 1. The elevator shall be provided with a fixture mounted in the jamb, or soffit of the elevator cab entrance. It shall notify waiting passengers by means of electrically illuminated direction arrows and audible gong as to which direction the elevator will be traveling. The gong shall sound once indicating an "up" traveling car and twice to indicate a "down" traveling car. Fixtures shall be vandal resistant and shall be stainless steel.
- D. Braille Elevator Plates and Signage:
 - 1. Plates and signage shall be high quality zinc die cast Braille and shall meet all ADA and ANSI requirements.

SECTION 2
DIVISION 21
FIRE SUPPRESSION

(SEE SECTION 02-28 FOR FIRE ALARM STANDARDS)

DIVISION 21 - FIRE SUPPRESSION

(NOTE: **SEE SECTION 02-28 FOR FIRE ALARM STANDARDS**)

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer's contract documents.

SECTION 21 0510 - MECHANICAL GENERAL – FIRE SUPPRESSION

PART 1 - GENERAL

1.1 GENERAL DESIGN CRITERIA

- A. Fire suppression systems are life safety systems and therefore are not subject to the energy conservation criteria applicable to other mechanical/plumbing systems.
- B. The fire suppression systems do not require a Life Cycle Cost Analysis.
- C. All fire suppression systems shall comply with the requirements of the applicable NFPA standards.
 - 1. All fire suppression systems shall comply with the applicable DOI/State Fire Marshal's Office requirements. See the following website for the latest documentation:
<http://www.ncdoi.com/osfm/engineering/documents/sprinkler%282008%29.pdf>.

1.2 STANDARDS

- A. Automatic sprinkler systems shall comply with NFPA 13 – Standard for the Installation of Automatic Sprinkler Systems.
- B. Standpipe and hose valve systems shall comply with NFPA 14 – Installation of Standpipes and Hose Systems.
- C. Fire pump systems shall comply with NFPA 20 – Installation of Centrifugal Fire Pumps.
- D. Fire water storage tanks shall comply with NFPA 22 – Water Tanks for Private Fire Protection.
- E. Site fire water systems shall comply with NFPA 24 – Installation of Private Fire Mains and Their Appurtenances.
- F. Automatic suppression systems for data rooms and server locations shall comply with NFPA 2001 and all appropriate NFPA standards.
- G. Laboratory suppression systems shall comply with NFPA 45 and all appropriate NFPA standards.
- H. All fire suppression systems shall comply with the North Carolina Department of Insurance, Office of State Fire Marshal document titles FIRE SPRINKLER AND SUPPRESSION SYSTEMS, latest edition.

1.3 DESIGN SUMMARY

- A. Fire protection systems shall be designed in accordance with the requirements of NFPA.
- B. Fire protection systems for State-owned facilities (facilities other than the Community Colleges) shall be submitted to the North Carolina Department of Insurance, State Property Fire Fund Division, 410 North Boylan Ave., Raleigh, NC 27603-1212 (919)733-3901 for review and approval at each phase of design.

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- C. Designer shall solicit input from local fire officials when developing fire protection plans for State-owned facilities.
- D. Sprinkler system design shall be shown on fire protection plans, and not included on floor plans of other trades.
- E. Provide a summary sheet with, at the minimum, the following information for each fire sprinkler zone: hazard classification, water application density, available water flow and pressure (static and residual data) as determined by a recent (within one year) water flow test, and test hydrant locations.
- F. Indicate the size and location of any fire pumps required.
- G. Indicate the location of all standpipes, tamper switches and flow switches. Provide a riser diagram for multistory (more than one floor) buildings.
- H. Capacities of equipment shall be described on drawings by the way of equipment schedules. Pump rooms shall be shown large scale plans (1/4" = 1'-0" minimum) with piping larger than 2 inches in diameter drawn double line. All valves and appurtenances (tamper and flow switches) shall be properly indicated. Backflow prevention and flow control devices shall also be shown.
- I. Ensure that "normally closed" type sprinkler valves are used when installed valve is designed to be normally shut/closed.

PART 2 - PRODUCTS

2.1 SYSTEM

- A. As required by NFPA 13 and 24, the sprinkler system shall typically include the following:
 - 1. An alarm check valve with outside water motor gong.
 - 2. A post indicator valve located 40 feet from building walls.
 - 3. A fire department connection on the system side of the water supply check valve.
 - 4. Fire department connections shall be on the street side of buildings and shall be located and arranged so that hose lines can be readily and conveniently attached to the inlets.
 - 5. All sprinkler flow and tamper switches shall be furnished and installed under Division 13, and wired under Division 26.
 - 6. Valves shall comply with the requirements listed in the appropriate NFPA standards and the OSFM documents. All valves shall be fitted with polished brass tags with the stamp-engraved system abbreviation and sequenced valve number. Valve tags shall be attached with brass chains or "S" hooks.
 - 7. Piping shall comply with the requirements listed in the appropriate NFPA standards and the OSFM documents.
 - 8. Dry valve gasket kits from valve manufacturer to be supplied at installation.
 - 9. Manufacturer supplied replacement packing gland kits be provided with each fire pump installed.
 - 10. CPVC (Blazemaster-Plastic Piping) shall not be used in campus sprinkler installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Specify that sprinkler heads be centered in ceiling tiles unless specific locations make this impossible.
- B. All associated valves for Fire Department Connections and/or Test Header Connections are to be located in Fire Pump Room or Fire Sprinkle Riser Room, no underground valves of these types are permitted.

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- C. Pipe all fire sprinkler drain lines to the exterior of buildings. All exterior drain openings shall be directed towards a solid surface.

SECTION 2
DIVISION 22
PLUMBING

DIVISION 22 – PLUMBING

Note: This is a guide for Designers only. Contents shall NOT be used in lieu of specifications as part of the Designer’s contract documents.

PART 1 - PLUMBING GENERAL

1.1 PLUMBING DESIGNER:

- A. Design for Maintainability. Plumbing systems and systems components shall be durable and easy to maintain. The Consultants shall incorporate into equipment and system design sufficient access and clearance for maintenance, repairs, and replacement. Incorporate instrumentation necessary for balance and initial adjustment, as well as for service and monitoring.
- B. Design for Reliability. Systems shall have a high degree of reliability. If an entire building system will be affected by lesser reliability of a component (for example, a pump serving building process chilled water system), then a redundant piece of equipment shall be provided to increase overall system reliability. Design for parallel operation is acceptable for redundancy.
- C. Design for Energy Conservation. The energy efficiency of building systems and equipment is an essential part of the University design philosophy. Any new project shall be designed with state of the art energy efficiency. Design standards published by American Institute of Architecture (AIA), American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) and the State of North Carolina shall be met or exceeded.
 - 1. Major energy consuming systems and equipment shall be specified and purchased based on Life Cycle Cost Analysis. Careful evaluation of energy conservation measures shall begin early in the design phase and continue throughout the design process.
 - 2. Three phase electric motors for mechanical equipment shall be specified to be Premium Efficiency.
 - 3. The thickness of insulation for chilled water, hot water, steam, and condensate shall be geared toward conserving energy. Insulation thickness shall be selected for optimum cost versus/ efficiency. Economic evaluation is desirable.
 - 4. The Designer shall submit a report indicating utility and energy use for new facilities. The total energy consumption shall indicate monthly use of electricity, water, and gas for the Water and associated energy requirements shall be shown for process water, irrigation and domestic hot water. Energy use estimates shall be submitted with each design phase as well as with each alternate design proposal. The Owner can make an exception for small-scale projects.

1.2 OWNER INTENT

- A. Plumbing Contract shall include:
 - 1. Gas piping systems, beginning with connections to piping provided by the gas utility or provider, to and including the connection with gas appliances or outlets. Where coordination with a gas utility or provider is required, such as in arranging for gas services to a building, coordination shall be through the Plumbing Contractor.
 - 2. Domestic water supply and sanitary sewer systems associated with buildings, from and including connection to existing mains, including provision of water meters, backflow preventers, vaults and manholes.

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3. Interior roof drainage piping systems, beginning with connections to roof drains fixtures to the point of disposition, five feet outside the building. Roof drains shall be specified by the Architect, and provided in the General Contract.
4. Fire sprinkler and standpipe systems shall be part of the General Contract.
5. Graywater systems should NOT be considered for buildings.
6. Rain water harvesting should be considered for all new construction. The collection system, storage cisterns and distribution system shall meet the requirements of the North Carolina State Plumbing Code. The water can be used for site irrigation and cooling tower make-up in the building. Mechanical condensate can be collected and harvested along with the roof rain water. The water should be treated prior to use in accordance with the State statutes. Currently there are no time limits on the storage of this water.
 - a. Detailed documentation must be provided to include operating instructions, PID loops, component wiring diagrams, sequences, and set points.
 - b. Provide above documentation on laminated 24 by 36 minimum sheet mounted in rain water mechanical room.
7. Domestic Solar Water Heating Systems should be considered for buildings with large shower, cooking and domestic hot water loads. The system shall be a complete solar water heating system designed to as a source of hot water and shall be provided by a representative of a NABCEP Certified Solar Distributor. The solar system controls shall be integrated into the BAS package and communication interfaces shall be included. The system shall be complete with all components necessary and shall be fully operational.
 - a. Detailed documentation must be provided to include operating instructions, PID loops, component wiring diagrams, sequences, and set points.
 - b. Provide above documentation on laminated 24 by 36 minimum sheet mounted in mechanical room.
 - c. Consideration must be given to removal/rejection of excess heat.

1.3 DIVISION OF WORK

- A. This section delineates the Division of Work between Division 22 (Plumbing Contracts) and Division 26 (Electrical Contracts).
 1. Specific work to be done under Division 26 is hereinafter listed or described. All other work necessary for the operation of Division 22 equipment shall be performed under Division 22.
 - a. All individual motor starters for mechanical equipment (pumps) shall be furnished and installed under Division 22 unless indicated as a part of a motor control center. Motor starters for equipment provided in motor control centers shall be furnished under Division 26.
 - b. Under Division 26, power wiring shall be provided up to a termination point consisting of a junction box, trough, starter or disconnect switch. Under Division 26 line side terminations shall be provided. Wiring from the termination point to the plumbing equipment, including final connections, shall be provided under Division 22.
 - c. All relays, actuators, timers, seven-day clocks, alternators, pressure, vacuum, float, flow, pneumatic-electric, and electric-pneumatic switches, aquastats, freezestats, line and low voltage thermostats, thermals, remote selector switches, remote push-button stations, emergency break-glass stations, interlocking, disconnect switches beyond termination point, and other appurtenances associated with equipment under Division 22 shall be furnished, installed and wired under Division 22.
 - d. All wiring required for controls and instrumentation not indicated on the drawings shall be furnished and installed by Division 22.
 - e. The sequence of control for all equipment shall be as indicated on the Division 22 Drawings and specified in the appropriate section.

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- f. Where electrical wiring is required by trades other than covered by Division 26, specifications for that section shall refer to same wiring materials and methods as specified under Division 26. No Exceptions.
 - 2. Many of the items covered in the plumbing guidelines pertain to those items which may be unique to The University of North Carolina at Charlotte, its systems or preference or requirements mandated by Facilities Management. Any item not specifically outlined or commented upon in these guidelines is left to the judgment of the engineering design professional to use current accepted good engineering practice. The construction documents are subject to review and comment by Facilities Management at any time during the course of design or construction of the project.
 - 3. Deviation from concepts noted in these guidelines requires approval of the Project Manager and Facilities Mechanical Engineer for The University of North Carolina at Charlotte. **RESIDENCE LIFE PROJECTS HAVE PLUMBING VARIANCES GRANTED BY THE STATE CONSTRUCTION OFFICE.** Verify applicability prior to beginning design.
 - 4. All floor plans and enlargements of floor plans shall bear North arrows, room numbers, and column lines conforming with the designations found on the Architectural floor plans. All floor plans and enlargements shall have the same directional orientation as the architectural floor plans. Site plans and floor plan directional orientation shall agree.
- 1.4 ADDITIONAL REQUIREMENTS FOR DRAWINGS
- A. Capacity of new equipment shall be described on drawings by way of equipment schedules. Equipment schedules shall indicate, in addition to technical data, the location of equipment and areas served by it. Schedules for air-handling units shall indicate minimum and maximum outdoor airflow in cubic feet per minute in addition to other information.
 - B. Flow diagrams for water and gas shall be shown on drawings with all piping sized. Direction of flow shall be indicated. The Consultant shall incorporate schematic piping diagrams for the following:
 - 1. Pressure-reducing stations
 - 2. Domestic hot water heaters
 - 3. Gas meter installations
 - 4. Others as they may apply to a specific project
 - C. Piping sizes shall be clearly indicated. All valves shall be shown. Valves shall be placed in locations with adequate access.
 - D. Mechanical equipment room layouts shall be drawn in 1/4" scale or larger. As many sections as necessary shall be provided to clarify installation of equipment, piping, and ductwork, and to show clearances for service. All large valves, particularly gate valves, shall be drawn to scale showing the location of the hand wheels.
 - E. The automatic temperature control schematic shall be shown on drawings. Sequence of operation description shall be included.

PART 2 - PRODUCTS

2.1 VALVES

- A. All valves (except plumbing fixture faucets, convenience hose bibs, shut offs at plumbing fixtures, and similar rough-in connections and end-use fixtures) shall be provided with 19-gage

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polished brass valve tags with the stamp-engraved piping system abbreviation and sequenced valve numbers. Valve tags shall be attached with brass chains or S-hooks.

- B. 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 and space). Valves intended for emergency shut-off and similar special uses shall be marked by “flags” in the margin of the schedule.
- C. All water valves to operate by turning the square nut clock-wise (right) to close and counter-clockwise (left) to open, as per UNCC requirements.
- D. Provide all underground valves with extensions and donuts around valve boxes.

2.2 LABELING

- A. Plumbing 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.. Pipe shall be identified with colored signs and arrows indicating its respective system and direction of flow. New equipment will be pre-painted by the equipment supplier before shipment.

<u>Piping System</u>	<u>Pipe Abbreviation</u>	<u>Paint Color (Devoe)</u>
Acid Waste	ACID	Safety Yellow (DC9400)
Chilled Water	CHW (S, R)	Safety Blue (DC 9800)
Chilled Beam Water	CB(S, R)	Car Blue (DC4035)
DI	DI(R)	Green
Condenser Water	CW (S, R)	Car Blue (DC4035)
Hot Water (heating)	HW (S, R)	Oxide Yellow (DC8800)
Rain Harvesting	RH (S, R)	Purple
Steam	S (HPS, MPS, LPS)	Safety Yellow (DC9400)
Steam Condensate	LPC, HPC	Safety Orange (DC9200)
Pumped Condensate	CPD	Oxide Red (DC7821)
Natural Gas	GAS (FG, ID)	Medium Yellow (DC 8600)
Relief Valve Vents		Orange
Duct work		White
Equipment		White
Hanger Rods		Flat Black
Domestic Cold Water	DCW	Medium Green (DC6650)
Non-Potable Cold Water	NP CW	Spruce (DC5323)
Lab Cold Water	LCW	Light Green (DC5574)
Domestic Hot Water	DHW	Light Buff (DC1810)
Lab Hot Water (S, R)	LHW	Interna'l Orange (DC6900)
Lab Vacuum	LV	Blue
Lab Waste	LW	Black (DC9903/9990)
Tempered Water	TW	Medium Brown (DC1400)
Domestic Hot Water Return	DHWR	Desert Sand (DC1046)
Lab Compressed Air	LA	Plymouth Grey (DC2100)
Nitrogen	N2	Light Grey (DC2973)
Sanitary Drain / Vent	SAN	Match Surrounding
Sprinkler / Fire Line		Safety Red (DC9000)

UNDERGROUND PIPING IDENTIFICATION

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- A. Permanent, bright colored, continuous plastic tape, intended for direct burial, shall be installed 8" below finished grade directly over all buried utilities for first stage of underground piping identification. Tape shall be printed to most accurately indicate type of buried utility.
- B. Tracer Wire: A #12 AWG or heavier (smaller AWG number), solid, insulated (RHW, THW, or polyethylene insulation is recommended); copper wire shall be taped to pipe at 15 to 20 foot intervals to be second stage of underground piping identification. Do not wrap wire around pipe. The wire must be one continuous, unbroken length. Coil tracer wire at meter location and street end with enough wire to extend a minimum of two feet above grade.
- C. Tracer Wire Boxes: Plastic gas services longer than 1000 feet in length from curb valve to meter riser must have tracer wire boxes installed at customer's expense in accordance with Company standards.

2.3 METERING

- A. The University operates utility distribution systems for electricity, potable water, steam/ condensate, hot water and chilled water. Natural gas is provided by Piedmont Natural Gas Co. Cost distribution for utilities is accomplished through a metering system and a prorated assignment of cost.
 - 1. Meters shall be approved for interface to the Building Automation System (BAS) for real time monitoring and trending.
 - 2. 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 cubic feet, and provide output to building automation.
 - 3. Non-sewered water (consumed but not returned to the sewer, e.g. irrigation, cooling tower makeup, etc.) should be metered at its source. Meter should be located in mechanical room, easily accessible, read in cubic feet and provide output to building automation. Meters and transmitters must conform to Charlotte Mecklenburg Utilities (CMU) Standards for providing sewer credits.
 - 4. Natural Gas metering shall comply with all requirements of Piedmont Natural Gas (PNG), and interface to the Building Automation System through a PNG provided pulse.
 - 5. Contact Facilities Engineering for metering requirements on special systems to include reclaimed water and solar water heating.

2.4 SOUND AND VIBRATION CONTROL

- A. The Consultant shall provide vibration isolation where required. There shall be no objectionable transmission of vibration from equipment to the building structure.
- B. Appropriate vibration isolation of equipment, piping and ductwork shall be specified. Attention shall be paid to the proper use of flexible duct and pipe connectors, the use of resilient pipe hangers and supports, anchors and guides, and the treatment of pipe and duct penetrations through building walls.
- C. Mechanical equipment rooms shall be placed preferably at ground level and away from occupied spaces to minimize transmission of vibrations and noise into the building.

PART 3 - PIPING INSULATION

PART 1 - EXECUTION

1.1 INSULATION FOR PIPING

- A. The Designer shall evaluate thermal insulation properties and moisture migration to prevent surface condensation. Designer shall evaluate insulation vapor permeability and potential for

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surface sweating to recommend type of insulation. In areas where insulated pipes are subject to physical abuse, an aluminum covering shall be applied around the insulation.

- B. Insulation of underground piping shall receive special attention. Adequate protection against ground water and electrolytic forces shall be provided.
- C. All valves and fittings shall be insulated with preformed fitting insulation. Provide also for insulation of all cold and hot surfaces of equipment when available from the manufacturer.

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 – PRODUCTS

1.1 GENERAL

Plumbing Fixtures must meet the following maximum water usage requirement which are based upon North Carolina Session Law 2007-546 (Senate Bill 668), OR existing NC Plumbing and Energy codes – whichever are more stringent.

- 1. Lavatory Faucets to be furnished with aerators with maximum flow of 0.5 gpm based on inlet pressure of 60 psi.
- 2. Showerheads, flow of 1.5 gpm or less based on inlet pressure of 60 psi.
- 3. Urinal Flush Valves 0.75 gpm per flush or less
- 4. Water Closet Flush Valves of 1.0 gpm per flush or less

1.2 PLUMBING FIXTURES

- A. All plumbing fixtures shall be as manufactured by American Standard, Crane, Eljer, Kohler, Zurn or Toto.
- B. Flush valve type fixtures are preferred over tank type fixtures. Flush valves shall be automatic unless otherwise approved by owner.
- C. Urinals – Urinals shall be low flow 0.125 gallons per flush.

1.3 PLUMBING FIXTURE TRIM

- A. Provide lavatory faucets manufactured by Zurn, Toto, Sloan, Kohler or Chicago.
- B. Provide laboratory faucets and accessories manufactured by Chicago.
- C. Automatic faucets should be used for all restroom lavatory faucets.

SECTION 22 4400 - WATER SYSTEMS

PART 1 - GENERAL

1.1 RISER DIAGRAMS

- A. Provide supply and waste riser diagrams for all multistory (more than one floor) buildings

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PART 2 - PRODUCTS

2.1 PIPING

- A. Sanitary sewer piping shall be cast iron. Joints for underground piping shall be bell and spigot with compression gaskets. Joints for piping above grade may be bell and spigot with compression gaskets or no-hub.
- B. Vent piping shall be cast iron or galvanized steel except that galvanized steel shall not be used underground.
- C. Drain, waste and vent piping for acid waste systems shall be of high silicon cast iron, borosilicate glass (above grade only) or polypropylene piping.
- D. Roof drain leaders above grade shall be galvanized steel or cast iron piping with no-hub or bell and spigot joints with compression gaskets. All roof drain piping below grade shall be cast iron piping with bell and spigot joints with compression gaskets.
- E. Water piping inside the building and above grade shall be type L hard drawn copper unless other approved by owner.
- F. Water piping below slab shall be type K soft annealed copper tubing with no joints below the slab. Water service shall be stubbed above floor as near the exterior wall as practical, rather than running below slab to an interior space.
- G. Solder joints in copper pipe shall be made with 95 percent tin, 5 percent antimony solder in sizes up to and including 1 1/4". Joints in pipe sizes above 1 1/4" shall be made with brazing solder.
- H. All piping shall be routed as to remain clear of transformer vaults, refrigerated spaces, switch rooms, elevator shafts, or other critical areas, and vault spaces over same. Do not specify drain pans under piping routed over this equipment. Reroute the piping.
- I. Undersides of roof drains, and horizontal storm water drains or roof leaders inside the building shall be insulated to prevent the formation of condensation. Undersides of floor drains receiving condensate drainage from a cooling coil, and associated traps and horizontal drain piping to point of connection with other sanitary sewer piping shall be insulated to prevent the formation of condensation.
- J. No piping except soil, waste or drain piping shall be installed in or below concrete slabs on grade.
- K. Cold water and hot water plumbing piping is not permitted in exterior walls except to supply hose bibbs.
- L. All main piping shall have accessible shut-off valves for isolation purposes. All branch piping from main shall have shut-off valves.
- M. Floor drains connected to the sanitary sewer shall be provided in all mechanical equipment rooms, custodial closets, restrooms and locker rooms.
- N. Hose bibbs shall be provided in all mechanical equipment rooms, kitchens, rooms that require wash down, and rooms with floor drains. All hose bibbs shall be provided with vacuum breakers.
- O. Provide supply and waste piping riser diagrams for all multistory (more than one floor) buildings.
- P. Verify with the local authority how elevator sump pump discharge shall be handled. This office prefers that pump discharge be routed to the sanitary sewer with an indirect (air-gap) connection. It is recommended that the pump also trigger an alarm to alert the building management system and/or maintenance personnel.
- Q. Specify testing in accordance with the plumbing code.

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SECTION 22 4500 - FUEL GAS SYSTEMS

PART 1 - GENERAL

1.1 GAS PIPING

- A. Gas piping shall be schedule 40 black steel and comply with ANSI B36.10, ASTM A 53 or ASTM A 106 in accordance with Section 306.1, page 45 of the North Carolina State Building Code. Volume VI -Gas.
- B. Indicate the location of the gas pressure regulator(s) and the gas meter. Indicate which contractor or utility will provide the regulator(s) or meter.
- C. Interior gas piping shall be painted yellow and identified or labeled "GAS" with stencils or labels in accordance with ANSI A13.1.

SECTION 22 8000 – PLUMBING SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. North Carolina General Statute 143-135.37(d) requires commissioning of major projects.
- B. Performance Verification. – In order to be able to verify performance of a building component or an energy or water system component, the construction contract shall include provisions that require each building component and each energy and water system component to be commissioned, and these provisions shall be included at the earliest phase of the construction process as possible and in no case later than the schematic design phase of the project. Such commissioning shall continue through the initial operation of the building. **The project design and construction teams and the public agency shall jointly determine what level of commissioning is appropriate for the size and complexity of the building or its energy and water system components.**
- C. Design for Commissioning. The plumbing designer will be responsible for ensuring and developing "... a systematic process of assuring that a building (*mechanical, electrical and plumbing systems*) performs in accordance with the design intent and the owner's operational needs." The Owner considers the following elements as a minimum requirement for building acceptance and inherently integral to the Plumbing Designer responsibilities, unless specifically notified otherwise by the Owner.
 - 1. Design Phase – Provide documentation to the commissioning agent with copy to owner for following:
 - a. Owner's project requirements and Basis of Design, to include single line drawings for Design Narrative.
 - b. Commissioning reviews of design documents.
 - c. Verification that operations and maintenance staff training through the plumbing contractor is specified.
 - d. Metering and sub metering to accomplish analysis of annual energy and utilities consumption versus projected consumption.
 - e. Clarify the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
 - 2. Construction Phase

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NOTE: Commissioning shall in no way reduce the designer scope and responsibility for Construction Administration to include verifying quality of system installation. Designer team is to:

- a. Attend the commissioning scoping meeting and selected commissioning team meetings.
 - b. Provide Installation Verification.
 - c. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
 - d. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. On site observations should be completed just prior to system startup.
 - e. The designers shall continue to assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
 - f. Startup and Checkout.
 - g. From the Contractor's red-line drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as shop drawings for the plumbing systems.
 - h. Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
3. Post Construction Phase
- a. Designer will provide classroom overview to university operations staff to include Basis of Design, potable water systems, lab systems, rainwater systems, emergency operations, system capacities and limitations, and metering.
 - b. M&V. Assist in reconciling discrepancies between actual energy/utilities usage and the submitted projection model.
- D. The Designer will include in bid documents the specific support and documentation required of the General Contractor (CM), Mechanical Contractor, Electrical Contractor, Plumbing Contractor, Controls Contractor, Designer, Owner and others as applicable to ensure acceptable commissioning.

Reference Division 01 General Requirements for commissioning guidelines. **Guidelines will be modified as appropriate for each project.**

SECTION 2
DIVISION 23
HVAC

DIVISION 23 - HVAC

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s contract documents.

SECTION 23 0510 - MECHANICAL GENERAL - HVAC

PART 1 - GENERAL

1.1 MECHANICAL DESIGNER:

- A. Design for Accessibility and Maintainability. Mechanical systems and systems components shall be durable and easy to maintain. The Consultants shall incorporate into equipment and system design sufficient access and clearance for maintenance, repairs, and replacement. Incorporate instrumentation necessary for balance and initial adjustment, as well as for service and monitoring. Galvanized steel or concrete shall be used for outside mechanical equipment supports. Details of mechanical supports shall be shown on the drawings.
1. Rooftop equipment should be minimized to reduce roof damage and access requirement. A full stairs or elevator shall be extended to roof for maintenance of roof mounted major mechanical equipment such as air handlers, pumps and rooftop package units.
 2. Location of all new equipment shall be planned to allow future replacement without major building modifications.
 3. **Terminal units, control valves, dampers and BAS controllers shall be a maximum of 2 feet above ceiling grid.**
 4. Hard ceilings access panels shall be a minimum of 24” square.
 5. There will be no controllers or control components, such as air valves control valves etc, in the ceiling of a controlled access space. These components will be above the corridor or in an interstitial space.
- B. Design for Reliability. Systems shall have a high degree of reliability. If an entire building system will be affected by lesser reliability of a component (for example, a pump serving building chilled water system), then a redundant piece of equipment shall be provided to increase overall system reliability. Design for parallel operation is acceptable for redundancy.
- C. Design for Energy Conservation. The energy efficiency of building systems and equipment is an essential part of the University design philosophy. Any new project shall be designed with state of the art energy efficiency. Design will meet or exceed standards published by American Institute of Architecture (AIA), American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) and the State of North Carolina. Metering and Verification, and reporting of energy and water use is a designer requirement.
1. Major energy consuming systems and equipment shall be specified and purchased based on Life Cycle Cost Analysis. Careful evaluation of energy conservation measures shall begin early in the design phase and continue throughout the design process.
 2. Building functions that require twenty-four hour a day operation, such as libraries, laboratories, computer rooms, and others as defined by the Owner shall be served by a system separate from that of offices or classrooms that are subject to different operating schedules.
 3. Economizer Cycle that allows the use of outdoor air for free cooling during the winter and intermediate seasons without the use of mechanical refrigeration equipment, shall be specified. The Designer shall provide heat recovery for all systems using 100 percent outdoor air. All mechanical systems shall be controlled and monitored by a direct connection to FM Building Automation System as applicable.

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4. Three phase electric motors for mechanical equipment shall be specified to be Premium Efficiency.
5. The Designer shall use variable volume air handling systems and variable volume pumping to optimize energy efficiency. Fans and pumps shall be selected with the highest efficiency available. Wire to water efficiency shall be evaluated for pumps prior to making the final selection.
6. The thickness of insulation for chilled water, hot water, steam, and condensate shall be geared toward conserving energy. Insulation thickness shall be selected for optimum cost versus efficiency. Economic evaluation is desirable.
7. Cooling towers shall be selected with fan motors or motors equipped with variable frequency drives to allow for energy efficient capacity control. Variable frequency drives will be located indoors.
8. Hydronic systems shall be designed with two-way modulating control valves to prevent energy waste. Minimum pump water flow requirement shall be maintained.
9. The Designer shall evaluate mechanical systems ENERGY EFFICIENCY not only at full load, but also at part load conditions using established computer models. The results shall be presented to the Owner. Energy use estimates shall be submitted with each design phase as well as with each alternate design proposal.
 - a. For code applicable facilities, the Designer shall submit an energy model report indicating energy use expressed in BTUs per sq. ft. per year. The total energy consumption shall indicate monthly use of electricity, steam, water, cooling and heating BTU use from Regional Utility Plants and gas.
 - b. Building consumption categories shall be further divided as practical to show energy use for lighting, motors, heating, cooling, production of domestic hot water, process loads and other major energy uses that may apply. The Owner can make an exception for small-scale projects.
 - c. Designer will provide projected computer generated month to month usage of all different utilities for measurement and verification. Data files such as Trace .TAF are to be forwarded to both owner and commissioning agent.
10. After building acceptance by owner, M&V will be conducted quarterly during the first year of occupancy by the designer and reviewed by the Cx. Energy model will be calibrated quarterly and updated data files forwarded to the owner and Cx.

1.2 OWNER INTENT

- A. HVAC Contract shall include:
1. All heating connections and controls for domestic water heating equipment serviced by steam or heating-hot water. Domestic water heating equipment, cold water supply to this equipment and domestic hot water from this equipment, including connections and valves, shall be in the Plumbing Contract.
 2. Refrigeration and cold storage systems having capacity 15 tons and greater capacity. Systems of less than 15 tons may be placed in the General Contract.

1.3 DIVISION OF WORK

- A. This section delineates the Division of Work between Division 23 (Plumbing and HVAC Contracts) and Division 26 (Electrical Contracts).
1. Specific work to be done under Division 26 is hereinafter listed or described. All other work necessary for the operation of Division equipment shall be performed under Division 23.
 - a. All individual motor starters for mechanical equipment (fans, pumps, etc.) shall be furnished and installed under Division 23 unless indicated as a part of a motor control center. Motor starters for mechanical equipment provided in motor control centers shall be furnished under Division 26.
 - b. Under Division 26, power wiring shall be provided up to a termination point consisting of a junction box, trough, starter or disconnect switch. Under Division

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- 26, line side terminations shall be provided. Wiring from the termination point to the mechanical equipment, including final connections, shall be provided under Division 23.
- c. Duct smoke detectors shall be furnished and wired by Division 26, installed by Division 23. Fire alarm AHU shut down circuits shall be wired from the fire alarm control panel to a termination point, adjacent to the fire alarm control panel, under Division 26. AHU control wiring from the termination point to the equipment will be under Division 23.
 - d. All relays, actuators, timers, programmable timers, alternators; pressure, vacuum, float, flow, pneumatic-electric, and electric-pneumatic switches; aquastats, freeze stats, line and low voltage thermostats, thermals, remote selector switches, remote push-button stations, emergency break-glass stations, interlocking, disconnect switches beyond termination point, and other appurtenances associated with equipment under Division 23 shall be furnished, installed and wired under Division 23.
 - e. All wiring required for controls and instrumentation not indicated on the drawings shall be furnished and installed by Division 23.
 - f. Roof exhaust fans with built-in disconnects provided under Division 23 shall be wired under Division 26 to the line side of the disconnect switch. A disconnect switch shall be provided under Division 26 if the fan is not provided with a built-in disconnect switch. In this case wiring from the switch to the fan shall be under Division 23.
 - g. The sequence of control for all equipment shall be as indicated on the Division 23 Drawings and specified in the appropriate section.
 - h. Where electrical wiring is required by trades other than covered by Division 26, specifications for that section shall refer to same wiring materials and methods as specified under Division 26. No Exceptions.
2. Many of the items covered in the mechanical guidelines pertain to those items which may be unique to The University of North Carolina at Charlotte, its mechanical systems or preference or requirements mandated by Facilities Management. Any item not specifically outlined or commented upon in these guidelines is left to the judgment of the engineering design professional to use current accepted good engineering practice. The construction documents are subject to review and comment by Facilities Management at any time during the course of design or construction of the project.
 3. Deviations from concepts noted in these guidelines require approval of the Project Manager and Facilities Mechanical Engineer for The University of North Carolina at Charlotte. **RESIDENCE LIFE PROJECTS HAVE MECHANICAL VARIANCES GRANTED BY THE STATE CONSTRUCTION OFFICE.** Verify applicability prior to beginning design.
 4. All floor plans and enlargements of floor plans shall bear North arrows, room numbers, and column lines conforming to the designations found on the Architectural floor plans. All floor plans and enlargements shall have the same directional orientation as the architectural floor plans. Site plans and floor plan directional orientation shall agree.
- 1.4 MECHANICAL EQUIPMENT ROOM DESIGN
- A. New mechanical equipment rooms shall be designed to have access from the outside, via an opening large enough to facilitate the removal of the largest piece of equipment therein
 - B. All mechanical equipment shall be within Mechanical Equipment Rooms (MER). MERs shall be large enough to allow proper servicing of equipment, allow for future growth, and include access for replacement of all mechanical equipment.
 - C. The Consultant shall locate the MER to protect the surrounding areas from equipment generated noise. If sensitive spaces exist above or adjacent to a MER, acoustical treatment shall be provided to maintain noise level to acceptable limits as noted in ASHRAE.

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- D. The layout of equipment within a MER shall allow access to all equipment components, including pulling tubes for converters, chillers, and air-handling unit coils. A minimum of 3 feet is required for access to filters, dampers, and valves and as a separation between equipment. Lifting eyes shall be provided in equipment rooms in which the moving of heavy equipment is anticipated and for above ceiling equipment, such as an environmental room compressor, that will be mounted above the room enclosure.
- E. MERs shall have space allocated within for storage of air filters and miscellaneous maintenance items.
- F. MERs shall be provided with sufficient lighting that is not obstructed by ductwork or piping. Column and wall-mounted lighting shall be included where necessary.
- G. All MERs shall be equipped with duplex convenience outlets suitable for operating small tools and drop-cord trouble lights.
- H. Provisions for domestic water services for maintenance purposes shall be provided.
- I. MERs located above the lowest floor shall have curbs around any equipment with water. The floor inside the curb will be sealed and a floor drain will be provided to prevent flooding the floor below.
- J. All MERs shall be provided with adequate ventilation and temperature control designed to prevent temperature buildup and freeze up.

1.5 ADDITIONAL REQUIREMENTS FOR DRAWINGS

- A. Capacity of new equipment shall be described on drawings by way of equipment schedules. Equipment schedules shall indicate, in addition to technical data, the location of equipment and areas served by it. Schedules for air-handling units shall indicate minimum and maximum outdoor airflow in cubic feet per minute in addition to other information.
- B. Ductwork layouts on 1/8" and 1/4" scale drawings shall be shown as a double line, drawn to scale. Single line duct layouts will be acceptable only on preliminary drawings.
- C. Flow diagrams for air, water, and steam shall be shown on drawings with all piping sized. Direction of flow shall be indicated. The Consultant shall incorporate schematic piping diagrams for the following:
 - 1. Chilled water systems
 - 2. Condenser water systems
 - 3. Hot water systems
 - 4. Converters
 - 5. Pumps
 - 6. Heating and cooling coils
 - 7. Steam main drips
 - 8. Flash tanks
 - 9. Pressure-reducing stations
 - 10. Domestic hot water heaters
 - 11. Cooling towers
 - 12. Others as they may apply to a specific project
- D. Piping and ductwork sizes shall be clearly indicated. All valves shall be shown, as well as volume dampers in ductwork, fire and smoke dampers, and access doors and must conform to accessibility and maintenance standards.
- E. Mechanical equipment room layouts shall be drawn in 1/4" scale or larger. As many sections as necessary shall be provided to clarify installation of equipment, piping, and ductwork, and to show clearances for service. All large valves, particularly gate valves, shall be drawn to scale showing the location of the hand wheels.

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- F. The automatic temperature control schematic shall be shown on drawings. Sequence of operation description shall be provided either on plans or specifications.
- G. Control valves shall have a valve authority of at least 0.25 unless approved by the Facilities Engineer. A control valve schedule shall be provided showing valve authority for all control valves larger than ¾". For terminal reheat control valves a typical valve authority is sufficient.

PART 2 - PRODUCTS

2.1 LABELING

- A. Mechanical equipment shall be labeled with name, number as designated on designer's contract documents, service and operational requirements, 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.
- B. Strap on Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed. Install tags with corrosion resistant chain.
- C. Laminated Plastic Name Plates: ASTM D 709, Type I, cellulose, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore. Nameplates shall be approximately 1-1/2" x 4", 1/16" thick, and have 1/2" high lettering. Face of plastic shall be black with white letters. Fasteners shall be self-tapping, stainless steel screws or contact-type with permanent adhesive.
- D. Metal Tags: Polished brass, 0.032" thick, with stamped letters; tag size minimum 1-1/2 inch diameter.
- E. See Div 09 9100 for paint general requirements. New equipment will be pre-painted by the equipment supplier before shipment. Colors (to be submitted to Owner for approval) for equipment and piping color schedule shall be as follows. Devco paint identification number is provided for reference only. Other manufacturers matching the paint and color should be considered.

<u>Piping System</u>	<u>Pipe Abbreviation</u>	<u>Paint Color (Devco)</u>
Acid Waste	ACID	Safety Yellow (DC9400)
Chilled Water	CHW (S, R)	Safety Blue (DC 9800)
Chilled Beam Water	CB(S, R)	Car Blue (DC4035)
DI	DI(R)	Green
Condenser Water	CW (S, R)	Car Blue (DC4035)
Hot Water (heating)	HW (S, R)	Oxide Yellow (DC8800)
Gray Water	GW (S, R)	Purple
Rain Harvesting	RH (S, R)	Purple
Steam	S (HPS, MPS, LPS)	Safety Yellow (DC9400)
Steam Condensate	LPC, HPC	Safety Orange (DC9200)
Pumped Condensate	CPD	Oxide Red (DC7821)
Natural Gas	GAS (FG, ID)	Medium Yellow (DC 8600)
Relief Valve Vents		Orange
Duct work		White
Equipment		White
Hanger Rods		Flat Black
Domestic Cold Water	DCW	Medium Green (DC6650)
Non-Potable Cold Water	NP CW	Spruce (DC5323)
Lab Cold Water	LCW	Light Green (DC5574)

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Domestic Hot Water	DHW	Light Buff (DC1810)
Lab Hot Water (S, R)	LHW	Internat'l Orange (DC6900)
Lab Vacuum	LV	Blue
Lab Waste	LW	Black (DC9903/9990)
Tempered Water	TW	Medium Brown (DC1400)
Domestic Hot Water Return	DHWR	Desert Sand (DC1046)
Lab Compressed Air	LA	Plymouth Grey (DC2100)
Nitrogen	N2	Light Grey (DC2973)
Sanitary Drain / Vent	SAN	Match Surrounding
Sprinkler / Fire Line		Safety Red (DC9000)

- F. Identify piping, concealed with plastic pipe markers using the same color coding identified for exposed piping in mechanical room. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- G. Identify piping with marker system. Markers shall be "snap-on" or "strap-on" type depending on applicable pipe size.
 - 1. For pipes up to 1" diameter, use 1 inch letters.
 - 2. For pipes 1-1/4" to 2" diameter, use 2 inch letters.
 - 3. For pipes 2-1/2" to 6" diameter, use 3 inch letters.
 - 4. For pipes over 6" diameter, use 4 inch letters.
- H. Identify pumps, air handlers, chillers, cooling towers, package units, heat transfer equipment, tanks, and water treatment devices with stencil painting. Small devices, such as in-line pumps, may be identified with tags.
- I. Identify control panels and major control components outside panels with plastic nameplates.
- J. Provide minimum 3/4" stick-on dots on the ceiling grid for identification of equipment hidden above ceiling. Color code as follows:
 - 1. Yellow - HVAC equipment
 - 2. Red - Fire dampers/smoke dampers
 - 3. Green - Plumbing valves
 - 4. Blue - Heating/cooling valves

2.2 VALVES

- A. All valves shall be provided with 0.032" thick polished brass valve tags with the stamp-engraved piping system abbreviation and sequenced valve numbers. Valve tags shall be attached with brass chains or S-hooks. Valve numbers shall be coordinated with other trades and any existing valves to avoid duplication of numbers.
- B. 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 and space). Valves intended for emergency shut-off and similar special uses shall be marked by "flags" in the margin of the schedule.

2.3 UNDERGROUND UTILITIES

- A. TRACER WIRE BOXES: Plastic gas and water services longer than 1000 feet in length from curb valve to meter riser must have tracer wire boxes installed in accordance with UNC Charlotte standards.
- B. All underground piping and utilities (both metallic and non-metallic), except copper pipe, shall have a separate copper tracer wire and non-metallic warning tape installed above the utility line.

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- C. The tracer wire shall be traced for continuity prior to backfill, immediately upon completion of backfill and compaction and once again during final utility location/as-built at the end of the project. This also will include landscape irrigation mains to the points of the valves. All above ground utility features such as vaults, manholes, valves, handholds, etc to be properly labeled. Contractor shall provide an inventory of all installed outdoor utility features including type and model.
- D. Identification Tape: The 1st stage of identification shall be a buried warning tape. This tape shall provide an early warning at shallow depth excavation. The tape shall be 6" wide, and buried approximately 18" to 30" above the service pipe, but a minimum of 10" below finished grade. It shall consist of multiple layers of polyethylene with an overall thickness of 3 to 5 mils. It shall be installed continuous from valve box to valve box or manhole to manhole, and shall terminate just outside of valve box or manhole wall. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to APWA color code standards. The lettering on the tape should name the utility it is protecting. (i.e. Caution Buried Sewer Line Below).
- E. TRACER WIRE: The 2nd stage of identification shall be a buried tracer wire. This tracer wire shall provide pipeline identification, be fully detectable from above grade utility locators, and be able to provide a depth reference point to top of pipe.
- F. All pipe, including lawn irrigation lines, and metallic pipe with compression gasket fittings installed underground shall have a tracer wire installed along the length of the pipe. The wire shall be taped to the bottom of the pipe at a maximum of 10' intervals and not allowed to "float freely" within the backfill.
- G. Tracer wire shall be single-conductor, 12 gauge minimum, copper single-conductor wire with type "UF" (Underground Feeder) insulation, and shall be continuous along the pipeline passing through the inside of each valve box. A #12 AWG or heavier (smaller AWG number), solid, insulated (RHW, THW, or polyethylene insulation is recommended), copper wire shall be taped to pipe at 10 foot intervals. Do not wrap wire around pipe. The wire must be one continuous, unbroken length. Coil tracer wire at meter location and street end with enough wire to extend a minimum of two feet above grade

2.4 METERING

- A. The University operates utility distribution systems for electricity, potable water, steam/condensate, hot water and chilled water. Natural gas is provided by Piedmont Natural Gas Co. Cost distribution for utilities is accomplished through a metering system and a prorated assignment of cost.
 - 1. Steam costs are generally allocated based on metering steam or condensate at the building. Each building shall be provided with a steam meter and/or a high temperature condensate meter designed for this severe service. Provide a meter of appropriate capacity on the discharge side of the condensate pump and include isolation valves, meter bypass, a square head rate cock to control flashing, and a digital pickup to interface with building automation system. Should a particular application require actual metering of the steam flow, insertion type meters of appropriate design should be provided. Meters must be approved for interface to the FM Utilities Monitoring System.
 - 2. 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 cubic feet, and provide output to building automation. Verify adequate turn down ration is provided with the meter for measurement at low flow.
 - 3. Non-sewered water (consumed but not returned to the sewer, e.g. irrigation, cooling tower makeup, etc.) should be metered at its source. Meter should be located in mechanical room, easily accessible, read in cubic feet and provide output to building automation. Meters and transmitters must conform to CMU standards for providing sewer credits.

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4. Chilled water or hot water (where pumped to another facility through a loop system) flow, temperature differential and energy consumption shall be measured and calculated for both the main building and the isolated structure. Output shall be in BTUH or Ton hours, be available at the BTU Meter, and be integrated to the building automation. Flow in GPM will be monitored. BTU meters shall be Onicon 10 with F3500 insertion magnetic flow sensor or approved equal.
5. Natural Gas metering shall comply with all requirements of Piedmont Natural Gas, and interface to the building automation system for monitoring gas usage in Therms and CFH. Controls contractor is required to integrate the meter with building automation system. Verify if gas usage in building for certain users needs to be metered and monitored separately for billing purposes.
6. Power Monitoring Interface: The Power Measurement Interface (PMI) device shall include the appropriate current and potential (voltage) transformers. The PMI shall be certified under UL-3111. The PMI shall perform continuous true RMS measurement based on 32 samples-per-cycle sampling on all voltage and current signals. The PMI shall provide outputs to the BAS based on the measurement and calculation of the following parameters:
 - a. Current for each phase and average of all three phases,
 - b. kW for each phase and total of all three phases,
 - c. power factor for each phase and all three phases,
 - d. Voltage for each phase and average of all three phases , and
 - e. Power consumption (kWH).

These output values shall be communicated to the BAS over the open-protocol LAN. Coordinate with electrical engineer to ensure electrical specifications require correct meter to accomplish power monitoring noted above.

Mount to allow manual reading without use of ladders.

2.5 VARIABLE FREQUENCY DRIVES

- A. Variable Speed Drive systems manufacturer shall provide a Modbus RTU, BacNet MSTP or LonWorks interface to the controls Building Automation System (BAS). Data available to the BAS must include all commands (on, off, speed) and status, control setpoints and zone process variables, and controller alarms. Integration of data to the BAS is the responsibility of the Control Systems Integrator.
- B. Variable frequency drives will be located indoors, unless approved by the University.
- C. Provide a manual bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built-in motor starter and a four position AUTO/OFF/LINE/TEST switch controlling three contactors.
- D. Phase loss protection modules shall monitor incoming 480V, 3-phase power and interrupt 120V control circuit. Phase loss protection shall be installed inside the VFD cabinet.
- E. Provide interlock to motor disconnect switch to prevent VFD damage.
- F. Drive rated motors shall be provided with grounding rings.

2.6 SOUND AND VIBRATION CONTROL

- A. Outdoor Equipment such as Cooling Towers, fans, and Air-cooled condensers shall be provided with low noise technology.
- B. HVAC equipment located in the building shall be carefully evaluated for sound level. If sound levels are expected to be higher than recommended in ASHRAE guidelines, sound control devices are required.

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- C. The Consultant shall determine the type of acoustical treatment that might be required. In general, all larger air-handling units will require sound attenuators in ductwork for both the supply and return fans. Some mechanical equipment rooms might require lightweight acoustic materials for walls to isolate equipment noise from the rest of the building.
- D. Acoustic lining is not an acceptable standard for duct systems. The Consultant shall provide other means of sound attenuation. Any use of acoustic lining in low pressure duct systems will require approval by the University Facilities Mechanical Engineer.
- E. Room terminal units such as variable volume terminals shall be selected for low sound levels. Air supply diffusers and registers shall have sufficiently low air velocity to meet low sound criteria.
- F. Air noise from a supply outlet is not acceptable. Outlet dampers are for “fine tuning” only. Provide dampers at the branch takeoff.
- G. The Consultant shall provide vibration isolation where required. There shall be no objectionable transmission of vibration from equipment to the building structure.
- H. Appropriate vibration isolation of equipment, piping and ductwork shall be specified. Attention shall be paid to the proper use of flexible duct and pipe connectors, the use of resilient pipe hangers and supports, anchors and guides, and the treatment of pipe and duct penetrations through building walls.
- I. Mechanical equipment rooms shall be placed preferably at ground level and away from occupied spaces to minimize transmission of vibrations and noise into the building.
- J. Fan wall system shall be utilized for critical noise and vibration isolation application.

SECTION 23 0518 – METERS AND GAUGES

PART 1 - GENERAL

PART 2 - PRODUCTS

- A. Electromagnetic Flow Meter: Insertion type flow meter for monitoring chilled and hot water flow shall be similar to Onicon model F-3500. The turn down ratio will exceed 80:1.
- B. BTU Meters: Shall be Onicon System 10 or equal.
- C. Steam Flow Meter: Shall be inline style vortex flow meter. Sensor shall have no moving parts. The sensor shall utilize a separated vortex bluff body and a sensor wing with a dual piezoelectric sensing technology to ensure maximum signal to noise rejection. The piezoelectric sensor shall be removable under steam pressures of up to 750 psig without steam shutdown. The flow meter electronics shall be microprocessor based. Meter shall be similar to EMCO model PhD.
- D. Glycerin-Filled Pressure Gauge: 4-1/2” dial with stainless steel or cast aluminum case, Plexiglas Lens, stainless steel movement, Polypropylene blow-out back plate, White scale with black divisions and numerals. Range for the gages shall be selected for type of service.
- E. Bimetallic Thermometers: 5” Dial type thermometers with stainless steel case, adjustable angle with front recalibration, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem. Range for the thermometers shall be selected for the type of service.

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SECTION 23 0520 - HVAC PIPING, VALVES & ACCESSORIES

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. The Designer shall clearly indicate the service for which pipe is intended when specifying pipe material. A schedule shall be provided that identifies pipe material and pressure class, application, methods of joining, fittings, and other relevant information.
- B. Appropriate devices for piping expansion shall be provided. Expansion joints, guides, and anchors shall be indicated on drawings. The Designer is responsible for calculating pipe stresses and location of anchors.
- C. The Consultant shall provide for positive means of draining and venting the piping system.
- D. Valves shall be provided to allow for isolation of branch piping and risers.
- E. Valves mounted 12' or greater AFF, or inaccessible by an 8' ladder, shall have a chain operator.
- F. Balancing valves shall be provided to facilitate system testing and balancing.
- G. Pressure taps on each flow-measuring device shall be extended outside of the insulation. Measuring devices shall be clearly indicated and at least one flow meter shall be provided.
- H. Welding procedures and requirements for welders' qualifications shall be clearly described in the specification.
- I. Pipe hangers and supports shall be selected to prevent pipe bending and deflection and to eliminate the transmission of vibration to the building structure.
- J. Piping shall be color-coded and labeled according to Labeling paragraph 2.1 E. Color chips shall be provided to the Owner for approval.
 - 1. All cold service insulated pipe (chilled water, interior condenser water lines, interior domestic cold water) to have rust inhibitive prime coat applied before insulation.
 - 2. All uninsulated pipe or bare metal to have rust inhibitive primer plus minimum 2 finish coats of approved color.

2.2 HEATING HOT WATER AND CHILLED WATER PIPING BELOW GRADE

- A. Piping shall be factory fabricated and insulated by Rovanco, Perma-pipe or Thermacor.
- B. Carrier Pipe: Carrier Pipe will be black carbon steel pipe conforming to ASTM A-53 Grade B Schedule 40. Pipe will be joined by welding to ANSI B.31.1 Code for Pressure Piping.
- C. All pipe and fittings will be insulated with polyurethane foam.
- D. All fittings will be factory prefabricated and insulated at pre-insulators plant.
- E. Jacketing Material shall be extruded black high density polyethylene (HDPE). The jacket throughout the entire system shall incorporate electric fusion, butt fusion or extrusion welding at all fittings, joint closures or other points of connection prohibiting the ingress of water.
- F. Moisture Barrier End Seals shall be factory applied, sealed to the jacket and carrier pipe. End seals shall be certified as having passed a 20 foot head pressure test. End seals shall be high temperature mastic completely sealing the exposed end of the insulation. Field applied end seals shall be installed at any field cut to the piping before continuing with the installation.
- G. Piping shall meet H-20 Highway loading with 24" of backfill is provided on top of pipe.

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- H. Flushing of piping 4" and larger shall utilize high-pressure "hydro-jet" process. Coordinate the limitations and requirements of hydro-jet process with the flushing subcontractor such that the piping is installed in a sequence and manner that allows every section of the new pipeline to be cleaned and flushed. Limitations may include maximum length of the pipe section, maximum number and/or degree of bends in the pipe section, maximum slope of the pipe section, equipment and excavation access requirements, and the minimum size of the openings required in the piping to allow for insertion and retraction of the cleaning head.
- I. Provide a by-pass valve on high-pressure steam line isolating valves.
- J. Butterfly valves shall be of the positive shut-off type.
- K. All water valves to operate by turning the square nut clock-wise (right) to close and counter-clockwise (left) to open, as per UNCC requirements.
- L. Provide all valves below grade with extensions and donut and valve box, when grade at location is altered.

SECTION 23 0593 - HVAC TESTING, ADJUSTING & BALANCING

PART 1 - GENERAL

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 TESTING ADJUSTING AND BALANCING

- A. Testing, Adjusting, and Balancing (TAB) shall be completed by an independent balancing company certified by AABC or NEBB.
- B. The TAB contractor shall be a sub-contractor to the CM at Risk or as designated by the owner.
- C. TAB shall be completed and the report shall be approved by the designer before the final inspection. The approved TAB report shall be available at the final inspection for State Construction review.
- D. The designer shall coordinate with the TAB contractor to spot check air and/or water flows.

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SECTION 23 0700 – HVAC INSULATION

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 INSULATION FOR PIPING SYSTEMS

- A. Steam and Condensate Piping Above Ground: Provide fiberglass or foamglass insulation.
- B. Steam and Condensate Piping in Manholes: Provide foamglass or calcium silicate insulation.
- C. Heating Hot Water: Provide fiberglass insulation.
- D. Chilled Water: Provide closed cell elastomeric or rigid foam insulation. Fiberglass insulation is not acceptable for chilled water duty.
- E. Condenser Water Exposed to Weather: Provide rigid foam insulation.
- F. Makeup water: Provide closed cell elastomeric insulation.
- G. Refrigerant Piping: Provide elastomeric insulation (Armaflex or Equal).

PART 3 - EXECUTION

3.1 INSULATION FOR DUCT SYSTEMS

- A. All supply and return air ductwork shall be insulated. It is suggested that insulation density for supply duct be not less than 3 pounds per cubic feet. Due to indoor air quality concerns, supply and return ductwork shall be wrapped with insulation, rather than internally lined. However, if noise transmission from the fan is a concern, designer may specify insulation liner only to the extent necessary to achieve the sound control desired.
- B. In occupied areas without hung ceilings where insulated ductwork is visible, double wall ductwork with solid liner will be used.
- C. Ductwork exposed to the weather that requires exterior insulation will be insulated with polystyrene board insulation. 0.016" thick Aluminum jacket will be provided on insulation. Fiberglass insulation will not be accepted.
- D. Canvas finish on ductwork insulation shall be provided in all spaces where it might be subject to damage, such as in equipment rooms.
- E. All ductwork in unconditioned spaces shall be provided with vapor-retarding finish.
- F. Asbestos abatement design for renovation projects will be provided in the contract documents.

3.2 INSULATION FOR PIPING SYSTEMS

- A. Provide 0.03" PVC jacket on all piping other than steam exposed to view in mechanical room and occupied spaces
- B. Provide 0.016" aluminum jacket on all insulated piping exposed to outdoors and in manholes. Provide electrical heat trace on piping prior to insulating the pipe exposed to outdoors.
- C. Provide canvas jacket on steam piping exposed to view in mechanical room and occupied areas.
- D. Provide aluminum jacket on steam piping in manholes.

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SECTION 23 0800 - MECHANICAL SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. North Carolina General Statute 143-135.37(d) requires commissioning of major projects.
- B. Performance Verification. – In order to be able to verify performance of a building component or an energy or water system component, the construction contract shall include provisions that require each building component and each energy and water system component to be commissioned, and these provisions shall be included at the earliest phase of the construction process as possible and in no case later than the schematic design phase of the project. Such commissioning shall continue through the initial operation of the building. **The project design and construction teams and the public agency shall jointly determine what level of commissioning is appropriate for the size and complexity of the building or its energy and water system components.**
- C. Design for Commissioning. The mechanical designer will be responsible for ensuring and developing "... a systematic process of assuring that a building (*mechanical, electrical and plumbing systems*) performs in accordance with the design intent and the owner's operational needs." The Owner considers the following elements as a minimum requirement for building acceptance and inherently integral to the Mechanical Designer responsibilities, unless specifically notified otherwise by the Owner.
 - 1. Design Phase – Provide documentation to the commissioning agent with copy to owner for following:
 - a. Owner's project requirements and Basis of Design, to include single line drawings for Design Narrative.
 - b. Commissioning reviews of design documents.
 - c. Verification that operations and maintenance staff training through the mechanical contractor is specified.
 - d. Building load data files and energy analysis data for Measurement and Verification requirement.
 - e. Metering and sub metering to accomplish analysis of annual energy consumption versus projected energy consumption.
 - f. Coordinate controls review with Commissioning Agent. Controls Contractor and Designer to verify understanding of all parties as to control sequence of operation and design intent. Clarify the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
 - 2. Construction Phase
NOTE: Commissioning shall in no way reduce the designer scope and responsibility for Construction Administration to include verifying quality of system installation. Designer team is to:
 - a. Attend the commissioning scoping meeting and selected commissioning team meetings.
 - b. Provide Installation Verification.
 - c. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
 - d. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. On site observations should be completed just prior to system startup.
 - e. The designers shall continue to assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the

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specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

- f. Startup and Checkout.
 - g. From the Contractor's red-line drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as shop drawings for the chilled and hot water, condenser water, domestic water, steam and condensate systems; supply, return and exhaust air systems and emergency power system.
 - h. Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
3. Post Construction Phase
- a. Designer will provide classroom overview to university operations staff to include Basis of Design, chilled and hot water systems, air distribution systems, emergency operations, system capacities and limitations, and metering.
 - b. M&V. Assist in reconciling discrepancies between actual energy usage and the submitted projection model.
- D. The Designer will include in bid documents the specific support and documentation required of the General Contractor (CM), Mechanical Contractor, Electrical Contractor, Plumbing Contractor, Controls Contractor, Designer, Owner and others as applicable to ensure acceptable commissioning.

Reference Division 01 General Requirements for commissioning guidelines. **Guidelines will be modified as appropriate for each project.**

SECTION 23 0900 - AUTOMATIC TEMPERATURE CONTROLS

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 SYSTEM

- A. Building Automation System:
- 1. The control system shall be fully compatible with the existing campus Building Automation System (BAS). The existing system is web-based Tridium. The new system shall have full control capability through the existing server. All systems must be completely and seamlessly programmable through the Tridium server. Systems that require additional computers or software to program and control will not be acceptable.
 - 2. The Contractor must provide the cost for the complete integration of the new system open protocol controller and / or gateway to the existing system interface, to include utilities monitoring and interface to the Tridium software.
- B. Control valves shall be sized so that the pressure drop across the valve at is at least 30% of the coil pressure drop at full design flow. Control valves shall have a valve authority of at least 0.25 unless approved by the Facilities Engineer. A control valve schedule shall be provided showing valve authority for all control valves larger than $\frac{3}{4}$ ". For terminal reheat control valves a typical valve authority is sufficient
- C. **Contact owner for updated controls integration specifications.**

SYSTEM FEATURES AND ARCHITECTURE (an overview)

- 1. UNC Charlotte intends to monitor and control the entire system from an existing browser-based Facility Management System (FMS). A Niagara AX server is located in Physical

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Plant. It is the intent of the University to integrate this project and all future campus direct digital control systems to this Niagara AX server using the competitive bid process. The entire FMS system including the products and labor detailed in specifications shall be provided by one of the acceptable control system integrators. Provide the appropriate number of Niagara AX based NAC(s) to integrate DDC system as necessary. NAC(s) to be JACE 7 series. Hard drives are not acceptable.

2. The scope shall include HVAC control and tuning, electrical, gas and water metering, energy management, alarm monitoring, and all trending, reporting and maintenance management functions related to normal building operations.
3. Power Fail Protection - All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the ASC or FPC.
4. The supplied system must incorporate the ability to access all data using Java enabled browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage.
5. UNC Charlotte access to the FMS shall be via a standard Internet browser from a remote location utilizing VPN, from a standard browser within the campus network or from a local workstation by direct connection to the Campus LAN. The Control Systems Integrator must provide a connection from every Network Area Controller (NAC) to the campus network to enable this access.
6. Provide integration of the new engineered systems such as Variable Speed Drives, new Variable Speed Pumping Systems, Chillers, etc. via a Modbus, Lon or BACnet interface provided by the equipment manufacturer. Provide graphics at the FMS to visualize the appropriate information from these systems.

SECTION 23 2213 – STEAM PIPING

PART 1 - GENERAL

1.1 STANDARD

- A. The University of North Carolina at Charlotte operates a Steam Plant which provides nominal 100 psig steam to the campus. Steam Plant is operational September 15 through May 20 of each year. May 20 to September 15 is reserved for scheduled maintenance and repairs of the steam system. Satellite boilers are operated during the Steam Plant shutdown to provide the minimum steam support required by the campus.
- B. All 125 psig steam distribution system piping, valves, fittings, flanges, etc. shall be rated at 250 psig up to and through the first reducing valve. Steam condensate piping and fittings shall be schedule 80. Steam line gaskets shall be Flexatallc brand.

PART 2 - PRODUCTS

2.1 UNDERGROUND DISTRIBUTION SYSTEM

- A. Manholes will be a minimum of 8 ft x 8 ft internally. Wall penetrations will use high temperature Link-Seals. Drains will be provided. Provide cast iron gravity drains to the nearest storm sewer. Use sump pumps only where gravity drains are not possible. Two access points will be provided for each manhole. Provide two manhole covers (16" over sump pit and 24" 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 galvanized steel ladder to 6" below cover in lieu

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of cast-in-place steps. Show detail of knockout panel for future line connections. Run rebar through knockout panel. Indicate sump location.

- B. Replacement underground piping will be direct burial, preinsulated steel piping. The system shall be Thermafab HT 406 manufactured by Thermacor Process, Inc., of Fort Worth, Texas, or equal, suitable for 406 degree F. Carrier pipe shall be steel ASTM A-106, Grade B seamless. Steam line shall be Sch 40, condensate line to be Sch 80 seamless. Jacketing material shall be High Density Polyethylene (HDPE) with electric-fusion pressure-testable joint closure. HDPE shall have minimum wall thickness of 150 mils. Pre-engineered systems shall be provided with all straight pipe and fittings factory preinsulated and prefabricated to job dimensions. Expansion/contraction compensation will be accomplished utilizing factory prefabricated and preinsulated expansion loops or elbows. End seals shall be factory applied.

2.2 STEAM VALVES

- A. Steam Service Isolation Valves (2 ½" and Smaller): Carbon steel Klinger, Bonetti or equal piston valves ANSI 300 flanged. Flanges shall be according to ANSI B 16.5, class 300." Valves shall have extension rod adapters and extension rods to grade.
- B. Steam Service Isolation Valves (3" and larger): Valves shall be Triple Offset Butterfly Valves - Quarter turn, metal to metal seated, utilizing "inclined conical sealing" to create torque seating effect. Valves shall have bidirectional bubble tight shutoff in accordance with ASME B16.34 and B31.3. Valve bodies shall be double flanged, cast steel with face to face dimensions conforming to ISO 5752, series 14 class 300. Valves discs shall be 316 SS. Valves shall be equipped with machined registered pinned brackets. Valves shall have graphite packing with minimum of four studs for precision adjustment. Valve seat shall be a minimum of three (3) layers of stainless steel with laminated graphite between rated to 932 degrees F. Actuators shall be heavy-duty gear operators. Valves shall have extension rod adapters and extension rods to grade. Valves shall be similar to Adams, Xomax series 9000, Vanessa 3300.
- C. Gate Valves for equipment isolation: Cast Steel body, CA-15 disc, bolted bonnet, rising stem, handwheel with field fabricated stem extension to grade, OS&Y, hardfaced seat rings, flanged ends, 300 SWP, Crane Fig. 33 or equal
- D. Gaskets: Gaskets at all flanges shall be carbon steel spiral wound with graphite filler material, Garlock Flexseal RW or equal. Gaskets are to be compressed to manufacturer's recommendation. Bolts will be ASTM A193 GR B7, nuts will be ASTM A194 GR 2H. Provide hardened steel washers under nut and bolt shoulder. Torque to manufacturer's recommendation for 250 psig saturated steam service. Bolts, nuts, and washers are to be lubricated with non-metallic lubricant (oil and graphite). Provide documentation of manufacturer's recommendation to University project manager.
- E. Manhole Modification: Core drill roof of manhole in line with valve extensions to allow valve operation from outside manhole. Provide metal valve box with extension and seal to prevent water leakage into manhole.
- F. Provide a by-pass valve on high-pressure steam line isolating valve.
- G. Steam pressure-reducing stations shall be designed to be two stage. Valves and fittings rated at minimum 250 SWP shall be used upstream of steam pressure reducing valves (PRVs). All PRVs shall be selected such that generated noise does not exceed 80dba.
- H. Steam condensate shall be pumped back to the steam plant. The Designer shall specify steam powered condensate pumps in all locations where HP steam is available.

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SECTION 23 6000 - HVAC EQUIPMENT

PART 1 - GENERAL

1.1 ELECTRICAL REQUIREMENTS

- A. Motor, controllers and other special equipment are sometimes provided and installed by other trades. This section specifies typical connections to that equipment.
- B. All individual motor starters or VFD's for mechanical equipment (fans, pumps, etc.) shall be furnished and installed under Division 23 (Mechanical Contractor) unless indicated as part of a motor control center. Motor starters for mechanical equipment provided in motor control centers shall be furnished under Division 26 Electrical Contractor. Under Division 26, power wiring shall be provided up to a termination point consisting of a junction box. Trough, starter, VFD or disconnect switch. Under Division 26 line side terminations shall be provided. Wiring from the termination point to the mechanical equipment, including final connections shall be provided under Division 23.
- C. Where unscheduled junction boxes are used by Contractor to facilitate wiring or to comply with limits of elbows and bends, they shall be concealed if at all possible to do so and still be left accessible. If this is impossible, they shall be recessed in walls or ceilings and provided with an oversized cover which shall be painted out to match adjacent surfaces. If it is necessary to mount such boxes exposed, the location shall be approved by the Engineer.
- D. All contactors, motor starters and combination type starters specified shall be equipped with Hand-Off-Automatic switches, pilot (run indicating) light, 120 volt control transformer, and two sets of auxiliary contacts. The switch and light shall be located on the unit cover. Starters shall be Square D, Cutler-Hammer, General Electric Co., or equivalent by others.
- E. All safety switches shall be heavy-duty type, NEMA 1 for indoor and NEMA 3R for outdoor use unless specifically stated otherwise. They shall be fused type unless specifically indicated otherwise on plans. Fused type shall be equipped with Bussmann Fusetron type fuses, or approved equivalent. Switches shall be by Square D, Cutler-Hammer, General Electric Co., or equivalent by others.
- F. All safety switches, motor starters, or other boxes or panels, designated as NEMA 3R or otherwise intended for outdoor use or use in wet areas, shall use rain tight conduit hub fittings with bonding screw.
- G. Control wiring shall not be installed in the same raceways as power wiring.
- H. VFD's shall have interlocks with disconnects to prevent damage when motors are disconnected.
- I. VFD rated motors shall have grounding rings.

PART 2 - PRODUCTS

2.1 COOLING TOWERS

- A. Cooling towers shall be located in such a way as to have sufficient unobstructed space to allow for adequate air supply for tower fans. Care shall be taken to prevent possible air recirculation and impacts on adjacent building structures.
- B. Cooling tower location shall be as near as practical to level conditions and as close as possible to the chillers and pumps to minimize pumping costs.

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- C. Tower locations shall be as far as possible from trees and other foliage. Any alterations to the campus grounds to accomplish this shall be coordinated with the FM Grounds Department.
- D. Screens shall be provided on tower intakes to keep debris and leaves out of tower sump. Balancing valves at hot water basins, extended lube lines and stainless steel cold water basins are required. Provide stainless steel cold and hot water basins, sump and plenum walkway (service platform).
- E. If two or more towers are operated in parallel, an equalizing line that connects the tower sumps shall be provided to balance water distribution. For towers with more than one cell, positive shut-off valves shall be provided to allow for cell isolation during maintenance shutdown. Equalizer lines are required for multiple cell towers. If control valves are used to isolate cell for water cooled equipment to operate with particular cell(s), control valves shall be provided in cooling tower supply line to isolate non-operating tower sump from the operating tower pump.
- F. Provide hot water basins with dams for low flow operation.
- G. Noise level shall be an important consideration in the selection of cooling towers. Provide low noise fans.
- H. Cooling towers shall be selected with variable frequency drives to allow for energy efficient capacity control. All cooling towers shall be provided with appropriate ladders with safety cages, railings at the top of the tower, and access platforms for maintenance.
- I. Cooling towers will be induced draft, crossflow design with gear drive or counterflow design with belt drive. Motors shall be out of the air stream if installation allows.
- J. Cooling tower cold water basin shall be provided with sump sweeper piping complete with spray nozzles. Cooling tower filtration system shall be provided using the sweeper piping.

2.2 AIR HANDLING UNITS

- A. The use of multi-zone air-handling units, spray coil systems, and ceiling-mounted fan coil units is not acceptable in new construction. For small renovation projects, an exception can be made if the need is substantiated. No fan coil units shall be installed concealed above ceilings without prior approval of the university Facilities Mechanical Engineer.
- B. Air-handling units that use 100 percent outdoor air shall be equipped with preheat, cooling and reheat coils to allow dehumidification control. If 100 percent outdoor air is used in air-handling units because of high exhaust requirements, such as in laboratories, heat recovery from exhaust air is required. Non-contaminating and low-maintenance heat recovery technology shall be used. Examples are ceramic heat wheels, phase change heat transfer, and coil loops.
- C. Units using more than 20% outdoor air will be provided with static air blender section.
- D. All large, central station air-handling units shall be equipped with stainless steel drip pans and moisture eliminators. The IAQ drain pan shall be double pitched to allow for complete condensate removal and shall be accessible for maintenance.

2.3 CHEMICAL WATER TREATMENT

- A. Contact university Facilities Mechanical Engineer for specific requirements.
- B. Conductivity controller provided with cooling tower systems shall be Lonworks compatible and communicate on Modbus, Ethernet or Bacnet with the DDC controls system used for the project.
- C. Cooling tower make up water will be metered. Verify type of water meter to be used if credit is to be claimed from CMUD.
- D. Provide pot feeders for closed loop systems.

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- E. Provide coupon rack for cooling tower water treatment.

2.4 CHILLED WATER SYSTEMS

- A. The desired cooling medium for air conditioning systems is chilled water. The University has regional utility plants and some small localized central chilled water plants that support several buildings. For new construction and renovation projects, the Consultant shall verify that the existing chilled water system will support the new load. Verification may require that the designer perform a detailed building audit to identify all building loads if this information is not readily available.
- B. Renovations to existing chillers and towers shall require careful and realistic scheduling in order to minimize the impact on building users.
- C. The Designer shall consider using a Water Side Economizer to meet winter cooling loads in applications where the use of 100 percent outdoor air for free cooling is not possible. Plate & frame heat exchangers are strongly recommended for this application.
- D. Use of a side stream filter is strongly recommended for the cooling tower side of the system. It is essential that the Designer provide means to service the heat exchanger without lengthy system shutdown.
- E. Marine water boxes shall be considered on all chillers 500 ton and larger.

2.5 BOILERS

- A. If connecting to either the Steam Plant steam distribution system or the Regional Utility Plants hot water system is not feasible, individual boilers may be considered. Where individual boilers are required,
 - 1. Gas fired, forced draft boilers will be utilized.
 - 2. Electric boilers are not acceptable.
 - 3. Temperature reset controls will be utilized on hot water systems.
 - 4. Boiler capacities will be limited to a maximum of 10 million Btu/hr INPUT where oil is used as the fuel.
- B. **Boiler gas vents / chimneys are expected to be terminated above roof.** Any exceptions will have to be verified with University's Facilities Mechanical Engineer before incorporating into design.
- C. When Fire Tube Hot Water Boilers are used they will be scotch marine wet back boilers.
 - 1. Gas fired burner will have minimum 8:1 turn down ratio. System will maintain fuel-air ratio automatically with gas temperature minimum 68 F above dew point of flue gases at boiler outlet. The burner will be low NOx burner.
 - 2. Combustion control: Parallel positioning type system with microprocessor controlled fuel air ratio. System to utilize linkage-less type direct servomotor control of each fuel control valve, combustion air damper and recirculation stack gas flow damper (if required). Servomotors to have repeatability accuracy of 0.1% of an angular degree and system to have a cross-limiting function for safety. System to accept 4-20mA, 0-5dcV or a digital signal from modulating temperature controller and/or an external firing rate control interface from the facility BAS.
 - 3. Flame safeguard system (FSG): Microprocessor based burner management control with UV flame scanner system, Modbus module and expanded annunciator. The Modbus module will allow burner control's interface with building BAS. Expanded annunciator will interpret the error codes to indicate the faults. All available system limits and applicable operation functions to be factory wired to FSG system for monitoring/annunciation (low water, no water flow, fuel pressure switch, high water temperature, pressure, etc.)

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Furnish window in control panel, or a remote display module in the main panel to view FSG status.

4. Provide remote start-stop relay and all components wired to panel terminal strip.
5. Provide permanently mounted and wired (6) digit non-reset elapsed time (hour) meter installed in main burner panel to initiate during active boiler use.
6. Integrate combustion and FSG to BAS.

2.6 REFRIGERATION EQUIPMENT

- A. Preference shall be given to chilled water production based on water-cooled centrifugal chillers. Other options may be considered if circumstances warrant and are approved by the Owner.
- B. Generally, the Designer shall select water-cooled reciprocating or rotary chillers for cooling loads up to 100 tons. For cooling loads over 100 tons shall be screw or centrifugal. Loads requiring high turn down shall be specified as magnetic bearing chillers.
- C. Air-cooled equipment shall be used for small renovation projects where physical limitations preclude the use of chilled water. Selection shall be based on 105° F ambient temperature.
- D. For water cooled machine, provide head pressure control for cold start up of the machine in lieu of cooling tower bypass.
- E. Manufacturer shall provide a Modbus, BacNet over Ethernet or LonWorks interface to the controls Building Automation System (BAS). Data available to the BAS must include all chiller data read on microcomputer control center, (on, off) commands and status, set points, and alarms. Integration of data to the BAS is the responsibility of the Control Systems Integrator.
- F. The Consultant shall specify chillers that utilize environmentally safe refrigerants that conform to the latest Environmental Protection Agency and OSHA requirements. Mixing of refrigerants within the same mechanical room is discouraged.
- G. Ventilation of all mechanical rooms with refrigeration equipment shall be provided. Ventilation shall be accessible for activation from an emergency switch in a protected enclosure located outside any of the mechanical room access doors. Mechanical room ventilation shall be negative to corridor or any other adjacent spaces. Ventilation and room design shall comply with the latest version of ASHRAE Standard 15. SCBA will not be installed.
- H. Provide refrigerant sensing devices according to latest ASHRAE standards. Tie the alarm output to the building DDC.
- I. Special attention shall be paid to evaluation of chiller noise levels. If necessary acoustical enclosure for the chiller compressor and accessories may be specified to maintain noise levels in mechanical room within acceptable level. Oil-less magnetic bearing chillers are recommended for chillers installed within the occupied building.
- J. Witness test. The Owner reserves the right to require a witness test of the machine purchased. The Owner and a representative of the Owner's choosing will, at no additional cost to the Owner or the Owner's representative, witness an eight hour test run of the purchased machine at the manufacturing facilities of the successful vendor. It shall be the manufacturer's responsibility to advise the Owner ten days in advance of the test date so travel arrangements can be made.

2.7 PUMPS

- A. Chilled water plants are designed with primary and secondary pumping systems. To increase overall building system reliability, each pumping system shall be specified with parallel pump operation sized for 125% of design flow. Consideration shall be given to primary variable volume systems.

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- B. Since pumps use considerable amounts of energy, it is of prime importance to select pumps with the highest efficiency available for the particular application. The designer shall evaluate the wire-to-water efficiency before the final selection is made.
- C. To prevent waste of energy in hydronic systems, three-way or bypass valves shall not be used except for “end of line” application. Use of variable frequency drives for pumps is recommended. If multiple pumps are to be used in parallel, pump VFD controller is recommended to be included as part of the VFD package. Manufacturers recommended for such application are ITT B & G, Armstrong, Systecon and Synchroflow.
- D. Manufacturer of VFD package shall provide a Modbus RTU, BacNet over Ethernet/MSTP or LonWorks interface to the controls Building Automation System (BAS). Data available to the BAS must include all chiller data read on microcomputer control center, (on, off) commands and status, set points, and alarms. Integration of data to the BAS is the responsibility of the Control Systems Integrator.
- E. Pumps shall be installed in mechanical equipment rooms. Outdoor pump installation shall be avoided.

2.8 AIR TERMINAL UNITS

- A. Air terminal units located above ceiling shall be located no more than 2’ above ceiling for access for maintenance.
- B. Use of fan terminal units must be pre-approved by Facilities’ Mechanical Engineer. If approved, the units and associated filters must be within 2’ above ceiling to allow easy reach by campus maintenance.

SECTION 23 7000 - AIR DISTRIBUTION

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 DUCTWORK

- A. Ductwork for air distribution shall be designed to yield minimum owning and operating costs by keeping the static and dynamic pressure levels of a duct as low as possible given the building's normal physical constraints
- B. Ductwork shall be free of excessive sound levels. Duct air leakage will not exceed 2 to 5 percent.
- C. To allow for proper system balancing, all branch ducts shall be equipped with balancing dampers.
- D. Air-measuring stations shall be provided for variable-volume systems using variable-frequency drives.
- E. Ductwork fabrication and installation shall follow the latest recommendation of SMACNA.
- F. The use of flexible ductwork shall be avoided. The maximum length of a flexible duct shall not exceed 5'. Avoid offsets and curves in flexible duct connections to diffusers and other terminal devices.
- G. Provide hard elbows at turn down to diffuser connections.
- H. Provide sound attenuation elbows on private office return grilles.

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- I. Provide access doors large enough to allow service and inspection of control dampers, reheat coils, humidifiers, fire dampers, and all applicable system components. An access door size of 24" x 24" is recommended.

SECTION 2

DIVISION 25

FACILITY MANAGEMENT AND CONTROL SYSTEM

DIVISION 25 - FACILITY MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes the scope of work for the Facility Management and Control System that must be installed by a qualified FMCS Contractor and integrated to the Enterprise Server by the Enterprise Developer.
- B. Provide Facility Management and Control System (FMCS) incorporating Direct Digital Control (DDC), energy management and equipment monitoring consisting of the following elements:
 - 1. Microprocessor based remote control panels interfacing directly with sensors, actuators, and environmental delivery systems to provide complete standalone DDC/EMS functionality. (i.e., HVAC equipment, etc.).
 - 2. Communication network to allow data exchange between remote panels and central web supervisor.
 - 3. Personal computer (PC) based central and associated operator station(s), and software functioning as the primary operator interface for FMCS. System shall utilize a graphics front end.
 - 4. Pneumatic, electric and electronic control for all items indicated including dampers, valves, panels and pneumatic and electrical installation.
- C. Chiller control:
 - 1. Controls installer shall interface the FMCS systems with the FMCS panel provided by the chiller manufacturer for each chiller. Control installer shall provide integrator panel and all wiring from FMCS to central chiller panel and from central chiller panel to individual chillers. **Chiller panel communications protocol shall be LONWORKS, BACnet MSTP or Modbus RTU to a JACE. BacNet/Modbus IP must be a separate network communicating through the Jace secondary IP port.**
- D. Provide submittals, installation, data entry, programming, startup, test and validation of FMCS, instruction of Owner's representative on maintenance and operation of FMCS, as-built documentation, and system warranty. See Section 1.11
- E. Completely coordinate with work of other trades.
- F. It is the owner's goal to implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).
- G. All labor, material, equipment and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

1.2 ANNEX L

- B-1 – General list of abbreviations and acronyms.
- B-2 – Glossary of Terms.
- B-3 – Standard for Screen Graphic Abbreviations.
- B-4 – Niagara AX Control System Point Naming Convention.
- B-5 – Default Building Occupancy Schedule.

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1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Related Sections include but are not necessarily limited:
 - 1. Division 00 – Bidding Requirements, Contract Forms and Conditions of the Contract.
 - 2. Division 01 – General Requirements.
 - 3. Section 20 05 00 – Special Mechanical Requirements
 - 4. Section 22 11 23 – Plumbing Pumps.
 - 5. Section 23 21 23 – HVAC Pumps.
 - 6. Section 25 10 10 – Facility Monitoring and Control System (FMCS) Integration.
 - 7. Section 26 00 10 – Electrical General Requirements.

- B. Other products which may be integrated and installed but not furnished under this section.
 - 1. Project specific equipment.
 - 2. Metering (if applicable)
 - 3. Electric pulse meter (if applicable)
 - 4. Gas metering (if applicable)
 - 5. Water metering (if applicable)
 - 6. Fire Alarm monitoring, with a minimum of a status if it is available from the panel
 - 7. Roof Top Units
 - 8. Lighting (if applicable)
 - 9. CRAC Computer Room Air Conditions

1.4 SCOPE OF WORK

- A. The Facility Management and Control System (FMCS) shall be comprised of Java Application Control Engine or Controllers (JACE) within each facility. The JACE shall connect to the owner's local or wide area network, depending on configuration. Each User shall configure a dashboard view of the pertinent data and this view shall be saved for later use. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through a standard Web browser, via the Internet and/or local area network. Each JACE shall communicate directly to LonMark/LonTalk (IDC), BACnet MSTP (IBC), MODBUS RTU devices and other open and legacy protocol systems/devices provided under this Division. It is the owner's goal to eliminate any gateway or redundant (redundant to the JACE functionality) device(s).
- B. The Facility Management and Control System (FMCS) as provided in this Division shall be based on the Niagara^{AX} Framework (or "Niagara^{AX}"), a Java-based framework developed by Tridium
- C. The work provided in this specification shall be performed by multiple entities. The FMCS Contractor shall have overall responsibility for the Division work. The Enterprise Developer shall be appointed by the Owner and shall provide all work at the Enterprise Server level. Owner will oversee and provide procurement for Enterprise Developer services.
- D. Systems Integrator shall provide overall management, coordination and responsibility for delivering integrated FMCS systems. The Systems Integrator shall review work performed by other Specialty Contractors such as low voltage, IT, security and control system subcontractors and coordinate the connection of these systems to the Owner's IT infrastructure in conjunction with the Owner's IT staff.
- E. All materials and equipment used shall be standard components. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.
- F. All wiring shall be done in accordance with all local and national codes.

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1.5 DIVISION OF WORK

- A. The FMCS contractor shall be responsible for all communicating thermostats, any miscellaneous controllers (IDC and IBC), control devices, control panels, controller programming, and controller programming software, controller input/output and power wiring and controller network wiring specified to be provided in Division 23.
- B. The **Division 28** (if applicable) contractors shall be responsible for all controllers Security JACE, control devices (BACnet, LONworks or Modbus), control panels, controller programming, controller programming software, controller input/output and power wiring and controller network wiring specified to be provided in **Division 28**. These devices shall be configured and commissioned by **Division 28** contractors and later managed in the JACE by FMCS contractor.
- C. The FMCS contractor shall be responsible for the Java Application Control Engine(s) (JACE), software and programming of the JACE, graphical user interface software (GUI), User Configurable Dashboard software and connection of the JACE to the local or wide area network. FMCS shall also be responsible for development of all graphical screens, Web browser pages, setup of schedules, logs and alarms, and network management for all IDC or IBC devices provided in Division 23 and 26. IDC or IBC devices not provided by FMCS contractor shall be configured and commissioned by appropriate contractor and later managed in the JACE by FMCS contractor.
- D. For reasons of security and consistency, it is the owner's intention to divide the work defined in this section into two sections. Work performed at the JACE level and below shall be performed by a qualified FMCS Systems Integrator. All work provided at the Enterprise Server and between the server and other systems shall be provided by the owner appointed Enterprise Developer. The Enterprise Developer shall be responsible for the "learning" of the WBI (web browser interface) from the JACE to the Enterprise Server, the configuration of the Periscope Dashboard software and the global integration strategies across JACE s and other intelligent building systems. The Enterprise Developer shall also be responsible for all Security integration at the Server level, if applicable. **All work pertaining to global strategies across sites and other intelligent building systems including between the JACE and other subsystems shall be by the FMCS.**

1.6 QUALITY ASSURANCE

The FMCS system shall be designed and installed, commissioned and serviced by Factory trained personnel (Niagara Ax Certification or equivalent). FMCS Contractor shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.

- A. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, and Governing Radio Frequency Electromagnetic Interference and be so labeled.
- B. UPS to be installed for 120v feeding power supply to JACE and battery backup option for Jace to also be installed.
- C. System to be installed by competent technicians, with full responsibility for proper operation of FMCS, including debugging and proper calibration of each component in entire system.
- D. Codes and approvals:
 - 1. Complete FMCS installation to be in strict accordance with national and local electrical codes, and Electrical Specification Divisions of these specifications. All devices designed for or used in line voltage applications to be UL listed.
- E. All system components shall be fault tolerant.
 - 1. Provide satisfactory operation without damage at 110 percent and 85 percent of rated voltage, and at +/- 3 hertz variation in line frequency.

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2. Provide static, transient, short circuit, and surge protection on all inputs and outputs. Communication lines to be protected against incorrect wiring, static transients, and induced magnetic interference. Bus connected devices to be a.c. coupled, or equivalent so that any single device failure will not disrupt or halt bus communication.
3. All real time clocks and data file RAM to be battery or capacitor backed.
- F. System overall reliability requirement: The system, including all components and appurtenances, shall be configured and installed to yield a Mean Time Between Failure (MTBF) at least 1000 hours.
- G. System accuracy and display: The system shall maintain an end-to-end accuracy for 1 year from sensor to Operator's console display for the applications specified and shall display the value as specified.
- H. All field equipment shall be rated for continuous operation under ambient environmental conditions of 35 to 120 degF dry bulb and 10 to 95 percent relative humidity, non-condensing. Instrumentation and control elements shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity and vibration conditions specified or normally encountered for the installed location.

1.7 SUBMITTALS

- A. Shop Drawings: Provide individuals experienced with the installation and startup of equipment related to this type of integration.
 1. One copy of shop drawings of the entire FMCS shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions.
 2. Complete system design information including:
 - a. Data entry forms for initial parameters. All text and graphics to be approved prior to data entry.
 - b. Valve, and damper schedules showing:
 - 1) Size.
 - 2) Configuration.
 - 3) Capacity.
 - 4) Location.
 - c. Wiring and piping interconnection diagrams, including panel and device power and sources.
 - d. Equipment lists (bill of materials) of all proposed devices and equipment.
 - e. Software design data including:
 - 1) Flow chart of each DDC program showing interrelationship between inputs, PID functions, all other functions, outputs, etc.
 - 2) Sequence of operation relating to all flow chart functions.
 - f. Control sequence.
 - g. DDC installation, block diagrams, and wiring diagrams for each piece of equipment.
 - h. DDC panel physical layout and schematics.
 - i. The network topology diagram shall indicate the location and room number of all DDC controllers.
 - j. The FMCS Contractor shall submit an architecture layout that depicts devices from the JACE down to the device level.
 - k. The FMCS Contractor shall submit an architecture layout that depicts network diagrams for JACE to JACE communications as well as JACE to Server.
 - l. BACnet specific designs:
 - 1) The FMCS Contractor shall submit a network topology diagram that includes the following on all BACnet devices
 - a) TCP/IP Address
 - b) MAC Address

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- c) Device instance number
- d) BACnet Port
- e) Devices configured for BBMD
- f) BACnet routers and subnets
- b. LonWorks specific designs:
 - 1) The FMCS Contractor shall submit a network topology diagram that includes the following on all LON devices
 - a) Neuron IDs
 - b) Routers
 - 3. Sequence of Operations: A complete written Sequence of Operation shall also be included with the submittal package. The FMCS Contractor shall coordinate data from other contractors supplying products and systems, as part of their package and shall provide catalog data sheets, wiring diagrams and point lists to the owner for proper coordination of work.
 - 4. If a project is considered a renovation project the FMCS Contractor shall update all existing master diagrams in order to keep as-built drawings completely accurate for the entire building.
 - 5. Digital Visio updateable drawings should be contained in JACE and Flashdrive.
 - 6. A copy of all networks must be drawn on the actual physical daisy chain as installed. This is the actual blueprint showing the floorplan, equipment location and the route in which the network was run. The Niagara Network must also be included i.e. Friday bldg. communicates to RUP (See ANNEX L section 20.0)
- B. Product Data:
 - 1. Complete list of product data including:
 - a. Data sheets of all products.
 - b. Valve, damper, and well and tap schedules showing size, configuration, capacity, and location of all equipment.
- C. Project Information:
 - 1. Certification of installer qualifications.
- D. Submittal shall also include a copy of each of the graphics developed for the Graphic User Interface including a flowchart (site map) indicating how the graphics are to be linked to one another for system navigation. The graphics are intended to be 80% - 90% complete at this stage with the only remaining changes to be based on review comments from the A/E design team and/or Owner. Submittal shall also include a copy of the expected Dashboard viewlets being provided for owner configuration. It is expected that the successful FMCS Contractor shall utilize the UNC Charlotte graphic templates as much as possible. The owner will provide an example of an acceptable graphic template. Where a particular graphic template does not exist, the Integrator shall create a similar template and gain approval during submittal process.
- E. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files.
- F. Contract Closeout Information:
 - 1. Operating and maintenance manuals.
 - 2. Owner instruction report.
 - 3. Certification that Owner Training has been provided by FMCS installer.
 - 4. As Built Instrumentation and Control Diagrams.
 - 5. Plan As-Built at 1/8 inch scale showing:
 - a. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files.
 - b. Two copies of the 'as-built' drawings shall be provided in addition to the documents on compact disk.

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- c. Division 23, 25 and 26 contractors shall provide as-builts for their portions of work.
 - d. The FMCS Contractor shall be responsible for as-builts pertaining to overall FMCS architecture and network diagrams. All as built drawings shall also be installed into the FMCS server in a dedicated directory.
 - e. Communication cable circuiting drawing with DDC panels and communication devices labeled.
 - f. Power wiring circuiting drawing showing 120 volt circuit source and low voltage transformer locations, identifications, and circuit to each controlled device per transformer for the DDC system.
- G. Any software needed to program or calibrate controls system will be provided along with any setup, configurations and data files. Also, any hardware needed to communicate with the controllers and/or devices will also be included.

1.8 JOB CONDITIONS

- A. Cooperation with other Trades: Coordinate the Work of this section with that of other Sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Systems Integrator's responsibility to check the Contract documents for possible conflicts between his work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers and structural and architectural features.

1.9 SOFTWARE LICENSE AGREEMENT

- A. It is the owners express goal to implement an open system that will allow products from various suppliers to be integrated into a unified Niagara system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include:
- 1. All custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the JACE, FMCS Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices.
 - 2. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner.
- B. The Owner has signed a software and firmware licensing agreement for the FMS software. 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. Systems Integrators that participate in the integration of UNC Charlotte's direct digital control systems must:
- 1. Be certified in the use, application and service of Niagara^{AX} 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 UNC Charlotte projects. Only approved integrators listed in this specification are eligible to participate in the project.
 - 2. Agree to use on any UNC Charlotte project any application standards, html pages, graphics templates, etc. developed by or for UNC Charlotte for the purpose of digital control, scheduling, alarming, graphics, etc.
 - 3. Agree that the application standards, html pages, graphics templates, etc. developed only for UNC Charlotte are the property of UNC Charlotte (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 UNC Charlotte facilities staff.

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4. Agree that certification on the manufacturer's software does not guarantee continued participation in UNC Charlotte's FMS projects.
5. Agree to provide UNC Charlotte's staff with the highest level of administrative password.
6. Agree that UNC Charlotte staff and other Systems Integrators can use the onsite UNC Charlotte software tools to modify JACE s, license files, passwords, provide software maintenance, etc., after warranty period expires.
7. The owner requires that all Niagara^{AX} based software and hardware on this project have the following Niagara Information Compatibility Statement (NICS). The Existing Niagara^{AX} Server complies with the requirements below. Organizations without the NICS below shall not be allowed to bid.
 - a. Brand ID = Vykon
 - b. Station Compatibility In = *
 - c. Station Compatibility Out = *
 - d. Tool Compatibility In = *

1.10 WARRANTY

- A. Provide all services, materials and equipment necessary for the successful operation of the entire FMCS for a period of two years after acceptance by the State Construction Office and provide hardware and software upgrade support during that period that corresponds with any upgrades performed by FM FIS.
- B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the FMCS contractor at no expense to the Owner.
- C. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.
- D. With owner pre-approval, the on-line support services shall allow the local FMCS Contractor remote access to monitor and control the facility's building automation system. Pending owner approval, this remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.
- E. Warranty Access
 1. Pending owner pre-approval, the Owner shall grant to the FMCS contractor, reasonable access to the FMCS during the warranty period. The owner shall allow the contractor to access the FMCS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

1.11 ACCEPTABLE SYSTEM CONTRACTORS

- A. The FMCS Contractor shall provide JACE hardware, software and DDC components. The successful FMCS Contractor shall not have password access to the Enterprise Server (Web Supervisor) and shall be restricted to JACE access.
- B. The FMCS Contractor shall have a technical support group accessible that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.
- C. FMCS Systems Contractors of the hardware and software components must be approved by UNCC prior to winning projects.
- D. UNCC List of Acceptable Contractors;
 - 1) **Platinum Building Automation** (using Honeywell Lonworks Controllers).
 - 2) **Schneider Electric Controls** (using Invensys I/A series Lonworks or approved BACnet).
 - 3) **United Automation Corporation** (using Honeywell Lonworks Controllers).
 - 4) **Mechanical Systems and Services** (using Honeywell Lonworks Controllers).

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- 5) **Johnson Controls** (using open protocol BACnet controllers and an approved Tridium systems integrator).

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, network devices and other devices as specified herein.
- B. The installed system shall provide secure passwords access to all features, functions and data contained in the overall FMCS.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate the most current ANSI/ASHRAE Standard BACnet, LonWorks technology, MODBUS, existing OPC if applicable, and other existing open and proprietary communication protocols if applicable in one open, interoperable system.
- B. The supplied computer software shall employ component-based technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including the most current ANSI / ASHRAE™ Standard, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via RS-485 (BACnet MSTP) or Ethernet (BACnet Ethernet/IP,) only by exception with prior UNCC FIS approval and only through the Jaces secondary IP port.
- C. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.
- E. 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. Systems employing a "flat" single tiered architecture shall not be acceptable.
 - 1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.

2.3 MATERIALS

- A. Temperature control system:
 - 1. Include:
 - a. Temperature sensors.
 - b. Humidity sensors.
 - c. Controllers.
 - d. Switches.
 - e. Relays.
 - f. Valves.

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- g. Dampers.
 - h. Damper operators.
 - i. Thermostats.
 - j. Humidistats.
 - k. Hygrometers.
 - l. Other associated controls required to maintain conditions described in detail on drawings, together with thermometers, gauges and other accessory equipment.
2. Provide complete system of wiring and air piping as necessary to fill intent of these specifications.
 3. Control sequences indicated illustrate basic control functions only.
 4. Provide additional controls required to meet intent of these specifications and make a complete system.
 5. Space temperature and humidity control.
 6. Control of air handling units.
 7. Control of exhaust systems.
 8. Control of cooling systems.
 9. Control of heating systems.
- B. Control panels. Where electronic sensing is used, furnish amplifier relays and transformer complete with overload protection.
- C. Electrical drawings indicate type of motor control required by equipment.
1. NETWORKS The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and OBIX for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Java Application Control Engine (JACE s), user workstations and, if specified, a local server.
- D. Local area network minimum physical and media access requirements:
1. Ethernet; IEEE standard 802.3
 2. Cable; 100 Base-T, UTP-8 wire, category 6
 3. Minimum throughput; 100 Mbps.

2.4 NETWORK ACCESS AND SECURITY

- A. Remote Access
1. For Local Area Network installations the Owner shall provide a connection to the Internet to enable access via the customer's Intranet to a corporate server. FMCS Contractor shall connect to IP drop provided by the Owner within 25 feet utilizing a minimum of Category 6 grade of patch cabling.
- B. JACE IP communications
1. FMCS Contractor will use DHCP and DNS for IP communications.
 - a. No static IPs or "hardcoded" IP addresses in the JACE will be accepted.
 - b. The FMCS Contractor shall request from UNCC FIS all required primary port TCP/IP network configuration settings for all JACE s via standard RFI. **The FMCS Contractor shall not assign any of the following configuration settings without FM FIS approval.**
 - 1) Domain name
 - 2) Host name
 - 3) Station Name
 - c. Secondary port
 - 1) For troubleshooting purpose, The FMCS Contractor shall configure the JACE's secondary port to a static IP address of 192.168.1.12X, where X is equal to last digit of JACE's serial number.
 - 2) The subnet mask shall be configured to 255. 255. 255.0
- C. Security and Authentication
1. 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.

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2. The Owner shall control/set all passwords and security levels for all operators. The Owner shall provide the FMCS and Enterprise Developer with the standard passwords required to be used in the Enterprise Server and the JACE.
3. The FMCS Contractor shall not use any passwords except those provided by the owner. The system administrator shall have the ability to set passwords and security levels for all other operators.
4. The FMCS Contractor shall not leave any default usernames/passwords on the JACE.
5. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object.
6. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected.
7. User Profile templates:
 - a. The FMCS Contractor shall program users in the JACE utilizing the following User profiles

User Profile	View Graphics	Operator Setpoints	All Setpoints	Add/Delete Users
Technician	X	X		
View Only	X			
Power User	X	X	X	X

8. SSL requirements
 - a. All communications between Niagara devices and the Enterprise server or user interface software, i.e., IDE, shall be secured using SSL encryption.
 - b. The following ports shall be used for SSL communications

Software Interface	Protocol	Specified Port
Browser	HTTPS	443
Niagara Station IDE	FOX	4911
Niagara Platform IDE	TLSv1	5011

2.5 Java Application Control Engine (JACE)

- A. The FMCS Contractor shall supply one or more Java Application Control Engine (JACE) as part of this contract to manage devices/points in all specification sections with the exception of Division 28 00 00 Security. Security JACEs are provided under Division 28 00 00 and all card access, video and intrusion detection shall be integrated into the existing Enterprise software by the Systems Integrator. The Systems Integrator shall be required to integrate BACnet zone information provided by the Division 28 into the HVAC and Lighting Sequence of Operation. The number of JACEs provided by the FMCS Contractor is dependent on the type/quantity of devices and points. It is the responsibility of the FMCS Contractor to coordinate with all Division contractors to determine the quantity and type of JACEs needed to fulfill the operating sequences.
- B. Java Application Control Engine (JACE) 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 JACE. It shall be capable of executing application control programs to provide:
 1. Calendar functions
 2. Scheduling
 3. Trending
 4. Alarm monitoring and routing
 5. Timesynchronization
 6. Integration of LonWorks controller data and BACnet controller data

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7. Network Management functions for all LonWorks based devices.
- C. The Java Application Control Engine must provide the following hardware features as a minimum:
 1. Two Ethernet Ports – 10/100 Mbps
 2. One RS-232 port
 3. One LonWorks Interface Port – 78KB FTT-10A (if applicable)
 4. One RS-485 port
 5. Battery Backup or equivalent
 6. 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 1 gigabyte storage capacity)
 7. The JACE must be capable of operation over a temperature range of 32 to 122°F
 8. The JACE must be capable of withstanding storage temperatures of between 0 and 158°F
 9. The JACE must be capable of operation over a humidity range of 5 to 95% RH, non-condensing.
- D. The JACE shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.
- E. JACE Alarm Notification and actions:
 1. The JACE shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers. The JACE 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.
 2. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
 - a. To alarm
 - b. Return to normal
 - c. To fault
 3. Provide for the creation of a minimum of eight of alarm classes (Must contain building name) for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
 4. Provide timed (scheduled) routing of alarms by building name and class, object, group or node.
 5. 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.
 6. Control equipment and network failures shall be treated as alarms and annunciated.
 7. Alarms shall be annunciated in any of the following manners as defined by the user:
 - a. Screen message text
 - b. Email of the complete alarm message to multiple recipients. Provide the ability to route email alarms based on:
 - 1) Day of week
 - 2) Time of day
 - 3) Recipient
 - c. Graphic with flashing alarm object(s).
 8. The following shall be recorded by the JACE for each alarm (at a minimum):
 - a. Time and date
 - b. Location (building, floor, zone, office number, etc.)
 - c. Equipment (air handler #, access way, etc.)
 - d. Acknowledge time, date, and user who issued acknowledgement.
 - e. Number of occurrences since last acknowledgement.
 9. Alarm actions may be initiated by user defined programmable objects created for that purpose.

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10. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
 11. A log of all alarms shall be maintained by the JACE and/or a server (if configured in the system) and shall be available for review by the user.
 12. Provide a “query” feature to allow review of specific alarms by user defined parameters.
 13. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
 14. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.
- F. JACE Data Collection and Storage.
1. The JACE shall have the ability to collect data for any property of any object and store this data for future use. See points list for required logs.
 2. The data collection shall be performed by log objects, resident in the JACE that shall have, at a minimum, the following configurable properties:
 - a. Designating the log as interval or deviation.
 - b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
 - c. 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.
 - d. 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.
 3. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action. All log data shall be archived to a database in the Enterprise Server and the data shall be accessed from a standard Web browser and the Periscope Dashboard.
 4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL, BQL & NQL statements.
 5. 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.
 6. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
 7. The JACE shall have the ability to archive its log data remotely to a server 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 archive.
- G. JACE Audit Log
1. Provide and maintain an Audit Log that tracks all activities performed on the JACE. 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 to a server. For each log entry, provide the following data:
 - a. Time and date
 - b. User ID
 - c. Change or activity: i.e., Change set point, add or delete objects, commands, etc.
- H. JACE Database Backup & Storage

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1. The JACE shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval. Enterprise Developer shall coordinate with Owner to establish/implement a backup procedure.
 2. Copies of the current database and, at the most recently saved database shall be stored in the JACE. The age of the most recently saved database is dependent on the user-defined database save interval.
 3. The JACE 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.
- I. JACE Time Sync
1. Use the NtpPlatformServiceQnx in the Station/Services/PlatformServices/NtpPlatformServiceQnx. Use Time Servers greenarrow@uncc.edu and greenlatern@uncc.edu
- J. JACE Weather Station/ODA Temperature
1. The Web Supervisor has a dedicated weather station that will be available through the Niagara Network. While the Jace is not on the UNCC Network and for backup purposes all buildings are required to have their own Outdoor Air Temperature sensor to be used for economizer and other requirements but also be able to be overridden by the Web Supervisor Outdoor Air Temperature.
 2. Also available from the Web Supervisor is Outdoor Humidity, Dew point and Wet Bulb.
 3. The weather station in the Services of the Station should also be enable and set for Charlotte NC
 4. At this time Air Quality is not enable due to conditions beyond our control. Therefor this property should be set to False.
- K. JACE Loading.
1. UNCC desires for the SI to design the system to properly load balance across multiple JACEs. I.e.; UNCC does not want 1 Jace operating at 80% and another is operating at 20%

2.6 INTEGRATED DEVELOPMENT ENVIRONMENT (IDE)

- A. It is the intent of UNCC to manage and maintain all Niagara devices on the BAS network to the same Niagara approved version. It is also the intent of UNCC to upgrade the version of Niagara once a year in April. However an upgrade to Niagara may be performed at any time based upon UNCC's discretion. It is the FMCS Systems Contractor's responsibility to check the currently installed/approved version of Niagara campus and to attain and perform any deployment with the current UNCC approved version.
- B. An integrated development environment for development of graphic screens, control logic, security, alarm notification and data storage has been established using the Niagara Workbench Tool and currently resides on a Server in the existing data center and several laptops. The successful FMCS Contractor shall utilize its own laptop for all programming and graphical development. The Enterprise Developer shall utilize the IDE at the server via a VPN connection or its own separate laptop IDE. The IDE residing on the central server shall be the most current version of the Niagara Workbench toolset and the FMCS Contractor shall utilize the exact same version when programming JACE s.
- C. The server and JACE IDE tools shall be identical; however, it shall be possible to limit views and commands via a unique user profile and password in either. The IDE shall include a quick viewing of, and access to, the hierarchical structure of the database. 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,

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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.

- D. System Diagnostics. The system shall automatically monitor the operation of all workstations, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
- E. Alarm Management:
1. The system will be provided with a dedicated alarm window or console. Refer to Sequence of Operations/Points List for Alarm strategies. The Alarm Console 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. Alarms shall be created and grouped per the owner's requirements by the FMCS Contractor at the JACE level. The Enterprise Developer shall bring the JACE alarms into the existing Enterprise server and generate the strategies to send alarms to the appropriate city or contractor parties.
 2. Alarms shall be capable of being routed to any of the following:
 - a. Local Alarm Console (by FMCS Systems)
 - b. Remote Alarm Station (by Enterprise Developer)
 - c. Email recipient (multiple if needed) (by Enterprise Developer)
 3. 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. Alarms shall be able to be mapped into groupings where the groupings have common displays, sounds or hyperlinks. This grouping shall be used to distinguish alarms when alarms are coming in from multiple sites or classes (i.e. buildings, regions, trades, etc) for faster recognition.
 4. The system shall be provided with an alarm database management view. The view shall allow a user with appropriate password to:
 - a. Filter or Clear old records before a certain date and time
 - b. Clear records older than the currently highlighted record
 - c. Clear all records
 - d. Modify the alarm table options including which alarm details are displayed, column width, etc.
 - e. Export the alarm database records to .pdf, text or CSV formats.
 - f. There will be 4 Alarm Classes, Critical Alarms Class, Non Critical Alarms Class, Maintenance Alarms Class and Network Alarm Class. There will be 5 Alarm Consoles one for each Class and a Master where all 4 go to one console. All Alarm classes and console will have the building name included ie; **Friday Critical Alarm Class and Friday Critical Alarm Console.**

2.7 WEB BROWSER CLIENTS

- A. The system shall also allow use of an unlimited number of clients using a standard Web browser including Chrome and Firefox™ (preferred). The system shall be capable of providing a rich user experience (including full use of the engineering toolset) through the use of java applets or a simple user interface using only HTML, CSS and JavaScript. Refer to Sequence of Operations for the client side display types that are required on this project.
1. Acceptable Browsers:
 - a. Firefox™
 - b. Google Chrome
- B. The Web browser shall provide the same view of the graphics, schedules, calendars, logs, etc. as is provided by the Graphical User Interface and match the look and feel of

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graphics in the Web Supervisor. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

1. The Web browser client shall support at a minimum, the following functions:
2. 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.
3. Graphical screens developed for the GUI shall be the same screens used for the Web browser client (unless clearly stated in the sequence of operation). Any animated graphical objects supported by the GUI shall be supported by the Web browser interface. Enterprise Developer shall provide a FMCS Contractor with a basis of performance/expectation for GUI. FMCS Contractor shall use this standard graphic template or modify the graphics slightly to achieve the desired specification requirement/outcome.
4. Storage of the graphical screens shall be in the Java Application Control Engine (JACE) and these graphics shall be “learned” by the Enterprise Server via **Export tagging**.
5. Jace will be set up for Export Tagging to UNCC_AXWS following proper Niagara standards.
6. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
7. Owner shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
 - a. Modify common application objects, such as schedules, calendars, and set points 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.
 - b. 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.
 - c. View logs and charts
 - d. View and acknowledge alarms
 - e. Setup and execute SQL queries on log and archive information.
8. The system shall provide the capability to specify a user’s (as determined by the log-on user identification) home page. Provide each specific user a defined home page based on their usage requirements. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
9. 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.
10. Graphics on JACE shall not have more than 2 tabbed panes and have a “load” time not exceeding 5 seconds.
11. Navigation page will follow this layout;
 - a. Home page – Main landing page with menu and a picture of the building.
 - b. Floor Plans, under floor plans folder are the individual floor plans and under them the individual VAV’s (meters and lighting to be shown on floor plan with layers and a legend.)
 - c. Systems
 - d. Equipment

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- e. Alarms
 - f. Schedules
 - g. Meters
 - 1) Power
 - 2) Water
 - 3) Gas
 - h. Documents (PDFs and Visio files)
12. Tagging required on all projects. Points shall be tagged appropriately with Haystack, Niagara, and UNCCs tag libraries. Equipment shall be tagged with the same name as on the drawings. See template for examples.
 13. Alarms are required when network or controllers go down.
 14. Alarms shall include out of range source information.
 15. All PID set point adjustments on a secure/hidden graphic. This file will be restricted by the system administrator.
 16. Autotune is not acceptable and will be disabled.
 17. Network punchdown blocks are required.
 18. Legends to show what the different colors are (See ANNEX L 2.4)
 19. All floorplans to in a SVG or Scalable Vector Format.
 20. Layouts shall be designed for screen Resolution 1366x800
 21. VAV summary Page - Room Temp, Act temp, set point, damp position, reheat valve position, supply air temp, override color
 22. Page for Max Terminal Box used for Set Point Calculation to allow for step up or step down of air flow. Ability to disable and enable vav boxes in calculation
 23. Show what points are in override, down, stale, in Alarm, and fault. (See proper color scheme in ANNEX L 2.1 Default Colors)
 24. Label units (ahu) to show what they feed
 25. Network diagram to show jace network inter-connectivity
 26. Jaces to use outside air temp and campus weather station for temperatures
 27. Valves need to be labeled and position shown.
 28. All flow meters and temperatures need to be trended
 29. Page to show sequences tcva tcb valves
 30. Page definitions with standards - AHU, CHW, Floorplan, VAV pages, DHW summary page, VAV summary page, water and gas meter page, electric meter
 31. Insert maps (key plan) when zoomed in floor plans
 32. Thermostat box on vav page
 33. Lighting floor plan
 34. Show where meters are in the building, show icon on floor plan and link back to summary page.
 35. Floorplan zones - don't use conflicting colors
 36. Control diagram show network addresses for each device
 37. Control valve Tuning required on the graphics.
 38. DomHW.px water temp, tank name
 39. PX page naming convention
- C. Navigation on left side of page should have the same look and operation as Web Supervisor. See ANNEX L for more details.
- D. JACEs shall be on Niagara 4.1 at a minimum or at the latest version Niagara that UNCC is running on the web supervisor. Check with UNCC Facilities Information Systems.

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2.8 SERVER FUNCTIONS & HARDWARE

- A. Provide a general, intuitive navigational path from the server to the JACEs. Store all required O&M data sheets, drawings, help files, etc on the server from the UNCC approved Web Supervisor Contractor (Activelogix).
- B. All JACEs to be JACE 8000s Vykon only jaces.

2.9 SYSTEM PROGRAMMING

- A. The Jace's Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of controllers need to be accessible through the Jace/GUI through password access as assigned by the system administrator.
- B. A library of control, application, and graphic components shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control components from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display components to the application components to provide "real-time" data updates. Any real-time data value or component property may be connected to display its current value on a user display. Systems requiring a separate software tool to create applications and browser user interface displays shall not be acceptable.
- C. Programming Methods:
 - 1. Power Fail Protection - All System set points, proportional band, control algorithms and any other programming parameters shall be stored such that a power failure of any duration does not necessitated reprogramming the ASC or FPC.
 - 2. Provide the capability to copy components from the supplied libraries, or from a user-defined library to the user's application. Component shall be linked by a graphical linking scheme by dragging a link from one component to another. Component links will support one-to-one, many-to-one, or one- to-many relationships. Linked components shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to components on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
 - 3. Configuration of each component will be done through the component's property sheet using fill-in the blank fields, list boxes, and selection buttons requiring the use of custom programming, scripting language, or a manufacturer-specific procedural language for every component configuration will not be accepted.
 - 4. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
 - 5. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database component s shall not be allowed.
 - 6. The system shall support component duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.
 - 7. All PIDs shall have adjustable set point exposed to the graphics in a secure/hidden page.

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- D. Network and Device Naming Conventions.
 - 1. All Network names will not have spaces or underscores. I.e.; BacnetNetwork is acceptable. Bacnet Network is not acceptable.
 - 2. Device names will not have spaces, underscores are acceptable. VAVs must have a room name associated with it. I.e.; VAV1_1Rm126. The #1 after VAV corresponds with the floor it is on and the digit after the underscore identifies the VAV.
 - 3. All Network and Device names must be kept to a minimum and subject to UNCC acceptance.

2.10 COMPONENTS LIBRARIES

- A. A standard library of components shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
- B. The components in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group components created in their application and store the new instances of these components in a user-defined library.
- C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated components and applications as they are developed.
- D. Contractor will use the Niagara template station file as provided by FM FIS. The template station will be made available to the FMCS Contractor upon request via standard RFI.
- E. Contractor shall not use any "non-standard" or OEM JAR files unless approved by FM FIS. A JAR is considered "non-standard" if it is not included in Tridium's "Niagara AX Developer" release made available to developers and to OEM partners. An example of a non-standard JAR is "jcigrahicssmall.jar". A current list of approved JARs will be made available to the FMCS Contractor upon request via standard RFI.
Source codes made available to FIS to store and use.
- F. Any approved non-standard JAR files become property of UNCC with a copy of the source code to store and use
- G. All control components shall conform to the control component specified in the BACnet specification.
- H. The component library shall include components to support the integration of devices connected to the Java Application Control Engine (JACE). At a minimum, provide the following as part of the standard library included with the programming software:
 - 1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific components to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.
 - 2. For devices not conforming to the LonMark standard, provide a dynamic component that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file and documentation for the device to facilitate device integration.
 - 3. For BACnet devices, provide the following components at a minimum:
 - a. Analog In
 - b. Analog Out
 - c. Analog Value
 - d. Binary
 - e. Binary In

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- f. Binary Out
 - g. Binary Value
 - h. Multi-State In
 - i. Multi-State Out
 - j. Multi-State Value
 - k. Schedule Export
 - l. Calendar Export
 - m. Trend Export
 - n. Device
4. For each BACnet component, provide the ability to assign the component a BACnet device and component instance number.
5. For BACnet devices, provide the following support at a minimum:
- a. Segmentation
 - b. Segmented Request
 - c. Segmented Response
 - d. Application Services
 - e. Read Property
 - f. Read Property Multiple Write Property
 - g. Write Property Multiple
 - h. Confirmed Event Notification
 - i. Unconfirmed Event Notification
 - j. Acknowledge Alarm
 - k. Get Alarm Summary
 - l. Who-has
 - m. I-have
 - n. Who-is
 - o. I-am
 - p. Subscribe COV
 - q. Confirmed COV notification
 - r. Unconfirmed COV notification
 - s. Media Types
 - t. Ethernet
 - u. BACnet IP Annex J
 - v. MSTP
 - w. BACnet Broadcast Management Device (BBMD) function
 - x. Routing

2.11 LONWORKS NETWORK MANAGEMENT

- A. The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as “binding”. Systems requiring the use of third party LonWorks network management tools shall not be accepted.
- B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
- C. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
- D. These tools shall provide the ability to “learn” an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.

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- E. The network management database shall be resident in the Java Application Control Engine (JACE), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.
- F. All LonNetworks must be installed to industry standards and are not exceed a max length of 3500 ft. Wire is to be installed in separate conduit if non-plenum and installed in accordance with proper Lon specifications, no more than 60 devices and no Lon repeaters, point and trend counts to assure proper polling of devices and points. Plenum cable is allowed without conduit with University approval. All points and devices are required to update correctly and not go into fault, stale or offline. Proof of network reliability by means of but not limited to LonNetwork Scan tool, Oscilloscope and Polling Service. Copies of these operations are to be submitted to UNCC before warranty period begins.

2.12 BACNET/MSTP NETWORK MANAGEMENT

- A. The Java Application Control Engine shall support the integration of device data from BACnet TCP/IP or BACnet MSTP system devices. The connection to the BACnet system shall be via an RS485, or Ethernet IP as required by the device prior UNCC approval is required for IP/Ethernet controls and only through the secondary IP port of the Jace.
- B. Provide the required components in the library, included with the Graphical User Interface programming software, to support the integration of the BACnet system data into the FMCS. Components provided shall include at a minimum:
 - 1. Read/Write BACnet AI Points
 - 2. Read/Write BACnet AO Points
 - 3. Read/Write BACnet AV Points
 - 4. Read/Write BACnet BI Points
 - 5. Read/Write BACnet BO Points
- C. Read/Write BACnet BV Points, All scheduling, alarming, logging and global supervisory control functions, of the BACnet system devices, shall be performed by the Java Application Control Engine.
- D. The FMCS supplier shall provide a BACnet system communications driver. The equipment system vendor that provided the equipment utilizing BACnet shall provide documentation of the system's interface and shall provide factory support at no charge during system commissioning
- E. BACnet Conformance:
- F. Logic controllers shall as a minimum support MS/TP BACnet LAN type. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Logic controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
 - 1. Files Functional Group
 - 2. Reinitialize Functional Group
 - 3. Device Communications Functional Group
 - 4. Refer to Section 22.2, BACnet Functional Groups, in the BACnet Standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- G. All BacNetworks must be installed to BacnetNetwork industry standards with attention to number of devices, routers, and overall length, point and trend counts to assure proper polling of devices and points. All points and devices are required to update correctly and not go into fault, stale or offline. Proof of network reliability by means of

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but not limited to BacnetNetwork Scan tool, Oscilloscope and Polling Service. Copies of these operations are to be submitted to UNCC before warranty period begins.

2.13 COMMUNICATING THERMOSTATS

- A. The manufacturer of the Thermostat hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.
- B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.
- C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.
- D. Communicating Thermostats shall be LON or BACnet thermostats. FMCS Contractor shall standardize on a single protocol for all thermostats and IDC/IBCs (if non thermostat controllers are needed) provided, i.e. all controllers provided shall be of the same protocol. This does not necessarily apply to controllers provided in other sections of the specification as there may be limited choices, but when possible, standardize on a single protocol
- E. Acceptable providers of the Communicating Thermostat hardware and software components as specified herein are as follows. Acceptance as a product provider does not provide approval to be an acceptable FMCS Systems Integrator.

2.14 LON DEVICES (IDC)

- A. The manufacturer of the hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.
- B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.
- C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.
- D. Acceptable manufacturers of the DDC hardware and software components as specified herein are as follows. Acceptance as a product manufacturer does not provide approval to be an acceptable FMCS Systems Integrator.
- E. Communicating Thermostats shall be LON or BACnet thermostats. FMCS Contractor shall standardize on a single protocol for all thermostats and IDC/IBCs (if non thermostat controllers are needed) provided, i.e. all controllers provided shall be of the same protocol. This does not necessarily apply to controllers provided in other sections of the specification as there may be limited choices, but when possible, standardize on a single protocol
- F. Acceptable manufacturers of the VFD hardware and software components as specified herein are as follows. Acceptance as a product manufacturer does not provide approval to be an acceptable FMCS Systems Integrator.

2.15 BACNET DEVICES (IBC)

- A. The manufacturer of the hardware and software components must be primarily engaged in the manufacture of BAS as specified herein, and must have been so for a minimum of five (5) years.
- B. The manufacturer shall be ISO 9001:2000 certified. This is to insure that all manufacturing, design and support policies comply with a minimum quality assurance standard. Corporate quality assurance policies should be available for examination upon request by the owner or his agent.

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- C. The manufacturer of the hardware and software components shall have a technical support group accessible via a toll free number that is staffed with qualified personnel, capable of providing instruction and technical support service for networked control systems.
- D. Acceptable manufacturers of the DDC hardware and software components as specified herein are as follows. Acceptance as a product manufacturer does not provide approval to be an acceptable Systems Integrator.
- E. Acceptable manufacturers of the VFD hardware and software components as specified herein are as follows. Acceptance as a product manufacturer does not provide approval to be an acceptable FMCS Systems Integrator.

2.16 LON/BACNET CONTROLLER(S) STANDARDS

- A. Where possible provide LON Controllers or BACnet Controllers that can meet the required sequence of operation and can be configured rather than custom programmed. All controllers shall be designed for easy installation and servicing including removable enclosures, removable terminals, and factory applied labels for all I/O. All internal points shall be fully supported by the Graphical User Interface (GUI), allowing the user to easily modify them and monitor them. All of the internal programming points (e.g. variables, constants, PID's, timers, inputs and outputs) shall be exposed to the network on dedicated network variable outputs.
- B. Performance Standards for Inputs - Provide software selectable universal inputs. Analog inputs - shall have the following minimum level of performance: 10 bit A to D resolution; manage thermistors with an accuracy of: $\pm 0.9\text{oF}$, and a Potentiometer. For VAV Applications provide a differential pressure input sensor built in to the controller with an adjustable range of .05" to 2" H₂O (125-300PA) static pressure with a minimum accuracy of + or - 3%. Minimum response time shall be 0.5 seconds from input to output time.
- C. Performance Standards for Outputs – Analog outputs shall have the following minimum level of performance: Tri-mode Voltage of 0-10 VDC (linear), digital 0-12 VDC (off/on) or PWM. All analog outputs shall be equipped with an auto-reset fuse. Output Resolution shall be a minimum 8 bits digital / analog converter. Digital outputs shall be provided with a minimum of a triac output rated at 24VAC and 1 amp. All analog outputs and power supply shall be fuse protected
- D. Application Specific Controllers (ASC) - A controller designed through its I/O configuration and configurable control logic to be used for a specific type mechanical equipment. Typical applications are VAV boxes, Fan Coil Units, Roof Top Units, Unit Ventilators, Split DX Systems, and Heat Pumps. Lighting Controls, etc. All ASC's shall conform to the LonMark or BACnet standards so long as such a standard exists for its intended application. The ASC shall allow the use of its spare I/O as dumb I/O to be shared over the network to JACE where a sequence of operation can be applied to the I/O. Such applications shall include but not be limited to exhaust fan control, heaters, light control, etc. Freely Programmable Controllers (FPC) shall be a controller designed for more complex sequences of operations such as built up AHU's, central plant operations, electrical monitoring, and control and management for chillers, boilers and generators. These FPCs are to allow for the flexibility of custom control programming to meet the needed sequences of operation.

2.17 MODBUS SYSTEM INTEGRATION

- A. Java Application Control Engine (JACE) shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.
- B. Provide the required components in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FMCS. Components provided shall include at a minimum:
 - 1. Read/Write Modbus AI Registers
 - 2. Read/Write Modbus AO Registers
 - 3. Read/Write Modbus BI Registers
 - 4. Read/Write Modbus BO Registers
- C. All scheduling, alarming, logging and global supervisory control functions, of the Modbus system devices, shall be performed by the Java Application Control Engine.

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- D. The FMCS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning.
- E. Provide a Modbus Interface to the following equipment:
 - 1. switchgear
 - 2. packaged pumping system
 - 3. building energy metering
- F. A copy of Modbus Registers must be included in HTML format for each device in the files/lib/ModbusReg of the JACE
- G. If more than one brand of Modbus devices are on the same Modbus network each brand may need to have its own dedicated Modbus network to avoid Modbus network communication issues. If multiple brands are on the same network Contractor will need to prove proper communications and have UNCC approval before warranty period begins.
- H. All Modbus Networks must be installed to Modbus Network industry standards with attention to number of devices, routers, and overall length, point and trend counts to assure proper polling of devices and points. All points and devices are required to update correctly and not go into fault, stale or offline. Proof of network reliability by means of but not limited to Modbus Network Scan tool, Oscilloscope and Polling Service. Copies of these operations are to be submitted to UNCC before warranty period begins.

2.18 THIRD PARTY INTEGRATION

- A. The Java Application Control Engine shall support the integration of device data from the existing control system. The connection to the existing system shall be via an RS-232 or RS485 connection between the Java Application Control Engine and the existing control system {if applicable on this project}.
- B. Provide the required data points from the third party integration per sequence of operations and/or points list.
- C. All Third Party Networks must be installed to industry standards with attention to number of devices, routers, and overall length, point and trend counts to assure proper polling of devices and points. All points and devices are required to update correctly and not go into fault, stale or offline. Proof of network reliability by means of but not limited to Scan tool, Oscilloscope and Polling Service. Copies of these operations are to be submitted to UNCC before warranty period begins.

2.19 SENSORS (3 names, remove and/or equal)

- A. All control items, except thermostats, sensors and transmitters located in rooms shall be properly identified with engraved plastic nameplates permanently attached. Nameplates shall have white letters on a black background.
- B. All sensors shall be provided in NEMA 4X enclosures where exposed to the Pool environment.
- C. Room thermostat, sensor and transmitter locations shall be coordinated to align vertically or horizontally with adjacent light switches or other control devices. Room thermostats and sensors shall be mounted with the bottom 5'-0" above the floor. Sensors installed in areas where they are subject to physical abuse (ex: gymnasiums) shall be furnished with protective type aspirating guards. Sensors installed on exterior walls shall be installed on non-conductive (cork) sub-base. Sensors shall have plus or minus local set point control feature.
- D. Temperature Sensors: Thermistor type with an accuracy of plus or minus 0.40 degree F over the entire control range. Sensors for pipe installations shall be immersion type,

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brass well, and thermistor with integral lead wire. Sensors for duct application shall be insertion probe type, stainless steel probe, integral handibox, and thermistor with integral lead wire. Space temperature sensors shall be compatible with the unit controller and shall be provided in a decorative metal or plastic enclosure (Nema 4X where exposed to pool environment). Space temperature sensors shall be provided with set point and temperature indication only. Outdoor temperature sensors shall be mounted inside a protective weather and sun shield and shall be located on a North wall.

- E. Humidity Sensors: Thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%), 12 - 30 VDC input voltage, analog output (0 - 10 VDC). Operating range shall be 5 to 95% RH and -40 to 170 degree F. Duct mounted type sensors shall have a stainless steel insertion element, sealed to prohibit corrosion. Sensors shall be selected for wall, duct or outdoor type installation as appropriate.
- F. Carbon Dioxide Sensors (CO₂): Sensors shall utilize Non-dispersive infrared technology (N.D.I.R.), repeatable to plus or minus 20 PPM. Sensor range shall be 0 - 2000 PPM. Accuracy shall be plus or minus five percent (5%) or 50 PPM, whichever is greater. Response shall be less than one minute. Input voltage shall be 20 to 30 VAC/DC. Output shall be 0 - 10 VDC. Sensor shall be wall or duct mounted type, as appropriate for the application, housed in a high impact plastic enclosure required in all classrooms and labs.
- G. **Carbon Monoxide and Nitrogen Dioxide Dual Gas Detection System (CO/NO₂): (Service Bays):**

- 1. Dual gas detection system:
 - a. The detection system shall consist of one integral CO sensor and one remote NO₂ sensor.
 - b. CO and NO₂ sensors shall be electrochemical. Twinset sensors shall be equipped with compensatory circuits for variations in relative humidity and temperature and maintain a high level of accuracy. The Twinset unit will be capable of operating within relative humidity ranges of 15-90% and temperature ranges of 32degF to 104degF (0oC to 40oC) with an optional capacity of operating at extended temperature ranges.
- 2. The unit is manufactured within an ISO 9001-2000 production environment.
- 3. The unit alarm levels are to activate fans, dampers and alarms and the unit is to be installed in accordance with the following parameters:
 - a. The CO operating levels shall typically be 35 PPM, 100PPM and 100PPM 30 minutes time-delayed (1-60min adjustable) for the LOW, HIGH and ALARM levels respectively.
 - b. NO₂ operating levels shall typically be 1PPM, 2PPM and 3PPM for LOW, HIGH and ALARM levels respectively.
 - c. The sensor shall have typically three SPDT relay contacts to operate at the selected operating levels, visual indicators and an alarm buzzer. The operating levels can also be programmed to have different time delays.

Table of factory default operating levels	FIRST ALARM SET POINT (LOW)	SECOND ALARM SET POINT (HIGH)	THIRD ALARM SET POINT (ALARM)	RADIUS OF COVERAGE
Carbon Monoxide (CO)	35 PPM	100 PPM	100PPM 30Min	50 feet
Diesel (NO ₂)	1 PPM	2 PPM	3PPM	50 feet

- 4. Sensing element shall require no more than a yearly calibration. CO and NO₂ sensors shall have a maximum life of 2 years whereas combustible gas sensors shall have a maximum life of 3 years

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5. The unit shall be housed in a NEMA 3 robust PVC enclosure.
 6. The remote sensor to control unit field wiring shall be done by using 2 x #18 (for CO/NO2) or 3 x # 18 (for combustible gas) low voltage wires.
 7. Acceptable:
 - a. Base:
 - b. Optional:
- H. Combustible Gas Detection (Service Bays)
1. Combustible gas detection:
 - a. The detection system shall consist of one combustible gas sensor.
 2. Combustible sensors shall be catalytic bead (pellistors). Sensors shall be equipped with compensatory circuits for variations in relative humidity and temperature and maintain a high level of accuracy. The UNISET unit will be capable of operating within relative humidity ranges of 15-90% and temperature ranges of 32degF to 104degF (0oC to 40oC) with an optional capacity of operating at extended temperature ranges
 3. The unit is manufactured within an ISO 9001-2000 production environment.
 4. The unit alarm levels are to activate fans, dampers and alarms and the unit is to be installed in accordance with the following parameters.
 5. Combustible Gas operating levels shall typically be 20%, 30% and 40% L.E.L. for LOW, HIGH and ALARM levels respectively. The unit shall have typically three SPDT relay contacts to operate at the selected operating levels, visual indicators and an alarm buzzer. The operating levels can also be programmed to have different time delays.

Table of factory default operating levels	FIRST ALARM SET POINT (LOW)	SECOND ALARM SET POINT (HIGH)	THIRD ALARM SET POINT	RADIUS OF COVERAGE
Combustibles	20% L.E.L.	30% L.E.L.	40% LEL	25 feet

6. Sensing element shall require no more than a yearly calibration. Combustible gas sensors shall have a maximum life of 3 years.
 7. The sensor shall be housed in a NEMA 3 robust PVC enclosure. Explosion-proof enclosure is also available.
 8. The remote sensor to control unit field wiring shall be done by using 4 x # 18 (for combustible gas) low voltage wires.
- I. Differential Air Pressure Switch: Differential pressure switches for proving fan operation or sense dirty air filters shall be SPDT type, UL approved, and selected for the appropriate operating range of the equipment to which it is applied. Sensor shall have ¼” compression type fittings and shall have an adjustable set point. Furnish with ¼” barbed type static pressure tips.
- J. Current Switches (Type 1): For proving fan or pump operational status, provide solid or split-core type current status switches with adjustable set point and solid-state internal circuitry. Current switch shall have induced power, trip point set adjustment to plus or minus 1% over a range of 1 to 135 amps, trip and power LED, and field adjustable to indicate both On-Off conditions and loss of load (broken belt, etc.). Units shall have a five-year manufacturer’s warranty.
- K. Current Switches (Type 2): For proving fan or pump operational status, provide solid or split-core type current switches (“Go/No” type). Current switch shall have induced power, 100 percent solid state with no moving parts. Units shall have a five-year manufacturer’s warranty.
- L. Low Temperature Sensors: For sensing low temperatures in air handling units, provide SPST type switch, 35 to 45 degree F range, manual reset, vapor charged twenty foot long sensing element, and 120- volt electrical power connection.

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- M. Pressure Transmitters: For sensing static pressure in a duct system (usually for VAV systems), provide a pressure transmitter with integral capacitance type sensing action, solid state circuitry, accuracy of plus or minus 1% of range, zero and span adjustments, 10 to 35 VDC operating voltage, 4 to 20mA output, and integral inlet port connections. Select pressure range suitable for the application.
- N. Line Voltage Thermostats: For control of equipment using line voltage on-off thermostats (exhaust fans, unit heaters, etc.) provide 120 volt UL Listed wall mounted thermostats. Thermostat shall have a range of 50 to 90 degree F with minimum 2 degree F differential, snap acting switch, and dial adjustment for temperature setting.
- O. Firestat: For sensing sudden increases in duct temperature (ex: fire condition), provide 120 volt UL Listed SPST switch with adjustable setpoint that breaks the circuit on a rise in temperature above the setpoint and de-energizes the air handling unit fan.
- P. Aquastat: For sensing temperature of a fluid within a pipe system, provide 120-volt SPST strap-on type aquastat, temperature control range of 100 to 240 degree F (adjustable).
- Q. Air Flow Monitoring Device:
 - 1. Provide airflow/temperature measurement devices (ATMD) where indicated on the plans. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
 - 2. Each ATMD shall consist of one or more sensor probes and a single, remotely mounted, microprocessor-based transmitter capable of independently processing up to 16 independently wired sensor assemblies.
 - a. Each sensor assembly shall contain two individually wired, hermetically sealed bead-in-glass thermistors.
 - b. Thermistors shall be mounted in the sensor assembly using a marine-grade, waterproof epoxy. Thermistor leads shall be protected and not exposed to the environment.
 - c. The airflow rate of each sensor assembly shall be equally weighted and averaged by the transmitter prior to output.
 - d. The temperature of each sensor assembly shall be velocity weighted and averaged by the transmitter prior to output.
 - e. Each transmitter shall have a 16-character alpha-numeric display capable of displaying airflow, temperature, system status, configuration settings and diagnostics.
 - 3. All Sensor Probes
 - a. Each sensor assembly shall independently determine the airflow rate and temperature at each measurement point.
 - b. Each sensor assembly shall be calibrated at a minimum of 16 airflow rates and 3 temperatures to standards that are traceable to the National Institute of Standards and Technology (NIST).
 - c. Airflow accuracy shall be +/-2% of Reading over the entire operating airflow range.
 - 1) Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.
 - d. Temperature accuracy shall be +/-0.15° F over the entire operating temperature range of -20° F to 160° F.
 - e. The operating humidity range for each sensor probe shall be 0-99% RH (non-condensing).
 - f. Each sensor probe shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to the remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.

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- g. Each sensor assembly shall not require matching to the transmitter in the field. A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter for each measurement location.
- 4. Duct and Probes
 - a. Probes shall be constructed of extruded, gold anodized, 6063 aluminum tube. All wires within the aluminum tube shall be Kynar coated.
 - b. Probe assembly mounting brackets shall be constructed of 304 stainless steel. Probe assemblies shall be mounted using one of the following options:
 - 1) Insertion mounted through the side or top of the duct
 - 2) Internally mounted inside the duct or plenum
 - 3) Standoff mounted inside the plenum
 - c. The number of sensor housings provided for each location shall be as follows:
 Total #

Duct Area (sq.ft.)	Sensors / Location
< 2	4
2 to < 4	6
4 to < 8	8
8 to < 16	12
≥ 16	16

- d. The operating airflow range shall be 0 to 5,000 FPM unless otherwise indicated on the plans.
- 5. Fan Inlet Probes
 - a. Sensor assemblies shall be mounted on 304 stainless steel housings.
 - b. Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel plated steel.
 - c. Mounting feet shall be constructed of 304 stainless steel.
 - d. The operating airflow range shall be 0 to 10,000 FPM unless otherwise indicated on the plans.
- 6. Transmitters
 - a. The transmitter shall have an integral LCD display capable of simultaneously displaying airflow and temperature. The LCD display shall be capable of displaying individual airflow and temperature readings of each independent sensor assembly.
 - b. The transmitter shall be capable of field configuration and diagnostics using an on-board pushbutton interface and LCD display.
 - c. The transmitter shall have a power switch and operate on 24 VAC (isolation not required).
 - 1) The transmitter shall use a switching power supply fused and protected from transients and power surges.
 - 2) The transmitter shall use “watch-dog” circuitry to assure reset after power disruption, transients and brown-outs.
 - d. All interconnecting pins, headers and connections on the main circuit board, option cards and cable receptacles shall be gold plated.
 - e. The operating temperature range for the transmitter shall be -20° F to 120° F. The transmitter shall be installed at a location that is protected from weather and water.
 - f. The transmitter shall be capable of communicating with other devices using the following interface option: Linear analog output signals for airflow and temperature: Field selectable, fuse protected and isolated, 0-10VDC/4-20mA (4-wire)

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7. The ATMD shall be UL listed as an entire assembly.
8. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans.

2.20 DAMPERS AND ACTUATORS (Strip out any brand names)

- A. Damper actuators shall be sized by the **FMCS Contractor** for the intended application. Unless noted otherwise, dampers will be furnished by the **FMCS Contractor** for all field installed dampers that are not included as part of the equipment. In general, provide opposed blade type dampers for modulating control and parallel type dampers for two-position control applications.
- B. Control Dampers. Provide all automatic control dampers not specified to be integral with other equipment. Frames shall be 5 inches wide and of no less than 16-gauge galvanized steel. Inter-blade linkage shall be within the frame and out of the air stream. Blades shall not be over 8 inches wide nor less than 16-gauge galvanized steel triple V type for rigidity. Bearings shall be acetal, oilite, nylon or ball-bearing with ½ inch diameter plated steel shafts. Dampers shall be suitable for temperature ranges of -40 to 180F. All proportional control dampers shall be opposed or parallel blade type as hereinafter specified and all two-position dampers shall be parallel blade types. Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 6". Dampers with dimensions of 24 inches and less shall be rated for 3,000 fpm velocity and shall withstand a maximum system pressure of 5.0 in. wc. Dampers with dimensions of 36 inches and less shall be rated for 2,500 fpm velocity and shall withstand a maximum system pressure of 4.0 in. wc. Dampers with dimensions of 48 inches and less shall be rated for 2,000 fpm velocity and shall withstand a maximum system pressure of 2.5 in. wc. Side seals shall be stainless steel of the tight-seal spring type. Dampers shall be minimum leakage type to conserve energy and the temperature control manufacturer shall submit leakage data for all low leakage control dampers with the temperature control submittal. Maximum leakage for low leakage dampers in excess of sixteen inches square shall be 8 CFM per square foot at static pressure of 1 inch of WC. Low leakage damper blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage. Testing and ratings shall be in accordance with AMCA Standard 500. Damper blade width shall be no greater than 8 inches, and dampers over 48 inches wide by 74 inches high shall be sectionalized. Testing and ratings to be in accordance with AMCA Standard 500.
- C. Damper Actuators: Damper actuators shall be provided for all automatic dampers. Damper actuators controlled through the DDC system shall be low voltage electronic type, either modulating or two-position, as required to achieve the intended sequence of operation. Provide with spring return when required for fail-safe operation. Modulating dampers shall be positive positioning in response to a 2 – 10 VDC or 4 - 20mA control signal. Actuator shall include the capability of adding auxiliary switches for position indication. Furnish actuators other than spring return type with a release button (clutch) or handle on the actuator to allow for manual override. Power supply to the actuator shall be by 120 VAC, 24 VAC, or 24 VDC and the actuator shall be furnished with a factory installed 3-foot cable with end fitting for field connection. All actuators shall be UL Listed by the manufacturer.

2.21 VARIABLE FREQUENCY DRIVES

- A. All Variable Frequency drives including Chilled Water System drives shall be ABB VFD or equivalent. Variable frequency drives shall be UL listed and sized for the power and loads applied. Drives shall include built-in EN 61800-3 Category C2 radio frequency interference

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(RFI) filters and be constructed to operate in equipment rooms and shall not be susceptible to electromagnetic disturbances typically encountered in such environments. Similarly, the drives must not excessively disturb the environment within which it is used. All VFDs over 3 horsepower shall be provided with an AC choke. VFDs shall be installed in strict conformance to the manufacturer's installation instructions, and shall be rated to operate over a temperature range of 14 to 104 F.

- B. VFD automatic operation shall be provided with a BACnet MSTP, BACNET TCP/IP, Modbus RTU or Modbus TCP/IP communications protocols. Each VFD shall be fan cooled and have an integral keypad and graphical display unit with wizards and built in manuals for user interface.
- A. Three types of faults shall be monitored, "FAULT" shall shut the motor down, "FAULT Auto-reset" shall shut the motor down and try to restart it for a programmable number of tries, and "FAULT Trip" shall shut the motor down after a FAULT Auto-reset fails to restart the motor. Coded faults shall be automatically displayed for the following faults:
 - 1. Over current
 - 2. Over voltage
 - 3. Earth ground
 - 4. Emergency stop
 - 5. System (component failure)
 - 6. Under voltage
 - 7. Phase missing
 - 8. Heat sink under temperature
 - 9. Heat sink over temperature
 - 10. Motor stalled
 - 11. Motor over temperature
 - 12. Motor underload
 - 13. Cooling fan failure
 - 14. Inverter bridge over temperature
 - 15. Analog input control under current
 - 16. Keypad failure
 - 17. Other product unique monitored conditions
- B. In addition to annunciating faults, at the time of fault occurrence the VFD shall capture and make available to the user certain system data for subsequent analysis during fault trouble shooting, including duration of operation (days, hours, minutes, seconds), output frequency, motor current, motor voltage, motor power, motor torque, DC voltage, unit temperature, run status, rotation direction, and any warnings. The last 30 fault occurrences shall be retained as well as the fault data listed in the previous sentence of each fault. New faults beyond 30 shall overwrite the oldest faults.
- C. The display unit keypad shall **provide start up wizard and** allow setting operational parameters including minimum and maximum frequency, and acceleration and deceleration times. The display shall offer user monitoring of frequency, unit temperature, motor speed, current, torque, power, voltage, and temperature.

2.22 CONTROL VALVES

- A. Control Valves: (Globe Type) Valves shall be 2-way or 3-way pattern as shown constructed for tight shutoff and shall operate satisfactory against system pressures and differentials. Two-position valves shall be 'line' size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Two-way water valves shall have equal percentage flow characteristics and three-way valves shall have equal percentage flow characteristics straight through and linear through the bypass. Provide valve position indicator on all valves. Leakage rate shall be no more than 0.05% of Cv.

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1. Valves 1/2 inch through 1 1/2 inch shall be screwed pattern except where solder connections are specified for valves 1/2 or 3/4 inches. Three-way valves bypass port shall be of one size reduced Cv to preclude the need for a bypass port balancing valve. Valve and cartridge replacement tool shall be configured for maintenance or replacement without draining the coil to prevent water spill; however, an integral isolation valve on the control valve outlet will also be acceptable. Valves shall close off against 58 psi minimum.
 2. Two inch valves shall be “screwed” configuration and 2-1/2 inch and larger valves shall be “flanged” configuration and ANSI-rated to withstand the pressures and temperatures encountered. Valves shall have stainless-steel stems and spring loaded Teflon packaging with replaceable discs.
- B. Control Valves: (Characterized Ball Valves) Control valves ½ to 2 inches shall be 2-way or 3-way forged brass screwed pattern as shown constructed for tight shutoff and shall operate satisfactory against system pressures and differentials. Two-position valves shall be ‘line’ size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Two-way water valves shall have equal percentage flow characteristics and three-way valves shall have equal percentage flow characteristics straight through and linear flow through the bypass. Leakage rate shall be ANSI Class IV (no more than 0.01% of Cv). Valves shall be rated for no less than 350 psig at no less than 250 degrees F. provide a removable handle to operate valves manually during actuator power loss or failure.
- C. Two-way valves shall close off against 100 psi minimum, and three-way valves shall close off against 40 psi minimum. Valves shall have stainless-steel or chemically nickel-plated brass stem and throttling port. Valves shall be tagged with Cv rating and model number.
- D. Butterfly Control Valves: Valves shall be Honeywell or equivalent. Where specified butterfly control valves over 2” in size shall be cast iron body type for 2-way or 3-way applications specified constructed for tight shutoff and shall operate satisfactory against system pressures and differentials. Valves shall have tapped lugs for standard flange connection, and designed for isolation and removal of downstream piping at full rated pressure. Two-position valves shall be ‘line’ size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Valves shall be rated for bubble tight shutoff at no less than 150 psi. Valve disc shall be aluminum bronze. Valve stems shall be stainless steel, with inboard top and bottom bronze bearings, and an external corrosion resistant top bearing to absorb actuator side thrust.

2.23 ELECTRICAL MISCELLANEOUS

- A. Panels: All enclosures for DDC controllers and devices shall be fabricated in accordance with UL Standards from code gauge steel. Enclosures shall be provided with a continuous hinge on the door and a flush latching mechanism. Enclosures shall be shop painted with standard grade enamel coating. Back panels shall be furnished when required to facilitate installation of boards or accessories. All enclosures installed outdoors shall be constructed to NEMA 3R standards. All controllers shall be installed within an approved enclosure unless the controller will be installed within the control cabinet section of the equipment that it is intended to control. Enclosures shall facilitate the mounting of gauges, switches, pilot lights, and the like, on the face panel when required. Control devices that are mounted on the face of the panel shall be identified with engraved nameplates.
- B. Power Transformers: Step-down power transformers shall be provided for all DDC controllers and associated accessory devices as required. Transformers shall be sized and selected to accommodate all connected accessory items. Transformers shall be UL Listed Class 2 type with 120 VAC primary, 24 VAC secondary.

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- C. Relays: Miscellaneous control relays shall be provided as required to energize or control equipment and devices within the control system. Relays shall be located as close as practical to the controlled device (motor, motor starter, etc.). Where approved by NC State Building Codes, relays may be installed within starters and equipment control panels where space is available. Relays installed outside of the controlled device shall be provided with a NEMA enclosure suitable for the location where installed.

2.24 ELECTRICAL AND COMMUNICATION WIRING

- A. Wiring: All wiring devices and accessories shall comply with the requirements of NC State Building Codes. All wiring shall be installed in a neat and professional manner. Control wiring shall not be installed in power circuit conduits or raceways unless specifically approved for that purpose. All wiring, except plenum wiring (where allowed), shall be run in electrical conduits. Plenum cable will be allowed in concealed locations where accessible. All cable must be installed with 90° angles and strapped according the NC State Building Codes.
- B. Provide all interlock and control wiring. Provide wiring as required by functions as specified and as recommended by equipment and device manufacturers to achieve the specified control functions.
- C. Low voltage conductors shall be stranded bare or tinned-copper with premium grade polymer alloy insulation. For shielded cable, furnish multi-conductor of overall polyester supported aluminum foil with stranded tinned copper drain wire to facilitate grounding. Coaxial shield shall be copper braided type. Provide shielded cable where recommended by the equipment or device manufacturer, grounded in strict accordance with the manufacture's recommendations.
- D. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Terminations for Fire Alarm Control Panel (FACP) interface shall be accomplished by the Electrical Contractor or his designated subcontractor.
- E. FMCS Contractor shall provide power for all control devices and components from the closest available power source or as indicated on the power Drawings. When acceptable to the equipment manufacturer, low voltage power may be obtained from the internal equipment power source or transformer. Electrical Power for Systems Contractor's use has been provided at j-boxes located on plans.

2.25 IT or Telecommunication Rooms

- A. IT or telecommunication rooms shall be monitored with a minimum of temperature and humidity. Temperature shall be shown on the floor plans. Humidity Alarm - below 30% or above 70% and Temperature Alarm - when over 80°F.
- B. HVAC Units/CRAC Units that supply air for rooms with over \$100,000 in equipment or supplies conditioned air for over 500 square feet shall be required to have an integration card which shall communicate with the BAS system for alarm monitoring.

PART 3 -EXECUTION

3.1 GENERAL

- A. The Facility Management and Control System (FMCS) shall be designed, installed, and commissioned in a turnkey fully implemented and operational manner; including all labor not noted in the “Work by Others” paragraph of Part I of this section of these specifications, and not noted in other sections of these specifications.

3.2 SEQUENCE OF OPERATION

A. General:

1. HVAC systems shall be controlled with Direct Digital Control (DDC) according to sequence contained in this section of specifications and shall be stand-alone.
 - a. Additional points or software programming not listed but which are required to meet following sequences of operation shall be provided.
2. House controllers, relays, transducers, and other components required for stand-alone control in NEMA 1 enclosure with lockable door.
3. All VFD's shall be monitored by FMCS for trouble conditions. Signal shall be a set of dry contacts wired to BAS. Operator will use VFD control panel for diagnostics.
4. Set points:
 - a. All set points given in the sequence of operations or in the drawings are for system startup and are preliminary. Optimum operating set points must be determined during actual occupancy and will be affected by many factors. These may include:
 - 1) Weather conditions.
 - 2) Building occupancy.
 - 3) Building utilization patterns.
 - 4) Variations in building construction.
 - 5) Variations in operating characteristics of actual installed building equipment.
 - b. It is the responsibility of the building operators to determine those settings and operating methods which provide the best balance of operating efficiency and occupant comfort. This is an ongoing process. Optimum settings change as operating conditions change.
 - c. Current switches for motor starters shall be set to indicate failure of motor, for motors with VFDs, the setting shall be below normal minimum operating point. For belt driven motors, the setting shall be capable of detecting belt breakage.
5. The position of all valve and damper actuators shall be communicated to the FMCS.
 - a. Modulating actuators: Utilize feedback signal integral to actuator (or equivalent external device).
6. Two position actuators: Utilize auxiliary contacts integral to actuator (or equivalent external device) to indicate full open position. Full closed position shall also be indicated where specifically required by sequence of operation.
7. Position feedback shall not be required for air terminal unit, unit heater, or fan coil unit actuators.
8. Where space temperature sensors have set point adjustment and unoccupied mode override button, the unoccupied mode shall be overridden to occupied mode of operation for one hour (adj.), unless specified otherwise.
9. Standalone Operation
 - a. All DDC controllers that are attached to the FMCS must operate in a “standalone/occupied” fashion during the loss of communications on any Ethernet network, serial subnetwork, supervisory system, subsystem or peer system

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- b. All DDC controllers shall revert to the stand-alone mode upon detecting a loss of communication with the relevant system for more than 5 minutes (adj.).
- c. If it is not equipped with a RTC
 - 1) The unit shall default to occupied mode.
- d. If equipped with a RTC
 - 1) The controller shall revert to a default schedule residing in the DDC controllers programming logic.
 - 2) The FMCS Contractor shall submit the default stand-alone schedule to the owner for approval during the submittal process.
 - 3) The last value (preferred) or a hardcoded default value shall be used for all set points to maintain acceptable operational levels during communication outages.
- 10. All Utility Metering History Points: All points that are used for metering and/or are being used in a calculation that is being collected in history shall have the transient flag removed. The Transient Flag Removal program will be provided to installing contractor by FIS Control Dept.
- 11. Sequence of operation for equipment will be provided by the Universities DOR (Designer of Records)

3.3 OWNER TRAINING

- A. General: Owner training shall be executed in four phases. The System Integrator will provide at no cost to the owner, Phase I, Phase II, Phase III and Phase IV training classes. A proposed training agenda will be submitted to the Commissioning Agent in writing, and approved by the Commissioning Agent before the training takes place.
 - 1. The first phase shall take place at the customer job site and will be scheduled at a time preceding owner acceptance. The purpose of the training is to provide an introduction and an overview of the FMS, and ensure owner's laptop is updated with control tools (software and cabling) and functional with installed controllers. (Phase I and Phase II may be combined.)
 - 2. The second phase of training shall be a follow-up training to address specific building system and questions of the operators. Training shall take place at the customer job site and will include a site-specific walk through and hands on site-specific instruction. Completion of this training shall be a condition of system acceptance.
 - 3. Phase III and Phase IV training shall be provided as a follow-up and enrichment to the introductory and site-specific training.

3.4 PHASE I – ON SITE TRAINING

- A. This training will be primarily a classroom lecture/demonstration of approximately 1 hour to give the operator with little or no experience an introduction to the FMS. Presentation materials (PowerPoint, handouts) must be provided to the commissioning agent. Phase I may be combined with Phase II.
 - 1. Building automation fundamentals.
 - 2. System architecture and functions as they pertain to the site.
 - 3. System access using the Browser User Interface and FMS software.
 - 4. Example of basic software controller programming and tuning.
 - 5. Editing parameters such as set points and schedules.
 - 6. Developing trends and day to day system monitoring.
 - 7. Troubleshooting tools. (Correlation of graphic display to sequences.)
 - 8. The complete range of hardware and software products.

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9. Building walk-thru.

3.5 PHASE II – ON SITE TRAINING

- A. The manufacturer and the controls contractor shall provide 6 hours of on-site training in the maintenance and operation of the installed system for up to (4) personnel. The training shall be documented and a syllabus and O&M manuals shall be submitted and approved by the commissioning agent 2 weeks prior to the training. The training should include the following:
 1. HVAC systems layout including the locations of air handlers, DDC controllers, VAV boxes, pumps. This will include a walk-thru at the building.
 2. Review of O&M manual and control system as-builts:
 - a. Using As-Built documentation, Sequences of operation, control drawings, input/output summaries.
 - b. Field sensor and actuator location and maintenance.
 - c. Field controller location and maintenance.
 - d. FMS hardware operation and maintenance.
 - e. FMS software site specific capabilities.
 3. Sequence of operations for each control loop.
 4. Operation and troubleshooting including:
 - a. Modification of ASC or FPC setpoints, parameters, etc.
 - b. Calibration and adjustment.
 - c. Trending.
 - d. Hands on training in the troubleshooting and replacement of components including sensors, transmitters, control valves and actuators. Contractor shall have examples of each component and demonstrate measurement of input and output signals, and any operator adjustments available.
 - e. DDC controller functions and operation.

3.6 PHASE III – ON SITE TRAINING

- A. No later than 6 months and no earlier than 4 months from building acceptance, the SI will repeat Phase I and Phase II training. Training to be consolidated into one 4 hour session.

3.7 PHASE IV – ON THE JOB TRAINING

- A. SI and/or controls contractor shall coordinate all site visits and provide opportunity for university personnel to receive OJT during warranty work. Additionally, provide 2 days of OJT control loop tuning with owner utilizing owner laptop.
- B. The DDC contractor shall provide an additional 4 hours on-site training session twelve (12) months after project completion. The purpose of the session will be to review any operational problems that have developed. In addition, the contractor will lead Facilities Operations personnel through a comprehensive annual preventative maintenance of the controls system. This shall be scheduled at least one (1) month in advance.

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3.8 WARRANTY ACCESS

- A. The Owner shall grant the Contractor, reasonable access to the BAS system during the warranty period. The owner shall provide at no cost to the contractor web browser access (VPN) for remote service and troubleshooting during warranty period.

SECTION 2
DIVISION 26
ELECTRICAL

DIVISION 26 - ELECTRICAL

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer's contract documents

SECTION 26 0100 - ELECTRICAL GENERAL

PART 1 - GENERAL ELECTRICAL DESIGN

This guideline is based upon the 2011 North Carolina State Construction Office (SCO) Electrical Guidelines and Policies. It is the designer responsibility to be knowledgeable and proficient in application of the current referenced guideline. The more stringent of the NEC, SCO or University guideline will be enforced unless exception is given by Authority Having Jurisdiction.

1.1 GENERAL REQUIREMENTS

- A. Design for Safety.
- B. Design for Maintainability. Electrical systems shall be durable and easy to maintain and access. The Consultant shall incorporate into equipment and system design sufficient access and clearance for maintenance, repairs and replacement. Electrical Rooms shall be a minimum of 100 SF and as close to square as possible (i.e. avoid rectangular or irregularly shaped rooms).
- C. Design for Reliability and Redundancy. Ensure electrical rooms have the proper ventilation.
- D. Design for Energy Efficiency. Designing energy efficient building systems to meet State mandated energy goals is an essential part of the University's design philosophy. Any new project shall be designed with state of the art energy efficiency. Design standards published by the American Institute of Architecture (AIA), American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) and the State of North Carolina shall be met or exceeded.
- E. Major energy consuming systems and equipment shall be specified and purchased based on a Life Cycle Cost Analysis. Careful evaluation of energy conservation measures shall begin early in the design phase and continue throughout the design process.
- F. It is the responsibility of the designer to provide concise, detailed, comprehensive drawings and specifications suitable for the project.
- G. Coordinate with the University Project Manager and Facilities Engineer for any question and/or discrepancies with this guide.
- H. The design engineer shall provide a short-circuit study and shall ensure that coordination study is performed between the main protective devices for the system, feeder protective devices for the system, and all downstream protective devices. Reference North Carolina State Construction Office Electrical Guidelines and Policies – 2011.

1.2 ELECTRICAL DESIGN PROVISIONS

- A. **The electrical design shall be in complete compliance with the current edition of the North Carolina State Construction Office Electrical Guidelines and Policies. In addition, the following provisions shall be incorporated into the contract documents:**
 - 1. RESIDENCE LIFE PROJECTS HAVE ELECTRICAL VARIANCES GRANTED BY THE STATE CONSTRUCTION OFFICE. Verify applicability prior to beginning design.

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2. All materials shall be new, with required UL label, and manufacturer's label or nameplate giving complete electrical data. Where a manufacturer's catalog number is used, all parts shall be furnished to make it complete and fit the construction intended.
3. The Contractor shall be responsible for the security and storage of all materials and equipment.
4. Current editions of the National Electrical Code and the North Carolina State Building Code shall be met.
5. The Contractor shall secure and pay for all permits, fees, inspections, and licenses required. Upon completion of the job he shall present to the Engineer a certificate of inspection and approval from the inspection authorities.
6. The Contractor shall coordinate all necessary power outages with the University and Duke Power as required by giving a 30 day written notice to each agency. No power shall be reinstated to any facilities or equipment until an inspection and certificate is obtained from the NC State Construction Office of the Electrical Inspector.
7. The Contractor shall notify Piedmont Natural Gas and Time Warner for location of gas and TV cable prior to digging. Contractor shall notify University for location of all other underground utilities prior to digging.
8. Required excavation for installation of all electrical work shall be provided by the Electrical Contractor and replacement and compaction shall be performed according to other specifications relating to the particular type of work. All excavations must comply with OSHA guidelines.
9. In unfinished areas, such as equipment rooms, etc., exposed equipment shall be furnished with suitable factory applied finishes, i.e. standard gray enamel finish for panelboards, etc. Equipment furnished in finishes such as stainless steel, brushed aluminum, etc. shall not be painted.
10. The electrical drawings shall be diagrammatic only, and are intended to explain system function and define quality of materials and installation. They are not intended to define construction methods.
11. The Contractor shall not scale drawings for outlet and equipment locations. Unless specifically dimensioned on drawings or defined in specifications, outlets and equipment shall be located as evidently intended or as detailed on Architectural drawings. Lighting outlets are to be centered or spaced symmetrically unless they are dimensioned. Any dimensions shown on the drawings shall be verified in the field by the contractor prior to roughing. All outlet and equipment locations shall be coordinated with the other trades.
12. **Medium voltage conductor separable connectors (T-body) for splices in underground vaults are approved by State Construction Office (SCO) for UNCC installation. TEE TAPS ARE NOT ALLOWED.** Communication from SCO available on request.

SECTION 26 0200 – SEISMIC REQUIREMENTS FOR ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. Electrical installation shall meet the seismic requirements as specified by the North Carolina State Building Code (hereinafter referred to as the State Building Code).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All free standing electrical equipment such as switchboards, motor control centers, transformers, generators, etc., shall be mounted on 4 inch housekeeping pads mechanically connected to the structural floor.

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SECTION 26 0501 – ARC FLASH ANALYSIS

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. For all new buildings and services the electrical equipment manufacturer shall provide an arc flash analysis per NFPA 70E. Analysis shall include providing all labels. The electrical contractor shall install labels in the field. Electrical contractor shall set breakers to match the associated coordination study. Provide an arc flash analysis report for review by the engineer.
- B. Review arc flash requirements with owner when adding electrical equipment to existing facilities.

SECTION 26 0502 – ELECTRICAL TESTING

PART 1 - GENERAL

1.1 FEEDER INSULATION RESISTANCE

- A. All current-carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. Each fixture and item of equipment for connection under the Contract shall be tested for insulation resistance from its conductors to its grounded surface or contact. These tests shall be done with a 500 volt (minimum) high voltage "megger."
 - 1. Minimum readings shall be one million (1,000,000) or more ohms for #6 AWG and smaller wire, 250,000 ohms or more for #4 AWG and larger wire, between conductors and between conductor and the grounding conductor.
 - 2. The contractor shall send a letter to the engineer and the State Construction Office certifying that the above has been done and showing the tabulation of the megger readings for each panel or feeder. This shall be done at least four (4) days prior to final walk-through by engineer and the State Construction Office (SOC).
 - 3. At final walk-through by the engineer and the SCO, the contractor shall furnish a megger and demonstrate that the panels comply with the above requirements. He shall also furnish a clamp-on type ammeter and a voltmeter to take current and voltage readings as directed by the engineer or the SCO representatives.

1.2 GROUND SYSTEM TESTING

Upon completion of installation of the electrical grounding and bonding systems, the ground resistance shall be tested with a ground resistance tester. Where tests show resistance-to-ground is over 25 ohms, appropriate action should be taken to reduce the resistance to 25 ohms, or less, by driving additional ground rods. (The compliance should be demonstrated by retesting.)

1.3 THERMOGRAPHIC IMAGING

- A. A thermographic imaging survey shall be required for the following equipment installations:
 - 1. Medium Voltage Cable terminations.
 - 2. Pad Mount Transformer connections (primary and secondary).
 - 3. Service Entrance Switchboard Connections.
 - 4. Emergency Generator Connections.
 - 5. Automatic Transfer Switch Connections.

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- B. The thermographic imaging survey shall be performed by a thermographic imaging contractor who is a level III certified Thermographer and who has received accreditation through a NETA accredited Thermography training program. The imaging contractor shall have an equipment calibration program that is traceable to the National Institute of Standards and Technology (NIST). Imaging equipment must be calibrated within the last six months. Imaging equipment shall include a Forward Looking InfraRed camera able to detect emitted thermal infrared radiation and convert the detected emissions into a visual image. The imaging contractor shall provide a test report to the engineer and owner. Deficiencies shall be addressed by the Electrical Contractor.

1.4 CIRCUIT BREAKERS TESTS

- A. The following tests shall be performed on the service entrance breaker and distribution circuit breakers in the service switchboard and in service and distribution panelboards rated 1000A or higher. Tests shall be performed by a qualified factory technician at the job site. All results shall be recorded and presented to the engineer.
 1. Phase tripping tolerance (within 20% of UL requirements).
 2. Trip time (per phase) in seconds (delay).
 3. Instantaneous trip (amps) per phase (pickup).
 4. Insulation resistance (megaohms) at 100-volts (phase-to-phase, and line-to-load).
 5. Set final trip functions to match the engineers approved overcurrent protection device coordination and arc flash study.
 6. Ground fault protection on circuit breakers shall be tested in the field in accordance with the NEC and properly calibrated and set to match the coordination and arc flash studies.
 7. List all breakers settings on the as-built drawings.

SECTION 26 0519 – CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. All material shall be Third Party listed and shall be installed in conformance with the National Electrical Code.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Normal trade standard "Building Wire" of copper. Aluminum conductors shall not be installed. Each conductor shall bear easily readable markings along entire length, indicating size and insulation type.
- B. Conductors #10 AWG and smaller shall be solid. #8 AWG and larger shall be stranded.
- C. All wire shall be new, manufactured within the last 6 months.
- D. Insulation on conductors #6 AWG and smaller shall be suitable colored in manufacturing. Conductors #4 and larger may be identified with bands of proper color plastic tape near each termination and in each junction box.
- E. Conductor insulation shall be as follows:
 1. Insulation on service and feeder conductor shall be 600 volt type XHHW or THHN/THWN.
 2. Branch circuit conductors shall be minimum #12 AWG, with 600 volt THHN/THWN insulation. Circuit wires carried through rows of fluorescent fixtures shall be at least Type RHHW or THHN.

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3. Conductors in any location subject to abnormal temperature shall be furnished with an insulation type suitable for temperature encountered as designated by the NEC.
- F. Type MC Cable shall not be used.
- G. Fire alarm and control wiring shall have stranded copper conductors.
- H. All wiring lugs including, but not limited to, breakers, panelboard / switchboard lugs, safety switch lugs, and transformers lugs, shall be rated for use with 75°C conductors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All wiring shall be color coded:
1. On 120/208 volt, 3 phase, 4 wire systems - phase A, black; phase B, red; phase C, blue; neutral, white. On 277/480 volt, 3 phase, 4 wire systems - phase A, brown; phase B, orange; phase C, yellow; neutral, light gray. Ground conductor on all systems shall be green.
 2. Unless noted or accepted otherwise, busses in panels and switchgear shall be considered "A", "B", and "C" from left to right, top to bottom, or front to back when facing equipment.
 3. Control wiring shall not use black, red, or blue; but shall use white for neutrals and green for grounding. Any other colors may be used but the coding shall provide same color between any two terminals being joined.
 4. Switch legs, including "travelers" in 3-way and 4-way switching systems, shall be same color as phase leg.
 5. Conductors shall be labeled within all junction boxes, etc. using plastic "punch" tape, identifying the conductors according to circuit numbers.
 6. Wires within panel boards, terminal cabinets, and similar equipment shall be neatly squared and "bunched" together and held with plastic ties.

3.2 MEDIUM VOLTAGE CABLE TESTS AND GUARANTEES

- A. The cable shall be tested at the factory. The contractor shall be required to furnish a Certified Manufacturer's Test Report for the "Master Reel" of each cable length shipped, for approval by the Engineer. The test report shall include.
1. A high voltage test (AC).
 2. Insulation resistance values.
 3. Corona test.
 4. Leakage current curves submitted for each minute up to 10 minutes at test voltage.
- B. The manufacturer's test report shall be sent to the Engineer and Owner.
1. After installation, but prior to energizing the system, the contractor shall also high spot the system in accordance with the Design Engineer's specified testing procedure, as witnessed and "signed-off" by the Design Engineer. Copies of this test report shall be sent to the Owner, to the Engineer, and to the State Construction Office, attention Design/Review Section.

SECTION 26 0526 – GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SPECIFIC REQUIREMENTS

- A. All systems and equipment shall be grounded in accordance with NEC Article 250.

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- B. All grounding conductors shall be contained within a raceway, unless specifically noted otherwise.
- C. The raceway system shall not be relied on for ground continuity. A green grounding conductor, properly sized per the NEC shall be run in ALL raceways less than 600 volts except for telecommunications, and data raceways.
- D. All systems above 600 volts shall have grounding systems.

PART 2 - PRODUCTS

2.1 GROUND RODS

- A. Provide made grounding electrode in compliance with NEC.
- B. Ground rods shall be copper clad 10 foot minimum length, 3/4" in diameter.

2.2 GROUNDING CONDUCTORS

- A. Grounding conductors shall be sized in accordance with the requirements of the NEC.
- B. Grounding conductors for branch circuits shall be copper Type THHN/THWN.
- C. Bonding shall be done with insulated bonding bushings and lugs.

2.3 GROUND CLAMPS

- A. Clamps for attachment of grounding conductors to water pipes, etc. shall be of bronze or brass, with conduit hub with insulated bonding bushings and compression type lugs.
- B. Where available on the premises, bond together the following:
 - 1. Metal water pipe.
 - 2. Building metal frame
- C. Where required by NEC Article 250, provide "made" grounding electrodes to supplement the above. Bond together all available and made electrodes.
- D. Service ground clamps shall be attached to cold water mains at an accessible point and before its size is reduced. Clamp shall be accessible after construction is complete. Grounding conductor shall be without splice into the service enclosure where it shall be connected to main service ground buss, and interconnected with system neutral.

PART 3 - EXECUTION

3.1 PAD MOUNT TRANSFORMERS, VAULTS, MANHOLES, MV SWITCHES

- A. Pad mounted transformers and medium voltage switches shall be connected to ground rods with copper grounding conductors. Ground rod clamps shall be accessible after construction is complete. Grounding conductors shall be continuous without a splice.
- B. Each manhole, hand hole and underground vault shall have a ground rod(s) installed in bottom. Ground rod and copper grounding conductor shall bond all metallic parts inside manhole, hand hole and vault. Ground rod clamps shall be accessible after construction is complete. Grounding conductors shall be shall be continuous without a splice.
- C. Upon completion of installation of the ground rods and bonding system for pad mounted transformers, medium voltage switches, manholes, hand holes and underground vaults, the ground resistance shall be tested with a ground resistance tester. Resistance to ground shall be

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less than 25 ohms. If test indicates a greater resistance, appropriate measures shall be taken, including driving additional ground rods, to reduce the resistance to less than 25 ohms. Contractor shall send a letter to the engineer and owner certifying that the ground resistance test has been performed and stating the resistance measured at each for pad mounted transformer, medium voltage switch, manhole, hand hole and underground vault.

- D. Bushings shall be used wherever metallic conduits stub into transformer cabinets. The bonding jumper shall be sized by NEC Section 250 and lugged to the box.
- E. Provide new grounding bushings and grounding conductors on the existing secondary conduits turning up into new pad mounted transformers

3.2 EQUIPMENT GROUNDING, ETC

- A. Ground all fixed and portable appliances and equipment connected under the project with a green grounding conductor. This wire shall be carried inside the raceway and flex from equipment to nearest grounding portion of raceway system. Connect at both ends with suitable lugs.
- B. Each grounding type receptacle shall be grounded. Grounding may not be through the grounding yoke.
- C. Any feeder raceway anywhere in the system which enters a box or cabinet through part of a concentric knockout shall be fitted with a bonding bushing and jumper. The jumper shall be lugged to the box.

3.3 DRY TYPE TRANSFORMER SECONDARY GROUNDING

- A. Equipment on the secondary side of transformers shall be considered "service" and be bonded and separately grounded directly to the main service ground bus or electrode. Grounding conductor may be run in feeder raceways back to main service enclosure.
- B. In addition, transformer secondaries shall be provided with a local grounding electrode consisting of a clamp on a local 3/4" (minimum) copper cold water pipe or a grounded member. Grounding conductor shall be sized as shown on plans.
- C. All grounding system tests shall be fully documented as to time of day, weather condition, ground moisture, "megger" readings, etc. Submit a report in writing to Owner and Engineer.

SECTION 26 0529 – HANGARS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SPECIFIC REQUIREMENTS

- A. Full and proper support shall be provided for all items of electrical equipment, raceways, etc. All materials, whether exposed or concealed, shall be firmly and adequately held in place. Fastening and support shall afford safety factor of three or higher.
- B. All fixtures, raceways, and equipment shall be supported from the structure. Nothing may be supported from suspended ceilings or HVAC ducts.

1.2 MATERIALS

- A. Recessed fixtures shall be supported with 10 gauge steel wire or with the same type of wire used to support the lay-in ceiling track if heavier/stronger than 10 gauge steel wire adjusted as necessary to level fixture. Fixture shall be supported at the two opposite ends of the fixture to the building structural frame. Attach one end of the support wire to one corner of the luminaires

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and the other end to the building's structural system. The lay-in luminaire shall be screwed to the main runners of the lay-in ceiling track at all four corners using sheet metal screws.

- B. Recessed ceiling speakers, where specified with an enclosure, shall have the enclosure - supported directly from the structure with a minimum of two 10 gauge wires run perpendicular to the ceiling and not pulling to one side. If recessed ceiling speaker is specified without an enclosure and is mounted in a suspended ceiling, the speaker shall be supported using T -Bar bridges such as Soundolier No. 81-8, or other device specifically designed for such support. In addition, each of the four corners of the ceiling grid block enclosing the speaker shall be supported from the structure using 10 gauge steel wire run perpendicular to the ceiling plane.
- C. Other devices using octagonal or 4" square ceiling boxes, such as smoke detectors, dome lights, exit signs, etc., where installed in suspended ceilings shall be attached to the ceiling system using Caddy, or other, hangers specifically designed for such support. In addition, each of the four corners of the grid block enclosing the box shall be supported from the structure using 10 gauge steel wires run perpendicular to the ceiling plane.

SECTION 26 0533 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. All material shall be U.L. listed and shall be installed in conformance with the National Electrical Code.

PART 2 - PRODUCTS

2.1 OUTLET AND JUNCTION BOXES

- A. Galvanized or aluminum of gauge required by NEC.

2.2 RACEWAYS

- A. Rigid metal conduit (RMC) shall be used for feeders leaving all freestanding switchboards, switchgears, and all panel feeders. Raceways used in service entrance concrete duct banks shall be PVC Schedule 40, except for the stub-ups which shall be RMC. RMC shall be used for feeder or branch circuits exposed to weather. RMC shall be used in all mechanical rooms. Use RMC anywhere conduit is exposed and subject to damage below 8 feet above finished floor.
- B. Electric metallic tubing (EMT) may be used for general branch circuits. EMT shall not be installed in any location where exposed and subject to severe physical damage, severe corrosive influence, outdoors, underground, in below slab-on-grade or in earth.
- C. EMT couplings and connectors shall be compression-gland type of malleable steel, galvanized or sherardized. Connectors shall be insulated-throat type. Set screw, indenter, or cast type fittings are not acceptable.
- D. PVC conduit may be used under slab and underground. No exposed PVC allowed. Fittings for PVC shall be U.L. listed for the use, and shall be installed per the manufacturer's instructions. Under slab PVC conduit runs shall utilize RMC elbows and RMC up through slab, and transition to EMT or RMC in masonry walls. PVC may be used for underground outdoor branch circuits and under slab branch circuits. Bends in PVC shall be made by methods approved by the manufacturer and the NEC.

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- E. Galvanized "flex" in dry and "sealtite" in wet locations shall be used for connection to mechanical equipment or transformers, or for lighting fixture whips. Green ground wire shall be installed and NEC followed. Flex runs shall be no greater than six feet in length.

2.3 FASTENINGS AND SUPPORTS

- A. Galvanized Steel or other non-corroding material.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION

- A. 1/2" minimum lighting fixture whips are acceptable, otherwise minimum raceway size shall be 3/4".
- B. All runs of empty conduit only shall have a 100# nylon pull rope installed in the conduit.
- C. Rigid metal conduit shall be made up with full threads.
- D. Underground runs, except under concrete floor slabs, shall have a minimum of 24" cover. Backfill shall be made in 6" layers – tamping each layer to a density of 95% of maximum possible.
- E. Raceways run external to building foundation walls, with the exception of branch circuit raceways, shall be encased with a minimum of 3" of concrete on all sides. Encased raceways shall have a minimum cover of 18", except for raceways containing circuits with voltages above 600 volts, which shall have a minimum cover of 30".
- F. Branch circuit raceways run underground external to building foundation shall be run in raceways installed in accordance with the NEC, and shall be of a type approved by the NEC as "suitable for direct burial". Minimum raceway size shall be 3/4".
- G. All underground raceways shall be identified by underground line marking tape located directly above the raceway at 6" to 8" below finished grade. Tape shall be permanent, bright colored, continuous printed, metal compounded for direct burial not less than 6" wide and 4 mils thick. Printed legend on tape shall indicate general type of underground line below.
- H. Where underground raceways are required to turn up to cabinets, equipment, etc., and on to poles, the elbow required and the stub-up through the slab or earth to equipment shall be of rigid steel conduit.
- I. Grounding type insulated bushings shall be used where raceway enters boxes with concentric or oversized knockouts. These bushings shall also be used wherever conduits stub into switchboards or transformer cabinets. Grounding type insulated bushings shall always be used on both ends of conduits feeding panelboards.
- J. Provide suitable fittings where raceway crosses building expansion joints.
- K. Run concealed in finished areas.
- L. All PVC conduits, except those installed for services, shall contain green grounding conductor.
- M. All runs exposed and all runs above accessible ceilings shall be neat and square with building structure such as walls and ceiling/roof structures. Multiple parallel runs shall use trapeze supports where possible.
- N. The use of "LB's" shall be limited as much as possible.

3.2 BOX INSTALLATION

- A. Outlet boxes shall be sized in accord with NEC. All lighting outlet boxes shall have fixture studs. Device boxes shall be sectional type or 4" square equipped with plaster rings as required to

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mount the device. Set edge flush with finished surface. Boxes may be installed at top or bottom of a masonry course.

- B. Where installed in metal stud partitions, wall boxes shall be supported from two adjacent studs. Support on a single stud is not acceptable.
- C. Ensure all devices meet ADA requirements and specific project requirements regarding mounting heights and locations. Coordinate questions with Architect and Project Manager:
- D. The following are standard mounting heights:
 - 1. Switch boxes 46" from finished floor to center. Boxes beside doors shall be mounted so edge of trim plate is 2" from edge of door trim on strike side.
 - 2. Telephone boxes 18" from finished floor to center and vertical. Boxes for wall phones shall be 46" from finished floor and vertical.
 - 3. Panel cans 6' - 4" (\pm 4" in concrete block construction) from finished floor to top of can.
 - 4. Fire alarm pulls stations 46" from finished floor to center.
 - 5. Fire alarm chimes, horns, flashing lights, etc., 80" to bottom above finished floor or 6" below finished ceiling, whichever is lower, to comply with ADA requirements.
- E. Mount boxes for receptacles to receive device in a vertical position and locate:
 - 1. Centered 18" above finished floor.
 - 2. Centered 6" above counters, shelves, or cabinets where apparently intended to be so placed.
 - 3. Centered 4" above high edge of backsplashes.
 - 4. Where devices are to be ganged, provide boxes to receive devices trimmed with a gang plate.
- F. As soon as installed, all raceway openings shall be closed with plastic inserts to prevent entrance of foreign matter during construction. All enclosures shall be kept clean of any foreign matter.
- G. All outlet boxes, junction boxes and pull boxes shall have their covers and exterior visible surfaces painted with colors to match color scheme outlined in Section 260553. This includes covers on boxes above all type ceilings. In addition, the box cover shall be labeled using a permanent, black marking pen to identify circuits or systems in box.

SECTION 26 0543-UNDERGROUND DUCT BANK SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. System shall consist of single, round bore conduit encased in concrete. The minimum number and size of ducts shall be indicated on the drawings. Changes in direction of runs exceeding 10 degrees shall be accomplished by using special couplings or bends manufactured for this purpose. Duct lines shall be installed so that the top of concrete or future concrete as shown is not less than 30 inches below finished grade or finished paving at any point.
- B. Ducts should be pitched to drain toward manholes and away from buildings and equipment. Minimum slope shall be 4-inches in 100-feet. Where necessary to achieve this between manholes, ducts should be sloped from a high point in the run to drain in both directions.
- C. Concrete encased non-metallic duct shall be supported on plastic separators coordinated with duct size and spacing. Separators shall be spaced close enough to prevent sagging and deforming of ducts. Separators to the earth and to ducts should be secured to prevent floating during placement of concrete. Steel or tie wires should not be used in such a way as to form conductive or magnetic loops around ducts or duct groups.
- D. Where duct lines enter manholes or pull boxes, the conduits shall terminate in end bells. Conduit shall be thoroughly cleaned before laying. During construction and after the duct line is

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completed, the ends of the conduit shall be plugged to prevent water washing mud into the conduits.

- E. All underground raceways shall be identified by underground line marking tape located directly above the raceway at 6 to 8 inches below finished grade. Tape shall be permanent, bright-colored, continuous printed, metallic tape compounded for direct burial not less than 6 inches wide and 4 mils thick. Printed legend shall be indicative of general type of underground line below. Where it is necessary to cut a tapered end of a piece of conduit at the site, the cut shall be made with a tool or lathe designed to cut a taper to match the taper of the particular conduit to be used.
- F. All ducts should be sealed at terminations, using sealing compound and plugs, as required to withstand 15 psi hydrostatic pressure.
- G. After the duct line has been completed, a mandrel not less than 12 inches long, having across section approximately one-fourth inch less than the inside cross section of the conduit shall be pulled through each conduit after which a brush with stiff bristles shall be pulled through to make certain that no particles of earth, sand, or gravel have been left in the lines.
- H. The conduit furnished shall be concrete encased plastic. Concrete shall be colored red for all MV Cable Duct Banks.
- I. Installation of duct banks comprising multiple single conduits: each single conduit shall be completely encased in concrete with a minimum of 3" between conduits and a minimum thickness of concrete encasement of 3" which may be increased to fit the actual shape of the trench. Spacing assembly shall be made of non-metallic, non-decaying material. Joints in conduits shall be staggered at least 6". Ducts shall be securely anchored to prevent movement during the placement of concrete.
- J. Waterproof, 130 pound tensile test marking cord shall be installed (marked at least every foot), in all ducts, including spares, after thoroughly rodding, clearing and swabbing all lines free of any and all obstructions.
- K. Installation of single conduit shall be completely encased in concrete. The thickness of concrete shall be not less than 3" on the sides, bottom and top of conduit.
- L. Concrete: Concrete shall be 3000 psi class. Where a connection is made to an existing duct line, the concrete encasement shall be well bonded to the existing encasement. Use 1/2" diameter stainless steel rod minimum doweled in existing duct bank for cold joints, 2' - 0" into old envelope and 2' - 0" beyond.
- M. Connections to New Manholes: Concrete encased duct lines connecting to underground structures shall be constructed to have a flared section adjacent to the manhole to provide shear strength. Underground structures shall be constructed to provide for keying the concrete envelope of the duct line into the wall of the structure. Vibrators shall be used when this portion of the envelope is poured to assure a seal between the envelope and the wall of the structure.
- N. Connections to Existing Manholes: For duct line connections to existing structures, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut the steel and bend it out to tie into the reinforcing of the duct line envelope. Chip out the structure wall to form a key for the duct line envelope.
- O. Design for spare ducts in each power duct bank as follows:
 - 1. 1-3 occupied ducts requires (1) additional spare duct, 4 or more occupied ducts requires (2) spare ducts minimum.
- P. Coordinate number of ducts and associated spares for Telecom duct bank with the University Telecommunications Department.

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PART 2 - PRODUCTS

2.1 MANHOLES/VAULTS:

- A. Underground structures shall be poured in place or may be of precast construction. Horizontal concrete surface of floors shall have a smooth trowel finish. Concrete shall be cured by applying two coats of white pigmented membrane forming-curing compound in strict accordance with the manufacturer's printed instructions, except that precast concrete may be steam cured. Curing compound shall conform to ASTM C 309. Duct entrances and windows shall be located near the corners of structures to facilitate cable racking. Covers shall fit the frames without undue play. Steel and iron shall be formed to shape and size with sharp lines and angles. Casting shall be free from warp and blow holes that may impair their strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide all necessary lugs, rabbets and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. The words "electric" and "telephone" shall be cast in the top face of all power and telephone manhole covers, respectively.
- B. Medium Voltage Switch vaults shall have spring assist lids for access to termination and switching compartments.
- C. Optional Precast Concrete Construction: In lieu of poured-in-place concrete manholes and hand holds, the Contractor may, at his option, provide precast concrete structures subject to the requirements specified below. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes and handholds.
- D. General: Precast concrete structures shall have the same accessories and facilities as required for poured-in-place structures. Likewise, they shall have plan area and clear heights not less than those of poured-in-place structures. Concrete materials and methods of construction shall be the same as for poured-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work shall have an ultimate 28-day compressive strength of not less than 4000 pounds per square inch. Structures may be precast to the design and details shown for poured-in-place construction, precast monolithically and placed as a unit; or, they may be of assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. All structures shall be identified with the manufacturer's name embedded in, or otherwise permanently attached to, an interior wall face.
- E. Structure top and bottom shall be designed for full dead, superimposed dead and live load including impact. Structure sidewalls shall be designed for lateral earth and hydrostatic pressures plus live load (H20 Truck) adjacent to structure. Tops and walls of structures shall be designed for AASHTO standard H20 highway loading, with 30 percent loading added for impact and with design load being that which produces maximum shear and moment. All dead and live loads, as well as impact loading, shall be considered in design. Walls shall be designed to withstand all soil pressures, taking into consideration the soil to be encountered and ground water level present at the site and assuming that the H20 design vehicle will operate on surfaces adjacent to the structure. Ground water level shall be assumed to be three feet below ground surface unless a higher water table is indicated in the boring logs. Design shall also take into consideration stresses induced in handling units. Lifting devices shall be provided for properly handling units. Calculations and shop drawings shall be submitted covering the design and manufacture of precast units and shall bear the seal of registered professional engineer.
- F. Joints: Mating edges of precast components shall be provided with tongue and grooved joints. Joints shall be designed to firmly interlock adjoining components and to provide waterproof junctions. Joints shall be sealed watertight using preformed plastic strip conforming to AASHTO M 198, Type B. Sealing material shall be installed in strict accordance with the sealant manufacturer's printed instructions. Provisions shall be made for waterproofing cable entrances into structures and at covers in the top slab.

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- G. Pulling-in irons shall be steel bars bent as indicated on drawings, and cast in the walls and floors. In the floor they shall be centered under the cover, and in the wall they shall be not less than 6 inches above or below, and opposite the conduits entering the structure. Pulling-in irons shall be projected into the structure approximately 4 inches. Irons shall be zinc-coated after fabrication.
- H. Cable racks, including arms shall be made from 50% glass-reinforced nylon or a non-metallic material having equal mechanical strength, thermal resistance, chemical resistance and dielectric physical properties. Cable racks, including rack arms and insulators, shall be sufficient to accommodate the cables. Racks in power manholes shall be spaced not more than 3 feet apart and each manhole wall shall be provided with a minimum of 2 racks.
 - 1. Provide stainless steel hardware for mounting fasteners. Coat threads of anchor bolts with anti-seize compound immediately prior to installing nuts.
 - 2. Rack arms shall be 8", removable type, and rated capable of supporting 450 lbs working load and 1,000 lbs short term rated.
 - 3. Rack arms shall have slots or holes for securing cables with non-metallic cable wire ties.
- I. Precast Manhole/Vault Installation: Commercial precast assembly shall be set on 6 inches of level, 90 percent compacted granular fill, 3/4 inch to one inch size extending 12 inches beyond the manhole on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator. Drain sumps shall be provided for all precast structures.
- J. Coordinate requirement for sump pumps in manholes and vaults with Project Manager.
- K. Install 1/0 bars copper ground conduct around inside perimeter of manhole. Connect to 3/4" x 10' - 0" ground rod inside manhole. Bond with #6 bare copper from ring to manhole cover frame, sump covers, etc.

SECTION 26 0553-EQUIPMENT IDENTIFICATION LABELS

PART 1 - GENERAL

1.1 NAMEPLATES

- A. Furnish and install engraved laminated phenolic nameplates for all safety switches, panel boards, transformers, switchboards, motor control centers, low voltage systems and other electrical equipment supplied for the project for identification of equipment controlled or served, phase, voltage, etc.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Nameplate material colors shall be:
 - 1. Blue surface with white core for 120/280 volt equipment.
 - 2. Black surface with white core for 227/480 volt equipment.
 - 3. Bright red surface with white core for all equipment related to fire alarm system.
 - 4. Dark red (burgundy) surface with white core for all equipment related to security systems.
 - 5. Green surface with white core for all equipment related to "Emergency" systems.
 - 6. Orange surface with white core for all equipment related to telephone systems.
 - 7. Brown surface with white core for all equipment related to data systems.
 - 8. White surface with black core for all equipment related to paging systems.
 - 9. Purple surface with white core for all equipment related to television systems.
- B. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by phenolic tags with wire attached to conduit or outlet.

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- C. All outlet boxes, junction boxes and pull boxes shall have their covers and exterior visible surfaces painted with colors to match color scheme outlined above. This includes covers on boxes above all type ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Nameplates shall be securely attached to equipment with self-tapping stainless steel screws, and shall identify equipment controlled, attached, etc. Letters shall be 1/2 inch high minimum. Embossed, self-adhesive plastic tape is NOT acceptable for marking equipment and shall not be used.

SECTION 23 0800 – BUILDING COMMISSIONING SERVICES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. North Carolina General Statute 143-135.37(d) requires commissioning of major projects.
- B. Performance Verification. In order to be able to verify performance of a building component or an electrical system component, the construction contract shall include provisions that require each building component and each electrical system component to be commissioned, and these provisions shall be included at the earliest phase of the construction process as possible and in no case later than the schematic design phase of the project. Such commissioning shall continue through the initial operation of the building. **The project design and construction teams and the public agency shall jointly determine what level of commissioning is appropriate for the size and complexity of the building or its electrical system components.**
- C. Design for Commissioning. The electrical designer will be responsible for ensuring and developing "... a systematic process of assuring that a building (*mechanical, electrical and plumbing systems*) performs in accordance with the design intent and the owner's operational needs." The Owner considers the following elements as a minimum requirement for building acceptance and inherently integral to the Electrical Designer responsibilities, unless specifically notified otherwise by the Owner.
 - 1. Design Phase – Provide documentation to the commissioning agent for
 - a. Owner's project requirements and Basis of Design, to include single line drawings for Design Narrative.
 - b. Commissioning reviews of design documents.
 - c. Verification that operations and maintenance staff training through the mechanical contractor is specified.
 - d. Building load data files and energy analysis data for Measurement and Verification requirement.
 - e. Metering and sub metering to accomplish analysis of annual energy consumption versus projected energy consumption.
 - 2. Construction Phase
 - a. NOTE: Commissioning shall in no way reduce the designer scope and responsibility for Construction Administration to include verifying quality of system installation
 - b. Attend the commissioning scoping meeting and selected commissioning team meetings.

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- c. Installation Verification.
 - d. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
 - e. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. On site observations should be completed just prior to system startup.
 - f. The designers shall continue to assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, drawings or equipment documentation is not sufficient for writing detailed testing procedures.
 - g. Startup and Checkout.
 - h. From the Contractor's red-line drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as shop drawings for the fire alarm, normal power distribution and emergency power distribution systems.
 - i. Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
3. Post Construction Phase
- a. Designer will provide classroom overview to university operations staff to include Basis of Design, standard power riser, emergency and standby power riser, and metering.
 - b. M&V. Assist in reconciling discrepancies between actual electrical energy usage and the submitted projection model.
- D. The Designer will include in bid documents the specific support and documentation required of the General Contractor, Mechanical Contractor, Electrical Contractor, Plumbing Contractor, Controls Contractor, Designer, Owner and others as applicable to ensure acceptable commissioning. Reference Division 01 General Requirements for commissioning guidelines. Guidelines will be modified as appropriate for each project.

SECTION 26 1313 – MEDIUM VOLTAGE SWITCHES

PART 1 - GENERAL

1.1 MEDIUM VOLTAGE SWITCHGEAR

- A. Switchgear shall be multiple way, manually operated switches with circuit interrupters.
- B. Switchgear shall consist of a gas-tight tank containing SF6 gas, load interrupter switches with visible open gaps and integral visible grounds. Manual operating mechanisms and viewing windows shall be located on the opposite side of the tank from the bushings and bushing wells so that operating personnel shall not be required to perform any routine operations in close proximity to high-voltage elbows and cables.
- C. Switchgear shall include microprocessor-based overcurrent control to initiate fault interruption on designated ways.
- D. Switchgear shall be suitable for sub-surface installation.
- E. Switchgear may be installed either as a pad mount or vault configuration depending on the location and visibility. Coordinate requirement with Project Managers.
- F. The University prefers S&C brand Medium Voltage Switchgear. S&C brand shall be bid as a preferred alternate.

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- G. Design for each medium voltage switch to be loop fed such that each switch has two independent source feeds.
- H. Pad mount switches shall be mounted on fibercrete box pads engineered and manufactured to support the particular switch.

SECTION 26 1200-DRY-TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 MATERIALS

- A. Transformers shall be furnished in accordance with the following:
 - 1. For 60Hz service.
 - 2. Built in accordance with NEMA Standards.
 - 3. Insulation shall conform to NEMA ST 20 standards for 2200 C UL system. Transformers 25KV A and larger shall be rated for 1150 C temperature rise over 400 C ambient, provided case temperature rise shall not exceed 450 C over 400 C ambient. The transformer overload capability shall be in accordance with IEEE C57.96 for standard transformers.
 - 4. Transformers shall have been rated for sound level in accordance with American Standards Association Standard ASA- C89.1-latest edition. Sound rating shall be same as, or less than, maximum decibel rating recommended by the standard for transformer size and type specified. This information shall be indicated on transformer nameplate.
 - 5. Primary winding shall be rated 480 volts for use on a 3-phase, 4-wire system and connected Y. Furnish with full KVA rated taps of the manufacturer's standard, but not less than two - 2 1/2% above rated voltage and 4 - 2 1/2% below rated voltage. After load is applied, set taps to deliver as near 120/208 volts as possible.
 - 6. The designer shall evaluate the need for K-rated transformers on case-by-case basis. Coordinate with Project Manager.

1.2 MOUNTING

- A. Transformers over 15 KVA shall be floor mounted. Four vibration dampeners per transformer shall be employed as necessary to avoid transmitting vibration to building structure.
- B. Transformers 15 KVA and under may be wall mounted.
- C. Installation shall meet seismic requirements of Section 260200 of these guidelines.

1.3 CONDUIT CONNECTIONS

- A. No conduits shall be attached directly to transformer housing.
- B. Where construction permits, stub conduits up into transformer housing from beneath. Stubs shall be fitted with fiber-throated grounding bushing with suitable lug. Stubs shall be bonded together and to transformer case with ground wire of size required by N .E.C.
- C. Where connection must be made to housing, provide vibration dampening assembly consisting of:
 - 1. Female hub-type liquid-tight connector.
 - 2. Male hub-type liquid-tight connector.
 - 3. Short length (approximately 6") liquid-tight flexible conduit.
 - 4. Bonding jumper of NEC size on inside of assembly. Bond from lug to transformer case panel or switch can.

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- D. All transformers, in addition to having the secondary neutral grounded to the system grounding conductor, shall also have the secondary neutral grounded to a local grounding electrode as required by NEC.

SECTION 26 2413-SWITCHBOARDS

PART 1 - GENERAL

1.1 GENERAL

- A. Switchboard shall be provided with painted "schematic" bus on front of enclosure to depict actual bus arrangement inside cubicles.
- B. Provide a laminated drawing of the building electrical riser next to each switchboard in the main electrical room framed and mounted under glass.

1.2 BUSSING

- A. All busing shall be silver-plated copper.
- B. Switchboards shall have a 100% neutral bus of the same material as the main bus. A copper ground bus shall be provided in each section

1.3 METERING

- A. Main section shall be equipped with a GE Power Management Power Quality Meter or equivalent device. The intent is to be able to connect to a central monitoring station PC. The Power Meter shall provide for readouts of A, V, VA, W, var, kWh, kvarh, kVAh, PF, Hz, demand W, demand var, demand A, demand VA. Values shall be in true RMS. The Power Meter shall have (4) output relays, (4) isolated analog outputs that can replace transducers.
- B. The Power Meter shall be able to perform Harmonic Analysis with trigger trace memory, waveform capture, event recorder and data logger.
- C. The Power Meter shall have built-in data communications to allow Multi-point communication to multiple computer workstations, programmable controllers, and other host devices, at a minimum data rate of 9600 baud. The Power Meter shall be able to communicate with the Owners Tridium Niagara Software through the Network Area Controller, NAC, Panel for building management and/or other monitoring functions. The Power Meter shall be compatible with Modbus RTU Communications.

1.4 CIRCUIT BREAKERS

- A. Each circuit breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate, as well as exercise the circuit breaker operating mechanisms.
- B. Feeder breakers shall be thermal magnetic with trip ratings as shown on plans. Feeder breakers shall be bolt-in.
- C. Evaluate main service breaker for applicability of rack-out type breaker. Coordinate with Project Manager.

1.5 TESTING

- A. Perform the following tests on the service circuit breaker. Testing shall be performed by a qualified factory technician at the job site. All readings shall be tabulated:
 - 1. Phase tripping tolerance (within 20% of U.L. requirements).

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2. Trip time (per phase) in seconds.
 3. Instantaneous trip (amps) per phase.
 4. Insulation resistance (in mega ohms) at 100 volts (phase to phase, and line to load).
 5. Ground fault protection on the main breaker shall be performance tested in the field and properly calibrated and set in accordance with the coordination study.
- B. All tests specified shall be completely documented indicating time of day, date, temperature and all pertinent test information.
- C. All required documentation of readings indicated above shall be submitted to the engineer prior to, and as one of the prerequisites for, final acceptance of the project.

SECTION 26 2416 – DISTRIBUTION AND BRANCH CIRCUIT PANELBOARDS

PART 1 - GENERAL

1.1 SPECIFIC REQUIREMENTS:

- A. Equipment shall be built to NEMA Standards where such standards exist

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The Designer shall design all new panels to have 20 percent blank breaker spaces. The Designer shall require that the Contractor install 10 percent unassigned spare breakers in each new panel.
- B. Panels shall be marked with their maximum short circuit current rating at the supply voltage and shall be Third Party listed and bear the Third Party label. When required, panels shall be suitable for use as service equipment.
- C. Distribution and branch circuit panelboards shall be bolt-on type.

2.2 CABLE CONNECTIONS

- A. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position.

2.3 CIRCUIT BREAKERS

- A. Panel Board Circuit Breakers
1. Minimum interrupting capacity rating of any panel assembly shall be 10,000 amps.
 2. Branch circuit breakers shall be bolt-on, thermal-magnetic, molded case. Single pole, 15 and 20 ampere breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.
 3. Following the NEC requirement, AFCI are only required in bedrooms with permanent cooking appliances.
- B. Distribution Board Circuit Breakers
1. Distribution Board Breakers shall be one, two, or three pole molded case circuit breakers rated 600VAC. Breakers shall be high interrupting construction.
 2. Breakers with frame sizes greater than 100 amperes shall have variable magnetic trip elements which are set by a single adjustment (to assure uniform tripping characteristics in each pole). A push-to-trip button shall be provided on the cover for mechanically

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tripping the breaker. The breaker shall have reverse connection capability and be suitable for mounting and operating in any position.

3. Circuit breakers shall have removable lugs. Lugs shall be UL listed for copper conductors only, rated 75 degrees C. Breakers shall be UL listed for installation of mechanical type lugs.

2.4 CONSTRUCTION FEATURES

- A. Panels shall be sized so that they will pass through door openings and hatch openings, be assembled if required within the room that they are located/mounted, installed to meet NEC clearance requirements and installed for maintainability.
- B. Top or bottom gutter space shall be increased six inches where feeder loops through panel. End plates shall be galvanized Code gauge (minimum) and shall be supplied without knockouts.
- C. Covers shall be constructed of high grade flat sheet steel of Code gauge minimum with the following:
 1. Door flush with face and closed against a full inside trim stop. Hinges shall be inside type.
 2. A combination flush latch and Yale, Corbin or equivalent, tumbler-type lock, so panel door may be held closed without being locked. All such locks on same job shall be keyed alike. Plastic lock type trims are not acceptable.
 3. Finish of manufacturer's standard color of top-grade enamel over a phosphatized or other approved rust inhibitor treatment and prime coat.
 4. Four or more cover fasteners of a type which will permit mounting plumb on box. Cover shall also have inside support studs to rest on lower edge of can while being fastened.
 5. Distribution and lighting type panelboards shall be furnished with covers hinged to backbox. Hinge shall be continuous "piano" hinge type permanently spot welded to the panelboard cover. Hinge shall in turn bolt securely to the backbox.
- D. For lighting panels, breakers shall be "Quicklag" type bolted to the supply bus. Plug-in types are not acceptable.
- E. Supply lugs shall be installed on busses and neutral bar so they may be readily and securely tightened from the front with panel in place and wired. A suitable arrangement shall limit their movement out of plumb. It shall not be possible to move the lugs so that metal parts between phases are closer than 3/8".
- F. All panels shall have copper busses, with substantial connections where breakers bolt to busses.
- G. All wiring lugs in panelboards and all breakers shall be rated for use with 75 degree conductors.
- H. All branch circuit panels shall be equipped with copper ground busses.
- I. Panelboards shall be equipped with directory cards mounted behind heavy clear plastic shields in substantial frames attached to inside face of doors. Cards shall be a minimum of three inches wide.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be as follows
 1. All unused openings shall be closed.
 2. Only one solid wire is allowable under a screw. Provide an approved lug for connecting stranded wire or more than one solid conductor.
 3. Each lighting or branch circuit panelboard mounted flush in a wall shall have a minimum of five empty 3/4" conduits stubbed out into the ceiling space above panel for future use unless all circuits in a panel are assigned. Seal ends of conduit with caps or with U.L. approved fire stopping material.

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- B. Labeling shall be as follows
1. Label all equipment in conformance with documents.
 2. For branch circuit panels, directory cards shall be neatly typed to indicate load served by each breaker or fuse. Directory cards shall indicate circuits in a manner analogous to the physical circuit breaker arrangement (i.e. odd numbered circuits in one column, even numbered circuits in another). Mount cards behind heavy plastic. Panelboard directory card shall be neatly typed with circuits assigned as shown on schedules. Space typing on card so all is visible when inserted into frame. Use room names and numbers as provided by Owner, not those shown on schedule. Names and numbers on schedule relate to plans only for construction. Indicate spare breakers in pencil (not typed) so that owner can erase and change as necessary in the future.
 3. Next to each breaker within distribution panels, attach a label indicating load served. Wording shall be as shown on its diagram or schedule on the drawings. Labeling shall also be attached to separately-mounted breakers, switches, transformers, wiring gutters and controllers of all types.
 4. Centered above door on panel cover attach a label indicating panel designation-for example, "Panel A;-voltage- 120/208 VOLTS": and from where served - "FED FROM PANEL MDP".
 5. Interrupting capacities shall be as indicated on the panel schedules. All ratings are for fully rated panels and breakers; series ratings are not acceptable.

SECTION 26 2713 – ELECTRICITY METERING

PART 1 - GENERAL

1.1 SUMMARY

- A. All new buildings (and facilities with significant electrical consumption) shall have electric meters, to be provided and installed by the Prime Electrical Contractor. If there is no Electrical Prime Contractor, the contractor with the greatest contract dollar value shall provide and install the meter.
- B. All new service boards shall be equipped with electric meters.
- C. Power Monitoring Interface: The Power Measurement Interface (PMI) device shall include the appropriate current and potential (voltage) transformers. The PMI shall be certified under UL-3111. The PMI shall perform continuous true RMS measurement based on 32 samples-per-cycle sampling on all voltage and current signals. The PMI shall provide outputs to the BAS based on the measurement and calculation of the following parameters:
- Current for each phase and average of all three phases,
 - kW for each phase and total of all three phases,
 - power factor for each phase and all three phases,
 - Voltage for each phase and average of all three phases , and
 - Power consumption (kWH).

These output values shall be communicated to the BAS over the open-protocol LAN. Coordinate with electrical engineer to ensure electrical specifications require correct meter to accomplish power monitoring noted above.

Mount to allow manual reading without use of ladders.

1.2 SUB METERING

- A. The designer shall coordinate with the owner for sub metering requirements covering major mechanical equipment/systems and other tenant loads. Standby (generator) power must be sub metered.

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- B. Provide sub metering to enable measurement and verification requirements for building commissioning.

SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. New receptacles are to be installed with ground pin up.
- B. Specific Requirements:
 - 1. Where two or more devices are indicated for gang installation, they shall be trimmed with gang type plates.
 - 2. Ground each receptacle by means of a separate code size ground wire (#12 minimum) connecting the receptacle ground terminal to the ground bus in the distribution panel..
 - 3. Designer shall evaluate the need for isolated grounding systems. Isolated ground wires shall be installed continuous from IG receptacle to the isolated ground bus in the panel. In addition, a separate ground wire shall bond the box and conduit and run with the circuit conductors to the normal ground bus bonded to panel.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All wiring devices of any one general type (i.e. all duplex receptacles, all wall switches, etc.) shall be of the same manufacturer, color and shall match throughout.
- B. All duplex receptacles shall be rated 20 Amp, NEMA 5-20R, unless otherwise noted.
- C. All safety switches shall be heavy duty.

2.2 WIRING METHOD FOR BRANCH CIRCUITS

- A. Although not prohibited by the NEC, conductors serving two separate power systems (i.e. 120/208 V and 277/480 V) shall not be mixed in the same raceway, pull box, or junction box. Exception is where control wiring is a different voltage than the power.
- B. Use dedicated neutrals in all designs. Sharing of neutrals is not allowed for single phase branch circuits.
- C. Three phase circuits shall be limited to one circuit per raceway (three [3] different phase wires and a neutral if needed).
- D. The neutral carrying all or any part of the current of any specific load or run shall be contained in the same raceway or enclosure with the phase wire or wires also carrying that current. No split neutrals permitted.
- E. Under the above requirements and with required color coding system, no feeder or branch circuit raceway will contain more than one wire of the same color, except for switch legs and control circuits.
- F. Conductors feeding lighting outlets shall not be combined in the same raceway with conduit serving convenience receptacles. Lighting outlets and convenience receptacles shall not be connected on the same circuit unless specifically intended.
- G. Outlets in the same general area shall be circuited together.
- H. The designer shall evaluate the need for dedicated neutrals (one dedicated neutral per phase) in each project.

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2.3 RECEPTACLES

- A. Ground-Fault Interrupters (GFI) shall be as follows:
 - 1. Where indicated, provide general-duty, duplex receptacles, ground-fault circuit interrupters: grounding type UL-rated Class A, Group 1, 20 Amperes rating, 120 Volts, 60 Hz: with solid-state ground-fault sensing and signaling: with 5 milliamperes ground-fault trip level. Within the extent of applicable codes, "feed-through" GFI's may be installed.

2.4 MISCELLANEOUS

- A. All receptacles on emergency or UPS power circuits shall be red in color. Do we want different colors for isolated ground and/or switched receptacles,
- B. Unless noted or specified otherwise, device trim plates shall be type 302 stainless steel to suit device. All plates in the job shall be same make and match throughout.
- C. Wiring devices shall be 20 amp minimum and shall be of the grounding type, with hex-head green grounding screw, to be connected to the green ground conductor. Self grounding type is not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Devices shall be mounted tightly to boxes and be adjusted plumb and level.
- B. Two or more devices ganged shall be trimmed with gang plate.

SECTION 26 3000 - EMERGENCY POWER SUPPLY SYSTEM

PART 1 - GENERAL

1.1 WARRANTY

- A. The engine generator set shall be guaranteed against defective parts or workmanship for a period of five years from the date of final inspection and acceptance. Warranty conditions shall be included in submittals. Warranty shall include all parts and labor, including travel to and from the job site and expenses and equipment necessary to perform replacement and and/or repairs.

PART 2 - PRODUCTS

2.1 ENGINE/GENERATOR SET

- A. Engine generator set shall be Caterpillar, Cummins, Kohler, or approved equivalent.
- B. Packaged generator set shall be third party listed. UL2200 or CSA or both.
- C. The new engine generator shall be rated KW as required, continuous standby, 60 hertz, 0.8 power factor, 4-cycle diesel or natural gas. The generator, if its diesel, shall have a sub-base fuel tank unless otherwise approved by Facilities Mechanical Engineer.
- D. The generator set shall be capable of cranking and picking up the assigned loads, meeting the minimum frequency and voltage stability requirements of these specifications, within 10 seconds after loss of utility power.
- E. Engine shall be water cooled, solid-injection type, either vertical in-line or v-type. The engine shall be equipped with fuel filter, lube oil filter, intake air filter, lube oil cooler, service meter, gear-driven water pump, and instruments, including a fuel pressure gauge, water temperature

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gauge, lubricating oil pump and pressure gauge, battery charging ammeter, and engine hour meter.

- F. Engine shall be furnished with a 24 volt starting system with batteries. Batteries shall be industrial grade lead acid with current limiting battery charger. Batteries shall be oversized for proper starting in temperature extremes. The battery charging system shall be automatic, solid state, current limiting and float equalizing and shall maintain the battery at normal capacity, recharge battery after cranking and be capable of recharging a completely discharged battery within 8 hours. System shall be capable of automatically switching from one charging rate to another to meet the needs of the battery. The battery charging system shall have a 120 volt input and shall also be equipped with overload protection, voltage surge suppressors, D.C. ammeter, D.C. voltmeter, low D.C. voltage alarm relay, battery charger malfunction alarm contact and have a minimum continuous output of 10 amperes D.C. and be third party listed.
- G. Engine shall be equipped with one jacket water heater with recirculating pump, if available from the manufacturer. Heaters and pump shall be a single assembly with a single point power feed connection.
- H. Engine shall have radio frequency suppression.
- I. Air flow shall be away from engine. The radiator shall be protected by a strong grille or screen guard and the fan shall be provided with a screen guard.
- J. The Engine Generator must be able to meet Mecklenburg County emissions requirements (Tier 4).
- K. Engine shall be equipped with an institutional grade (critical) muffler-silencer. Critical grade silencer shall be provided to reduce engine exhaust noise to a maximum dBA level of 85 at a distance of 10 feet. The Contractor shall also furnish all necessary flexible and hard exhaust piping necessary for a satisfactory installation. Terminate exhaust piping using a hinged cap on top of pipe to keep out rain. Exhaust piping and silencer shall be stainless steel to prevent rusting or be internally mounted. Exhaust pipe size shall be such that exhaust back pressure does not exceed maximum limitation required by engine manufacturer. Silencer shall provide a minimum of 32 dBA attenuation.
- L. The generator set shall have a digital control panel mounted on the unit with LCD readout and controls listed by the manufacturer as standard as well as those specified herein. Controls shall provide for automatic shutdown in case of high water temperature, overspeed, overcrank, or low oil pressure. Include additional alarms for NFPA 110 and 99 compliance.
- M. The generator set shall be equipped with main line circuit breakers, as required, mounted on the unit. Circuit breakers shall be adjustable electronic trip type, molded case, rated as indicated on plans, and with shunt trip for engine shut down tripping. Furnish with auxiliary position contacts. Provide generator mounted circuit breakers, molded case or insulated case construction, 3 pole, NEMA 1 P22. Breakers shall utilize a 24 VDC shunt trip. The breaker shall be UL listed with shunt trip device connected to engine/generator safety shutdowns. Breaker shall be housed in an extension terminal box mounted on the side of the generator. Mechanical type lugs, sized for the circuit breaker feeders shown on drawing, shall be supplied on the load side of breaker.
- N. Provide generator set with battery-powered emergency lighting suitable for installation. The battery-powered emergency lighting shall be powered from the load side of the automatic transfer switch.
- O. Generator parameters (see 2.4 C) shall be able to be monitored through the Building Automation System (BAS) via LonWorks, Modbus, or approved equal.

2.2 OUTDOOR ENCLOSURE

- A. Generator shall be housed in an outdoor enclosure intended for both weather protection as well as sound reduction. Housing shall be painted aluminum, 14 gauge minimum, with access doors with panic hardware. Doors shall provide full access for operation and servicing and be lockable via in-handle lock tumblers.

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- B. Platforms are required for larger sized generators to enable accessibility for maintenance personnel. Evaluate need for platform with the Project Manager.
- C. Acoustic insulation shall reduce engine generator noise to an average of 79 dBA at 23 feet. Air intake and discharge inlets shall be supplied. Acoustic insulation material shall consist of sound absorbing material.
- D. Engine silencer shall be independently supported from the engine-generator.
- E. Engine shall be provided with oil and water drains to exterior of enclosure with a bronze body ball valve installed on engine and plumbed to exterior coupling with high quality hose. Fumes disposal shall be extended to radiator discharge using an oil resistant high quality hose.

2.3 CONCRETE PAD

- A. Contractor shall provide a separate concrete pad for generator enclosure. Pads shall be a minimum of 12" beyond base x 12" deep with No.6 rebar on 12" centers in a horizontal grid pattern. Rebar should clear surfaces by 3" minimum in all directions. Concrete mixture shall be a 1:2:3 mixture of cement, sand, and aggregate with maximum of 4" slump and 28-day compressive strength of 3000psi.

2.4 REMOTE MONITOR PANEL

- A. Provide and install a 16-light remote monitor panel for the emergency generator and a remote alarm indicator in a location(s) as directed by the University.
- B. Alarm panel shall be U.L. labeled and shall operate on 24 volts DC. Power shall be supplied from the generator starting batteries.
- C. The remote alarm panel shall be designed to contain all the alarm and monitor functions for the generator individually plus alarms and indicators to the emergency system. These alarms and indications shall comply with NFPA 110 and NEC Sections 700 and 701, and shall include the following as a minimum:
 - 1. For generator:
 - a. Battery charger malfunction
 - b. Low lubricating oil pressure
 - c. Low coolant temperature
 - d. High coolant temperature
 - e. Overcrank
 - f. Overspeed
 - g. Generator running
 - h. Generator Not in automatic
 - i. Alarm buzzer and silence switch (for all alarms)
 - j. Lamp test switch (for all lamps)
 - k. Utility power available
 - l. ATS in normal
 - m. ATS in emergency
 - n. Low gas pressure
 - o. Enclosure breach
 - p. Panel shall also include an emergency "STOP" button (mushroom type)
- D. The alarm panel shall contain an alarm light and signal with silence switch to give an indication of any of the alarm conditions above, but shall not indicate them separately. In addition, it shall indicate utility and/or emergency power "on" using a green lamp and red lamp respectively. A lamp test switch shall also be provided.
- E. Panels, alarms, meters, etc., shall be appropriately labeled using laminated plastic labels, red letters on white background, professionally engraved. Contractor shall submit a drawing for approval showing layout prior to purchase or fabrication.

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2.5 AUTOMATIC TRANSFER SWITCHES

- A. Contractor shall furnish and install one NEMA 1 enclosed automatic transfer switch. Switch shall be 4 wire, 4 pole, 100% rated continuous. Acceptable switches are Russelectric RMTD, ASCO and Zenith. Features and functions shall be as follows:
1. Shall be UL 1008 listed.
 2. Shall be capable of switching the load to either source under all conditions.
 3. Visual indication of switch positions.
 4. Complete engine starting capability.
 5. Adjustable time delay on transfer to emergency and retransfer to Utility, adjustable from 0-30 minutes.
 6. Adjustable time delay for engine cool-down after re-transfer to normal, adjustable from 0-30 minutes.
 7. Switches shall have complete engine starting capability with adjustable time delay for momentary utility power outages or dips.
 8. Each transfer switch shall be equipped with a U.L. listed manual operator in the event the electrical operator should become inoperative. The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent flashover, and shall be arranged so that the transfer switch can be manually operated under load, without opening the enclosure door.
 9. All solid state control circuitry.
 10. Contacts shall be silver plated copper.
 11. Shall be rated for 42,000 amps withstand current, symmetrical.
 12. Switching shall incorporate a time adjustable transition neutral position where the load is disconnected from both power sources.
 13. Timed auxiliary contacts. Two individually timed N.O.-N.C. contacts.
 14. Controls shall be digital incorporating LCD backlit display visible while the enclosure door is closed.
 15. A selectable load/no-load digitally programmable exerciser shall be incorporated within ATS.
- B. Operation of transfer switch shall be as follows:
1. The switch shall automatically transfer to the emergency source in less than 10 seconds upon loss of utility power.
 2. When the utility source returns, switch should automatically, after a time delay, return to the utility position.
 3. Loss of utility power on any phase, or reduction of voltage on any phase below 80%, the transfer switch shall cause generator start.
- C. Switch shall be equipped with overrides necessary to operate switch manually (by electric push buttons) under all conditions.
1. Transfer switch shall be completely assembled, wired, and tested at the factory prior to shipping and installation

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Engine generator set shall be mounted on heavy structural steel base fastened to the concrete pad. Provide pad depth to accommodate the slope of the grade while keeping the pad a minimum of 6" above grade. Generator set shall be mounted using heavy duty, open, stable viscous vibration dampers of the type approved for seismic areas. Vibration dampers shall be mounted between the engine/generator and base frame.
- B. Supplier shall provide a competent factory trained service engineer\technician to coordinate the installation, check-out, and start-up and testing of the complete generator system.
- C. On-site testing in the presence of the owner shall include testing of all safety devices and shall include a four hour running test first at 50% load for 1 hour, then at 75% load for 1 hour and last

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at 100% load for 2 hours. Then, after the cool down period the generator shall be started and after 10 seconds be applied 100% load for 30 minutes. The capability of the system to pick up full standby service load within 10 seconds of power outage shall also be demonstrated. Supplier shall furnish load bank.

- D. Supplier shall provide complete on-site training in the operation of the systems for the Owner at times chosen by the Owner to include all work shifts.
- E. Supplier shall provide, upon completion of installation but before final acceptance by Owner, three complete sets of operating instructions, maintenance manuals, and drawings, showing full details for care and maintenance of each item of equipment. In addition, a simplified set of step-by-step operating instructions, encased in a suitable frame for placing at the generator location, shall be provided with the operation and maintenance manuals.

3.2 MISCELLANEOUS

- A. When applicable, power elevators from the engine generator. Coordinate requirements with the University.

SECTION 26 3353 UNINTERRUPTIBLE POWER SUPPLIES

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. The designer shall evaluate the need for a UPS by project.
- B. UPS units in excess of 150 kVA shall have an external bypass.
- C. UPS units for large computer rooms shall be closed transition type.

SECTION 26 5000 - LIGHTING

PART 1 - GENERAL

1.1 GENERAL INTERIOR

- A. Daylighting
 - 1. Day lighting shall be considered in the design of new construction. Some keys to successful day lighting include:
 - a. Maximize southern exposure (orient building on an east – west axis).
 - b. Concentrate on the most heavily used spaces.
 - c. Use roof monitors and light baffles to increase winter radiation, reduce summer radiation and eliminate glare from direct sunlight.
 - d. Use glass on the roof equal to 10% to 12% of the building floor area.
 - e. Provide day-lighting controls.
- B. Interior lighting control
 - 1. Large Classrooms and Conference Rooms shall have dual technology motion detectors to control ceiling light fixtures when room is not occupied, unless room function dictates otherwise. Detectors shall have manual override.
- C. Suspended luminaires
 - 1. All pendent-style fixtures shall have screens or closed tops to prevent trash from being thrown into the light cavities. If the specified fixtures are not manufactured with this feature, the Designer shall provide the design for removable screens with maximum 1/8-inch mesh to be provided, assembled and installed by the Contract who installs the

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fixtures. The contractor who installs the pendent fixtures shall install protective covers to prevent construction dust and debris from settling inside the fixtures. The light fixtures installer shall be responsible for cleaning dirty fixtures prior to University acceptance.

- D. Recessed lighting
 - 1. Recessed lighting shall be installed with minimum clearance above fixture equal to thickness of fixture to ensure maintainability and accessibility.
- E. General exterior
- F. Parking, roadway, and walkway
 - 1. Appropriate lights fixtures and poles shall be used in parking lots, streets and along pedestrian walkways. Contact Planning Department to coordinate pole lighting installation requirements and to obtain campus standard detail drawings.
 - a. Roadway Lighting – 30' tall round tapered aluminum poles by McGraw Edison (GR Series), Spaulding, Hubbell, Lithonia or approved equal. Single/double head as applicable. Malaga Green, 400WHPS.
 - b. Parking Lot Lighting – 30' tall round tapered aluminum poles by McGraw Edison (GR Series), Spaulding, Hubbell, Lithonia or approved equal. Single/double head as applicable. Malaga Green, 400WHPS.
 - c. Walkway Lighting –Citadel fixture by Hadco (Citadel V25), AMP, Sternberg, Spring City or approved equal. Malaga Green, 150WHPS. Coordinate pole height with surrounding/similar areas.
 - d. Charlotte Research Institute Pole: PX W19 12 S4
 - 1) Color : Malaga Green ; Fixture: LT30K 150S MOG ACT GR3 TV Multi-Tap Color Fixture: Malaga Green.
- G. Temporary lighting
 - 1. The Electrical Contractor shall provide adequate temporary lighting at the Project site for other contractors. If there is no electrical contractor, the prime contractor with the greatest contract monetary value shall provide temporary lighting specified herein.

PART 2 - PRODUCTS

2.1 LAMPS

- A. The Electrical Contractor shall provide all new lamps in all lighting fixtures at date of Beneficial Occupancy. In lieu of installing all new lamps at Beneficial Occupancy, the Contractor may elect to warranty all lamps (for labor and material) for a period of 2 years with the requirement that defective lamps be replaced within seven calendar days of notice. The Contractor shall provide a 5 percent "attic stock" of all types of lamps installed by the Contractor, delivered to the University within 14 days of Beneficial Occupancy. "Attic Stock" is not intended for use during the 2 year Warranty Period.
- B. Ballasts for T-8 lamps shall be electronic; shall be instant start; shall comply with FCC and NEMA limits governing electromagnetic and radio frequency interference and shall not interfere with normal operation of other electrical equipment; shall meet all applicable ANSI and IEEE standards; shall have a total harmonic distortion (THD) of less than 20% but not less than 10%; shall be equipped with surge protection; shall not be affected by lamp failure and shall yield normal lamp life; shall have power factor above 90%; ballast factor of .88 or .90; lamp current crest factor shall not exceed 1.7; and shall allow remaining lamp(s) to maintain full output if companion lamp(s) fail. The electronic ballasts shall be provided with end-of-life shutdown circuit. Provide with 5-year full replacement warranty for electronic ballast. Manufacturer shall have a 5-year minimum manufacturing experience. Motorola, Magnetek, Osram / Sylvania, EBT, or Advance.
- C. Lamps shall be G.E., Phillips, or Osram/Sylvania..4200K with a CRI of at least 80.
- D. Unless noted otherwise, all fluorescent fixtures shall be provided with high power factor, U.L. approved and CBM-made Class "P" ballasts, "sound rated A" and meet or exceed ANSI C82.11

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requirements. HID fixtures shall be provided with constant wattage high power factor ballasts. Ballast shall be provided for proper voltage based on circuit assignment indicated on plans.

- E. Ballast design shall withstand line transients per IEEE 587, Category A and shall meet FCC Rules and Regulations, Part 16.
- F. The various lighting technologies to include T-5 fluorescent, LED and Induction lighting will be evaluated for each project.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Surface-mounted fluorescent fixtures being installed on combustible material shall be mounted at least 1-1/2" from the surface of the material; except units which are plainly marked on fixtures U.L. approved for mounting directly to such surfaces.
- B. Mount all fixtures plumb and square. Keep rows in perfect line.

SECTION 2
DIVISION 27
UNC CHARLOTTE ITS DEPARTMENT
ITS Telecommunications Standards -
Specifications Manual for Construction and
Renovations

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ATTACHMENTS:

The attachments provide assistance for base design details to the project RCDD and design teams. Attachments in this document provide details for the following:

- **Attachment 1:** UNC Charlotte ITS RCDD requirements document
- **Attachment 2:** UNC Charlotte ITS Bid Alternate Materials List (legacy systems)
- **Attachment 3:** UNC Charlotte ITS Bid Alternate Materials List (CAT 6A UTP cabling)

PHOTOS:

- **Appendix A:** Telecommunications equipment racks
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- **Appendix C:** Electrical Outlets
- **Appendix D:** Conduit labeling and alternate cabinet systems
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UNIVERSITY OF NORTH CAROLINA CHARLOTTE
INFORMATION TECHNOLOGY SERVICES DEPARTMENT
MISSION STATEMENT

The University of North Carolina Charlotte Information Technology Services (ITS) Department is responsible for a wide variety of technology based systems along with the supporting infrastructure for the campus community. The campus community currently consists of approximately 27,000 students and 3,500 faculty and staff employees (October 2014), all requiring reliable, high speed data and voice network services.

The UNC Charlotte campus has well over 80 buildings ranging from academic or business office buildings, research, athletic, resident life, dining, parking deck structures, and university support facilities. UNC Charlotte ITS supports a wide array of technology based systems, some of which are listed below and required to support the facilities and their occupants.

- Primary data center(s) supporting the campus wide data network
- Network equipment systems
- VoIP systems
- Wireless Access Points
- POE IP camera systems
- Multi-story building structured cabling systems
- Underground telecom infrastructure systems
- Outside plant fiber optic and copper cable distribution systems
- Code Blue emergency phone systems
- Residence Life CATV and internet fiber optic interconnection and trunk line systems

The campus community demands on the ITS Department requires a robust reliable network, 24X7, 365 days a week. To provide the level of services required, ITS must establish a cabling and network infrastructure system that meets the requirements and guidelines of the industry. This document will outline specific criteria which are required to perform a telecommunications design and deployment on the UNC Charlotte campus.

The UNC Charlotte ITS Department is committed to providing a high level of service the campus community has come to rely on. In order to achieve this initiative, ITS routinely works with university capital project and construction management teams, architectural design firms, Registered Communications Distribution Designer (RCDD), and other supporting teams who are contracted to provide telecommunications services on UNC Charlotte construction projects. ITS also promotes this initiative through other internal university design projects issued by the Design Services department in our Facilities Management building. It is intended that with the specific guidelines being presented in this document, along with compliance with the UNC Charlotte Design and Construction Manual, that all telecommunications projects on the campus be implemented successfully.

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SECTION 1: REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER (RCDD) REQUIREMENTS AND RESPONSIBILITIES

The RCDD requirements document defines the responsibilities of the RCDD for any UNC Charlotte construction project that requires their professional services. It is also located in **Attachment 1** of this document.

Below is the link to the university Design and Construction Manual.

<http://facilities.uncc.edu/our-services/business-related-services/facilities-planning/design-and-construction-manual>

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SECTION 2: HORIZONTAL TWISTED PAIR STRUCTURED CABLING AND DEPLOYMENT CATEGORIES

Horizontal cabling systems:

UNC Charlotte ITS has the responsibility for managing the horizontal (unshielded twisted pair) structured cabling deployments for the campus. UNCC ITS maintains a standardized horizontal structured cabling system consisting of Commscope cables and The Siemon Company termination hardware.

Horizontal structured cabling systems deployed require 20 year product installation and applications based warranties. The Siemon Company is responsible for providing warranties for the partnering cable solution installed and they require specific installation criteria in order to be in the Siemon cable warranty program. Siemon requires a Certified Installer (CI) to perform the cabling installations in order to qualify for the 20 year cable warranties. Non Siemon CI telecom installation companies cannot install nor provide the required 20 year cable warranties.

UNC Charlotte ITS currently posts and maintains a standardized bid alternate material list document that is to be issued on all UNC Charlotte bid projects requiring telecommunications cabling unless otherwise directed by ITS. The document provides detailed lists of all base components which UNCC ITS requires on each structured cabling deployment. This document will be updated as required. Each project issuing the bid alternate material list will be provided the most current edition at time of project design and bid.

Please see UNC Charlotte ITS bid alternate material list in ***Attachment 2*** of this document.

Category of cables:

The current UNC Charlotte ITS horizontal unshielded twisted pair structured cabling system deployment consist of Category 6 and Category 6A cables.

The primary system deployed on all projects for voice and data applications will be the Category 6 horizontal structured cabling system unless otherwise directed by UNC Charlotte ITS. This system is to be installed utilizing a “home run” method between the telecom room serving the area of installation and the telecom outlet in the field unless otherwise directed by project documentation.

The installation of Category 6A cabling systems will be utilized in specific areas within a facility that may require higher bandwidth applications this cabling system would provide. Typically these areas would consist of research labs, high end computing labs, server rooms, etc. The use of Category 6A cable in these areas and any other area in a facility will be determined during the design of a facility.

UNCC ITS will allow the use of a gel flooded Category 6 twisted pair cable in specific applications. These applications consist of installations where moisture could be present in the cable pathway and a dry plenum rated twisted pair cable cannot be installed. ITS will allow the use of transition points for changeover of flooded cable to dry cable when required in a facility. The proper rated termination block(s) will be required pending category of cable being transitioned. Typical Category 6 transitions utilize a 210 style termination block.

Specialty cables other than what are listed in the bid alternate material list document will be addressed on a building by building basis during the design of a facility. It is the responsibility of the RCDD telecom designer to address these cables with UNCC ITS during facility design.

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All twisted pair cables must be rated for the environment they are installed within.

Cable count requirements:

UNC Charlotte ITS standard telecommunications outlet is to be provided with two (2) Category 6 or two (2) Category 6A cables unless the outlet location requires additional cables due to the installation environment. Outlets requiring more than two (2) cables are to be detailed on the project symbol legend showing the correct amount of cables required.

ITS requires that offices in facilities receive a minimum of one (1) telecommunications outlet on the opposing side walls. These outlets are to be detailed during the project design process with furniture lay outs considered while placing outlets. Each outlet is to receive two (2) cables with unused faceplate ports blanked off. If a specific project design is required to provide value engineering in order to bring a project into budget, one side wall with two (2) cables in the faceplate can be deleted if the occupant can operate on a single telecommunications outlet with only two (2) cables in the office. However, ITS would require that the additional outlet box with conduit be installed for future telecommunications cabling and be provided a blank faceplate to be installed by the project.

Cable termination requirements:

UNC Charlotte ITS requires all Category 6 UTP cables be terminated on individual RJ-45 jacks at the outlet and at the patch panel utilizing the 568-A termination schematic. All Category 6A UTP cables are required to be terminated on the proper RJ-45 Z-Max jack at the outlet and patch panel utilizing the 568-A termination schematic.

Telecommunications outlets in the field are to be white double gang 6 port faceplates for the category cable installed unless otherwise directed. Faceplates are to be populated with white RJ-45 type jacks with matching flip up door cover that will accept a slide in designation icon. Unused white faceplate ports are to be provided with white blanks. Other termination housings such as surface mount boxes are to be white with white RJ-45 jacks as required. Category 6A outlet jacks are not equipped with flip up doors that hold the color icon. The jacks have a color cover with a location in which to place a colored icon.

Category 6 cables terminated in the telecommunications rooms are to receive black jacks installed in unpopulated black patch panels rated to accept the cable installed. Z-Max patch panel jacks will be the standard gray color only that come in the patch panel/jack termination kit for telecom room terminations.

Color coded icon systems are required on the horizontal cable installs at the outlet and the patch panel. The color coded icons provide the designation of use for the cable installed in the faceplate and patch panel. The icon color code chart is provided in the UNCC ITS bid alternate material list - ***Attachment 2***.

Cable installation environments:

Typical telecommunications outlets should be installed in an environment which provides protection from moisture and dirt infiltration, utilizing dry plenum rated overhead horizontally installed cabling to the outlet.

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Telecommunications outlets that are installed in areas where moisture can build up and water applications are utilized for wash downs, or food service and industrial equipment environments where outlets are exposed to the elements, require the Siemon Industrial Max series jack and faceplate termination system. Dry or gel flooded cables can be terminated on the Industrial Max jacks.

All cables, cable terminations, and cable termination housings are to be rated for the environments in which they are installed.

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SECTION 3: ITS STRUCTURED CABLING - INFRASTRUCTURE SUPPORT SYSTEMS

Conveyance Systems:

UNC Charlotte ITS accepts various methods of cable support infrastructure systems. These systems can range from the following:

- Wire basket cable tray systems
- J-Hook tree systems
- Steel telecom ladder racking systems (primarily in telecom rooms)
- Aluminum cable tray systems
- Conduits and conduit sleeves
- Wire Mold systems
- Poke through and in slab floor boxes

Other cable tray systems or specialty conveyance systems can be reviewed on a building by building basis if the systems listed will not provide the required cable conveyance support infrastructure.

All cable tray system or specialty conveyance systems must be installed utilizing all factory components related to the environment the installation is performed in or passes through. Conveyance systems must be installed with structures rated to support the system and with the system fully loaded. J-Hook systems supported by overhead wire must convert to overhead threaded rod supports when more than two 4" J-Hooks are applied to a single overhead support.

All cable tray or specialty conveyance systems must be sized to accommodate the base installation of cabling within a facility. Conveyance systems must accommodate 40% cable growth potential beyond the base installation.

Projects are not limited to one type of conveyance system but can utilize a combination of cable conveyance systems to provide proper cable support within a facility. All systems installed must comply with telecommunications industry standards requirements regarding spacing of supports and type of cables that can be installed within the supports provided.

Cable tray systems should not be installed through fire walls or areas that are not accessible. Conduit pathways or conduit sleeve systems can be utilized for these applications. Sufficient conduits or sleeves are required to accommodate base installation plus 40% growth potential. UNC Charlotte ITS supports the use of EZ-Path telecom fire rated sleeve systems be installed when applicable through fire rated wall penetrations. The EZ-Path sleeve systems provide a fire rated solution out of the box without requiring additional time consumption and inadequate fire rating efforts on standard conduit sleeves. In time, these sleeves will get over filled with cables and the fire rating will be non-compliant.

Some facilities may require separate sleeve systems for different cable types on a project. These sleeve systems are to be provided with a color coding system applied to the conduit by the project contractors. The color code system is to be detailed in project documentation for the specific project installation.

UNCC ITS prefers in slab floor boxes rather than poke throughs for both Category 6 and Category 6A cables. Poke throughs designed and accepted for a project sharing telecom and electrical connections should be no less than 10" in diameter. Category 6A cables cannot be installed in poke throughs unless

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the poke through is specifically designed to accommodate a category 6A cable install with the proper bend radii and required structured cabling system termination hardware.

Telecommunications Outlet Infrastructure Requirements:

UNC Charlotte ITS requires sufficient telecommunications outlets be programmed in the design of a facility to supply adequate voice and data connectivity to the occupants. Amounts of cables and outlets required within a facility will be determined during early programming meetings with the designers and occupants.

All standard ITS Category 6 UTP telecommunications outlets, unless otherwise directed, are provided with a double gang back box and a double gang plaster ring with a 1" conduit home run from the outlet box to the hallway cable conveyance system. The 1" conduit should end within 10" to 12" of the hallway cable conveyance system. The 1" conduit installed in a home run fashion can support up to 4 Category 6 cables without exceeding fill rates in the conduit. If an individual Category 6 outlet requires more than 4 cables, an additional 1" conduit will be required from the outlet to the hallway conveyance system.

The standard ITS telecom double gang outlet will be trimmed out with a double gang 6 port faceplate with the unused jack openings provided with blank covers.

Other ITS telecom outlets provided in a facility may not require the double gang plaster ring with double gang faceplate set up as the standard outlet. Some outlets will require a single gang plaster ring be installed on the double gang back box with the 1" conduit to accessible pathways. The outlet would be trimmed out with a single gang faceplate. These locations are typically public access phones, millwork applications where a double gang faceplate would not be feasible, etc.

Some ITS outlets will be installed in wire mold systems or other type metal conveyance and termination system. ITS requires the decora type insert be provided with the required amount of jack openings in these applications with the correct trim ring applied. These outlets are to be color coordinated with the conveyance/termination system they are being installed in.

- Example – Brushed stainless = Gray insert with gray jacks and gray trim ring
- Example – Tan or Ivory = Ivory insert with ivory jacks and ivory trim ring
- Example – White = White insert with white jacks and white trim ring

The installation of a Category 6A UTP cable system will not utilize the same conveyance infrastructure from the outlet to the hallway conveyance systems as a Category 6 cable. Category 6A cable installations require more bend radius area for the cable than a standard Category 6 cable installation. Category 6A cable installs will require the utilization of an open architecture support system to the outlet location from the hallway conveyance system such as a J-Hook system.

A 1-1/4" EMT conduit is to be attached to the wall stud structure and stubbed up above the wall top plate inside the wall cavity where the telecom outlet would be installed. Install the 1-1/4" conduit to where the outlet opening will be and stop conduit. Place plastic bushings on each end of the conduit. Provide a pull string from the outlet opening thru the 1-1/4" stubbed up conduit and tie off above ceiling for use by the telecom contractor. Telecom contractor is to replace string when cable installation is complete.

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In lieu of installing a standard double gang back box with double gang plaster ring to house the telecom cable jack terminations, a double gang box eliminator can be provided. The box eliminator, when installed, should be the type that will not allow any movement after installation and when the faceplate with jacks is attached.

Category 6A UTP cables are to be installed in wire mold or other enclosed conveyance systems with termination locations within. The enclosed conveyance system will need to be sized properly to accommodate the 6A UTP cabling and termination systems.

Any other area of a facility in which Category 6A UTP cables would be required and cannot be delivered in a standard conveyance system will be addressed on a case by case basis.

Labeling requirements:

UNCC ITS requires that labeling systems be applied to all telecommunications installs as per minimum EIA – TIA labeling requirements and UNCC ITS specific requirements. The RCDD will be responsible for providing the industry standard labeling requirements in the telecom bid documentation and to provide detailed drawings showing labeling fields on the specific devices they are applied to.

Typical faceplate labeling will show the following: Tel Room #, Rack #, PP letter, PP Port #(s).

Example: 101-R1-A-24,25

Patch Panel systems will utilize a letter assignment in the rack they reside in. The letters will start at **A** and continue down the rack (**example: R2**) to the last patch panel in the rack. When starting a new rack of patch panels the letters will start over at **A** again and relate to the rack number (**example: R4**) the patch panel is installed in. **UNCC requires that patch panel installations in a single rack do not exceed 9 panels.**

Other specific labeling systems not covered by industry standards or by ITS will be addressed as required during project design.

Please refer to **Appendix F** for photo examples of the various outlet configurations on campus.

SECTION 4: TELECOMMUNICATIONS ROOM REQUIREMENTS

Main Distribution Frame room requirements (MDF):

UNCC ITS, when applicable, requires standard division of the main distribution frame (MDF) and intermediate distribution frame (IDF) rooms. The MDF can be located in various spaces within a facility, but is typically located on the lowest level of a facility in a central floor space area to accommodate IDF stacked room(s) on other floors located above.

MDF is to serve the following primary purpose:

- Provide outside plant conduit duct bank entrance
- Provide outside plant copper and fiber optic termination points
- Provide equipment racks and/or equipment cabinets to house primary building serving electronics
- Provide primary termination point for building copper, fiber optic, and CATV riser systems
- Provide primary termination point for telecommunications room(s) grounding riser system

Horizontal twisted pair structured cabling systems are not typically installed to the MDF. Some facilities due to either their size or floor plan may require the MDF be combined with an IDF as a shared entity. If the MDF is required to become a shared space with an IDF, the room will have to be placed to accommodate telecommunications industry standards for the length of the horizontal cabling being installed. Shared rooms will be considered on a facility by facility design basis as requirements dictate.

MDF is not to house the following electronics based facility services unless otherwise noted:

- Open Options access panels (per facility basis)
- Fire alarm panel equipment (fiber optic communications link terminations only)
- Security systems
- Area of Rescue systems
- Energy monitoring systems
- Video head end equipment (per facility basis)
- Video recording equipment – NVR
- Any other peripheral electronic based building service device not pre-approved by ITS

MDF is to be sized and equipped with the following infrastructure:

- MDF is to be sized to accommodate a minimum of four (4) equipment racks placed in a single file row with 12" vertical wire managers between each rack and on the side rail of each end rack. Some telecom rooms may require additional equipment racks. This will be determined on a facility by facility basis.
- Clearance from front and back of standard equipment racks with wire management systems to the walls should be minimum of 48" from the outside of the mounting foot on the front and back of the equipment rack to the wall it faces.
- There should be a minimum 48" of clearance on at least one side between the last rack side wire manager or equipment cabinet and/or combination of both, and the side wall of the telecom room for access to back of the row.
- Some MDF telecom rooms may require a hybrid system of equipment racks and enclosed equipment cabinets due to security reasons. The UNCC ITS bid alternate material list contains part number(s) for enclosed cabinet(s). When installing a hybrid system or a complete enclosed

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equipment cabinet install, proper clearances must be maintained for front and rear access of the enclosed equipment cabinet chosen for a project.

- All walls in the MDF are to be covered with ¾" fire retardant plywood with the AC Grade side of plywood showing. All fire retardant stamped bands are to be left exposed on all sheets of plywood installed. Plywood is not to be painted. Plywood to be installed from 6" AFF to 8'6" AFF.
- Floors can be left with a smooth sealed concrete finish that will not allow future shedding of the concrete. Some rooms may require epoxy paint seal on the floor or non-static VCT tile. This will be determined on room by room basis during project design.
- All walls of the MDF are to receive a minimum of **one (1) Duplex 120 VAC, 20 AMP 5-20R outlet**.
- Specific power outlets are required over the MDF equipment racks and cabinets and are to be mounted directly to the overhead steel cable runway. Each equipment rack or enclosed equipment cabinet that houses ITS electronics will get the following: **One (1) 208 VAC, 30 AMP L6-30R twist lock receptacle tied to building generator stand by power system; Three (3) 208 VAC, 20 AMP L6-20R twist lock receptacles tied to standard building power**. In some housing or specialty buildings, the IDF may be required to have **125 VAC, 30 AMP L5-30R twist lock receptacles** instead and will be identified during project design.
- There are to be no ceilings in the MDF except when required to meet dry or gas operated fire suppression system codes for containment.
- Telecom rooms need to meet minimum or required fire suppression codes for room type.
- MDF to receive sufficient lighting to cover the entire room placed at proper intervals within the room and mounted at a minimum of 24" above steel cable runway system.
- MDF to receive sufficient air conditioning systems to support room systems and functions. The size and type of air unit(s) are to be determined by room use along with electronic equipment BTU output estimates. BTU ranges are currently between 12,400 and 21,800 BTU/Hr and greater.
- MDF to have sufficient steel telecom runway systems installed around the perimeter of the room and over the equipment racks and/or cabinets to support the base cable installation with 40% growth potential. Runway is to be installed at a height of 7'6" AFF utilizing runway elevation kits on the equipment racks and cabinets. Runway systems are to be installed using all factory rated components to provide a complete runway system within the room conditions it is installed. Runway system is to be completely grounded.
- Standard equipment rack setups are to be installed utilizing 12" vertical wire managers in-between each rack and on the side rail of each end rack unless some rooms may dictate that 6" vertical wire managers be installed. 6" w/m determined on a room by room basis during project design.
- Equipment racks to have 6" wide vertical side rails to accommodate the 12" vertical wire managers unless otherwise directed by ITS.
- Equipment racks to be completely grounded and bolted to floor.
- Enclosed equipment cabinets come equipped with internal vertical wire management and are to be completely grounded.

Any deviations from the required installation of four (4) consecutive equipment racks or cabinets in a row due to MDF room size and configuration can be granted if the room will accommodate the minimum standard installations listed above. RCDD telecom designer is responsible for consulting with UNCC ITS for approval of IDF room deviations.

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Intermediate Distribution Frame room requirements (IDF):

UNCC ITS requires individual telecommunications serving rooms be installed on each floor of a facility. Some facilities, due to size and footprint, may require additional IDF rooms on each floor. Although not optimal or recommended, the routing of horizontal station cables between floors to the same IDF is utilized where space for IDF rooms are limited. IDF rooms should be oriented on each floor of a facility where they can accept the maximum amount of horizontal structured cabling without exceeding telecommunications industry standards associated with the allowable length of the cable type installed.

IDF rooms are to serve the following purpose:

- Provide termination point for horizontal structured cabling system
- Provide termination point for dedicated copper and fiber optic cable riser feeds
- Provide equipment racks and/or cabinets to house floor serving electronics
- Provide grounding point in telecommunications grounding riser system

IDF rooms are not to house the following electronics based facility services unless otherwise noted:

- Open Options access panels (per facility basis) or other security systems
- Fire alarm panel equipment (fiber optic communications link terminations only)
- Area of Rescue systems
- Energy monitoring systems
- Video head-end equipment (per facility basis)
- Video recording equipment – NVR
- Any other peripheral electronic based building service device not pre-approved by ITS

IDF rooms are to be sized and equipped with the following infrastructure:

- Minimum of two (2) equipment racks placed in a single file row with 12" vertical wire managers between each rack and on the side rail of each end rack. IDF Telecom rooms may require additional equipment racks which will require additional room size and will be determined by the amount of horizontal twisted pair cables installed to the room and future growth potential.
- Clearance from front and back of standard equipment racks with wire management systems to the walls should be a minimum of 48" from the outside of the mounting foot on the front and back of the equipment rack to the wall it faces.
- There should be a minimum 48" of clearance on at least one side between the last rack side wire manager, or equipment cabinet, or combination of both, and the side wall of the telecom room for access to the back of the row.
- IDF telecom rooms may require a hybrid system of equipment rack(s) and enclosed equipment cabinet(s) due to security reasons. The UNCC ITS bid alternate material list contains part numbers for enclosed cabinets. When installing a hybrid system or enclosed equipment cabinet install, proper clearances must be maintained for front and rear access of the enclosed equipment cabinet chosen for a project.
- All walls in the IDF are to be covered with ¾" Fire Retardant plywood with AC Grade side of plywood showing out. All fire retardant stamped bands are to be left exposed on all sheets of plywood installed. Plywood is not to be painted. Plywood to be installed from 6" AFF to 8'6" AFF.
- Floors can be left with a smooth sealed concrete finish that will not allow future shedding of the concrete. Some rooms may require epoxy paint seal on the floor or non-static VCT tile and will be determined on a room by room basis during project design.

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- All walls of the IDF are to receive a minimum of **one (1) Duplex 120 VAC, 20 AMP 5-20R outlet**.
- Specific power outlets are required over the IDF equipment racks and cabinets and are to be mounted directly to the overhead steel cable runway. Each equipment rack or enclosed equipment cabinet that houses ITS electronics will get the following: **One (1) 208 VAC, 30 AMP L6-30R twist lock receptacle tied to building generator stand by power system; Three (3) 208 VAC, 20 AMP L6-20R twist lock receptacles tied to standard building power**. In some housing or specialty buildings, the IDF may be required to have **125 VAC, 30 AMP L5-30R twist lock receptacles** instead and will be identified during project design.
- There are to be no ceilings in the IDF except when required to meet dry or gas operated fire suppression system codes for containment.
- Telecom rooms need to meet minimum required fire suppression codes required for room type.
- IDF to receive sufficient lighting to cover the entire room placed at proper intervals within the room and mounted at minimum of 24" above steel cable runway system.
- IDF to receive sufficient air conditioning systems to support room systems and functions. The size of the air unit is to be determined by room use along with electronic equipment BTU output estimates. BTU ranges are currently between 12,400 and 21,800 BTU/Hr and greater.
- IDF to have sufficient steel telecom runway systems installed around the perimeter of the room and over the equipment racks and/or cabinets to support the base cable installation with 40% growth potential. Runway to be installed at a height of 7'6" AFF utilizing runway elevation kits on the equipment racks and cabinets. Runway system should utilize all factory rated components to provide a complete runway system within the room condition it is installed in and needs to be completely grounded.
- Standard equipment rack set ups are to be installed utilizing 12" vertical wire managers in between each rack and on the side rail of each end rack unless rooms dictate that 6" vertical wire managers are to be installed. 6" wire managers are to be determined on a room by room basis during project design.
- Equipment racks to have 6" wide vertical side rails to accommodate the 12" vertical wire managers unless otherwise directed by ITS.
- Equipment racks to be completely grounded and bolted to floor.
- Enclosed equipment cabinets come equipped with internal vertical wire management and are to be completely grounded.

Deviations from the required installation of two (2) consecutive equipment racks or cabinets in a row due to IDF room size and configuration can be granted if the room will accommodate the minimum standard installations listed above. The RCDD telecom designer is responsible for consulting UNCC ITS for approval of IDF room deviations.

Please refer to **Appendix A, B, C and D** of this document for photo examples for this section.

Specialized telecom room requirements:

Specialized telecommunications distribution facilities or specialized telecom rooms can consist of data centers, server rooms, specialized computing node rooms, etc. Facility type and usage would dictate the requirement of specialized telecommunications service rooms. The RCDD telecom designer will be responsible for coordinating with UNCC ITS and providing design criteria and installation oversight to projects requiring these specialized facilities.

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Equipment rack and cabinet utilization requirements:

Please refer to ***Appendix A (figure 1) and D (figure 5)*** provided in this manual.

Standard 19" equipment racks and enclosed equipment cabinets (when required) are used to house university electronics and UPS systems, horizontal cable termination systems, and copper and fiber optic cable termination systems. Equipment racks and cabinets can be installed for use by non-campus telecommunications provider entities. Requirements are based on type of facility being constructed and the possible use by non-campus telecommunications provider entities.

Project RCDD telecom designer will be responsible for coordinating with UNCC ITS and providing design criteria and installation oversight to projects requiring non-campus telecommunications provider entity termination housings.

UNCC ITS standard 19" equipment rack with vertical wire management system deployments consists of no less than two (2) 19" racks which will be placed side by side. ***When facing the front of the racks in a two rack configuration the first rack to the left will house electronics and the rack to the right will house patch panel terminations.***

When installing a UNCC ITS standard four (4) rack configuration the same will apply - facing the front of the racks, rack one to the left will contain electronics, rack two will contain patch panels, rack three would contain electronics, and rack four would contain patch panels. If more than four racks are required the same requirements would extend down the rack line.

NOTE: All patch cable patching from electronics to patch panels "**always**" enter or exit to the right. UNCC ITS utilizes chassis electronics with blade technology. Installing patch cords to the left of the electronics will cover the fan blade module and causes issues when performing service or replacement of the module.

When installing enclosed equipment cabinets in lieu of the two (2) standard 19" equipment racks in a side by side method either in a combination of two (2) or four (4), no external wire management systems are required. The cabinets will contain factory installed internal vertical wire managers. The adjoining cabinets' side access panels should be removed for clear internal access between the equipment cabinets. Equipment and patch panel installations along with the patching methods listed above will be required in enclosed equipment cabinets.

When joining an enclosed equipment cabinet to a 19" rack with external vertical wire management, the equipment cabinet can be installed beside the vertical wire manager as close as needed for the space the installation is occurring in. No Physical connection is required between the cabinet and the 19" rack wire manager.

Elevated steel runway systems at the standard of 7'6" are to be installed over the equipment cabinets as the standard 19" rack system deployments require. Hardware for the runway systems is contained in the UNCC ITS telecommunications bid alternate material list.

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Fan doors or rack mount fan packs will not be required in the standard equipment cabinet deployment unless usage of cabinet dictates additional air movement is needed. No additional power strips will be required. If required, the fan assisted systems can be added during project design to the bid alternate material list.

SECTION 5: RISER CABLING SYSTEM REQUIREMENTS

Fiber optic riser cable(s) type and installation requirements:

UNC Charlotte ITS requires both Single Mode and Multi-Mode fiber optic cable riser systems be installed within a facility from the MDF to each floor serving IDF. These cables are to be run in a home run method from termination point to termination point with no splices or intermediate break out access points.

The ITS standard fiber cable(s) utilized for building riser applications are to provide a plenum jacketed distribution fiber cable contained in a spiral metal wrapping with plenum coating applied to the spiral metal wrapping. Deviations from the plenum rated armored fiber cable installations require approval from ITS during project design.

ITS base SM and MM fiber cable riser systems consist of a single 12 strand SM fiber cable and a single 12 strand MM 62.5-125 grade fiber cable be installed from the facility MDF to each floor serving IDF in the methods and types listed above. Deviations from the base strand counts can be initiated during the facility design if a facility usage requires additional or less strands than the base requirement. Some facilities due to use and size may require high strand count SM and MM fiber cables be installed from the MDF to each first floor serving IDF and then a smaller strand count can be installed from the first floor IDF rooms to the stacked IDF rooms above.

Both SM and MM plenum rated armored fiber riser cables are to be direct terminated to LC connectors utilizing anaerobic adhesive method unless otherwise directed by UNCC ITS during project design. The SM and MM fiber optic riser cables when terminated are to be installed into LC coupler panels for the mode of fiber terminated.

SM and MM fiber cables are to be housed in a single 2RU rack mount fiber optic enclosure at the IDF and can share the same enclosure. When terminating the SM and MM fiber cables in the MDF that feed each IDF individually, each set of SM and MM fiber cables will be terminated in a single 2RU fiber cabinet designated for the IDF the cables feed to. Do not utilize one single cabinet with multiple floors terminated inside the cabinet at the MDF.

UNCC ITS purchases, installs, terminates, tests, and maintains all outside plant fiber optic building entrance cables unless otherwise directed during project design.

Copper riser cable(s) type and installation requirements:

UNCC ITS requires copper multi pair riser cables be installed within the facility from the MDF to each floor serving IDF. The copper riser cables are to be installed in a home run method from termination point to termination point. Copper riser cables are to be plenum rated non-shielded type composition Category 3 rated.

Non-standard or installation specific for environment copper riser cables if required are to be addressed during facility design by the RCDD and ITS.

Copper riser cable pair counts may vary per facility and are to be established by the PRCCD and ITS during the telecommunications design of a facility.

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Methods in which the copper riser cables can be installed to provide point to point terminations vary and will be established during project design.

- One method is to home run each copper riser cable between the MDF and the IDF it installs to. The copper riser cable(s) would terminate on a 110 wall field in the MDF. In the IDF, the cable would be ran directly to an analog voice patch panel at the top of the patch panel rack or cabinet. The patch panel would be sized to accommodate the copper riser cable terminated at the patch panel. Typically this will either be a 24 port or 48 port patch panel. Populate the patch panel ports with the accompanying jack and terminate one pair each on the center analog pin out on each of the 24 or 48 jacks populating the patch panels. This home run cable would be a 25 pair cable at a minimum unless specified otherwise during project design.
- The alternative method is to run a higher copper pair count between the MDF to the first serving floor IDF that it installs to. At the MDF, the high pair count cable will terminate on a 110 wall field. At the IDF, also terminate the higher copper pair count on a 110 wall field. From the 110 wall field in the IDF, install a hand off cable to an analog patch panel located in the top of the patch panel rack or cabinet. Repeat termination steps listed in the first method at the patch panel. Additional riser cables can be installed from this 110 wall field to the IDF's stacked above with the terminations performed in the IDF's directly to the rack or cabinet analog patch panel as listed above.

If the two methods listed above will not provide the copper riser cable terminations required on a project, other methods can be addressed during facility design.

UNC Charlotte ITS provides, installs, terminates, tests, and maintains all outside plant copper building entrance cables unless otherwise directed during project design. ITS will install a copper hand off cable from the building entrance protector over to the building riser 110 wall field in the MDF and terminate to provide analog connectivity to the copper riser cable system from an external analog source.

Some facilities may not receive an actual outside plant copper cable feed from an external source. The facility may generate its own analog dial tone utilizing voice gateway devices such as a Cisco VG224 installed in the facility. The analog devices are provided, installed, and brought on line by UNCC ITS. ITS will install the necessary hand off cables from the voice gateways over to the 110 wall field in the facility MDF for analog connectivity to the copper riser system.

UNCC ITS provides all copper cross connects or patches to the building copper riser system in the MDF and in the IDF's.

See **Appendix B and D (figure 4)** for photo examples for both cabling riser systems.

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SECTION 6: OUTSIDE PLANT INFRASTRUCTURE SUPPORT SYSTEMS

Telecommunications manhole requirements:

UNCC ITS is responsible for design input, implementation, and management of the UNCC campus wide underground manhole system covering approximately 600 acres of interconnected facilities. The manhole systems range from older campus core systems to modern manhole systems currently being installed on campus.

A standard telecommunications manhole is to have inside dimensions of 12'X6'X7' (LXWXH). The manholes are to be engineered and rated for the environment installed in. Proper mastic seal tapes are to be utilized when installing the two halves of the manhole together, in between all concrete extension rings placed on top of the manhole structure, and in between the steel access cover and the last concrete extension ring. The steel access ring placed on top of manhole should accept no smaller than a 32" diameter steel manhole lid rated for the environment installed in.

Telecommunications manhole steel lids are to be cast with the letters "communications" embedded in the casting. Manhole lids will also require flush mount pull up lift handles installed in the lids.

Variations on telecom manhole sizes, types, and access other than the standard manhole system listed are to be determined during design of a specific facility or for the project issued specifically for placing new manholes. ITS must approve any variances from the standard telecommunications manhole required.

Telecommunications manholes are to be cast with duct bank entrance windows with 4" conduit terminators on each end wall and one located in the corner of both side walls on opposite ends of the manhole.

Telecommunications manholes are to have cable racking installed utilizing the factory cast in wall nylon anchor systems placed at specific intervals around the interior of the manhole. Cable racks are to be installed at each of the anchor system verticals cast in the manhole walls. Cable racks can be the standard galvanized metal systems or the new fiberglass systems as long as they are bolted to the proper vertical anchor systems and placed at the proper intervals. All cable racks are to receive the specific cable support arms for the rack type installed. Each vertical rack is to receive a minimum of four (4) cable support arms at 8" long (minimum).

Telecommunications manholes are to receive a drainage system. The system can be accomplished by several methods.

- Draining the telecom manhole into the electrical manhole typically installed as a pair to the telecom manhole. A sump pump system is installed in the electrical manhole to remove the water from the telecom and electrical manholes.
- The installation of a gravity drain from the telecom manhole to a storm sewer or to day light.
- The installation of a sump well beside either the telecom or electrical manholes that both manholes drain to and are pumped out to a source that will remove the water from the area.

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Telecommunications manholes are to receive a grounding system inside the manhole connected to a lightning dissipation apparatus installed inside the manhole or to an external source outside the manhole.

Telecommunications manholes should always be designed and installed in areas where they are accessible by vehicle when possible. Refrain placement of manholes in planter beds, vehicle traffic lanes and area topologies where they will be in a natural drainage pathway from rain run-off.

Telecom manhole spacing should not exceed a distance of 450 conduit feet in any run.

The use of stacked factory precast concrete rings with correct mastic sealing tape properly sized for the manhole installed will be accepted. ***Bricking extensions on new telecom manhole entrances will not be permitted.*** Use of bricking will only be allowed when the existing telecom manhole extended access is already bricked and concrete rings cannot be applied properly. If the existing bricked manhole access extension is three (3) feet or less, the brick access extension must be removed and replaced with the proper factory precast concrete extension rings and with a new steel access ring and steel lid (if necessary) to fit the new concrete extension rings.

If a new manhole entrance extension ring systems exceeds 6' in depth before entering the telecom manhole, the use of factory steel step systems bolted to the precast nylon anchor systems in the precast access extension rings will be necessary. The installation of a galvanized ladder will be required from the last steel step to the floor of the manhole. The galvanized ladder should be ordered and installed not to hang straight but at an angle to allow proper access into the manhole.

New telecommunications manholes are to be cleaned out at the end of the project and verified by the responsible project design team and UNCC ITS for acceptance and bid document compliance.

Refer to ***Appendix H*** for photo examples.

Intermediate in ground junction boxes (Quazite boxes):

UNCC ITS requires the deployment of Quazite boxes in smaller scaled telecommunications outside plant installations. The Quazite boxes can range in size and depth depending on the size of the conduits installed to the box and the quantity and size of telecommunications cables to be installed in and through the box that interconnect with other boxes.

When installing underground telecom conduits that require Quazite boxes to be placed as access points, a box will be required at no less than 300 conduit feet intervals.

When installing Quazite boxes for emergency phone installations, the box can share the 110 VAC circuit with the telecom cable as long as the two are divided in the Quazite box with a Nema rated junction box that contains the electrical circuit. Voltage higher than 110 VAC is **NOT** allowed in the Quazite box with the telecom cable.

Quazite boxes should not be placed in elevated areas above where the conduits from the box enter a facility. The boxes should not be installed in areas where water can run or pond over the box. This can cause water entry into the box and allow water into the conduits causing flooding issues in the facility where the conduits enter. If an installation requires the box to be in an area that could cause water entry

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into the box on a regular basis, the box will have to be equipped with a drain line ran from the box to daylight or the closest storm drain.

Please refer to **Appendix G** for photo examples.

Telecommunications duct bank and conduit requirements:

UNCC ITS is responsible for design input, implementation, and management of the campus wide underground encased and non-encased duct bank and conduit bank systems interconnecting the campus telecom manhole and in ground junction box systems. The conduit systems range from older campus core systems to the modern conduit systems now being installed at UNC Charlotte.

Various types of encased telecommunications duct bank systems are installed for projects on the UNCC campus. These systems can range from primary trunk systems, smaller secondary distribution systems feeding off of the primary trunk systems and building entrance systems.

- Primary encased duct bank systems contain a minimum of six (6) four inch (4") conduits placed on required conduit stacking chairs to allow proper concrete coverage.
- Secondary distribution encased duct banks systems to contain no less than four (4) four inch (4") schedule 40 conduits placed on required conduit stacking chairs to allow proper concrete coverage.
- Building entrance encased duct bank system to contain a minimum of three (3) four inch (4") schedule 40 conduits placed on required conduit stacking chairs to allow for proper concrete coverage. Once the conduits go under the building slab system, encasement can stop after the conduits are installed beyond the foundation footer of the facility.

Non-encased conduit systems consist of the following but are not limited to:

- Conduit systems for pedestal mount emergency phones located outside of a facility. These systems require one (1) two inch (2") schedule 40 conduit for telecom from a telecom room inside the facility to the pedestal location and a single one inch (1") schedule 40 conduit for power from an electrical room in the facility to the pedestal location. These conduits systems can be extended beyond the initial location using the same conduit and in ground junction box requirements detailed in this document.
- Other non-encased telecommunications conduit systems (if required) are to be addressed during facility design.

All telecommunications conduits are to be provided with the following:

- All telecommunications conduit systems installations, encased and non-encased, are to be inspected and approved by university ITS personnel before encasement. The site project management team will notify the university project manager when these inspections will be ready.
- All telecommunications conduits 2" and larger, encased and non-encased, are to have a conduit cleaning mandrel pulled through the conduits to verify obstructions or deformities of the conduits. This process is to be observed by university ITS personnel and project MEP firm, and signed off by the project MEP firm responsible for telecom and electrical design.

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- All telecom conduits are to be provided with a standard pull string by the conduit installation contractor. Telecommunications contractor utilizing the conduits is to replace and leave a functional future pull string when installs through the conduits are complete.

UNCC ITS must approve any deviations from the standard conduit system deployments provided. ***Failure to comply with these requirements will result in refusal of installation of the conduit system by the university ITS Department.***

Telecommunications duct bank diversity:

Some UNCC facilities may require diverse telecommunications duct bank pathways into the facility due to its function. Facilities requiring duct bank diversity will be identified during facility design and implemented accordingly through project bid documents.

Outside plant cable installation requirements:

UNCC ITS currently provides installations, terminations, and maintenance of all university owned outside plant fiber optic and copper cables, along with utilization of corrugated inner-duct and Max-Cell conduit lining systems. New outside plant cables and conduit lining systems are installed through telecommunications infrastructure conveyance systems such as manholes and telecom duct banks provided by the construction project.

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SECTION 7: SUPPORTED PERIPHERAL SYSTEMS

Emergency Phones:

See **Appendix E** for photo examples. UNC Charlotte deploys a standardized emergency phone system manufactured by Code Blue Corporation. UNCC ITS utilizes specific Code Blue emergency phone models for installation which consist of but not limited to:

- Exterior concrete pedestal mount pole phone units CB5-s, 9 foot tall
- Exterior parking deck mount pole phone units CB5-p, 7 foot tall
- Exterior wall mount stainless steel phone units CB2-e, approximately 36 inches tall
- Exterior/Interior wall mount stainless steel phone units 500-s small form phone

The Code Blue models listed can be found on the Code Blue website at <http://codeblue.com/>. The website contains schematic information regarding mounting and power requirements and can be incorporated into the project bid documents.

Code Blue emergency phone locations are to be provided as part of a project design process. Project designers are responsible for requesting meetings through the university project management team to meet with the university departments responsible for providing emergency phone locations.

UNCC ITS installation responsibilities for the Code Blue emergency phone system are listed below:

- ITS will purchase the Code Blue emergency phones (if required) for the project.
- ITS will receive the emergency phones and remove the phone modules from the phone housings for installation after the housings are installed.
- ITS will arrange delivery of the pole phone or wall mount housings to the project for installation on the provided infrastructure when requested.
- ITS will provide any factory Code Blue J-Bolts and template kits required for the pedestal mount pole phones.
- ITS to provide on-site contractor support to assist with any installation questions.
- ITS to mount the phone module back into the contractor installed housing and connect to the telecom contractor installed telecom line.
- ITS to install all cross connects required to provide dial tone to the phone module.
- ITS to program phone module, activate, label and test to the UNCC campus Police and Public Safety Department.

Project contractor installation responsibilities for the Code Blue emergency phone system are listed below:

- Project is to provide all conduits, 2" for telecom and 1" for power, and in-ground junction box systems as required by project documents and details.
- Project is to install all concrete pedestal bases per Code Blue factory specifications using Code Blue factory J-Bolt kits. No substitutions are allowed for the factory Code Blue J-Bolt kits or any extensions of J-Bolts when they are too short or installed incorrectly in the pedestal base.
- Project is to provide conduit and outlet box infrastructure as required by project documents and details to mount the Code Blue wall mount units.

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- Project is to accept delivery of the pole or wall mount enclosure(s) from ITS and install on contractor provided concrete pole bases or wall mount locations.
- Project is to provide 110 VAC electrical circuit to each model requiring AC power. Project documents will dictate which units will receive 110 VAC power.
- Project is to terminate electrical circuit into electrical panel breaker in facility and label panel. Contractor is to label the pole transformer access cover or inside of the wall mounted enclosure with the electrical panel and circuit information the emergency phone power source is located in.
- Project is to terminate 110 VAC circuit on step down transformer mounted in the Code Blue phone housing and power unit up when permanent power is available.
- Project is to install required telecommunications phone cable from telecom room in facility to each Code Blue housing and terminate the phone cable on the termination hardware specified. Coil two feet of cable inside the housing and terminate on a RJ-45 jack as required by project documents.

UNC Charlotte constructs multi-level parking structures on campus. Parking structures require large Code Blue emergency phone deployments ranging from 20 to 30 units typically. Units are typically the Code Blue 2E stainless steel wall mount models.

Some parking structures require the Code Blue 5-p 7' tall parking deck mount pole phone unit. These units require special mounting and conduits systems be incorporated into the pour of the deck. It is important these locations be verified and addressed early in project design how the deck mount pole phones mounting and utility infrastructure will be established.

Public Access Phones:

Specific facilities on campus, primarily Residence Halls at this time, will receive public access phones. These phones are not used for direct emergency ring down purposes. They are used by the general public (student, faculty and staff) for local area or campus calls.

Where applicable, these phones will be installed in Residence Halls since the student rooms are no longer provided with a campus dial tone. These phones are to be placed strategically on each floor as required during project design and directed by Residence Life project management teams.

The project will be responsible for the conduit, back box and plaster ring infrastructure along with the telecom cable to each of these locations. ITS will be responsible for providing all cross connects to extend dial tone to the location and providing the phone unit.

Two way direct communications:

Some facilities may require the installation of a two way direct communications device or phone. This unit will communicate directly to university personnel responsible for first response. Typically these locations are in elevator lobbies or possible entrapment areas in a facility emergency. These locations are usually outfitted with a Code Blue ring down push button phone supplied by the university ITS Department.

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These systems are not to be confused with an Area of Rescue system which some facilities may also require. UNCC ITS Department does not specify, install or maintain Area of Rescue systems. These systems fall under Life Safety and are managed by the department responsible for the building it is installed in and will be determined on a building by building basis as codes require.

Elevator Phones:

All facilities with elevator service will require phone line(s) be installed to the elevator equipment room(s) within the facility. Typically, an individual cable is installed per cab requiring elevator emergency phone service.

The project will be responsible for installing the telecom cable from the closest telecom room to the elevator equipment panel where the phone cable interface is required. The elevator installer typically terminates the phone cable directly to their control systems and will provide programming for the elevator phone line. ITS will provide dial tone to the elevator phone cable and work with the elevator installation company technicians to activate the elevator emergency phone to call university Police and Public Safety Department.

Cameras:

UNCC ITS does not provide specific project design information regarding camera systems nor does ITS supply projects with cameras for installation. These systems are managed by the university Facilities Management (FM) Department or by the managing department for the building. If a project requires camera systems to be deployed, the project design teams should coordinate this through the university project management team to meet with the FM authorities responsible for camera design, installation, and management.

Wireless Access systems:

UNCC ITS is responsible for design input, implementation, installation, and management of the wireless access system for the campus community. The UNCC ITS wireless access system is currently deployed in 52 buildings (academic, business, athletic or recreational) on campus with over 800 wireless access devices installed. Several of these devices are also serving outdoor student patio areas and courtyards.

All facilities will receive wireless access points when being designed. ITS will provide design input for the areas where the wireless drop locations will need to be located. Each wireless access point location requires two (2) Category 6 UTP cables, however, bandwidth requirements for newer wireless technology may necessitate the installation of CAT 6A UTP cables. This would be determined during the project design phase.

UNCC ITS is responsible for providing and installing wireless access points in a single facility or complex of facilities as required when facilities are complete.

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Building Automation Systems (BAS)/JACE Controllers:

UNC Charlotte Facilities Management Department is responsible for implementing and managing systems for monitoring building functions. These systems access mechanical systems in a facility for monitoring and programming for specific building operations.

UNCC ITS is responsible for providing data cables for university network connectivity to the head end device(s). ITS does not provide design criteria nor provide these devices to the projects for installation. UNC Charlotte Facilities Management Department is responsible for the implementation and management of these systems.

University 49er Card system devices:

UNC Charlotte deploys a closed card system on the campus known as the 49er card system. The system is utilized by students, faculty, and staff at UNCC and consists of several different types of readers providing access to doors, vending, laundry, value transfer stations, and copiers.

UNCC ITS is responsible for providing data cables for university network connectivity to the 49er Card device(s) and controllers when required on a project. ITS does not provide design criteria for the system and the devices that it communicates to nor provide the devices or controllers for a project.

The University 49er Card Department is responsible for the implementation and management of the system. Any questions regarding design and implementation of the 49er Card system will need to be coordinated and addressed through the university project management team.

Open Options systems:

UNC Charlotte Facilities Management department currently deploys the Open Options system. This system is utilized for access, camera interfaces, and security system interfaces.

UNCC ITS is responsible for providing data cable to the head end device(s) for campus network connectivity. ITS does not provide project design criteria for the system or the equipment to be installed. Any questions regarding design and implementation of the Open Options system will need to be coordinated and addressed through the university project management team.

Parking Structure and Parking Lot systems:

UNC Charlotte Parking Services department currently deploys various systems throughout the campus. These systems range from gate access and exit control, pay on foot stations, vehicle charging stations, camera systems, etc.

UNCC ITS is responsible for providing data cables to the individual or head end devices, security or parking services room for the facilities that will require campus network connectivity. ITS will provide specific details during design of the facilities for the required ITS telecom conduit infrastructure support systems.

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ITS does not provide design criteria for Parking Services systems or the equipment to be installed. Any questions regarding design and implementation of the Parking Services required systems will need to be coordinated and addressed through the university project management team.

Off campus video and data service providers:

UNC Charlotte Residence Life Department currently utilizes off campus providers for their video, data, and wireless services to the students residing in their housing facilities. Additionally, there is university supplied voice and data services to the admin and staff in the housing facilities. Other campus departments also utilize off campus providers for video feeds.

UNCC ITS currently provides the video and data service providers trunk pathways thru the university fiber optic network linking their electronic systems together and independently of any university electronics systems. No additional underground fiber optic work is required for these entities unless otherwise directed during design.

The structured cabling system(s) utilized for the students suites and other common student access areas within the facility will be determined at time of project design.

Fire alarm systems:

The UNCC ITS Department does not install, maintain, monitor, or provide design requirements for the campus wide fire alarm system. However, the ITS department does support the fiber connectivity for the trunk system that communicates to the Police and Public Safety Department.

The campus wide fire alarm system communicates on a fully independent and interconnected Multi-Mode (MM) fiber optic cable system. In new construction, the Project Design RCDD is responsible for designing the MM fiber optic riser trunk cabling that will be required from the closest telecom room to the main Fire Access Control Panel (FACP).

To assist with the design, there are two methods that can be used to provide connectivity to the panel. If the main FACP panel is within 20 meters of a telecom room that will have MM fiber cable in it, 20 meter fiber jumpers can be installed between the telecom room and the FACP provided there will be enough slack in the jumper to adjust to any changes in routing. The telecom contractor will install two (2) 20 meter MM fiber jumpers between the two rooms in contractor provided conduit or inner duct to protect the fiber jumpers.

The second method would be used if the distance exceeds 20 meters. In this scenario, a 6 strand MM plenum rated armored fiber cable will need to be installed between the telecom room and the FACP. This cable will be required to terminate with LC connectors on LC coupler panels in appropriate rated fiber enclosures on each end and be labeled as fire alarm communications trunk cables. Fiber optic jumpers provided by the university can then be installed from the termination cabinets to the FACP and in the telecom room as needed.

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SECTION 8: ITS TELECOMMUNICATIONS PROJECT DOCUMENTATION

Horizontal Structured Cable testing requirements:

UNC Charlotte ITS deploys the Siemon/Commscope horizontal cabling system which requires that a 20 year applications base warranty be applied.

The telecommunications regulations governing body(s) EIA/TIA establishes industry standard horizontal structured cable testing parameters. The EIA/TIA testing parameters are updated on a regular basis as dictated by the industry with advancing cable and electronics technologies.

All horizontal structured cable tests performed for warranty purposes must follow the minimum EIA/TIA testing standards along with any additional testing parameters the cabling warranty provider may require at the time of testing. All cable testers are to have the most current versions of the testing parameter software downloaded into the tester and are required to have current calibration certificates before testing is performed.

Cable testers must be able to provide test results in standard information text and graphic chart form on digital and print based media. ITS requires that all test results be saved on digital media and provided to the RCDD telecom designer for review no later than 5 days prior to any connectivity being applied to the horizontal cabling system. All horizontal structured cable test results require a **Full Pass** test result to obtain the required cable warranty.

ITS reserves the rights to perform random testing on the horizontal structured cable system before any network connections are made and once the cables are completely terminated end to end and the telecom contractor releases the system as complete.

The RCDD telecom designer will be responsible for providing additional test documentation required by industry standards and project close out documentation in the written bid installation specifications section issued for a project.

Fiber Optic cable testing requirements:

UNCC ITS deploys a Commscope fiber optic cable and termination system consisting of both SM and 62.5-125 grade MM fiber cables, LC direct terminate connectors, LC pre-terminated pig tails for fusion splicing, and LC coupler panels. Fiber termination and splicing housings are provided by OFS and Fiber-Fab.

ITS does not require warranties on the fiber optic outside plant or riser cable systems.

The telecommunications regulations governing body(s) EIA/TIA establishes industry standard fiber optic cable testing parameters. The EIA/TIA testing parameters are updated as the industry requires with advancing fiber cable and electronics technologies. All fiber optic cables are to be tested minimally to EIA/TIA industry standards and for the mode of cable installed.

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ITS requires the following test procedures on outside plant fiber optic cables if installed by the projects telecom installers. The following requires use of an Optical Time Domain Reflectometer (OTDR) and Power Meter.

- Bi-directional test of the MM strands at both 850 and 1300 wavelengths
- Bi-directional test of the SM strands at both 1310 and 1550 wavelengths
- Power meter test in one direction of MM strands at both 850 and 1300 wavelengths
- Power meter test in one direction of SM strands at both 1310 and 1550 wavelengths

ITS requires the following test procedures by a Power Meter on all interior fiber optic cable riser systems installed by the projects telecom installers.

- One direction test of the MM strands at both 850 and 1300 wavelengths
- One direction test of the SM strands at both 1310 and 1550 wavelengths

All test results for OSP and interior fiber testing are to be saved on digital media and provided to the RCDD for review no later than **5 days prior** before any connectivity is applied to the cables. All fiber cable strands tested must provide an industry standard passing test result when complete.

ITS reserves the rights to perform random testing on any fiber optic cable system before any network connections are made and once the cables are completely terminated or spliced end to end and the telecom contractor releases the system as complete.

The RCDD telecom designer will be responsible for providing additional test documentation required by industry standards and project close out documentation in the bid installation specifications issued for a project.

Copper multi-pair testing requirements:

Some UNCC projects may require the installation of outside plant copper multi-pair cables by the projects telecom installer. These cables are to be tested utilizing the Fluke Copper Pro multi-pair copper cable tester. The tester provides the copper multi-pair testing parameters required by the industry. The tester can also save the test information for download to digital or print media.

Test results provided by the Fluke Copper-Pro tester are to be saved on digital media and provided to the RCDD for review no later than **5 days prior** before any connectivity is applied to the cables. Test results are to provide a 100% pass result on the cable tested. The RCDD is to provide additional details on close out documentation for the Copper-Pro test results in the written bid specifications section in the project documentation.

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As-Built documentation requirements:

UNCC ITS requires that As-Built plan documentation be placed in each telecom room containing horizontal structured cable from the telecom room to the individual outlets in the field.

At a minimum, the As-Built plans to be placed on the telecom room walls should display:

- A clear floor plan drawing with no other utilities shown other than telecom
- Drawing to be presented on minimum 30" X 30" laminated or velum sealed paper
- Drawing to clearly show the outlet location in the field and the outlet identification
- Plans are to be attached to telecom room wall in a secure method (no thumbtacks)

ITS requires a rough draft As-Built plan be placed in each telecom room wall no later than 5 days prior to any connectivity being made in the facility. Final clean laminated or velum As-Built plans should be placed in the telecom rooms no later than 90 days after project is complete.

Telecom installation contractors are responsible for providing the telecom As-Built close out documentation as required by the RCDD in the project bid documents.

ITS/Project Design RCDD site visit requirements:

UNCC ITS requires that the Project Design RCDD perform site visits at critical phases of the telecommunications install to review the following during construction:

- Perform above ceiling inspections on cable conveyance systems, if designed by the RCDD, for proper installation.
- Perform above ceiling inspections when horizontal cable system installation is completed by the telecom contractor and ***before the ceiling tiles are installed.***
- Perform telecom room build out inspections when telecom rack, wire management, and runway systems are installed and cables are formed to termination areas.
- Perform inspection after cable terminations have been performed at the outlets and the patch panels.
- Perform final punch list inspections after telecom contractor has released project areas as complete.
- Perform other site visits if required by owner or telecom installation contractor during construction process.
- Perform final sign off on telecommunications installation project.

RCDD will be required to provide project inspection reports to the design team for review and release to the project contractors for corrective actions if required. Please refer to ***Attachment 1*** of this document for additional RCDD requirements.

Horizontal structured cable warranty requirements:

UNCC ITS requires that a 20 year applications based warranty be applied to the Siemon/Commscope horizontal structured cable system. The Siemon Company will retain ownership of the cable warranty and will provide warranty claim work if required at a future time if the cable system installed fails to perform at industry standards.

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At time of project bid and commencement of the telecom installation, the telecom contractor must retain a current Siemon Company Certified Installer (CI) certificate and be in good standing with the program. The RCDD will be required to verify that the telecom contractor utilized for the installation conforms to the CI installer requirements. If the telecom contractor does not meet the CI installer requirements, the RCDD will be responsible for notifying the project manager that the contractor does not meet eligibility and must be removed and replaced with a current certified CI installer.

SECTION 9: ITS BID DOCUMENTATION REQUIREMENTS

ITS Bid Alternate Specifications list document:

The UNCC ITS bid alternate material list is to be included in the telecommunications bid documentation for all university projects requiring installation of structured cabling systems.

The list provided in this document is a telecom materials alternate outside the base bid specification provided by the RCDD. UNCC ITS will provide additional bid documentation if required by the RCDD or other project design team members during project design.

End Document
10/29/15

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Attachment 1

**UNC CHARLOTTE ITS DEPARTMENT
REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
(RCDD) REQUIREMENTS**

The following UNC Charlotte ITS document is to serve as a primary minimum standards requirement for all UNC Charlotte Capital construction projects, and when applicable, with UNC Charlotte Facilities Management Design Services projects.

UNC Charlotte ITS Department retains ownership and distribution of this document. Any questions regarding the requirements contained within the document should be directed to the ITS department through the UNC Charlotte Construction Project Manager for the project being constructed.

UNC Charlotte ITS Department requires an RCDD on all design projects to be responsible for the day to day responsibilities of the telecom design unless directed otherwise in writing by the ITS Department. ITS strongly prefers the design process in which the RCDD works directly (direct employment or contractually retained) for the architectural design firm responsible for the project, as a standalone design entity. It is requested that the telecom designer not be a subcontracted consultant to the MEP firm.

If an architectural design firm does not have a properly qualified RCDD under direct employment, they are required to retain the services of a properly certified and credentialed RCDD. UNC Charlotte ITS requires that the RCDD retained for a UNC Charlotte design project work in the capacity as an independent RCDD and not be employed by any potential bidder or vendor for the construction of the project. This ensures that UNC Charlotte will receive the best bids from the best cabling companies with minimal possible conflicts of interests. The selected for a UNC Charlotte design project must be within a 2 hour radius of the Charlotte metro area.

Any RCDD in the role of telecom designer for the project is required to submit copies of all current BICSI certifications, other required credentials, and a resume to the project architect showing that the RCDD is active in the telecom design industry and in good standing with the BICSI accreditation organizations. UNC Charlotte ITS will require copies of the RCDD certificates and credentials from the architectural firm for ITS review and comments at the time of project bid submissions.

If the UNC Charlotte ITS Department determines that the telecom designer does not possess the qualifications to support the project, ITS reserves the right to require the architect to replace the RCDD with another that meets the requirements contained within this document and project documents and approved by the ITS Department.

UNC Charlotte ITS Department reserves the right to waive the requirement of the RCDD when deemed applicable by the UNC Charlotte ITS Department on specific projects in which the ITS Department will perform the cabling installation. This would typically be a specific project which would entail a smaller square footage facility with a small cabling deployment within the facility of approximately 50 to 60 telecom outlet locations. Competing design firms are required to clarify thru the UNC Charlotte Capital project manager and UNC Charlotte ITS Department if uncertain of the project requirements.

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RCDD CREDENTIAL/CERTIFICATION REQUIREMENTS:

The RCDD selected for a telecom design project on the campus of UNC Charlotte is required to provide the following credentials and certificates, or equivalent documentation when permitted.

- 1) Current BICSI Registered Communications Distribution Designer in good standing (RCDD) Certificate(s)
- 2) Knowledge of Wireless Access systems and Local Area Network systems design
- 3) Previous telecommunications design experience in Business, Research, and University campus environments is required
- 4) Minimum 5 years of telecommunications design experience to include:
 - Various types and categories of horizontal UTP/STP structured cabling systems including building riser systems with multi-pair copper and multi-strand MM and SM fiber optic cable systems.
 - Outside Plant multi-pair copper and multi-strand MM and SM fiber optic systems both underground and overhead.
 - Knowledge in the design and implementation of telecommunications conduit/duct bank systems and manhole deployments.
 - Large structured cabling system deployments successfully installing, terminating, and testing to completion a minimum of 500 Category 6 or higher category horizontal station cables.
 - Telecommunications and server room(s) deployments and requirements.

RCDD PROJECT DESIGN RESPONSIBILITIES:

- ITS will work directly with the RCDD thru the university FM project management team to develop a telecommunications installation tailored to the facility being built on campus.
- Provide and administer written bid spec for cabling project being bid.
- Provide and administer telecommunications “T” drawings to the project, to include and not limited to, telecom outlet locations, cable tray or cable support systems, telecom room lay outs and deployments with rack raceways, copper and fiber optic riser systems, grounding systems, wireless cabling systems, camera cabling systems, outside plant entrance cables, cable types and termination system to be installed, etc.
- Respond to and administer any addendums, amendments, RFP’s, RFI’s, etc., that are generated regarding the telecommunication cable or infrastructure installs.
- Provide and administer UNC Charlotte ITS Department **bid alternate material list** (to be provided by ITS to the RCDD) in written bid spec.
- Review first submission of the **bid alternate material list**, telecommunications technicians certifications submittals, and cabling system installed required certifications from telecom contractors with ITS and University construction project management for comments and/or re-submission(s). Re-submissions can be transferred electronically for review to ITS after the initial ITS submittal meeting.

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- Attend construction meetings
- Perform above ceiling walk-through inspections for compliance with project requirements.
- Perform telecom room build out compliance walk-throughs
- Perform final walk-throughs as required to provide the project with punch lists.
- Review all cable test data and as-built documentation
- Perform final acceptance inspections

Revision Date: October 29, 2015

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Attachment 2

UNC Charlotte - Bid Alternate Materials List (legacy systems)

This document is to serve as the UNC Charlotte ITS Department preferred vendor equipment bid alternate material list. This list and the material contained within are to be utilized by the UNC Charlotte ITS Department when conducting internal bid projects; by the Project Design RCDD (referred to as RCDD) on all UNC Charlotte Capital Improvements department projects; and UNC Charlotte Facilities Management Design Services department projects.

This is a **required bid document** for use by any of the project design sources listed in paragraph one. Pricing must be submitted by the competing telecommunications companies based on the manufacturers and part numbers contained in the lists within the accompanying document.

UNC Charlotte ITS does not support the use of the preferred vendor equipment bid alternate material list by a non-certified designer that does not hold a current RCDD Telecommunications Design Certificate acting in the role as a RCDD on any UNC Charlotte project. Consent to deviate from this requirement is to be requested in the project design bid process by the project facility designers or MEP Engineering firms responsible for providing this design service to the project. The requirement of the RCDD will be determined on parameters of the actual facility being designed and the requirements of that facility. UNC Charlotte ITS will review and respond to exemption requests from this requirement on a facility by facility request basis.

** See UNC Charlotte ITS Department RCDD requirement guidelines in the UNC Charlotte Master Campus Design Manual **

The material contained within the lists provided in this document, included with part numbers and installation details and recommendations, is to be utilized when providing telecommunications Intra and Inter facility telecommunications infrastructure cabling bids on the campus of UNC Charlotte.

The materials listed within this document are legacy utilized at this time on the campus for daily moves, adds, changes, renovations, and any new construction performed on the UNC Charlotte campus and auxiliary university sites located outside the current campus property boundaries.

The materials list that is provided in this document will not contain quantities, only the specific manufacturer and part number, and the detail for what that particular part or category of material can be utilized for within the cabling installation. Telecommunications companies competitively bidding on installation projects at UNC

Charlotte will be required to estimate quantities of the bid alternate preferred material based on information provided on the project drawings and written bid documentation. Bidding telecommunications companies will be responsible for providing all material required beyond the bid alternate base installation materials listed to provide a complete telecommunications installation. Those materials can include but not be limited to all consumables such as, tapes, strings, screws, nuts, bolts,

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anchors, grounding, labels, J-Hooks, or any other specialty consumables required to complete the telecommunications install.

UNC Charlotte ITS may request and review, at any time, telecommunications installation contractor's materials and documentation listings which contain part numbers and quantities of materials ordered. All intact, suitable to be installed and excess materials and components are to be turned over to UNC Charlotte ITS in a manageable and orderly manner after work is completed on the project.

UNC Charlotte ITS will provide clarifications on material or information contained within this document for the telecommunications installation contractor when requests are received thru the proper project channels. It is the responsibility of the telecommunications contractor to expedite and follow through to resolve all RFI's required for clarifications on any information contained within this document and other project documents.

UNC Charlotte ITS currently utilizes the following major manufacturer components in our day to day telecom infrastructure deployments:

- Commscope fiber optic and copper cabling
- Siemon jacks, faceplates, patch panels, patch cables, and terminations
- Siemon (current) and Panduit (legacy) wire management
- CPI Relay Racks and raceway components
- Commscope fiber optic components, coupling panels, direct application connectors, fusion splice pigtails, etc...
- OFS and TE/AMP fiber optic cabinets and splice bays w/ splice components

UNC Charlotte ITS utilizes a partnering horizontal structured cabling system deployment consisting of Commscope UTP cables with Siemon Company termination hardware. UNC Charlotte ITS requires minimum 20 year product application warranties on all applicable horizontal UTP cabling deployments as defined in the project bid documents. In order to install the Siemon/Commscope partnered cabling solution and provide the Siemon 20 year cable applications warranty, the telecommunications contractor must be in good standing and with current Siemon Company certifications at the time the project is being bid. In order to provide the required cabling installation certification and warranty, **the contractor must be Siemon CI certified to install the Siemon/Commscope cabling system.**

**** Note:** No "project specific" installations by a non-certified Siemon CI will be allowed. Contractor must be established, active, and in good standings in the Siemon CI program at time of project bid. ******

The telecommunications installation contractor selected for the project will be responsible for providing the project a clearly copied, highlighted, and legible material submittal, Siemon CI certification submittal, and technician qualification submittals as required and within the time frames set by the project. UNC Charlotte ITS along with the RCDD telecom designer will review and identify any deficiencies in the submittals for the project. If deficiencies are found, the submittals will be rejected and a re-submit will be requested along with the recommended corrections for the deficiencies. This process will continue until acceptable submittals with the correct telecom material along with any other requirements of the submittals process are approved.

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The following sections contain the UNC Charlotte ITS preferred manufacturer material lists. Each list will provide a cross section of preferred material required for installation. Additional components that a preferred manufacturer carries under their product lines can be submitted for use and reviewed in the material submittals process. Additional components being submitted cannot substitute for the required manufacturer base components.

Parts by each preferred manufacturer required to complete the install of a particular component or components combined may not be contained in the lists provided. The major base components will be listed but it will be the responsibility of the telecommunications contractor to provide all the parts required to install a component or components provided on the list. All items required for a complete install should be provided in the telecom material submittals and will be reviewed accordingly.

Telecommunications installer is not to deviate or substitute for any item contained in the following lists unless otherwise directed by the project with UNC Charlotte ITS approval. The only exception will be if “or equivalent” is specified at the end of a part number. If contractor proceeds with ordering telecom material without the proper material submittal review process and sign off, the contractor will be liable for replacement of unapproved materials at their expense if deemed unacceptable by the project.

Category 6A cable and components are also provided in the lists. Unless otherwise directed by contract documents to install CAT6A cable and components, all UNC Charlotte telecom installs will utilize the base Ultra Media CAT 6 cable and component system.

It is understood that part numbers may change and that some components may be deleted or discontinued by one of the preferred manufacturers listed and the material lists may not reflect those changes. It is the responsibility of the telecom contractor to bring these changes to the RCDD’s attention in the material submittal process. If part number changes or substitutions for a discontinued or non-compatible component are required, they will be reviewed and approved on a case by case basis.

UNC Charlotte ITS reserves the right to modify, add, or change any part that is contained in the material lists. UNC Charlotte ITS will notify the project in writing of the changes with the recommended corrective action.

SECTION 1: CABLES

The cables listed within this section are a reasonable representation of the primary base cables required to install on all UNC Charlotte projects. The manufacturer and part numbers, up to date at the time of release of this document, are provided. Project documents will clarify what cable types and any other specialty cables or cable assemblies that are required for installation and will be addressed on a project by project basis.

If cables listed below will not meet specific requirements set forth in the project documents due to fiber strand and copper pair counts, cable type or compositions listed, it will be the responsibility of the telecom contractor to clarify the application required and provide a part number under the preferred manufacturer listed that will meet the requirement in the material submittal process.

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Unless project documents with specific outside plant installation details are provided for the telecom project being bid. UNC Charlotte ITS purchases, installs, terminates, and tests all outside plant copper and fiber optic cables with required termination hardware to provide incoming voice/data services to a facility being constructed.

Manufacturer	Description	Part Number
Commscope	CAT 6 4 pair Plenum cable (UNCC GREEN)	Ultra Media 7504 Non Shielded
Commscope	CAT 6A 4 pair Plenum cable (UNCC GREEN)	10G4 Non Shielded
Commscope	CAT 6 Jell filled 4 pair cable	6-NF4
Commscope	Outside plant fiber cable 24/24 composite	D-048-LN-CM-F12NS-8W024-6F024
Commscope	Outside plant fiber cable 12/12 composite	D-024 LN-CM-F12NS-8W012-6F012
Commscope	Outside plant fiber cable 24 strand SM	D-024-LN-8W-F12NS
Commscope	Outside plant fiber cable 24 strand MM	D-024-LN-6F-F12NS
Commscope	Outside plant fiber cable 12 strand SM	D-012-LN-8W-F12NS
Commscope	Outside plant fiber cable 12 strand MM	D-012-LN-6F-F12
Commscope	Plenum fiber guard cable 24 strand SM	P-024-DZ-8W-FSUYL
Commscope	Plenum fiber guard cable 24 strand MM	P-024-DZ-6F-FSUOR
Commscope	Plenum fiber guard cable 12 strand SM	P-012-DZ-8W-FSUYL
Commscope	Plenum fiber guard cable 12 strand MM	P-012 DZ-6F-FSUOR
Superior/Essex	Plenum CAT 3 25 pair cable	18-499-36 "or equivalent"
Superior/Essex	Plenum CAT 3 50 pair cable	18-599-36 "or equivalent"
Superior/Essex	Plenum Cat 3 100 pair cable	18-799-36 "or equivalent"
Superior/Essex	Outside plant sealpic PE-89 50 pair cable	09-100-02 "or equivalent"
Superior/Essex	Outside plant sealpic PE-89 100 pair cable	09-104-02 "or equivalent"
Belden	Plenum foil wrapped 2 pair cable	Belden 8723

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SECTION 2: TERMINATION SYSTEMS - COPPER

The termination hardware systems listed within this section are a reasonable representation of the primary base termination hardware required to install on all UNC Charlotte projects. The manufacturer and part numbers, up to date at the time of release of this document, are provided. Project documents will clarify which termination hardware is to be utilized for installation in required applications for the facility being constructed.

Telecom installation projects can require termination hardware to be placed or mounted in vendor specific applications such as modular furniture, wire mold type raceways, lab tables, lecture halls, overhead carrier systems, floor poke-throughs, in floor junction boxes, above ceilings, etc. Materials contained in the list provide some specific components required to install the specialty vendor applications.

It is the responsibility of the telecom contractor to coordinate with the installers of the specialty vendor systems to provide the proper telecom material and termination hardware required to terminate in these applications. All color finishes are to be coordinated and matched; for example, a tan wire mold system would use tan telecom termination hardware; a brushed stainless wire mold system would use a gray telecom termination system; a black mounting hardware in a modular furniture application would require a black telecom termination system.

When terminating in wire mold systems UNC Charlotte requires that a Decora or “Designer” mounting frame be provided to house the terminated telecom jacks in and color coordinated to match the system being installed.

When terminating in modular furniture, it is the responsibility of the telecom contractor to provide the proper color matched jacks, mounting frames, surface mount housings, bezels, etc. and to provide a complete and secure installation within the modular furniture.

Specific color icons are required for terminations at the telecom outlets and at the patch panels and are provided in the list. The icons are to be placed in the protective jack cover door at the telecom outlets and in the jack faces when terminated in the unpopulated patch panels in the telecom rooms. The color icons are as follows for the specific application of the cable being installed.

- Green --- For all general use CAT6 or CAT6A horizontal cables --- Green Icon to be placed on each end
- Yellow --- For use on all CAT6 or CAT6A horizontal cables used for POE-IP camera locations wired back to the patch panel --- Yellow Icon to be placed on each end
- White --- For use on all CAT6 or CAT6A horizontal cables used for Wireless Access Devices wired back to the patch panel --- White Icon to be placed on each end
- Red --- For Use on all CAT6 or CAT6A horizontal cables used for Point of Sale, Credit/Debit Card, all monetary type transaction machines wired back to the patch panel --- Red Icon to be placed on each end
- Blue --- For use on individual jacks in the rack mounted Analog Dial Tone Patch Panel. Details of this requirement will be provided in project documents

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- Violet --- For Use on all CAT6 or CAT6A horizontal cables used for Audio/Video and specialized devices --- Violet Icon to be placed on each end

The following is a cross section for UNC Charlotte utilization of the required manufacturer base installation material used on all UNC Charlotte projects unless otherwise directed by bid documents.

- 48 Port unpopulated MAX patch panels
- 24 Port Z-MAX Category 6A UTP patch panel kits
- MAX DG faceplates 6 port white
- Z-MAX DG 6 faceplates 6 port white
- MAX CAT6 UTP jacks white with door
- MAX CAT 6 UTP jacks black no door
- Z-MAX CAT 6A UTP jacks white with door
- MAX and Z-MAX surface mount housings
- Specific color icons for both MAX and Z-MAX terminations
- MAX Industrial termination outlets where applicable
- 110 Tower termination systems
- 110 Tower systems wire management
- 210 Termination blocks (primary application utilized for transitioning gell filled 4 pair to dry plenum 4 pair)

**Note: UNC Charlotte purchases and installs all patch cords required for patch panel and outlet connections.

Manufacturer	Description	Part Number
Siemon	MAX CAT6 UTP jack white with door	MX6-F02-D
Siemon	MAX CAT6 UTP jack black no door	MX6-F01
Siemon	MAX CAT6 UTP industrial jack	X-6
Siemon	MAX CAT6 industrial jack dust cover	X-CAP
Siemon	Z-MAX CAT6A UTP jack white with door	Z6A-02D
Siemon	CT-Icon Green for MAX jacks	CT-ICON-07
Siemon	CT-Icon Yellow for MAX jacks	CT-ICON-05
Siemon	CT-Icon Violet for MAX jacks	CT-ICON-08
Siemon	Z-MAX Icon card Green	Z-ICON-07B (for use at jack and PP)

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Siemon	Z-MAX Icon card Yellow	Z-ICON 05B (for use at jack and PP)
Siemon	Z-MAX Icon card Violet	Z-ICON-08B (for use at jack and PP)
Siemon	MAX DG faceplate white 6 port	MX-FP-D-06-02
Siemon	MAX SG faceplate white 2 port	MX-FP-S-02-02
Siemon	MAX Industrial faceplate stainless 4 port	XFP-D-04-SS
Siemon	Z-MAX DG faceplate white 6 port	10GMX-FPD06-02
Siemon	Z-MAX SG faceplate white 2 port	10GMX-FPS02-02
Siemon	MAX surface mount housing white 2 port	SM2-02
Siemon	Z-MAX surface mount housing white 2 port	MX-SMZ2-02
Siemon	MAX designer jack mounting frames white 2 port	MX-D2-02
Siemon	MAX/Z-MAX faceplate blanks white	MX-BL-02
Siemon	MAX unpopulated patch panel 48 port	MX-PNL-48
Siemon	MAX unpopulated patch panel 24 port	MX-PNL-24
Siemon	Z-MAX 24 port UTP patch panel kit	Z6A-PNL-24K (kit contains 24 UTP 6A PP jacks)
Siemon	Z-MAX patch panel label holder	Z-PNL-PS (used to hold specific color icons required at PP)
Siemon	110 Tower termination system 5 pair clip	S110MA2-300FT
Siemon	110 Tower termination system 4 pair clip	S110MB2-300FT
Siemon	110 Tower wire management vertical	S110M-WM-300
Siemon	110 Tower wire management horizontal	S110-A2-RMS-02
Siemon	210 Termination system block 4 pair clip	S210AB2-64FT
Panduit	Consolidation point access housing	WMCPEBL (to house 210 cable transition blocks)

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SECTION 3: TERMINATIONS SYSTEMS - FIBER OPTIC

The termination hardware systems listed within this section are a reasonable representation of the primary base termination hardware required to install on all UNC Charlotte projects. The manufacturer with part numbers, up to date at the time of release of this document, are provided. Project documents will clarify which termination hardware is to be utilized for installation in required applications for the facility being constructed.

UNC Charlotte utilizes a hybrid fiber optic connectivity and enclosure system. The enclosure systems consist of Optical Fiber Solutions fiber optic cabinets and fiber optic splice enclosure cabinets, OFS fusion splice trays, TE/AMP direct terminate fiber cabinets, Uniprise fiber optic coupler panels, direct application termination connectors, and fiber optic jumpers utilized for fusion splicing pigtail cordage. Uniprise coupler panels provided in the material list will install into both the OFS and TE/AMP fiber cabinets. Project documents will dictate the use of the specific fiber optic enclosures and the methods of terminations that will be housed in them - fusion splicing or direct terminated.

UNC Charlotte currently utilizes the LC connector model on both MM and SM cables for direct terminate and pre-terminated pigtail fusion splicing applications. Project documents will dictate which termination or combination of termination methods will be performed on a specific project.

When direct terminating fiber cables, UNC Charlotte ITS requires the Anaerobic termination method utilizing the Uniprise fiber optic termination consumables kit with the proper grade polishing papers and current date adhesives for the connector type to be polished. Uniprise direct polishing procedures for the connector type applied are to be followed when performing direct terminations.

UNC Charlotte purchases and installs all fiber optic jumpers required for each project.

Manufacturer	Description	Part Number
OFS	Fiber optic termination cabinet 4RU	109182303
OFS	Fiber optic fusion splice shelf 5RU	301011037 (used with the 4RU enclosure for fusion splicing)
OFS	Fiber optic termination cabinet combo patch/splice 3RU	301039939
OFS	Fiber optic fusion splice trays	300386919
TE/AMP	2RU fiber termination cabinet (rack)	RMG-2000-000B
TE/AMP	Fiber termination cabinet (wall mount)	WMG-2000-00B
Uniprise	Fiber optic coupler panel SM LC 12 pack	PNL-BK-012-SFA-LC12-BL

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Uniprise	Fiber optic coupler panel MM LC 12 pack	PNL BK-012-MFA-LC12-BG
Uniprise	Fiber optic direct terminate connector MM LC	MFC-LCR-09-BG
Uniprise	Fiber optic direct terminate connector SM LC	SFC-LCR-09-BL
Uniprise	Fiber optic jumper SM LC to LC 10 Meter	FEWLCLC42-JXM010 (utilized for making fusion splicing pigtails)
Uniprise	Fiber optic jumper MM LC to LC 10 Meter	FEMLCLC42-BXM010 (utilized for making fusion splicing pigtails)
Uniprise	Fiber optic buffer tube break out kits	KIT-090-012

SECTION 4: RACKS, RACEWAYS, WIRE MANAGEMENT, CABLE SUPPORT SYSTEMS

The support hardware systems listed within this section are a reasonable representation of the primary base cable and electronics support hardware required to install on all UNC Charlotte projects. The manufacturer with part numbers, up to date at time of release of this document, are provided. Project documents will clarify which support hardware is to be utilized for installation in required applications for the facility being constructed.

UNC Charlotte, *in the past*, utilized a hybrid rack and wire management system consisting of standard Universal CPI 19" aluminum equipment racks with standard 3" side rails with accompanying CPI steel runway systems, along with Panduit 12" and 6" vertical and horizontal wire management systems. When performing installations in legacy facilities with the CPI/Panduit combination, additional CPI racks with Panduit wire management may be required to match the systems installed.

Presently, UNC Charlotte deploys a hybrid rack and wire management system consisting of a standard Universal CPI 19" Aluminum rack with 6" side rails and accompanying CPI steel runway systems. Siemon 12" and 6" vertical wire managers are utilized. Siemon 2 RU single-sided horizontal wire managers are installed on the front and back of each rack rail above and below each patch panel. This hybrid rack and wire management system is to be deployed in all new facilities at UNC Charlotte unless otherwise directed by project documents.

Base raceway system installs within a telecom room consist of 12" tubular universal steel raceway and accompanying installation components. Project documents will dictate if larger raceway systems with accompanying installation components are required within a telecom room.

Standard fiber optic duct or fiber runner fiber duct equivalent with required installation components and support systems attached to the raceway system or other support systems within a telecom room may be required. If required, project documents will dictate which type and size of fiber duct with support system is to be installed.

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Fully enclosed equipment cabinets can be required on some projects. Project documents will dictate the use of fully enclosed equipment cabinets as required.

Cable support systems supplemental to a primary cable tray pathway system such as J-Hooks, Cable Saddles, D-Rings, etc., may be required for installation. Telecommunications contractor is responsible for providing the correct type and quantities of the supplemental support system required to meet cabling industry standards regarding the cable being supported.

Manufacturer	Description	Part Number
CPI	Universal 19" equipment rack black	55059-703 (3" rail rack)
CPI	Universal 19" equipment rack black	66353-703 (6" rail rack)
CPI	Universal rack concrete mounting kit	40604-001
CPI	Universal 12" tubular steel runway black	10250-712
CPI	Rack to 12" runway mounting plate black	10595-712 (for 3" rail rack)
CPI	Rack to 12" runway mounting plate black	12121-712 (for 6" rail rack)
CPI	Runway elevation kit	10506-706 (required install to elevate steel runway 6" off of equipment racks)
CPI	Junction splice kits	11302-701
CPI	Triangular support brackets for 12" runway	11312-712
CPI	Universal runway end closing kits	11700-712
CPI	Equipment rack mount ground bus bar	10610-019
CPI	Universal runway wall angle support	11412-712
CPI	Universal runway ground strap kit	12061-001
CPI	Universal runway radius drop out	12100-712
CPI	Universal runway radius drop out	12101-701
Hoffman	Enclosed Cabinet with internal wire management, front and back perforated split door system	H3964
Hoffman	Wall mount equipment enclosure	EWMWG482425

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Hoffman	OPAL Pad-Mount cabinet, 3 door	T504030PM3
Hoffman	OPAL Pad-Mount cabinet, 5 door	T507030PM5
Siemon	Vertical 2 side wire manager with doors 6"	VCM-6D (used with CPI 6" rail rack)
Siemon	Vertical 2 side wire manager with doors 12"	VCM-12D (used with CPI 6" rail rack)
Siemon	Horizontal single side wire manager 2RU	HCM-6-2U (used with CPI 6" rail rack)
** Note: Vertical and horizontal wire managers listed below are primarily used for mounting to legacy CPI 3" rail equipment racks **		
Panduit	Vertical 2 side wire manager with doors 6"	WMPVHC45E
Panduit	Vertical 2 side wire manager 12"	PRV-12
Panduit	Vertical 12" wire manager	PRD-12
Panduit	Horizontal 2 side wire manager 2RU	NM-2
Panduit	Horizontal single side wire manager 1RU	NMF-1
Panduit	Horizontal single side wire manager 2RU	WMPHF2E
Panduit	Fiber optic fiber duct 4X4	S4X4YL6NM
Panduit	Fiber optic fiber duct cover	C4YL6
Panduit	Fiber optic fiber duct coupler fitting	FCF4X4YL
Panduit	Fiber optic fiber duct right angle fitting	FRA4X4YL
Panduit	Fiber optic fiber duct tee fitting	FT4X4YL
Panduit	Fiber optic fiber duct tee trumpet spill out	FTR4X4YL

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SECTION 5: CABLE PROTECTION, CABLE SPLICE ENCLOSURES, SPLICE MODULES AND OTHER MISCELLANEOUS MATERIALS

The materials listed within this section are a reasonable representation of the primary base cable support hardware required to install on all UNC Charlotte projects. The manufacturer with part numbers, up to date at time of release of this document, are provided. Project documents will clarify which support hardware is to be utilized for installation in required applications for the facility being constructed.

UNC Charlotte requires that all shielded inter-building outside plant copper cables are terminated on a direct terminate cable protection apparatus sized for the copper pair count requiring protection. Accompanying cable protector modules are required to fully populate cable protector installed. Typically cable protectors will require the additional installation of a non-shielded multi pair hand off cable. Hand off cable is to be terminated to the protector out going service block and ran to the 110 Tower termination systems for distribution to the building riser cable and station cable system where required. Project documents will dictate the contractor or university responsibility regarding the installation of this system under the project being bid.

Typically all outside plant incoming service cables are installed in a homerun method from hub facility to facility under construction. Splicing copper or fiber cables can be incurred on a project pending the installation environment and possible project deviations. Splicing will be determined on a building by building basis and will be outlined in project documents as required.

Unless project documents with specific outside plant installation details are provided for the telecom project being bid. UNC Charlotte ITS purchases, installs, terminates, and tests all outside plant copper and fiber optic cables with required termination hardware to provide incoming voice/data services to a facility being constructed.

Manufacturer	Description	Part Number
CIRCA	Direct terminate protector 110 in 110 out 25 pair	1880ECA1-25G
CIRCA	Direct terminate protector 110 in 110 out 50 pair	1880ECA1-50G
CIRCA	Direct terminate protector 110 in 110 out 100 pair	1880ECA1-100G
CIRCA	Direct terminate protector 66 in 66 out 25 pair	2625QC/QC
CIRCA	Cable protector protection modules	CT4B1E

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3M	Better Buried copper splice enclosures (to be poured)	BB 4X24 SB/2SC-LHS
3M	Splice enclosure re-enterable encapsulant	4442 High Gel Pouch in a pail 6000 grams 051138-36611
3M	MS2 copper straight splice modules	4000C-TR
3M	UR-2 copper straight splice connectors	UR-2

END OF DOCUMENT

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Appendix A: Telecommunications equipment racks



Figure 1: MDF and IDF rooms will typically be installed with a minimum of four racks with a standard equipment and patch panel configuration to be adhered to when installing network switches and patch cables. Rooms will have HVAC stand-alone units installed whenever possible and most be cooled 24X7, 365 days a year.



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Appendix B: Fiber enclosure, wall field terminations and cable conveyance systems

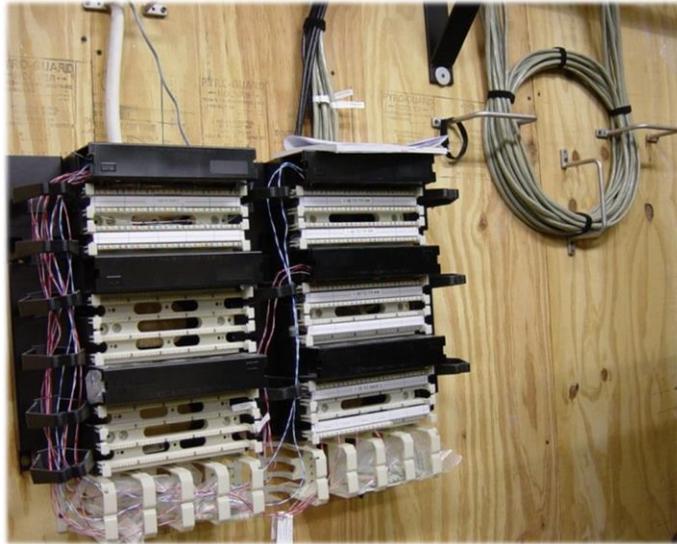
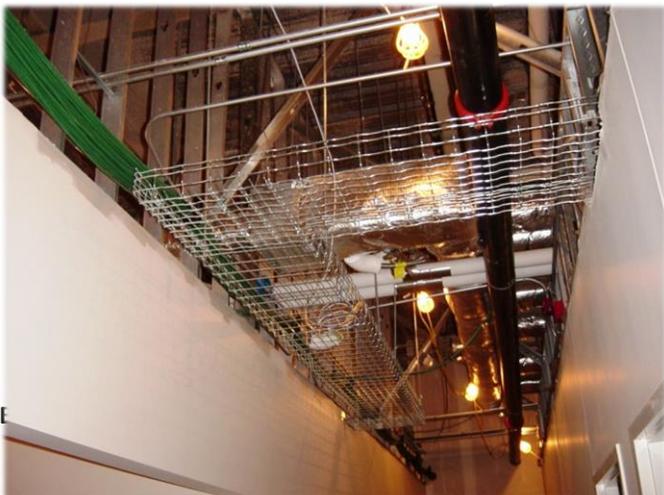


Figure 2: Fiber and copper cabling rack and wall field support systems compliment all cabling infrastructure systems used throughout campus. J-Hook and cable tray systems can be found in various building. Conveyance and pathway systems will be determined during project design.

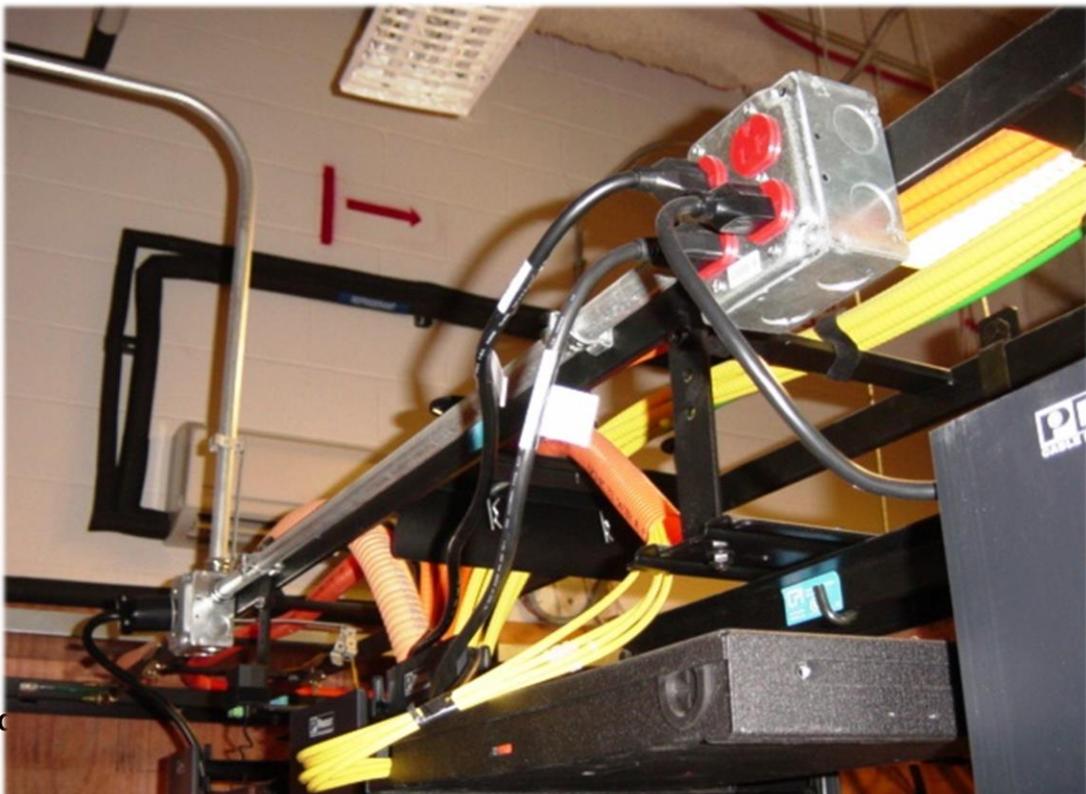


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Appendix C: Electrical Outlets



Figure 3: Outlet types vary in the MDF and IDF telecommunications rooms. Locations for these outlets will be determined at the beginning of the project during the construction design meetings. Typically, all outlets required will be installed above the equipment racks and in the rear of the rack system.



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Appendix D: Conduit labeling and alternate cabinet systems



Figure 4: Conduits entering from below slab should be labeled and bonded. Main Ground Bar systems will be installed in each MDF and IDF room.



Figure 5: Wall mounted and outdoor cabinet systems will be used when dedicated data rooms are not available or when space constraints exist. These installation exceptions are coordinated during project design.

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Appendix E: Code Blue emergency phones and Auxiliary Systems



Figure 6: Emergency Phones are installed throughout the campus. Code Blue Pole phones (standard) replace older Yellow Box phones. Wall mounted blue phones can be found in most parking decks.



Figure 7: Access Control, Building Automation Systems, and "Pay on Foot" stations are some examples of auxiliary systems supported by the campus network. The university network also supports video surveillance, vending, and point of sales devices through hard wire and wireless access systems.

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Appendix F: Network outlets



Figure 8: From the patch panel to the end user, UNCC ITS utilizes a standard for colored icons to identify the port function on the faceplate. Specific university functions will dictate which termination method or hardware is used to protect the network ports and will be determined during project design.



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Appendix G: Telecommunications boxes



Figure 9: Telecommunications boxes (Handholes) are utilized throughout the campus and tie back to other handhole or manhole systems as necessary to facilitate cable transitions, splices and interconnects between equipment and buildings. Local carriers such as AT&T, Time Warner, and Windstream enter our campus through a joint ductbank and handhole system that connect through conduits back to the university manhole as seen below.



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Appendix H: Telecommunications manholes



Figure 10: Telecommunications manhole and ductbanks are typically added during construction projects and when university growth requires additional conduit systems to allow for diverse fiber routes and network expansions. Extension rings are added as needed when terrain or other installation conflicts occur. Cable racking systems in manholes allow for an orderly transition of outside plant cables through the entry system.



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Attachment 3

UNC Charlotte - Bid Alternate Materials List (Category 6A UTP cabling)

This document is to serve as an amendment to the existing CAT 6 UTP UNCC ITS Bid Alternate Material List (Attachment 2) located in Section 2, Division 27, of the University of North Carolina Design and Construction Manual. The existing Bid Alternate Material List for CAT 6 UTP cabling is to remain an active resource. This document contains legacy material lists that are still required for ongoing projects at UNC Charlotte.

UNCC ITS is in the process of transitioning from our current structured cabling system to Siemon CAT 6A UTP cable with Siemon termination hardware. The new cabling system will transition to a complete end to end Siemon CAT 6A UTP structured cabling system. In some cases, the university may implement a Siemon F/UTP (shielded) CAT 6A cabling system. This will be determined during advanced planning and by the requirements for the new construction.

All major components required for the complete end to end installation of the cabling system, along with additional materials required for copper and fiber optic riser systems, telecom rooms, and other miscellaneous systems are listed. Parts contained in the list may also require additional materials or consumables to install and may not be listed. It is the responsibility of the telecommunications contractor to provide these additional components or hardware needed for a complete end to end cable install.

The telecommunications contractor for the project is responsible for estimating quantities and footages of the parts provided in the material list along with product specification sheets during the materials submittal process. Substitutions for materials listed are not allowed unless “or equivalent” for the item is provided with the part number. If the telecommunications contractor has questions or concerns related to materials contained in this revision or the existing bid alternate material lists, UNCC ITS will respond through the project RFI processes.

This material list contains components UNCC ITS deploys to provide a Siemon CAT 6A UTP warranted cabling system. This Siemon cable warranty is for 20 years (minimum) and will be submitted for by the telecommunications contractor responsible for the install.

To achieve the warranty, the telecommunications installer must be enrolled in the Siemon Company cabling warranty program and carry a current Siemon CI Certificate at the award of the telecommunications bid. Telecommunications contractors not meeting this requirement will be disqualified.

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SECTION 1: CABLES

The following list contains copper and fiber optic cables required for a typical horizontal and vertical cable deployment within a facility. If a project requires additional fiber optic strands or copper cable pairs other than the parts listed, these requirements will be addressed during the advanced planning sessions and during implementation should the need arise. If specialty cables are not listed and are required for a project, the specific cable will be identified in the project drawings and details.

All base fiber optic installations utilizing Multi Mode (MM) fiber optic cable will refer to the 6F-62.5/125 rated cable. The 50 Micron MM fiber optic riser cable provided in the list below will be utilized only when specifically directed by bid documents.

Outside plant cables are not provided in the revision list, however they are provided under the UNCC ITS existing materials list, Attachment 2. UNCC ITS typically purchases and installs the outside plant cable systems required for each facility unless otherwise directed by bid documents. If outside plant cables are required for a project and fall outside the responsibility of the ITS installation, such as an OP fiber optic or copper cable required to complete part of a building riser system, these cables will be addressed in project documents and drawing details.

Material list for cables:

- Siemon --- Category 6A UTP Plenum Cable, Green; 9C6P4-A5-07-AR1A
- Siemon --- Category 6A UTP Flooded Cable; 9C604-A5-01-R1A
- Commscope --- Plenum Armored 12 strand SM fiber optic cable; P-012-DZ-8W-FSUYL
- Commscope --- Plenum Armored 12 strand MM fiber optic cable; P-012-DZ-6F-FSUOR
- Commscope --- Plenum Armored 12 strand 50 Micron MM fiber optic cable; P-012-DZ-5L-FSUAQ
- Superior/Essex --- Category 3 Plenum 25 pair multi pair --- Part Number – 18-499-36
- Superior/Essex --- Category 3 Plenum 50 pair multi pair --- Part Number – 18-599-36
- Superior/Essex --- Category 3 Plenum 100 pair multi pair --- Part Number – 18-799-36
- Superior/Essex --- Outside plant seal-pic PE-89 50 pair cable --- Part Number – 09-100-02
- Belden --- Plenum foil wrapped 2 pair cable --- Part Number – Belden 8723 Plenum Rated

***Note: If 50 Micron MM fiber optic cable is required for the project, use the part number below.**

- Commscope --- Plenum Armored 12 strand 50 Micron MM fiber optic cable; P-012-DZ-5L-FSUAQ

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SECTION 2: TERMINATION SYSTEMS - COPPER:

The following list contains termination components required for the Siemon CAT 6A cabling system along with copper riser system terminations.

Field termination requirements may vary on the cabling systems; wall terminations, wire mold or systems furniture terminations, etc. To accommodate these termination environments, several termination housings will be provided in the material list and should cover most installs required.

If specialty termination housings are needed for a project, the specific housing will be addressed in bid documents and detailed drawings.

Specialty systems installs such as wire mold or modular furniture may require a specific color match between the system, the termination housing and modular jacks. This material list may not cover a specific housing or jack color required for a specialty system. The telecommunications contractor will be responsible to coordinate with the specialty systems installer for specific color matches if required. If a color cannot be matched with the offerings from the termination hardware manufacturer, the project design team will be required to approve an alternate color.

When installing CAT 6A jacks in faceplate housings, utilize the angled installation method when placing the jacks in the faceplate. The jack termination kit comes with a small color icon card. A color icon matching the jack color ordered will be required. Utilize the color matching icon with the blank side facing out in the jack. The utilization of the matching color icon blank will be required at the patch panel termination as well.

UNCC ITS will utilize colored jacks end to end to designate what a specific CAT 6A cable may be designated for. Unless otherwise directed by project bid documents and detail drawings, the following jack colors will be utilized for the application listed at the outlet and patch panel.

- Green --- For all general use CAT 6A horizontal cables. Green icon to be placed on each end.
- White --- For use on all CAT 6A horizontal cables used for Wireless Access Points. White icon to be placed on each end.
- Yellow --- For use on all CAT 6A horizontal cables used for POE-IP camera locations. Yellow icon to be placed on each end.
- Red --- For use on all CAT 6A horizontal cables used for Point of Sale, Credit/Debit Card, and all monetary transaction machines. Red icon to be placed on each end.

When installing CAT 6A UTP cables in an under slab on grade condition, the use of Siemon Category 6A UTP flooded cable will be required. The flooded UTP cable will require transitioning to dry UTP cable via a Panduit consolidation access enclosure and with a Siemon 210 termination block installed in the enclosure. These components are included in the following material list.

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When terminating CAT 6A UTP cables in an environment that can be considered a wet or corrosive area, the Siemon industrial ruggedized outlet termination system will be required. These components are also included in the following material list.

Material list for termination equipment:

- Siemon --- 10G faceplate 2 port SG, White; 10GMX-FPS02-02
- Siemon --- 10G faceplate 4 port SG, White; 10GMX-FPS04-02
- Siemon --- 10G faceplate 6 port DG, White; 10GMX-FPD06-02
- Siemon --- Industrial system faceplate SG 2 Port; XFP-S-02-SS
- Siemon --- Industrial system faceplate DG 4 port; XFP-D-04-SS
- Siemon --- MUTOA surface mount termination housing; MX-MMO-02
- Siemon --- Universal Modular Furniture Adapter; MX-UMA-01
- Siemon --- Category 6A UTP jack, Green; Z6A-07
- Siemon --- Category 6A UTP jack, White; Z6A-02
- Siemon --- Category 6A UTP jack, Yellow; Z6A-05
- Siemon --- Category 6A UTP jack, Red; Z6A-03
- Siemon --- Category 6A UTP Industrial jack; XG2-Z6A
- Siemon --- Category 6A UTP industrial jack dust cap; X-CAP
- Siemon --- Category 6A wall phone plate; MX-WP-Z6A-SS
- Siemon --- Category 6A surface mount box, White; MX-SM22-02
- Siemon --- Category 6A unpopulated patch panel; TM-PNLZ-24-01
- Siemon --- Category 6A unpopulated patch panel; TM-PNLZA-24-01
- Siemon --- Category 5E HD 24 port patch panel (used for terminating 25 pair analog hand off cables from 110 tower to equipment rack); HD5-24
- Siemon --- Equipment rack blank filler plate; PNL-BLANK-1
- Siemon --- 110 tower 5 pair clip termination system; S110MA2-300FT
- Siemon --- 110 tower 4 pair clip termination system; S110MB2-300FT
- Siemon --- 110 tower vertical wire manager system; S110M-WM-300
- Siemon --- 110 tower horizontal wire manager system; S110-A2-RMS-02
- Siemon --- 210 block 4 pair termination kit; S210AB2-64FT
- Panduit --- Consolidation point access enclosure (used to house 210 termination blocks); WMCPEBL

****NOTE:** The Siemon **Z6A-45-S(X)(XX)(X)**, 45 degree termination jack, may be utilized in existing infrastructure systems that cannot accommodate the standard Z6A series UTP jacks. If required, use of these jacks will be determined during project design.

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CATEGORY 6A IN-WALL OUTLET REQUIREMENTS:

CAT 6A structured cable systems require adequate infrastructure to provide the bend radiuses needed to install and terminate the cables in an in-wall outlet box. These systems include the in-wall outlet box and the conduit to the outlet box. A standard CAT 6A compliant in-wall outlet configuration will consist of the following components.

- 5 SQUARE in wall telecom outlet termination box with wire managers
- 5 SQUARE double gang and single gang plaster rings (as specified)
- 1-1/4" telecom conduit from the 5 SQUARE telecom outlet box home run to accessible hallway ceiling

Jack terminations at an outlet can utilize different housings for the CAT 6A jacks ranging from Siemon 10G faceplates to surface mount termination housings such as surface mount box or a Siemon MUTOA which are provided in the materials list. Project documents will provide direction on which type of outlet termination will be provided at each location.

SECTION 3: TERMINATIONS SYSTEM – FIBER OPTIC:

The following list contains components required for the termination of fiber optic cables. The parts listed are from various manufacturers and provide an end to end fiber optic solution. Typical installs within a facility will consist of Single Mode and Multi-Mode armored plenum rated fiber optic cables.

In lieu of direct terminating the fiber optic riser systems, UNCC ITS will require all new fiber optic cable riser systems to be fusion spliced to the corresponding SM and MM pigtails with factory pre-terminated LC connectors. The material list will provide part numbers for 10 meter, SM and MM LC to LC fiber optic jumpers. These jumpers will be utilized to make the SM and MM pigtails for fusion splicing. Each 10 meter LC to LC fiber optic jumper can be cut in the middle and can produce 4 pigtails for fusion splicing.

The 3RU OFS fiber optic patch/splice cabinet provided in the list will be utilized for all fiber optic riser cable patching and splicing. The fiber optic cabinet will accept a single fusion splice tray (ordered separately) and can hold 48 single fusion splices.

When designing a riser termination detail for a project, a 3RU patch/splice fiber optic cabinet can contain more than one SM and/or MM riser cable. For example, in the MDF where there are multiple IDF telecom room riser cables that have to be spliced, a typical riser install to a telecom IDF from the MDF will be a 12 strand SM and a 12 strand MM plenum armored cable for a total of 24 strands. You can combine two IDF's in one 3RU fiber optic cabinet in the MDF which equals the 48 fiber optic fusion splices the single tray will hold. The same 3RU patch/splice fiber optic cabinet will be utilized in the IDF where there may only be a 12 SM and 12 MM riser fiber cable to fusion splice.

When installing the Multi-Mode fiber optic cable required for the main Fire Alarm (FA) panel communications trunk, a fiber optic wall mountable interconnect center (WIC) will be required at the FA panel. A specific FA panel WIC enclosure and splice tray will be provided in the list for this activity.

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When working in a legacy facility that may contain direct terminated fiber optic riser systems, please refer to the existing material list for SM and MM LC direct terminate connectors and components. Factory issued direct termination consumables kits for the type and mode of fiber optic cable being direct terminated will be the responsibility of the telecommunications contractor to provide.

UNCC ITS typically purchases, installs, and fusion splices the outside plant fiber optic cable systems to the new facility unless directed differently by the bid documents.

Material list for fiber termination equipment:

- OFS --- 3RU patch/splice fiber optic cabinet; 301039939
- OFS --- Single fusion splice tray for 3RU cabinet; 300386919
- AFL --- Wall mountable interconnect center (Fire Alarm panel termination); WME02E
- AFL --- Wall mount enclosure fusion splice tray (Fire Alarm termination closure); FM002827-1
- Uniprise --- LC 12 pack SM LC coupler panel (will install in the OFS and AFL fiber optic patch/splice enclosures); PNL-BK-012-SFA-LC12-BL
- Uniprise --- LC 12 pack MM LC coupler panel (will install in the OFS and AFL fiber optic patch/splice enclosures); PNL-BK-012-MFA-LC12-BG
- Uniprise --- 10 meter LC to LC SM fiber jumper (utilized to make the SM pigtails required for fusion splicing); FEWLCLC42-JXM010
- Uniprise --- 10 meter LC to LC MM fiber jumper (utilized to make the MM pigtails required for fusion splicing); FEMLCLC42-BXM010
- Uniprise --- Heat shrinks (for fusion splicing); SFS-SLEEVE

***Note: For 50 Micron MM installations:**

- Uniprise --- 10 meter LC to LC 50 Micron MM fiber jumper (utilized to make the 50 Micron MM pigtails for fusion splicing); FEMLCLC42-MXM010
- Uniprise --- LC 12 pack 50 Micron MM coupler panel (will install in the OFS and AFL fiber optic patch/splice enclosures); PNL-BK-012-MFA-LC12-AQ

SECTION 4: MDF and IDF EQUIPMENT:

The following list contains components required for the installation of an MDF or IDF equipment room. The materials listed are from various manufacturers and will provide a complete telecommunications equipment room.

UNCC ITS will maintain the existing bid alternate material list for additional MDF/IDF telecom room build out equipment for legacy telecom rooms. The existing telecom rooms can vary on the type of equipment racks and wire management systems. If required, project documents will reference the existing bid alternate material list.

Some parts listed will require additional consumable materials such as nuts, bolts, anchors, screws, tie-wraps, Velcro, etc. These consumables are the responsibility of the telecommunications contractor.

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Other components may require additional parts to assemble. These smaller parts may not be on the list. It will be the responsibility of the telecommunications contractor to provide these additional parts with their telecom material submittals.

The telecommunications RCDD on the project design team will be responsible for providing details that outline construction of the telecom rooms based on the building floor plans. The materials in this list can be installed in various configurations and should be sufficient to provide a complete telecom room build out.

UNCC ITS incorporates the use of Siemon vertical and horizontal wire management systems with our standard 6" rail, 7' tall open frame 19" equipment racks. Vertical wire managers installed with the 6" rail racks can range from 6" wide to 16" wide type. Project documents and detail drawings will dictate the size of the vertical wire managers to be used.

Horizontal wire managers are to be 2RU and installed with the following patch panel configuration:

- Use 2RU horizontal wire managers with the CAT 6A unpopulated flat patch panels.
- Beginning at the top, install one 2RU horizontal wire manager at the front of the new 6" patch panel rack rail. Install another 2RU horizontal wire manager on the rear to line up with the 2RU manager installed on the front.
- Install a 1RU 24 port unpopulated 6A flat patch panel below the first 2RU horizontal wire manager on the front of the rack.
- Install a Siemon 1RU blank filler panel below the 1RU 24 port unpopulated 6A flat patch panel.
- Install a second 24 port unpopulated 6A flat patch panel below the 1RU blank filler panel.
- Install a single 2RU horizontal wire manager on the front and below the second 1RU 24 port unpopulated 6A flat patch panel. Install the 2RU horizontal wire manager on the rear to match the 2RU manager installed on the front.
- Repeat the patch panel, blank filler panel, patch panel and wire manager installation sequence down the front and rear of the patch panel rack until the rack is fully populated or as project documents direct.

UNCC ITS may also choose to install 24 port unpopulated CAT 6A **angled** patch panels in lieu of the flat panels listed above. When installing the CAT 6A angled patch panels, the use of the 2RU horizontal wire managers between the panels is not required. The angled patch panels are designed to manage CAT 6A station cables in the rear and CAT 6A patch cords in the front without the use of additional front and rear rack horizontal wire management.

Install the **angled** patch panels in the following configuration:

- Beginning at the top of the patch panel rack, install one 2RU wire manager on the front of the 6" rack rail. Rear wire manager will not be required.
- If required, the 24 port HD5E patch panel for analog service will be installed below 2RU WM.
- Install a 1RU 24 port unpopulated CAT 6A **angled** patch panel below the 2RU horizontal wire manager.

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- Install a Simon 1RU blank filler panel below the first 24 port unpopulated ***angled*** patch panel.
- Install a 1RU 24 port unpopulated CAT 6A ***angled*** patch panel below the 1RU Simon blank filler panel.
- Repeat the blank filler panel and patch panel installation sequence down the patch panel rack until the rack is fully populated or as project documents direct. Insert a 2RU WM between patch panel 10 and 11.

UNCC ITS may also utilize floor or wall mount enclosed equipment cabinets with vertical wire management installed from the factory. The use of additional horizontal wire management will be dependent on the type of patch panel installation that is required. Project documents will provide direction on which enclosed solution is required.

If additional cable management is required, such as fiber optic duct or additional finger type duct systems, project team will provide details and direction on what type of system to install. These parts are not included in the list. If these systems are required, it will be the responsibility of the telecommunications contractor to provide these components in the material submittal process.

UNCC ITS typically installs a 12" wide cable ladder rack system within the telecommunications rooms. If a wider cable ladder rack system is required in the room, the project will provide specific details on the size of the ladder rack system. In some cases, larger cable ladder rack systems (up to 18") may be required based on cabling design and quantities.

The cable ladder rack system requires the installation of a rack elevation kit with the rack to runway mounting plate. This is provided in the list. This kit is needed to elevate the cable rack at approximately 6" above the equipment rack and to provide the proper bend radius for the incoming station cables to be terminated.

The use of internal and external cable spillways mounted to the cable ladder rack system is recommended if the cabling aligns correctly above the vertical wire manager. The spillways are included in the material list.

Material list for MDF/IDF equipment:

- CPI --- 19" open frame 6" rail equipment rack, Black; 66353-703
- Hoffman --- Enclosed floor mount equipment cabinet, Black; PNC2089B
- Hoffman --- Enclosed wall mount equipment cabinet, Black; EWMWG482425
- CPI --- Concrete mounting kit for equipment rack; 40604-001
- CPI --- 12" tubular ladder rack, Black; 10250-712
- CPI --- Rack to runway mounting plate for 6" rail rack, Black; 12121-712
- CPI --- Cable ladder rack elevation kit, Black; 10506-706
- CPI --- Cable ladder rack junction splice kit, Black; 11302-701
- CPI --- Cable ladder rack butt splice kit, Black; 11301-701
- CPI --- Cable ladder rack triangular support kit, Black; 11312-712
- CPI --- Cable ladder rack end closing kit, Black; 11700-712

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- CPI --- Cable ladder rack wall angle support, Black; 11421-712
- CPI --- #6 ground strap kit; 12061-001
- CPI --- Equipment rack mount ground bus bar; 10610-019
- CPI --- Internal cable ladder rack radius cable drop out; 12100-712
- CPI --- Cable ladder rack side rail mount radius cable drop out; 12101-701
- Siemon --- Vertical 6" wide double sided wire manager with doors; VCM-6D
- Siemon --- Vertical 12" wide double sided wire manager with doors; VCM-12D
- Siemon --- Vertical 16" wide double sided wire manager with doors; VCM-16D
- Siemon --- Horizontal 2RU single sided wire manager; HCM-6-2U

SECTION 5: OUTSIDE PLANT CABLING:

As noted previously, ITS purchases, installs, and terminates the outside plant cables for a facility. However, a new facility may require outside plant cabling that are part of the building riser cable system. If the design dictates this, that has to be installed by the telecommunications contractor. Any copper cable installed in this OP configuration will require cable protection. If additional outside plant materials are required for an install, the materials needed to complete the install will be provided in the bid documents and telecom submittals. The following component list provides the type cable protector with protector modules.

Material list for cable protection:

- Circa --- 25 pair outside plant cable protector, direct terminate type; 1880ECA1-25G
- Circa --- 50 pair outside plant cable protector, direct terminate type; 1880ECA1-50G
- Circa --- Cable protection modules; CT4B1E

SECTION 6: CABLE SUPPORT SYSTEMS

UNCC ITS requires cable support systems to be installed on all projects. These can range from cable tray or J-Hook or conduit systems. ITS will work with the project RCDD and Electrical Engineers to design a cable support system that will accommodate the building design and floor plan and the requirements will be provided in the bid documents and project details. There are no cable support materials in this list.

Please note that if a J-Hook system is designed and accepted for a facility, the J-Hooks are to be installed as a "system" and not consist of numerous types and sizes of hooks throughout the facility. If J-Hooks are installed, they should allow for additional cable capacity growth of 40% minimum.

J-Hooks installed in a primary hallway cable pathway should be of 4" minimum size and installed in a "tree" fashion with 3/8" all thread hanger either installed from the deck above or other means and methods to support the tree system. If an all thread supported system cannot be installed due to above ceiling conditions, a wall mounted system can be installed in its place with the same conditions applying as if it was an all thread system. The system must maintain the same hook size throughout and provide 40% minimum growth capacity.

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When installing J-Hook branch offs from the primary hallway J-Hook system, the J-Hooks can range from 2" to 4" and either be 3/8" all thread hung or wall mounted depending on the conditions. J-Hooks smaller than 2" will not be installed on any project. The 40% minimum growth capacity in the branch installs is also required.

****NOTE:** When utilizing 4" conduits for sleeves, UNCC ITS requires use of Box Connector bushings instead of plastic slide-on bushings.

Please see Appendix A at the end of this document for photos of a typical all thread support system and a wall mounted support system that UNCC ITS will accept.

SECTION 7: TESTING REQUIREMENTS

UNCC ITS requires that all cable testers for copper and fiber optic cable testing be calibrated and loaded with current EIA/TIA testing software. These is a critical requirement to insure that all testing is performed correctly for warranty purposes.

All Siemon Company CAT 6A UTP cables are to be fully tested to Permanent Link parameters and per industry and The Siemon Company standards to obtain the 20 year warranty. Other testing requirements that may be required will be identified in the project documentation and details.

Full CAT 6A test documentation (PDF and tester raw files) are to be provided for the cable warranty application process along with any additional project specified documents. An electronic copy of these test results must be provided to UNCC ITS.

Fiber optic cable riser systems are to be tested but are not required to be warranted. OTDR testing on the riser system will not be required, however the fiber optic cable riser system is to be tested utilizing power meters which will produce a recordable dB loss budget for the cables being tested. The downloadable test files and documentation is to be provided to the project RCDD for review and acceptance.

When using the fiber optic power meters for acceptance testing, the following parameters are required.

- Power Meter testing to utilize the bi-directional testing method
- Power Meters are required to test at dual wavelength parameters for both SM and MM fiber optic cables.
- Dual wavelength testing parameters for the MM testing are to be at 850 and 1300
- Dual wavelength testing parameters for the SM testing are to be at 1310 and 1550

End Document:

Issue date: January 31, 2018

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Appendix I: All thread and wall mounted J-Hook support systems



Figure 1: J-Hook cable support systems can be installed to utilize all thread or wall mounted configurations. UNCC ITS will work with the design team during advanced planning to determine the best system to be used for the new construction.



SECTION 2
DIVISION 28
ELECTRONIC SAFETY AND SECURITY

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s contract documents.

SECTION 28 0100 - ELECTRONIC SAFETY AND SECURITY GENERAL

PART 1 - GENERAL

1.1 SUMMARY

- A. The following information is provided to ensure compatibility of card readers for use with UNC Charlotte's ID Card.

PART 2 - PRODUCTS

2.1 CARD READER REQUIREMENTS

- A. All card readers and supporting systems proposed for any building at UNC Charlotte must comply with the following ID Card Standards and be 100% compatible with the existing University equipment.
- B. The UNC Charlotte's ID Card uses a standard ABA accepted CR-80 colored card stock, size 2.12 inches high by 3.375 inches long, a card thickness of 0.030 inches, and the radius of corners .125 inches. The card meets ISO standards 7810 and 7813. The stripe is a three-track ABA stripe meeting ISO specifications 7811/2, 7811/4 and 7813. The ABA stripe provided employs high coercivity encoding. Card holder information is encoded on Track II of the ABA magnetic stripe.
- C. Card Reader Preferred Features:
 - 1. Card readers should be specifically designed for the college and university environment, and be made of rugged, rustproof metal. Readers should not have plastic casings or moving parts which are subject to frequent replacement due to shattering and breakage.
 - 2. Card readers should feature a continuous swipe-through style card slot with a floating read head, which reads the encoded information on Track II of the ABA magnetic stripe on the ID card.
 - 3. Card readers should be programmable from administrative workstations linked to its access control system by authorized operators only. No card reader programming shall be done at the reader.
 - 4. In the event of a communication disruption between the reader and its access control system, readers should be able to store a history of at least 4,000 transactions while offline, and automatically upload these transactions to the access control system when communication is restored.
 - 5. Card readers should have their control electronics mounted remotely within the interior of the secured area.
 - 6. Card readers should be protected against power line disturbances (i.e., have power line filter and watchdog timer circuitry).
 - 7. It is desirable for card readers and their supporting system to:
 - 8. Provide some sort of visual indication if card entry is valid, denied, or the card must be reinserted. (For security reasons, access control card readers should not visually indicate an offline condition.)

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9. Be able to support a high security option that allows use of a downloaded cardholder privilege database for offline authorization.
10. Be able to support an optional Personal Identification Number (PIN) pad.
11. Be capable of interfacing with proximity card recognition devices and other types of door opening systems and hardware.
12. Be able to support multiple alarm inputs/outputs that will activate other types of peripheral equipment (lights, video camera, sirens, etc.)

SECTION 28 3000 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. Each installation shall be an addressable system with battery backup, graphic annunciator and voice evacuation.
- B. Provide audiovisual speaker and light alarm devices throughout the building. Provide ceiling mounted horn/strobe whenever possible to avoid wall mounted locations.
- C. Provide addressable smoke detectors in the storage spaces, equipment rooms, fire alarm control panel locations and corridors. Addressable duct mounted smoke detectors will be provided for the central air handlers. Addressable heat detectors will be provided where there is cooking equipment and inside the boiler rooms.
- D. If smoke detectors are installed within 10 feet of a restroom door opening or within 10 feet from vanity/sink area, the smoke detectors shall be programmed as “verified” smoke detectors.
- E. Provide addressable fire alarm pull stations at the egress doors. Additional pull stations will be provided in the mechanical rooms.
- F. All work shall be in accordance with the recommendations of the N.C. Department of Insurance Guidelines for Fire Detection and Alarm Systems.
- G. Sprinkler System Interconnect: Flow switches shall be connected to energize the system and operate all speakers and visuals in the entire building. Valve tamper switches shall be connected to annunciate trouble signal only, both audibly and visibly.
- H. All clean agent releasing systems, pre-action sprinkler systems and/or special hazard systems shall be integrated with the building system fire alarm control panel if the fire alarm control panel is UL listed for those purposes.
- I. Digital Communicator: Provide complete digital communicator that is directly compatible without translators to the existing Simplex campus fire alarm monitoring system.
- J. Power fire alarm system with generator backed life safety circuit if available.
- K. Isolation relays (relays indirectly controlled by fire alarm system components) or 8 amp rated fire alarm system component relays shall be used whenever 120VAC (or greater) is switched by relay contracts to control auxiliary functions.
- L. Line voltage (120VAC transient) suppressors providing surge protection to the fire alarm control panel shall have dry contacts for remote monitoring of transient suppressor integrity. These contacts shall be monitored by the fire alarm control panel to indicate a trouble condition when the operating ability of the suppressor is lost.
- M. Fiber Optic cabling used for fire alarm network communications shall be 62.5/125 Micron Multi-mode cable. It shall also be red in color from any patched connection point to the fire alarm control panel.

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- N. Provide a landline connection adjacent to each fire alarm control panel.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. All wiring shall be in metal raceway.
- B. Access doors in ducts for duct detectors shall be installed by the mechanical contractor. Fire alarm contractor to coordinate installation with mechanical contractor.
- C. Final testing of the system shall be under the direct supervision of the manufacturer's representative. The Fire Alarm System shall be fully tested and certified in accordance with NFPA 72. When manufacturer's testing is complete, a letter of certification including the NFPA 72 Record of certification shall be sent to the Owner (State Construction Office) with a copy to the Engineer stating that the system has been tested and functions as intended by all applicable Codes and these plans and specifications.
- D. A demonstration of the entire system shall be provided for the Owner and Engineer upon completion of the project. Manufacturer's field engineer or technician shall be present for these demonstrations and shall assist the Contractor in performing the demonstration. Prior to the demonstration and inspection by the Engineer, the installing contractor shall submit to the Engineer the NFPA 72 signed certification of completion seven days in advance of this requested final inspection date. Once system is operational and accepted by the Owner and Engineer, 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. Contractor shall arrange to have the necessary number of people, radios, 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 all smoke and smoke "bombs."
- E. Any modification of an existing fire alarm system requires a new certification and graphics system update.
- F. All connections to the FACU and the system's programming shall be done only by the manufacturer, or by an authorized distributor that stocks a full complement of spare parts for the system. The technicians who do this are required to be trained and individually certified by the manufacturer, for the FACU model/series being installed. This training and certification must have occurred within the most recent 24 months. Copies of the technician's certifications must be part of the Shop Drawing submittal to the engineer, prior to installation. The submittal cannot be approved without this info.
- G. Separate walk test groups for all fire sprinkler devices shall be programmed into the fire alarm system.
- H. Duct Smoke Detectors shall be configured to report as Supervisory Alarms instead of Fire Alarms. They shall be configured to operate all necessary ancillary functions associated with smoke control such as air handler shutdown, damper activation, and smoke evacuation fans as required.

2.2 SUBMITTALS

- A. Contractor shall submit for approval complete data on all proposed system components, along with detailed wiring diagrams showing color coding and wire identification, terminal numbers, raceway sizes, number of conductors, etc.

SECTION 2
DIVISION 28
VOICE EVACUATION FIRE ALARM SYSTEMS
APPENDIX

DIVISION 28-VOICE EVACUATION FIRE ALARM SYSTEM APPENDIX

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.
- C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
 - 1. Fire alarm system detection and notification operations.
 - 2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, and other equipment as indicated in the drawings and specifications.

1.2 SCOPE OF WORK

- A. Provide a complete, non-coded, addressable, microprocessor-based fire alarm system with addressable initiating devices, non-addressable emergency voice alarm notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein. System shall be fully interconnected into the UNCC campus wide fire alarm network and be compatible with the existing Simplex graphics monitoring/command unit. Full network integration providing all points of the new system into the existing network shall be provided.

1.3 ACCEPTABLE EQUIPMENT AND SERVICE PROVIDERS

- A. Manufacturers: The equipment and service described in this specification are those supplied and supported by SimplexGrinnell and represent the base bid for the equipment.
 - 1. Subject to compliance with the requirements of this specification, provide products by one of the following:
 - a. Simplex, a Tyco International Company
 - b. Pre-bid approved equal
- B. Being listed as an acceptable Manufacturer in no way relieves obligation to provide all equipment and features in accordance with these specifications.
- C. Alternate products must be submitted to the Engineer two weeks prior to bid for approval. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
- D. The equipment and service provider shall be a nationally recognized company specializing in fire alarm and detection systems. This provider shall employ factory trained and NICET Level III certified technicians, and shall maintain a service organization within 100 miles of this project location. The equipment and service provider shall have a minimum of 10 years experience in the fire protective signaling systems industry.

1.4 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

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- B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
 - 1. Division 16: "Basic Electrical Materials and Methods."
 - 2. Division 16: "Wiring Methods."
 - 3. Division 13: "Fire Suppression."
 - 4. Division 15: "Fire Protection."
 - 5. Division 15: "HVAC Systems."
 - 6. Division 13: "Building Automation and Control."

- C. The system and all associated operations shall be in accordance with the following:
 - 1. North Carolina State Building Code, 2006 Edition.
 - 2. North Carolina Fire Prevention Code, 2006 Edition.
 - 3. North Carolina Mechanical Code, 2006 Edition.
 - 4. North Carolina Electrical Code, 2008 Edition.
 - 5. NFPA 72, National Fire Alarm Code, 2002 Edition.
 - 6. North Carolina DOI Fire Detection and Alarm System requirements, 2008 Edition.
 - 7. Local Jurisdictional Adopted Codes and Standards.
 - 8. North Carolina Accessibility Code, 1999 Edition with amendments.

1.5 SYSTEM DESCRIPTION

- A. General: Provide a complete, non-coded, addressable, microprocessor-based voice fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.

- B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of 100% on-site programming to accommodate system expansion and facilitate changes in operation. All programming shall be capable of being accomplished via the front panel and via a lap top computer. All software operations shall be stored in a non-volatile programmable memory within the FACP. Loss of primary and secondary power shall not erase the instructions stored in memory.

- C. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. Separate alarm, supervisory and trouble logs shall be provided.

- D. Wiring/Signal Transmission:
 - 1. Transmission shall be hard-wired, using separate individual circuits for each zone of alarm operation as required or addressable signal transmission, dedicated to fire alarm service only.
 - 2. System connections for signaling line circuits shall be Class A, Style 6 and notification appliance circuits shall be Class B, Style Y.
 - 3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.

- E. Remote Access:
 - 1. FACP shall have the capability to provide Remote Access through a Dial-Up Service Modem.
 - 2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.

- F. Required Functions: The following are required system functions and operating features:
 - 1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

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2. Non-interfering: The activation of an addressable device does not prevent the receipt of signals from subsequent activations.
3. Transmission to an approved Supervising Station: Automatically route alarm, supervisory, and trouble signals to an approved supervising station service provider if required, under another contract.
4. Transmission to existing graphic monitoring/command units: Automatically route alarm, supervisory, and trouble signals to the existing fire alarm network workstations in King Hall and in Electrical Shop 11.
5. Compatibility with outdoor Mass Notification System for UNCC campus. MNS shall have the ability to activate building voice Fire Alarm System and transmit voice messages over the building FAS.
6. Local Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote Annunciator, indicating the type of device, the operational state of the device (i.e. alarm, trouble or supervisory) and shall display the custom label associated with the device.
7. General Alarm: A system general alarm shall include:
 - a. Indication of alarm condition at the FACP and the Annunciator(s).
 - b. Identification of the device/zone that is the source of the alarm at the FACP and the Annunciator(s).
 - c. Operation of audible and visible notification appliances until silenced at FACP.
 - d. Audible Alarm Notification shall operate as a Temporal Code pattern with pre-recorded emergency voice evacuation messages.
 - e. Closing doors normally held open by magnetic door holders.
 - f. Unlocking designated doors.
 - g. Shutting down supply and return fans serving zone where alarm is initiated.
 - h. Closing smoke dampers on system serving zone where alarm is initiated.
 - i. Initiation of smoke control sequence.
 - j. Transmission of signal to the supervising station.
 - k. Transmission to campus fire alarm network graphic workstations.
 - l. Initiation of elevator Phase I functions (recall, shunt trip, illumination of indicator in cab, etc.) in accordance with ASME/ANSI A17.1, when specified detectors or sensors are activated, as appropriate.
8. Supervisory Operations: Upon activation of a supervisory device such as a tamper switch, the system shall operate as follows:
 - a. Activate the system supervisory service audible signal and illuminate the LED at the FACP and the graphic Annunciator.
 - b. Pressing the Supervisory Acknowledge key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
 - c. Record the event in the FACP historical log.
 - d. Transmission of supervisory signal to the supervising station.
 - e. Transmission to campus fire alarm network graphic workstations.
9. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.
10. System Reset
 - a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarmed the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
 - b. Should an alarm condition continue, the system will remain in an alarmed state.
11. Drill: A manual evacuation (drill) switch shall be provided to initiate an alarm on the FACP.
 - a. Manual Control: Manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble. The "off normal"

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- status shall be clearly identified in plain-language on the FACP alphanumeric display.
- b. Manual Bypass Control: The ability to perform a manual bypass of selected automatic functions shall be provided.
12. Circuit Enable/Disable Control: The system shall have provisions for disabling and enabling each circuit individually for maintenance or testing purposes.
 13. WALKTEST: The system shall have a one person test feature. Enabling the one person test feature at the FACP shall activate the "One Person Testing" mode of the system as follows:
 - a. The city circuit connection and suppression release circuits shall be bypassed for the testing group.
 - b. Control relay functions associated to the testing group shall be bypassed.
 - c. The FACP shall indicate a trouble condition.
 - d. The alarm activation of any initiation device in the testing group shall cause the audible notification appliances to sound a code to identify the device.
 - e. The control panel shall automatically reset itself after signaling is complete.
 - f. Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.
- G. Analog Smoke Sensors:
1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The FACP shall determine the condition of each sensor by comparing the sensor value to the stored values.
 2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
 3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 8 sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
 4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a Maintenance Terminal CRT Display or printed for annual recording and logging of the calibration maintenance schedule.
 5. Peak Value Logging: The FACP shall log the Peak Value of smoke obscuration or degree of temperature for each individual sensor to allow system calibration for maximum response time performance without nuisance alarms based on "actual ambient conditions".
 6. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
 7. The FACP shall continuously perform an automatic self-test on each sensor that will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
- H. Fire Suppression Monitoring:
1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
 2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.

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3. Hood Suppression Systems: Activation of a hood system shall initiate a general alarm sequence.
- I. Audible Alarm Notification: By voice/audible alarm in areas as indicated on drawings.
- J. Power Requirements:
 1. The control panel shall receive AC power via a dedicated fused disconnect circuit.
 2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic. If system is connected to a remote supervising station or central supervising station for monitoring provide 60 hours of standby with 15 minutes of alarm operation.
 3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control panel.
 4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control panel. A green "power on" LED shall be displayed continuously while incoming power is present.
 5. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be indicated at the control panel.
 6. The system shall support 100% of addressable devices in alarm operated at the same time, under both primary (AC) and secondary (battery) power conditions.
 7. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.6 SUBMITTALS

- A. General. Submit the following according to Conditions of Contract and Division 1 Specification Sections:
 1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
 2. Wiring diagrams from manufacturer.
 3. Shop drawings showing system details including location of FACP, all devices, circuiting and details of graphic Annunciator.
 4. Graphic file layouts for integration into existing fire alarm network graphic workstations.
 5. System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate in accordance with the prescribed backup time periods and under all voltage conditions in accordance with UL and NFPA standards.
 6. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, SLC, NAC, RAC, Sensor, and auxiliary control circuits.
 7. Operating instructions for FACP.
 8. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
 9. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
 10. Record of field tests of system.
- B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of

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shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions, if required, to make clarifications or revisions to obtain approval.

1.7 CAD DRAWING FILES

A. System provider to develop appropriate drawing files to be imported into the existing fire alarm network graphic workstations. All required programming for integration of these drawing files into the workstations is to be provided. New floor plan layouts are to be consistent with the existing building floor plan files.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A factory authorized installer is to perform the work of this section.
- B. Each and every item of the Fire Alarm System shall be listed under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

1.9 MAINTENANCE SERVICE

- A. Warranty Maintenance Service: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives.
- B. Basic Services: Systematic, routine maintenance visits on an annual basis at times scheduled with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.
- C. Additional Services: Perform services within the above 12 month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.
- D. Maintenance Service Contract: No later than 60 days prior to the expiration of the warranty maintenance services period, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. Owner will be under no obligation to accept maintenance service contract renewal proposal.

1.10 EXTRA MATERIALS

- A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:
 - 1. Break Rods for Manual Stations: Furnish quantity equal to 15 % of the number of manual stations installed; minimum of 6 rods.
 - 2. Fuses, two of each size in system.
 - 3. Manual fire alarm stations, furnish quantity equal to 2% of each type and number of units installed, but not less than one of each type.
 - 4. Addressable control relays, addressable monitor modules, isolator modules, isolator bases, furnish quantity equal to 4% of each type and number of units installed, but not less than one of each type.
 - 5. Indoor speaker appliances with strobe lights: Furnish quantity equal to 4% of each type and number of units installed, but not less than one of each type.
 - 6. Indoor Strobe only Notification Appliances: Furnish quantity equal to 4% of each type and number of units installed, but not less than one of each type.
 - 7. Heat Detectors or Sensors: Furnish quantity equal to 4% of each type and number of units installed but not less than one of each type.
 - 8. Smoke Detectors or Sensors: Furnish quantity equal to 6 % of each type and number of units installed but not less than one of each type.

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9. Sensor Bases: Furnish quantity equal to 6 % of the number of units of each type installed but not less than one of each type.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANEL (FACP)

- A. General: Comply with UL 864, "Control Units and Accessories for Fire Alarm Systems".
- B. The following FACP hardware shall be provided:
 1. Power Limited base panel with beige cabinet and door, 120 VAC, 60 HZ input power.
 2. 2000 Addressable point capacity inclusive of inputs and outputs in any combination.
 3. 2000 points of annunciation where one (1) point of annunciation equals:
 - a. 1 LED output or 1 switch input on a graphic driver module.
 - b. 1 LED on panel or 1 switch on panel.
 4. LED Annunciator in compliance with NCDOT requirements.
 5. Three (4) Class B, Style Y Notification Appliance Circuits (NAC; rated 2.5A @ 24VDC, resistive).
 6. One form "C" Auxiliary Output Circuits (rated 2A @ 24VDC, resistive); operation is programmable for trouble, alarm, supervisory or other selective control operations. Provide capability for switching up to ½ A @ 120VAC, inductive loads.
 7. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.
 8. The FACP shall support six (6) RS-232-C ports.
 9. Supervised serial communication channel for control and monitoring of remotely located LCD annunciators and I/O panels.
 10. Network Interface for connection to the existing Simplex campus fire alarm system network.
 11. Programmable DACT for either Common Event Reporting or per Point Reporting.
- C. Cabinet: Lockable steel enclosure. Arrange panel so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single panel is required to form a complete control panel, provide exactly matching modular panel enclosures.
- D. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.
- E. Voice Alarm: Provide an emergency communication system, integral with the FACP, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:
 1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface. Each amplifier shall be capable of performing constant supervision for non-alarm audio functions such as background music and general paging.
 2. Dual alarm channels permit simultaneous transmission of different announcements to different zones or floors automatically or by use of the central control microphone. All announcements are made over dedicated, supervised communication lines. All risers shall support Class A wiring for each audio channel.
 3. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone and up to 5 remote microphones.

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- F. Distributed Module Operation: FACP shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 7 (Class A) supervised serial communications channel (SLC):
1. Amplifiers, voice and telephone control circuits
 2. Addressable Signaling Line Circuits
 3. Initiating Device Circuits
 4. Notification Appliance Circuits
 5. Auxiliary Control Circuits
 6. Graphic Annunciator LED/Switch Control Modules

2.2 NETWORK FIRE ALARM CONTROL PANEL (NODE)

- A. Network fire alarm control panels shall include all features as described in this specification for stand-alone FACPs and shall have network communication capabilities as described herein.
1. All points monitored and controlled by a single node shall be capable of being programmed as "Public". Each point made public to the network may be programmed to be operated by any other node connected to the network.
 2. Network communications shall be capable of supporting "point lists" that can be handled as though they were a single point.
- B. The network shall provide a means to log into any node on the system via a laptop computer or CRT/Keyboard and have complete network access (Set Host) for diagnostics, maintenance reporting, and information gathering of all nodes in the system. Systems not meeting this requirement must provide all diagnostic tools required to support this function from selected points on the network. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
- C. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download.
- D. Network communication:
1. Network node communication shall be through a token ring, hub, or star topology configuration, or combination thereof.
 2. A single open, ground or short on the network communication loop shall not degrade network communications. Token shall be passed in opposite direction to maintain communications throughout all network nodes. At the same time the status of the communication link shall be reported.
 3. If a group of nodes becomes isolated from the rest of the network due to multiple fault conditions, that group shall automatically form a sub-network with all common interaction of monitoring and control remaining intact. The network shall be notified with the exact details of the lost communications.
 4. Fiber optics communication between buildings shall be provided via a fiber optics communication. Fiber optics communication shall multiplex digital communication via full duplex transmission over a fiber optic cable.
 5. The communication method shall be NFPA 72 style 7.

2.3 REMOTE MAINTENANCE TERMINAL (CRT) AND PRINTERS

- A. Fire Alarm Control Panel shall be capable of operating a remote maintenance terminal and/or printers; output shall be ASCII from an RS-232-C connection with an adjustable baud rate.
- B. The FACP shall be capable of supporting and supervising as many as two (2) printers, or one (1) maintenance terminal and one (1) printer.

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2.4 REMOTE LCD ANNUNCIATOR

- A. Provide Remote Annunciator(s) as required with the same "look and feel" as the FACP operator interface. The Remote LCD Annunciator shall use the same Primary Acknowledge, Silence, and Reset Keys, Status LEDs and LCD Display as the FACP.
- B. Annunciator shall have super-twist LCD display with two lines of 40 characters each. Annunciator shall be provided with three (3) programmable LEDs (two selectable as red or yellow; one selectable as green or yellow).
- C. Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.
- D. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
- E. The LCD shall display the following information relative to the abnormal condition of a point in the system:
- F. 40 character custom location label.
- G. Type of device (e.g., smoke, pull station, waterflow).
- H. Point status (e.g., alarm, trouble).
- I. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge, Silence and Reset operation shall be the same as the FACP.

2.5 EMERGENCY POWER SUPPLY

- A. General: Components include battery, charger, and an automatic transfer switch.
- B. Battery: Sealed lead-acid type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all notification appliances in alarm or supervisory mode for a period of 15 minutes. If system is connected to a remote supervising station or central supervising station for monitoring, provide battery capacity for 60 hours of standby with 15 minutes of alarm operation.

2.6 ADDRESSABLE MANUAL PULL STATIONS

- A. Description: Addressable double -action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.
- B. Protective Shield: Where required, as indicated on the drawings, provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations.

2.7 SMOKE SENSORS

- A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
 - 1. Factory Nameplate: Serial number and type identification.
 - 2. Operating Voltage: 24 VDC, nominal.
 - 3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
 - 4. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall

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provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.

5. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
 6. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
 7. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
 8. The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI.
 9. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
 10. Removal of the sensor head for cleaning shall not require the setting of addresses.
- B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type.
- C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.
- D. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.
1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.
 2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
 3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
 4. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
 5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
 6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
 7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
 8. Each duct smoke sensor shall have a Remote Test Station with an alarm LED and test switch.
 9. Where indicated provide a NEMA 4X weatherproof duct housing enclosure that shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

2.8 HEAT SENSORS

- A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
- B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.

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- C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
- D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

2.9 ADDRESSABLE CIRCUIT INTERFACE MODULES

- A. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems.
- B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.
- C. There shall be the following types of modules:
 - 1. Type 1: Monitor Circuit Interface Module:
 - a. For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
 - b. For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
 - 2. Type 2: Line Powered Monitor Circuit Interface Module
 - a. This type of module is an individually addressable module that has both its power and its communications supplied by the two wire signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
 - 3. Type 3: Line Powered Control Circuit Interface Module
 - a. This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.
- D. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.10 VOICE ALARM NOTIFICATION APPLIANCES

- A. Speaker: Speaker notification appliances shall be listed to UL 1480.
 - 1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted, shielded wire.
 - 2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
 - 3. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12 kHz for General Signaling.
 - 4. The S/V installs directly to a 4" square, 1 ½" deep electrical box with 1 ½" extension.

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- B. Visible/Only: Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 30cd, 75cd and 110cd. Provide an indicator inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.
- C. Speaker/Visible: Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480.
 - 1. Twisted/shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC.
 - 2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
 - 3. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12 kHz for General Signaling.
 - 4. The S/V installs directly to a 4" square, 1 ½" deep electrical box with 1 ½" extension.
- D. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with a Temporal Code Pattern operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.
- E. Accessories: The contractor shall furnish any necessary accessories.

2.11 NAC Power Extender

- A. The IDNet NAC Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be Class B, Style Y rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.
- B. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18 Ah batteries mounted in an external cabinet.
- C. The NAC extender panel may be mounted close to the host control panel or can be remotely located. The IDNET Addressable NAC Extender Panel when connected to an addressable panel shall connect to the host panel via an IDNet communications channel. Via the IDNET channel each output NAC can be individually controlled for general alarm or selective area notification.
- D. For IDNet connected NAC extender panels up to five panels can be connected on a single IDNet channel.
- E. Alarms from the host fire alarm control panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.
- B. Installation to utilize a complete conduit system in compliance with NCDOT requirements. Open cable installation is not permitted.

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- C. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
 - 1. Factory trained and certified personnel.
 - 2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
 - 3. Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.
- B. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.
- C. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.
- D. Install manual station with operating handle 48 inches (1.22 meters) above floor. Install wall mounted audible and visual notification appliances not less than 80 inches (2.03 m) above floor to bottom of lens and not greater than 96 inches (2.44 m) above floor to bottom of lens.
- E. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- F. Make conduit and wiring connections to door release devices, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors and other devices as indicated.
- G. Automatic Detector Installation: Conform to NFPA 72.

3.3 PREPARATION

- A. Coordinate work of this Section with other affected work and construction schedule.

3.4 WIRING INSTALLATION

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).
- B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
- C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.
- D. Mount end-of-line device in box with last device or separate box adjacent to last device for Class "B" supervision.

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3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
- B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
 - 1. Factory trained and certified.
 - 2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
 - 3. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
- C. Pre-testing: Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- D. Inspection:
 - 1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
 - 2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- E. Acceptance Operational Tests:
 - 1. Perform operational system tests to verify conformance with specifications:
 - a. Each alarm initiating device installed shall be operationally tested. Each device shall be tested for alarm and trouble conditions. Contractor shall submit a written certification that the Fire Alarm System installation is complete including all punch-list items. Test battery operated emergency power supply. Test emergency power supply to minimum durations specified. Test Supervising Station Signal Transmitter. Coordinate testing with Supervising Station monitoring firm/entity.
 - b. Test each Notification Appliance installed for proper operation. Submit written report indicating sound pressure levels at specified distances.
 - c. Test Fire Alarm Control Panel and Remote Annunciator.
 - 2. Provide minimum 10 days notice of acceptance test performance schedule to Owner, and local Authority Having Jurisdiction.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Use NFPA 72 Forms for documentation.
- H. Final Test, Record of Completion, and Certificate of Occupancy:
 - 1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy. Provide completed NFPA 72 Record of Completion form to Owner and AHJ.

3.6 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound pressure levels and adjusting controls and

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sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.7 TRAINING

- A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
 - 1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintenance of the system. Provide a minimum of 8 hours training.
 - 2. Schedule training with the Owner at least seven days in advance.

SECTION 2
DIVISION 31
EARTHWORK

DIVISION 31 - EARTHWORK

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s contract documents.

PRIMARY GUIDANCE

1.1 Existing Topography:

- A. All new project site plans shall be developed from a new topographical map developed specifically for that project; not from “record document” information or previous project grading plans. Surveys will be conducted by a North Carolina professional land surveyor. Accurate information is essential and “special” conditions such as asbestos, lead paint, underground tank leaks, etc, shall be addressed.

SUBSURFACE EXPLORATION

1.2 Designer Responsibilities:

- A. 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 the UPM and submit a Request for Proposals for soils exploration. UPM will provide names of pre-qualified testing companies. This will include investigative work and surveyor reports, laboratory tests (incl. test borings), soil analysis (incl. 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 six copies of the site exploration report to the University.
 - 1. Information To Be Included In Contract Documents:
 - a. 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 used or abandoned. Facilities Management will assist with identifying existing conditions and will provide drawings as available. Clearly indicate the project boundary.

SECTION 31 1000 – SITE CLEARANCE

PART 1 - EXECUTION

1.1 Clearing:

- A. Organic material scheduled for demolition shall be stripped. Contractor will provide option to the UPM for the re-use of this material. Debris not wanted by the university shall be promptly removed from University property.

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SECTION 31 2000 – EARTHWORK

PART 1 - GENERAL

1.1 ALLOWANCES

- A. Rock removal allowances shall be realistic estimates based on the subsurface exploration data. Designer is responsible for coordinating the number and locations of soil borings with the UPM to ensure sufficient geotechnical data is available (see Appendix).

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXCAVATION FOR STRUCTURES

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

3.2 BACKFILL

- A. Backfill material shall be free of debris.
- B. 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.
- C. Under lawn and planting areas not adjacent to structures: The upper one foot of soil below finish grade – 90% maximum. Remainder – 95%.

3.3 GRADING

- A. Maintain existing grade inside drip line of trees to be saved. Do not allow open excavations adjacent to trees for longer than two days to prevent soil moisture reduction.
- B. Finish Grading:
 - 1. Slopes shall be flat 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.

3.4 COMPACTION

- A. 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 analysis shall be performed by a qualified independent laboratory (conforming to ASTM standards), under the supervision of a registered professional engineer specializing in geotechnical engineering. Soils proposed for fill, backfill, and embankments shall be analyzed by the geotechnical engineer to determine acceptability; no soil shall be placed until approved by the geotechnical engineer. A representative of the testing laboratory shall provide inspection during placement and compaction operations; tests shall be made in quantity that will assure uniform compaction and density of each course or lift of fill.

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2. Outside of 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.

3.5 FIELD QUALITY CONTROL

- A. The University solicits proposals for the testing laboratory. The designer will provide the UPM with a scope of services for the Materials testing contract. Note that this construction materials testing program is different from the soils exploration program.

SECTION 31 6000 – PILE FOUNDATIONS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Before a decision 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.
- B. 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.

SECTION 2
DIVISION 31
EARTH MOVING – APPENDIX

DIVISION 31 – EARTH MOVING APPENDIX

SECTION 31 2000 – EARTH MOVING

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 following:
 - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses and exterior plants.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage course for slabs-on-grade.
 - 4. Subbase course for concrete walks and pavements.
 - 5. Subbase and base course for asphalt paving.
- B. Related Sections include the following:
 - 1. Division 1 Section "Allowances" for quantity allowance provisions related to unit-price rock excavation and authorized additional excavation.
 - 2. Division 1 Section "Unit Prices" for unit-price rock excavation and authorized additional excavation provisions.
 - 3. Division 1 Section "01040 – Control of Blasting Operations" for additional blasting requirements.
 - 4. Division 2 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping topsoil, and removal of above- and below-grade improvements and utilities.
 - 5. Division 2 Section "Sub-drainage" for drainage of foundations, slabs-on-grade, walls and landscaped areas.
 - 6. Divisions 2, 15, and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.3 UNIT PRICES

- A. Unit prices for earthwork are included in Division 1 Section "Unit Prices."
- B. The following prices shown include measurement by cross section, contractor shall employ a land surveyor, registered in the State of North Carolina, acceptable to the Designer and University, to measure and seal all cross section calculations.
 - 1. General mass site rock disposed of offsite. Measurement shall be by cross section prior to excavation. Unit prices shall include time, labor, transportation, all offsite disposal costs, and measurement.
 - 2. Also included is replacement of qualified rock volume with equal volume of imported structural fill, which will include purchase, transportation, placement and compaction.
 - 3. Utility trench rock or pit rock used or disposed of off site. Measurement shall be by cross section of excavation. Unit price shall include removal, transportation, offsite disposal, and measurement. Also included is replacement of qualified rock volume with equal

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volume of imported structural fill, which will include purchase, transportation, placement and compaction.

4. Removal and offsite disposal of unsuitable soil. Measure shall be by cross section of excavation. Unit price shall include removal, transportation, all offsite disposal costs, and measurement. Also included is replacement of qualified rock volume with equal volume of imported structural fill, which will include purchase, transportation, placement and compaction.
 5. Import structural soil: Measurement shall be by cross section of excavation. Unit price shall include purchase, transportation, placement, compaction and measurement.
- C. Basis of Measurement: The quantity of undercut and rock excavation shall be the number of cubic yards of rock or unsuitable material, authorized by the Geotech Engineer to be removed, measured in its original position by a land surveyor, registered in the State of North Carolina. Surveyor shall calculate actual rock quantities.
- D. Basis of Payment: Payment shall be made at the contract unit price per cubic yard. This price shall be full compensation for all materials, equipment, labor, tools and incidentals necessary to complete the item regardless of the depth encountered, only the material authorized by Geotech Engineer and Architect shall be paid for. The price includes disposal of unsuitable material off of job site. Material used to replace rock or “undercut” areas shall be obtained from approved off site borrow source or suitable on site material. Also, see 5 sketches at the end of this section describe conditions for rock payment.

1.4 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.
 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Difficult Excavation/Weathered Rock: Material that has a density of between 100 and 200 blows per foot. This material can be excavated by a D-9 Dozer with a single or double shank ripper though production will be slow. Difficult excavation/weathered rock can be anticipated and shall be accomplished within the base bid. No unit price will be established and no additional cost will be allowed.
- I. Mass rock excavation consists of the removal and satisfactory disposal off site per applicable unit price of bedrock, rock in lenses, or boulders 1 cubic yard or larger composed of hard

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granite or similar material requiring the use of rock drills and specialized equipment for removal, and that is measured, in place, prior to removal. In the event rock as defined above is encountered, the contractor shall immediately notify the Geotech Engineer and the Architect. If requested, the contractor shall demonstrate that material cannot be removed by ripping with a D-9 dozer or equal equipped with a single tooth ripper or a crawler tractor rated at a penetration force of 34,000 pounds, with a pry out force of 72,000 pounds, pulling a single-tooth ripper, with ripping performed in a crisscross pattern or against the natural bedding plane. The Contractor may be required to provide equipment specification data verifying the above minimum-rated equipment will be used for demonstration purposes. The equipment is to be in good repair and in proper working condition.

1. If rock is encountered, the contract sum shall be adjusted in accordance with the unit prices submitted by the contractor after the attached Rock Excavation Approval Form is completed.
2. Upon encountering rock, the contractor shall remove all overburden from the material and notify the Geotech Engineer and Architect that the material is ready for measurement. The Geotech Engineer will then determine if the material is qualified rock, 48 hours, excluding weekends and holidays, after receipt of contractor's notice. Once the material is judged as qualified rock, the contractor's registered land surveyor shall survey, by cross section, the rock in place and submit the cross sections and calculations to the architect and geotechnical engineer for approval. All parties must agree, and confirm quantities, evidenced by their signature on the "rock excavation approval form," prior to removal of rock.
3. Any material moved or removed without the measurement and approval will be considered as earth excavation. The Geotech Engineer, with concurrence from the Architect, shall be the final judge on what is to be classified as rock excavation.
4. Limit of payment shall be from top of rock to 6 inches below subgrade, as indicated on rock removal conditions 1-5 attached.

J. Trench rock excavation consists of the removal and satisfactory disposal off site of material composed of hard granite or similar material in trenches less than 10 feet wide that **cannot** be effectively removed using a 125-hp excavator with a pull of 36,500 pounds at the rate of 6 inches per 10 minutes or more or a backhoe equipped with a minimum ½ cubic yard heavy-duty trenching bucket placed on a machine capable of a lifting capacity of 7,500 pounds at a trench depth of 10 feet at the rate of 6 inches per 10 minutes or more, and that is measured, in place, prior to removal. In the event rock as defined above is encountered, the contractor shall immediately notify the soils engineer. The Contractor may be required to provide equipment specification data verifying that the above minimum-rated equipment will be used for demonstration purposes. The equipment is to be in good repair and in proper working conditions.

1. If trench rock is encountered, the contract sum shall be adjusted in accordance with the unit prices submitted by the contractor after the attached Rock Excavation Approval Form is completed.
2. Any material moved or removed without the measurement and approval will be considered as earth excavation. The Geotech Engineer, with concurrence from the Architect, shall be the final judge on what is to be classified as rock excavation.
3. Upon encountering rock, the contractor shall remove all overburden from the material and notify the Geotech Engineer and Architect that the material is ready for measurement. The Geotech Engineer will then determine if the material is qualified rock, 48 hours, excluding weekends and holidays, after receipt of contractor's notice. Once the material is judged as qualified rock, the contractor's registered land surveyor shall survey, by cross section, the rock in place and submit the cross sections and calculations to the architect and geotechnical engineer for approval. All parties must agree, and confirm quantities, evidenced by their signature on the "rock excavation approval form," prior to removal of rock.

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4. The trench rock payment limit shall generally be the diameter of the pipe plus 2 feet, by the depth of the pipe plus 6 inches, as indicated on attached rock removal conditions 1-5.
 5. For rock excavation, a trench shall be defined as a linear excavation that is 5 feet or less in width and 2 feet or greater in depth. All other rock excavation shall be considered general mass rock excavation.
 6. Trenches that are located within the limits of mass rock removal shall be classified as mass rock.
- K. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- L. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- M. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- N. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

- A. Product Data: For the following:
1. Each type of plastic warning tape.
 2. Geotextile.
- B. Samples: 12-by-12-inch samples of subdrainage geotextile.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
 2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.

1.6 QUALITY ASSURANCE

- 1.7 Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Quality Requirements."
- A. Dirt, Concrete, asphalt and rock removed as a result of earthmoving projects are not to be sent to a landfill and should either be reused on site or should be sent to a reclamation facility for screening and re-use.

1.8 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
1. Notify Architect not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's written permission.
 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

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PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, AND PT or combination of these group symbols. Suitable of soils shall be determined by onsite Geotechnical Engineer. Unsuitable soil shall be so classified by structure, content, unit weight less than 90 lbs., plastic soils, etc. Soils too wet or too dry will not be considered unsuitable if useable at optimum moisture. Unsuitable soil is only defined below subgrade elevations.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- K. Backfill and Fill: Satisfactory soil materials.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 - 4. Tear Strength: 56 lbf; ASTM D 4533.
 - 5. Puncture Strength: 56 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: No. 40 No. 60 No. 70 sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.5 per second, minimum; ASTM D 4491.

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8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 1. Survivability: Class 2; AASHTO M 288.
 2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
 3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
 4. Tear Strength: 90 lbf; ASTM D 4533.
 5. Puncture Strength: 90 lbf; ASTM D 4833.
 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

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1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system specified in Division 2 Section “Dewatering” to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to project site or using explosives on project site.
1. Do not damage adjacent structures, property, or site improvements or weaken the bearing capacity of rock subgrade when using explosives.
 2. Use of explosives shall be permitted only after submittal of an approved blasting plan and only as required to remove rock.
 3. Coordinate with university construction manager for owner approval and notices to the campus community.

3.4 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified by the Geotech Engineer, cross sectioned by the registered Land Surveyor, and reviewed by the Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.
1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 2. Rock excavation includes removal and disposal of rock.
 - a. Do not excavate rock until it has been classified by the Geotech Engineer, cross sectioned by the Surveyor, and reviewed by the Architect..

3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- B. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.

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1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
 - B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: 12 inches each side of pipe or conduit.
 - C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 1. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 2. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
 - D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- 3.8 SUBGRADE INSPECTION
- A. Notify Architect when excavations have reached required subgrade.
 - B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - C. Proof-roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
 - D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 - E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.
- 3.9 UNAUTHORIZED EXCAVATION
- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.
- 3.10 STORAGE OF SOIL MATERIALS
- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

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1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 1. Construction below finish grade including, where applicable, sub-drainage, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.
- C. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- D. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- E. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 1. Under grass and planted areas, use satisfactory soil material.
 2. Under walks and pavements, use satisfactory soil material.
 3. Under steps and ramps, use engineered fill.
 4. Under building slabs, use engineered fill.
 5. Under footings and foundations, use engineered fill.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 % of optimum moisture content.
 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2% and is too wet to compact to specified dry unit weight.

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3.15 **COMPACTION OF SOIL BACKFILLS AND FILLS**

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent. Additionally, under all site pavements and floor slabs, upper 18" of subgrade to be compacted to 100%. Under heavy duty asphalt pavements, upper 24" of subgrade to be compacted to 100%.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at [95] percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

3.16 **GRADING**

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 **SUBSURFACE DRAINAGE**

- A. Sub-drainage Pipe: Specified in Division 2 Section "Sub-drainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of sub-drainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support sub-drainage pipe. Encase sub-drainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 95% of maximum dry unit weight according to ASTM D 698.
 - 2. Place and compact impervious fill over drainage backfill in 6 inch thick compacted layers to final subgrade.

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3.18 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 - 1. Place base course material over subbase course under hot-mix asphalt pavement.
 - 2. Shape subbase and base course to required crown elevations and cross-slope grades.
 - 3. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 - 4. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698, ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 - 1. Place drainage course 6 inches or less in compacted thickness in a single layer.
 - 2. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 4000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

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- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and re-compact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

SECTION 2
DIVISION 32
EXTERIOR IMPROVEMENTS

DIVISION 32 – EXTERIOR IMPROVEMENTS

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s contract documents.

STANDARD SPECIFICATIONS AND GUIDELINES

1.1 GENERAL GUIDELINES

- A. All material furnished by the contractor to be installed on the project shall conform to the minimum requirements of the latest revisions in effect on the date of the Standard Specifications published by the described organizations, unless other requirements are stated in these Specifications.

1.2 STANDARDS

- A. The Standard Specifications as listed below, or the latest revisions thereof, shall govern all of the work on this project, except as where amended in the UNC- Charlotte Landscape Construction Standards.
- B. Standard Specifications for Roads and Structures, North Carolina Department of Transportation, July 1995 Edition or most recent edition.
- C. North Carolina Erosion and Sediment Control Planning and Design Manual (NCDENR)
- D. American National Standards Institute Safety Standards for Pruning, Trimming, Repairing, Maintaining, Removing Trees and Cutting Brush
- E. American Standards For Nursery Stock, 1990 Edition. American Association of Nurserymen, Inc. (ANSI 260.1 – 1990)
- F. Tree and Shrub Transplanting Manual, 1981 Edition. International Society of Arboriculture
- G. Standardized Plant Names, Second Edition, 1942. American Joint Committee on Horticultural Nomenclature.
- H. Guide for Establishing Values of Trees and Other Plants, International Society of Arboriculture, Revision IV, June 1979.
- I. National Arborist Association Standard, 1988 Edition.
- J. American Wood Preservers Association Standards
- K. Chapter 21 of City Code entitled Trees and Administrative Guidelines
- L. City of Charlotte Soil Erosion Control Ordinance
- M. American National Standards Institute A300 for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices
- N. Crop Fertilization Based on NC Soil Tests; NCDA

1.3 ADDITIONAL STANDARDS

- A. Other standard specifications may be combined with those listed above under a single caption whenever referred to in the Specifications as follows:
 - 1. AAN - American Association of Nurserymen
 - 2. AASHTO - American Association of State Highway and Transportation Officials
 - 3. AIA - American Institute of Architects

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4. ANSI - American National Standards Institute, Inc.
5. ASLA - American Society of Landscape Architects
6. ASTM - American Society of Testing and Materials
7. AWWA - American Water Works Association
8. AWPA - American Wood Preserver's Association
9. CMLDS – Charlotte Mecklenburg Land Development Standards Manual
10. FSS - Federal Specifications and Standards, General Services Administration
11. GS - General Statutes of North Carolina
12. ISA - International Society of Arboriculture
13. NAA - National Arborist Association
14. SPIB - Southern Pine Inspection Bureau
15. TCIA – Tree Care Industry Association
16. UL - Underwriters' Laboratories

DEFINITION OF TERMS:

1.1 USAGE

- A. Whenever the following terms are used in the Standard Specifications, in any of the contract documents, or in the plans, the intended meaning of such terms shall be as follows:
1. "Owner" or "Engineering Department" shall be replaced by the words "University of North Carolina at Charlotte"
 2. "Engineer" or "Resident Engineer" shall be replaced by the words "Landscape Architect (University), and/or Grounds Superintendent and/or Project Coordinator or their duly authorized representative."

The following definitions will apply:

1. Anti-desiccant: Material applied to plant surfaces for retarding excessive loss of plant moisture and inhibiting wilt. It shall be an approved emulsion, which will provide a film over plant surfaces permeable enough to permit transpiration.
1. Branch Collar: Wood tissue that forms around the base of a branch between the main stem and the branch. Usually, as a branch begins to die, the branch collar begins to increase in size.
2. Caliper: Diameter of a tree six inches (6") above the ground for trees less than four inches (4") and twelve inches (12") above the ground for trees greater than four inches (4") in diameter.
3. Cambium Layer: Growing point between the bark and sapwood.
4. Closure: Refers to the roll of the wound wood growth around the wounded area.
5. Critical Root Zone (CRZ): Area of undisturbed ground, which contains sufficient roots to preserve a tree's health. Determined by calculating the area with a radius in feet equal to one foot in length for each one inch of trunk diameter measured at Breast Height (4.5 feet above grade). When an area of ground cannot be protected in a circle of this radius, the CRZ area may be defined as an asymmetrical shape of the same size.
6. Cut, The: The exposed wood area that remains after the branch has been removed.
7. Cut Back: Specified reduction of the overall size of the tree or individual branches, but may include the overall reduction of the sides as well as the top of the tree.
8. D.B.H.: Diameter of a tree four and a half feet (4 ½') above the average ground line.
9. Dormant: A condition of non-active growth. Deciduous trees are considered to be dormant from the time the leaves fall until new foliage begins to appear.
10. Elevating: The removal of lower branches for under-clearance.
11. Existing Soils: A naturally occurring soil that has not been relocated or was present on site before construction. Shall be natural, fertile, agricultural topsoil, capable of sustaining vigorous plant growth.

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12. Girdling Roots: Located above or below ground level; circular growth around the base of the trunk or over the individual roots applies pressure to the bark area, thereby choking or restricting the flow of sap.
13. Heading Back: The cutting back of terminals of a temporary limb or branch to a lateral branch or bud to slow its growth, while allowing it to produce food resources for the tree. This is a common nursery practice.
14. Lifting: The removal of lower branches for under-clearance or sight line issues.
15. Parent Stem: The main trunk system of the tree.
16. Planting Medium/Mix, Acceptable: A soil mix developed by amending the existing soil or removing the existing soil and replacing with new soil mix (as defined in Section #_____ SOILS). Soil mix shall be of uniform composition throughout, with admixture of subsoil. It shall be free of stones, lumps, live plants and their roots, sticks, and other extraneous matter.
17. Precut or Pre-cutting: The removal of the branch at least 6” beyond the finished cut to prevent splitting into parent stem or branch.
18. Pruning: The removal of dead, dying, diseased, or live, interfering objectionable and weak branches in a scientific manner.
19. Sap Flow: The definite course assumed by sap in its movement through a tree.
20. Scars or Injuries: Natural or man-made lesions of the bark in which wood is exposed.
21. Small Tree: May be a small maturing (less than 35’ at maturity) or large maturing tree (more than 35’ at maturity). This can be either a single trunk or multiple trunk specimens. Limbing needs will be determined by Grounds Superintendent or designee.
22. Suckers: Abnormal growth of small branches usually not following the general pattern of the tree.
23. Temporary Limb: A limb left on a small tree to provide for tree growth until permanent scaffold limbs and adequate top limbs are developed. If large, they are headed back to prevent their challenging the desired terminal for dominance.
24. Thinning Out: The removal of live branches to reduce wind resistance and to create more space.
25. Top Soil: Native soil on site or natural soil harvested from another site than naturally has the texture and composition to meet the specification described under “Soil section #_____, and is free of noxious weed seed, shall constitute an Acceptable Planting Media (APM).
26. Topping: Any pruning practice that results in more than one-third of the foliage and limbs being removed. This includes pruning that leads to the disfigurement of the normal shape of the tree.
27. Tracing: Careful cutting of the bark along the lines of sap flow to encourage wound closure.
28. Tree Training: Pruning young trees in a specified manner to shape their growth in keeping with their genetically determined natural form and the urban requirements immediately surrounding them.
29. Trimming: The same as pruning.
30. Water Breaker: A hose end device used to diffuse a stream of water.
31. Wound Wood: New growth made by the cambium layer around all of a wound.

PLANS

1.2 MINIMUM REQUIREMENT

- A. All newly prepared site plans must show the following:
- B. General Information (to be shown on all plans):
 1. Title block with site name and address
 2. Scale
 3. Vicinity Map
 4. North arrow
 5. Street R/W line(s)

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6. Property lines
7. Setback/side yard lines(s)
8. Clearly distinguish between existing and proposed conditions (i.e., contours, structures, etc.)
9. Survey of existing trees (size and species)
 - a. If trees are to be preserved, show tree protection fencing with dimensions from tree(s)
 - b. Tree preservation notes on grading and erosion control plans
 - c. Existing and proposed overhead and underground utilities
 - d. Existing and proposed irrigation systems
10. Planting Material & Plant Index or legend. Include all plant materials including turf, sod, seeding, etc.
11. Distinguish between areas receiving topsoil, planting mix, etc.
12. Listing of:
 - a. Designer
 - b. Contact Person
 - c. Address
 - d. Telephone Number
 - e. Fax Number

1.3 EROSION CONTROL:

- A. Proposed erosion control measures.
- B. Denuded limits delineated.
- C. Denuded acreage listed.
- D. Denuded drainage areas (on and off-site)

1.4 Landscaping Requirement:

- A. Electrical Lines-distribution or transmission lines and poles present
- B. Provide staking plan or dimension key landscape areas
- C. Show and label proposed trees (small or large maturing to be planted), shrubs, ground covers, and/or grass and any other plantings and landscape materials (mulches, hardscapes, etc.) etc.
- D. Landscape notes

SECTION 32 1216 – PAVING

PART 1 - GENERAL

1.1 SUMMARY

This is a pedestrian oriented campus and, as such, designs should be prepared with pedestrian traffic (including those with mobility impairments) as the highest priority. All sidewalks associated with new building construction shall be brick. Asphalt is generally not acceptable in developed areas.

PART 2 - PRODUCTS

2.1 AUXILIARY MATERIALS

- A. Curbs And Gutters: Cast-in-place concrete shall be used unless other design is required to match existing conditions.
 1. Expansion joints shall be specified and shown on the drawings.

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- B. All Asphalt scraps from paving or repair projects are to be recycled.

PART 3 - EXECUTION

3.1 ASPHALT INSTALLATION

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

3.2 ASPHALT REPAIR

Repairs of asphalt paving: 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.

3.3 ASPHALT CURBS

Curbs shall pitch to catch or release water as required by adjacent paving grades.

3.4 PAVEMENT MARKING

Parking Lots Markings Spacing: All parking layout designs shall utilize dimensional requirements, (See Annex F, attached herewith). All parking spaces shall be marked with double lines per University standards.

SECTION 32 1313 – CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

This is a pedestrian oriented campus and, as such, designs should be prepared with pedestrian traffic (including those with mobility impairments) as the highest priority. All sidewalks associated with new building construction shall be brick. The University mandates brick sidewalks in the following sectors: Charlotte Research Institute, Academic Core, and Chancellor/ Alumni. In other sectors, where the budget is limited, poured concrete with troweled joints, or a combination of concrete and brick may be acceptable. All sidewalk design, including coordination with street fixtures and furniture (lighting, trees, landscaping, benches, seat walls, bike racks, bollards, etc.) will necessitate coordination with the Facilities Landscape Architect.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

- A. Unless specified otherwise on drawings, all reinforcing steel shall be ASTM A-615, Grade 60 and shall be fabricated and placed in accordance with ACI 301. All continuous rebar reinforcing shall be lapped as shown on the drawings.
- B. If wire fabric is required, it shall be welded cold-drawn steel wire fabric, ASTM A-185.

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2.2 CONCRETE

- A. Air entraining admixture is required, with a minimum of 4%. THE CONTRACTOR SHALL PROVIDE THE DESIGNATED REPRESENTATIVE ALL DELIVERY TICKETS WHICH SHALL VERIFY THE ABOVE REQUIREMENTS.
- B. Curing compound shall be "Clean Bond" by Guardian Chemical Company; Sealkure by Toch Brothers, Inc; or Klearseal by Penn-Dixie. (See Annex F)

2.3 ACCESSORIES

- A. Expansion joint material shall be asphalt impregnated fiber board, manufactured explicitly for such use and shall comply with NCDOT Specification 420-12(c). Black "house sheathing" material is not acceptable.
- B. All concrete scraps from paving or repair projects are to be recycled.

SECTION 32 1400 – UNIT PAVERS

PART 1 - GENERAL

1.1 SUMMARY

This is a pedestrian oriented campus and, as such, designs should be prepared with pedestrian traffic (including those with mobility impairments) as the highest priority. All sidewalks associated with new building construction shall be brick. The University Facilities Master Plan gives priority to brick sidewalks in existing areas of campus, especially in high-traffic, high visibility locations. The University mandates brick sidewalks in the following sectors: Charlotte Research Institute, Academic Core, and Chancellor/ Alumni. In other sectors, where the budget is limited, poured concrete with troweled joints, or a combination of concrete and brick may be acceptable. All sidewalk design, including coordination with street fixtures and furniture (lighting, trees, landscaping, benches, seat walls, bike racks, bollards, etc.) will necessitate coordination with the Facilities Landscape Architect.

PART 2 - PRODUCTS

2.1 BRICK PAVERS

- A. Brick Pavers, Unless noted otherwise on the drawings, shall be 2-1/4" x 4" x 8" "English Edge Pavers", repressed lugged, chamfered, Color Red, manufactured by Pinehall Brick Company, P O Box 836, Madison, NC 27025
 - 1. See Annex F, attached herewith.
- B. All brick scrap from paving or repair projects are to be recycled.
- C. Pavers in crosswalk pavers in streets shall be vehicular grade concrete "oaks blend" by Pavestone or approved equal.

2.2 SETTING BED MATERIALS

- A. Fill Material Composition:
 - 1. If soil fill is necessary, all fill material shall be free of organic or foreign material.
 - 2. All fill materials shall be placed in minimum six-inch lifts and shall be compacted to 100% of maximum density by standard proctor (ASTM-D-698).
 - 3. The Owner may elect to test the compacted soil, (testing shall be done at the Owner's expense).

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- B. Felt Underlayment:
 - 1. 30-pound asphalt roofing felt.
- C. Expansion Joint Material:
 - 1. Asphalt impregnated fiber board, manufactured explicitly for such use and shall comply with NCDOT Specification 420-12(c). Black "house sheathing" material is not acceptable.
- D. Sub-Base Material (Setting Bed):
 - 1. Granite screenings as described by NCDOT Specification 1012.1C3.
- E. Mortar Sand to fill the vertical gaps between bricks shall meet the requirements of Standard Specifications for aggregate for Masonry Mortar (ASTM-C-144-81),
- F. Aggregate Base Course:
 - 1. "Type A, Aggregate Base Course" as defined by NCDOT Specification 1010.2. (See Annex F).

SECTION 32 8410 – LANDSCAPE IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

Work Included in this Section:

The work of this section shall consist of providing and installing the underground sprinkler system as specified on the drawings and as specified herein.

1.3 MANUFACTURING QUALIFICATIONS:

Provide underground sprinkler system as a complete unit produced by a single manufacturer for all portions of work, including heads, drip lines, valves, piping circuits, controls, and accessories; unless otherwise noted specifically on the drawings.

1.4 SUBMITTALS:

Product Data:

Submit manufacturer's technical data, cut sheets, and installation and maintenance instructions for underground sprinkler system.

1.5 EXISTING CONDITIONS:

Verification of Underground Utilities:

The Contractor shall be responsible for verifying the exact location of all underground utilities prior to any excavation.

1.6 PRESERVATION OF EXISTING TREES:

The Contractor shall comply with the Tree Preservation and Protection Standards.

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PART 2 - PRODUCTS

PVC Pipe and Fittings: Pipe specified shall be virgin high-impact Polyvinyl Chloride (PVC) pipe having a minimum working pressure rating of Class 200 up to and including 1 ¼" and Class 160 or pipe above 1 ¼". All PVC pipe shall be continuously and permanently marked with manufacturer's name, material size, and schedule. Pipe shall conform to US Department of Commerce Commercial Standard CS207-60 or latest revision. Material shall conform to all requirements of Commercial Standard (CS256-63), or latest revisions(s). All fittings to be used on specified PVC pipe shall be Schedule 40 PVC, Type 1, and must be made in the USA. All fittings shall be identified as to pressure rating or schedule.

Solvent for use on PVC pipe and fitting shall be of a type approved by the manufacturer of the pipe. Primer shall be purple primer by the same manufacturer as solvent. Solvent and primer application shall be in accordance to the manufacturer's recommendations. Excessive solvent and primer within and outside of the pipe is unacceptable.

- A. Risers and Swing Joint Nipples: All pipe risers ¾" to 1" shall be non-plasticized polyvinyl chloride, Schedule 80 threaded pipe. Fittings on risers shall be PVC Schedule 80 threaded elbows. If the plan shows a non-PVC riser, compatible fittings to the riser specified shall be used.
- B. Irrigation Valves: Irrigation valves shall be molded valves with 24 volt solenoid as per the Equipment List noted on the drawings. Valves shall be globe type operated by low-voltage solenoids normally closed, manual flow adjustment.
- C. Backflow Preventer: Backflow preventer shall be the responsibility of the Irrigation Contractor. Irrigation point of connection is downstream side of the meter. Backflow preventer shall be installed by a licensed plumber or Irrigation Specialist and shall comply with state and local codes. Backflow preventer selection and installation is to meet or exceed local and state codes, and manufacturer's recommendations.
- D. Meters: Irrigation Specialist shall coordinate with Facilities Management/HVAC Supervisor for the installation of the irrigation meter(s) and shall be responsible for all costs and fees associated. All meters & valves installed in public Right-Of-Way shall be installed below grade. Meter size(s) shall be as indicated on the plan.
- E. Sprinkler Heads: All full and part circle sprinklers shall be of the fixed spray or gear driven variety as is specified on the plans. These sprinklers shall be of the pop-up type with spring retraction. The sprinkler shall be easily serviced from the top. It shall have an accessible screening device and shall perform to the manufacturer's specifications with regard to the diameter of throw and applied volume at a given pressure. Spacing of heads shall not exceed the manufacturer's maximum recommendation. No over spray shall be allowed to encroach on roadways or sidewalks. All pipes crossing under any streets shall be enclosed in a PVC sleeve as noted on plan. Pipe shall be Schedule 80 PVC, Type 1, and must be made in the USA..
- F. Valve Covers, Sleeves, Boxes: Fiberglass or concrete boxes with fiberglass or equal covers capable of withstanding lawn tractor traffic, and as specified in the Equipment List on the drawings. Ametec or approved equal. All systems shall be approved by Grounds Superintendent and installed to prevent unnecessary watering after substantial rainfall.
- G. Drainage Backfill: NCDOT number 78M washed stone.
- H. Automatic Control System: Furnish automatic controller as specified in the Equipment List, including 24 volt timer and all connection devices. Electrical hook-up to the controller shall be by others unless specifically noted otherwise on the plan or Equipment List.
- I. Exterior Control Enclosure: Manufacturer's standard weatherproof enclosure with locking cover, complying with the NFPA 70 (National Electric Code) and according to the Equipment List shown on the Drawings.
- J. Control Lines Hydraulic: All control tubing shall be polyethylene tubing. All control tubing shall be rated for a minimum continuous working pressure of 200 psi and have a ¼" O.D. + .003". All

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tubing connections shall be brass compression couplings or tees utilized self-aligning brass ferrules, secured by 1/4" plastic retainers.

- K. Electrical Installation: Electric control lines from each controller to the automatic valves shall be direct burial UF wire of a different color than the black and white wires used on the 115 volt A.C. power. All 24 V.A.C. single strand wire shall be a minimum of 14 gauge, direct burial. Where multi-connector wire is used; it shall be a minimum of 18 gauge. Manufacturer's recommendations shall be followed concerning waterproofing all connections. The joining of all underground wires shall be by the use of direct burial splice kits. All Splices shall be waterproof. In all cases wire shall be adequately sized to avoid excessive voltage drop.
- L. Quick Coupling Valves and Keys: Quick coupling valves and keys shall be as specified on the drawings. Mount on galvanized pipe triple swing joints. A minimum of two keys with swivel ell adapters will be given to the Grounds Superintendent. All quick couplings shall be stacked with a 1/4" steel bar and secured with minimum two (2) hose clamps.

PART 3 - EXECUTION

3.1 INSPECTION

Inspection of Work in Progress: The Landscape Architect shall make frequent observations of the Contractor's work while such work is in progress. The Landscape Architect/Project Coordinator shall bring to the attention of the Contractor any work which does not meet the specifications of the contract and the Contractor shall correct such work as brought to his attention

3.2 STAKING OF SPRINKLER LOCATIONS

- A. Staking of sprinkler locations shall be done by the Contractor and approved by the PM/Engineer. Location shall be according to plans provided with field modifications to adjust to local conditions and actual plant locations.

3.3 EXCAVATION

- A. The Contractor shall notify NC ONECALL at 1-800-632-4949 48 hours prior to beginning trenching. The Contractor shall exercise care to avoid causing damage to any and all underground utilities and structures. The Project Coordinator shall advise the Contractor of any underground utilities or structures of which he is aware; however, it is the Contractor's responsibility to locate and to protect all utilities including irrigation. Any damage to utilities including irrigation shall be corrected and paid for by the Contractor. **Damage must be repaired within forty-eight hours of occurrence.** All excavation shall be unclassified and shall include all materials encountered. The minimum depth of cover for piping 6" and larger shall be 18". The minimum depth of cover for piping less than 6" shall be 12". On existing sodded areas, sod shall be removed, preserved, and replaced to its original state once backfilling is accomplished. Root damage within the critical root zone in violation of specifications will result in monetary damages being assessed based on loss of utility and shortened life of the tree. If trenching is necessitated through existing asphalt roadways, the Contractor shall saw cut asphalt to the width of the trench plus one foot (1') each side prior to trenching unless noted otherwise on the plan. Removal of cut asphalt and replacement of all asphalt shall be the responsibility of the Contractor. Repair will be made with full depth asphalt or as directed by the engineer.
- B. SLEEVES – IRRIGATION

Due to continuing expansion within the University, it has become necessary that a sleeving design become part of all new projects. Sleeves should consist of 2, 4" non-corrugated pipe to

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be placed at least every 250'. For smaller projects, spacing will be every 100' to 150' and determined during plan review. Sleeves should be placed under all new roads and new sidewalks. The sleeving plan should be part of the overall design of the project and be included in the site plan so that any changes made can be made on the as-built for future use. As-builts of sleeves will be made available to the Project Managers, whether through Capital or Design Services. A copy of the 'as-built' will be provided to the Grounds Superintendent. Marking of the end of the sleeves will be made by stubbing-up the end of the sleeve (pipe) at 90 degrees and daylighting to the finish grade and/or by placing a metal post at the end of the sleeve – even with the finished grade. These markings will be noted on the "As-Builts."

3.4 BORING

See Section #_____ – TREE PRESERVATION AND PROTECTION

3.5 BACKFILLING

Backfill material shall be select backfill if existing soils are deemed unacceptable by Grounds Superintendent or designee and/or Irrigation Specialist.

3.6 INSTALLATION OF SYSTEM MAIN

Installation of the system main shall be in accordance with the manufacturer's instructions and shall proceed from the point of connection of supply for the system pumping station, reservoir, water meter, or existing line. All ring type or gasketed pipe shall be thrust blocked at all tees, elbows, and end caps per manufacturer specifications. The main and laterals shall be flushed and pressure tested for 24 hours prior to making any head connection.

3.7 INSTALLATION OF LATERAL LINES

Lateral lines may be installed by standard trenching techniques or by "pulling in" pipe. If the "pull in" method is used, the pipe "plow" shall be a vibratory type and equipped with a turf roller device to prevent tearing of the turf. The Mole or Bullet which precedes the pipe and is used to form the opening for the pipe, shall be not less than 1" larger in diameter than the outside diameter of the pipe. Starting and finishing holes shall not exceed a 2 foot square opening, with the sod removed from such holes to be preserved and replaced. Lateral pipes and fittings shall be installed in accordance with the manufacturer's recommendations, including the snaking-in of the PVC pipe to prevent excessive strain when contracting in cold weather. All lateral lines shall be thoroughly flushed prior to the installation of any automatic valves or sprinkler heads.

3.8 SPRINKLER HEADS

All sprinklers shall be installed on pop-up risers or as shown on the drawings. The sprinkler head shall be installed so that the top is 1/4" above the finished grade level. If finished grade has not been established, the sprinkler will be extended a minimum of 4" above existing level and marked with a stake to prevent damage by equipment. Backfill around the swing joint and sprinkler shall be free of large rocks, roots, or foreign debris. Matched precipitation will be required on all full and part circle sprinklers operating on the same zone. Mount stationary riser sprinklers on three schedule 80 PVC 90 ells FPT x FPT to make up the three elbow swing joint. Mount pop-up sprinklers with an 18" minimum length of 2" polyethylene tubing. Tubing to withstand 400 psi burst test and shall have a wall thickness of 0.1". Fittings for tubing shall be compatible and made by the same manufacturer.

3.9 CONTROL LINES

All control lines shall be installed in a neat and orderly fashion and may be installed either in the main and lateral trenching or in their own separate trench. The lines shall be bundled together

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and taped every 10'. Control line connections shall be as approved in a proceeding section of these specifications. All wire shall be furnished in minimum 2,500 foot reels and spliced only at valve or tee locations. Wire sizing shall be as specified on the plan. The joining of all control wire will be by the use of wire nuts installed in Scotch DBY or DBR or an approved equal direct bury splice per installation instructions provided by manufacturer. A minimum of 18 inches of additional wire shall be looped up at each control valve or head. Control tubing and wire runs shall be installed with enough slack and/or occasional loops to prevent excessive strain due to thermal contraction.

3.10 CONTROL EQUIPMENT

All automatic valves and controllers shall be installed following the recommendations of the manufacturers of said equipment, and more specifically, in accordance with the drawings accompanying the contract. The location of all controllers shall be approved by the Landscape Architect before the actual installation of said controllers.

3.11 QUICK COUPLING VALVES

All quick coupling valves shall be mounted on galvanized pipe triple swing joints.

3.12 VALVE BOXES, DRAINS, ETC

All valve boxes or any other miscellaneous marker or access box shall be installed so the top of said structure is flush with finished grade. Valve boxes shall be installed so that no portion of the box rests directly on any section of the systems piping. Valve boxes shall be installed so that the top of control valves are easily accessible for maintenance. All extensions of valve boxes necessary to reach proper grade shall be made with extensions approved for that particular brand. Any valve box located within the sidewalk shall be concrete.

3.13 MATERIALS:

Flow sensor: Toro IR 220P

Controller: Sentinel Controller

Meter: Rainbird for Neptune T-10 with Tricon/S Register (located upstream of the controller)... ideally we would like the meter installed in the building

Master Valve: standard irrigation valve put in after the backflow

Backflow: sized per project – reduced pressure backflow

3.14 TESTING AND ACCEPTANCE OF SYSTEM

- A. Testing System: Upon completion of the irrigation system and after sufficient time has been allowed for solvent weld joints to cure, the entire system shall be tested for proper operation. All air will be flushed from the system and all components will be checked for proper operation by the Contractor. Balancing and Adjustment: The Contractor shall balance and adjust the various components of the sprinkler system so that overall operation of the system is most efficient. This includes a synchronization of the controllers, adjustments to pressure regulators, pressure relief valves, part circle sprinkler heads, and individual station adjustments on the controllers.
- B. Operational Testing: Perform operational testing after hydrostatic testing, backfill is in place, and sprinkler heads are adjusted to final position. Demonstrate to Landscape Architects representative that the complete system meets coverage requirements and that automatic controls function properly.
- C. Final Grades at Heads: After completion of sodding, planting and mulching and settlement with establishment of the final grades, carefully adjust all irrigation equipment so it will be flush with or not more than ¼" above grade.
- D. Notice of Completion: When the Contractor is satisfied the system is operating properly, and all work and clean-up is completed, then he shall issue the notice of completion to the

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PM/Engineer. The notice of completion shall include the request for final inspection. Final Inspection with Landscape Architect/Grounds Superintendent/Project Coordinator; The Landscape Architect/Grounds Superintendent/Project Coordinator will respond to the notice of completion by the Contractor and shall appear at an agreed upon time for the final inspection. Any inconsistencies to the plans or specifications shall be noted by the Landscape Architect and a written copy of corrections shall be given to the Contractor. Record Plan Acceptance: Acceptance of the system is based on the furnishing, by the Contractor, of a completed record plan, which is acceptable to the Owner and /or the PM/Engineer.

- E. Training of Maintenance Personnel in Operation and Maintenance System: The Contractor's responsibility of training maintenance personnel of the Grounds Department in the operation and maintenance of the system shall not be waived due to acceptance of the system. In addition, the Contractor shall provide the Grounds Department with available parts list, trouble-shooting list, and specification sheet. If this responsibility is not fulfilled, the cost of obtaining the training by the Grounds Superintendent shall be shown as a deduction in the final payment.

3.15 GUARANTEES

The work included under this contract shall be guaranteed by the Contractor against all defects and malfunctions due to faulty workmanship or defective material for a period of one year from the date of final acceptance by the Project Coordinator. Upon being informed by the Project Coordinator of any defects or malfunctions; the Contractor shall affect all necessary repairs and/or replacements in a reasonable expedient manner at no additional cost to the Project Coordinator. Emergency repairs, when necessary, may be made by the Grounds Superintendent without relieving the Contractor of his guarantee obligation. The Contractor shall be obligated to repair any settling of backfilled trenches which may occur during the guarantee period. The Contractor is also obligated to restore any and all damaged plantings, paving, or improvements due to trench settlement or repairs within the year period. If the Contractor does not respond to the Project Coordinator's request for repair work within a period of 5 days, the Project Coordinator may proceed with such necessary repairs and charge the Contractor for all expenses incurred in the repair work.

3.16 RECORD DRAWING

The Contractor shall provide and keep up to date a complete set of record drawings which shall be corrected daily to show changes in sprinkler locations, controller locations, piping locations, pipe sizes, and any deviations from the original irrigation design drawing as provided to him. All isolation valve locations, backflow prevention, water meters, and quick couplers shall be shown with actual measurements to reference points so they may be located easily in the field. Upon completion of the work, the Contractor shall furnish the Grounds Superintendent or designee with two complete sets of record drawings showing the irrigation system as installed.

SECTION 32 8420 – LANDSCAPE GRADING AND DRAINAGE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Related Documents:
1. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

- B. Description of Work:

Work Included in This Section:

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1. Stripping, stockpiling, and redistribution of topsoil, rough grading, rock removal, and excavation of the site.
- C. Related Work Specified Elsewhere:
 1. NCDOT Division 2 – Earthwork
Shrub and Groundcover Planting (Section #____)
Tree Planting (Section #____)
Seeding and Sodding Turfgrass (Section #____)
- D. Existing Conditions:
 1. Contractor shall accept actual conditions at the project site and do work specified without additional compensation for possible variation from grades and conditions shown, whether surface or subsurface. All grading work shall be unclassified except for rock removal as described herein.
- E. Protection:
 1. Benchmarks and Monuments: Maintain carefully all benchmarks, monuments and other reference points. If disturbed or destroyed, replace as directed. If found at variance with the drawings, notify the Project Coordinator before proceeding to lay out work.
 2. Protection of Existing Work Remaining: All existing curbs, sidewalks, driveways and paving damaged in performance of this work shall be restored without additional cost to the Owner in the manner prescribed by authorities having jurisdiction.
 3. Tree Preservation and Protection: During all phases of earthwork and site grading, the Contractor shall comply with Section # _____ Tree Preservation & Protection.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil and Planting Mix: see "Soil" section # _____
- B. Non-woven Filter Fabric: Fabric for wrapping perforated pipe and washed stone shall be the non-woven filter type, Mirafi 140NL, Webtec NO-4, Linq 130 EX, or an approved equal.
- C. Surplus Material: Contractor shall remove unsuitable materials and surplus excavated materials from the site and legally dispose of it.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine the areas and UPM under which earthwork and site grading is to be performed and notify the PM/Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Testing:
 1. Laboratory: The Grounds Department shall employ services of a testing laboratory to perform tests required under this section.
 2. Quality Control Testing During Construction: It is the responsibility of the Contractor to notify the PM/Engineer at appropriate times when Testing is required. Field density tests shall be performed in accordance with ASTM D-698.
 3. Density tests will be provided to Grounds for areas compacted during construction before proceeding with soil work.
- C. Soil Preparation
 1. Soils for all landscaped areas will conform to section # ____ "Soils" for all soil types, either topsoil or planting mix.

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2. Soil Test: A sample of the proposed topsoil or planting mix shall be submitted to the Grounds Superintendent 30 calendar days prior to installation and be approved prior to delivery to the site. Organic matter will be defined as organic/humus such as sawdust or leaf-mold that has completed the decomposition process.
3. Soil preparations for planting areas are divided into four categories depending on the situation.
 - a. Type 1
 - 1) The “Type 1” planting bed preparation is intended for areas in which the existing soil is of sufficient quality that it can be retained and amended to achieve the plant mix specification. Backfill materials/soils cannot meet this criteria and is covered by Type 2.
 - 2) Existing vegetation shall be removed by scraping away the top 3” of existing grade. Subsoil to 12” remove rocks (including gravel) and debris and remove from the site.
 - 3) This material shall be hauled away and disposed of in accordance with the contract provisions.
 - 4) The contractor shall install a sufficient quantity of soil and soil amendments to achieve the desired/specified final grade and soil specification. Soil shall be added in an amount sufficient to account for natural consolidation of the final soil product. Unless otherwise specified, the plant bed shall be graded as follows:
 - a) Roadway medians 2” to 4” above top/curb at center of median
 - b) Sidewalk planting strips-achieve positive drainage from front of walk to back of curb
 - c) All soil amendments shall be mixed thoroughly and completely with the existing soil.
 - 5) All stone and debris is to be removed from the median areas and shoulder of the roadways. No further work (any new material added) is to proceed until this stone and debris is removed. Hand raking is strongly recommended.
 - 6) There is to be no damage to the existing trees or their root systems during this work. All damages will be the responsibility of the contractor to correct or replace at the direction of the Grounds Superintendent or representative. All turf work is to be outside of the mulch ring areas.
 - b. Type 2
 - 1) The “Type 2” planting bed preparation is intended for areas in which the existing soil is to be removed to a depth of 18” and replaced with soil meeting the plant mix specification. This preparation also includes the tilling, loosening, sub-soiling of the material from 18” to 36” deep in order to provide aeration and lessen the compaction. Backfill materials/soils fit into this category and must be removed/replaced.
 - 2) Existing soil shall be removed and disposed of in accordance with the contract provisions. The existing layer of soil between 18” and 36” deep shall be tilled in place and inspected by Grounds Superintendent or designee prior to plant mix/soil being added to reach final grade.
 - 3) The contractor shall install a sufficient quantity of approved plant mix to achieve the desired/specified grade. Soil shall be added in an amount sufficient to account for natural consolidation. Unless otherwise specified, the plant bed shall be graded as follows:
 - a) Roadway medians & Planting beds – crown height in inches shall be equal to median width in feet with a maximum height of 6 inches.
 - b) Roadway plants strips-achieve positive drainage from front of walk to back of curb
 - c) Plant beds in turf areas or around buildings – 6” above surrounding grade at center of bed, 2” above grade at edge of bed.
 - 4) All planting beds and areas to be mulched shall have a 4” V-cut trench installed at the perimeter of the planting bed and adjacent to concrete walks,

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curbing, and grassed areas. The V-cut trench shall form the bed line edge. Trench depth and width shall be consistent and uniform throughout the installation.

- 5) All work shall be achieved from the sides of the planting bed areas. The contractor shall not allow equipment to operate on the loosened soil or plant mix.

c. Type 3

- 1) The "Type 3" planting is intended for individual tree and individual/group Shrub planting where no soil replacement is required unless specified by the Grounds Superintendent or designee.

The tree and shrub planting procedures, including preparation of backfill and planting hole are found under: TREE PLANTING – Section # _____ and SHRUB AND GROUNDCOVER PLANTING Section # _____. For tree installations follow Standard Detail 40.01 "Tree Planting".

d. Type 4

- 1) The "Type 4" planting is intended for individual tree planting in medians and roadside planting strips and shoulders.

The preparation for installation of the trees shall include the tilling of a 10'x10' area centered on the new tree location. The existing soil shall be broken up to a depth of 18" within that 10'x10' area and one cubic yard of composted soil conditioner shall be thoroughly mixed throughout. Soil in the bottom of the tree pit shall be firmly tamped to reduce settling.

D. Drainage:

1. Subsurface drainage shall be installed in all medians where drain lines can be tied into the existing storm drain system. A 4" slotted, corrugated drain pipe shall be installed along each edge of the median in the bottom of the planting area. Drain pipe shall be laid in the specified non-woven geotextile fabric, then covered with a minimum 6" of #57 washed stone, then wrapped with the specified non-woven geotextile fabric. Special care shall be exercised when filling medians with soil so as not to crush or damage the drainage system.

SECTION 01 5635 – PRUNING AND REMOVAL OF EXISTING TREES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK:

WORK INCLUDED IN THIS SECTION:

Provide all supervision, labor, tools, equipment, services and expertise required to perform tree maintenance work as specified herein. Where extent of pruning is not quantified in the construction drawings, bids shall be based on unit prices and extent of pruning will be field determined after the award of contract.

RELATED WORK SPECIFIED ELSEWHERE:

Tree Planting (Section #____)

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Tree Preservation and Protection (Section #____)

Fertilization of Existing Trees (Section #_____)

1.3 QUALITY ASSURANCE:

Bidding on this contract shall be limited to individuals, partnerships and corporations actively engaged in the field of arboriculture. Bidders shall derive a majority of income from arboriculture work. Bidders shall demonstrate competence, experience, and financial capability to carry out the terms of this contract. The University may require proof of these qualifications.

PART 2 - PRODUCTS

2.1 BIDDING:

- A. All bidders must have in their possession or available to them by formal agreement at the time of bidding, trucks, devices, chippers, stump grinders, hand tools, aerial and other equipment and supplies which are necessary to perform the work as outlined in these specifications.
- B. Yard Waste to be mulched (on-site or hauled to a grinding facility) unless diseased or contaminated with chemicals.
- C. Grounds Department may receive chipping materials or other if specifications contrast.

PART 3 - EXECUTION

3.1 SAFETY STANDARDS:

- A. All equipment to be used and all work to be performed must be in full compliance with the most current revision of American National Standards Institute, Standard Z-133.1 (Safety Requirements for Pruning, Trimming, Repairing, Maintaining, and Removing Trees and for Cutting Brush). These standards are made part of this contract by this reference. The Contractor shall be solely responsible for pedestrian and vehicular safety and control within the work site and shall provide the necessary warning devices, barricades, and ground personnel needed to give safety protection, and warning to persons and vehicular traffic within the area.
- B. Cleanup: All debris from tree trimming, tree removal, and stumping operations shall be cleaned up each day before the work crew leaves the site, unless permission is given by the University to do otherwise. All lawn areas shall be raked, all streets and sidewalks shall be swept, and all brush, branches and logs shall be removed from the site. Areas are to be left in a condition equal to that which existed prior to the commencement or arboriculture operations. It shall be the responsibility of the Contractor to remove and to dispose in a proper and acceptable manner all logs, brush, and debris resulting from the tree maintenance operations at no additional cost to the University.
- C. Supervision: This contract will be under the direct supervision of the University or its authorized representatives. Any alterations or modifications of the work performed under this contract shall be made only by written agreement between the Contractor and the University authorized representatives and shall be made prior to commencement of the altered or modified work. No claims for any extra or materials shall be allowed unless covered by written agreement.
- D. Work Crew Supervision: The Contractor shall provide qualified supervision of each crew at all times while working under this contract. Each supervisor shall be authorized by the Contractor to accept and act upon all directives issued by the University. Failure for the supervisor to act on said directives shall be sufficient cause to give notice that the Contractor is in default of the contract unless directives would create potential personal inquiry of safety hazards.
- E. Large Tree Pruning: Cutting back or topping shall not be permitted. Pruning will be done under the supervision of a certified Arborist according to the latest revision of Standards of the

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National Arborist Association for Shade Trees and made a part of these specifications attached. The pruning class requirement will be a Medium Pruning as outlined in these documents except where tree training is prescribed for small trees.

1. Generally, the pruning will consist of primarily a Class II, Medium Pruning, unless specified otherwise; and lifting the lower bottom branches of trees for under-clearance as directed by the University. In some cases there is the need to control extended growth. To remedy this, where noted in the field a drop-crotch / canopy reduction pruning will be used. In no case will trees be topped or rounded over. Trees to receive the drop-crotch treatment will be flagged or identified in the field prior to the work beginning. No more than 1/3 of the total live canopy will be removed. The Grounds Superintendent or representative will / must be present for this work to proceed.
- F. Under-clearance pruning to provide for pedestrian and vehicular clearance shall be done to provide clearance as directed by the University.
1. Pruning is to be performed by tree workers who, though related training and on the job experience, are familiar with the techniques and hazards of this work including trimming, maintenance, repairing or removal, and equipment used in such operations.
 2. The use of climbing spurs or irons is not approved in pruning operations on live trees.
 3. This type of work is a potentially hazardous occupation and is to be undertaken only by trained personnel or under the supervision of trained personnel, all of whom are covered with workers compensation, property damage, public liability, and completed operations insurance.
- G. Medium pruning shall consist of the removal of dead, dying, diseased, interfering, objectionable and weak branches on the main trunks as well as those within the leaf area. An occasional branch up to one inch in diameter may remain within the main leaf area where it is not practical to remove it. The following specifications shall apply:
1. All cuts shall be made sufficiently close to the trunk or parent limb, without cutting into the branch collar to leaving a protruding stub, so that closure can readily start under normal conditions. Clean cuts with sharp tools shall be made at all times.
 2. All cuts at the trunk are to be made with a pruning saw. Heading back large limbs may be done with loppers, pole pruners, or power equipment.
 3. Where branches are too heavy to handle, to prevent slipping or peeling the bark, it is necessary to precut these branches. Where necessary, to prevent tree or property damage, branches shall be lowered to the ground by proper ropes or equipment.
 4. On trees known to be diseased, tools are to be disinfected with a 20% Clorox solution after each cut and between trees, which there is known to be a danger of transmitting the disease to the tools.
 5. Old injuries are to be inspected. Old wounds that are not closing properly and where the callus growth is not already completely established should be traced where appropriate.
 6. All branches are to cut back to a live lateral, which shall be at least 1/3 diameter of the severed branch. Heading back limbs as part of tree trimming pruning is accepted.
 7. All girdling roots visible to the eye are to be reported to the Grounds Superintendent or designee.
 8. The presence of any structural weaknesses, disease condition, decayed trunk or branches, split crotches or branches should be reported in writing to the Grounds Superintendent or designee, and corrective measures recommended.
 9. All stubs not callused over shall be pruned in the same manner as outlined above in this action. Care shall be taken so as to not damage the callousing tissue.
 10. Cutting back or topping shall not be permitted.
- H. Tree Removal:
1. Trees shall be removed in accordance with accepted industry standards and procedures and in accordance with the following minimum requirements.
 2. Extreme care shall be taken so as to prevent limbs, branches and trunks from falling and creating damage to adjacent homes, driveways, sidewalks, trees, shrubs, streets and other property, both public and private. Debris and logs shall not be left on the public right-of-way overnight. It shall be the responsibility of the Contractor to remove and

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dispose in a proper and acceptable manner all logs, brush and debris resulting from the tree removal operation unless otherwise directed by the University Grounds Department. Removal of such debris shall be performed daily so as to not disrupt the work of the Contractors on the site.

- I. Stump Grinding:
 - 1. Work shall include, but is not limited to, all labor, equipment, and material necessary to grind all stumps identified in the contract and those identified in the field by the PM/Engineer.
 - 2. All exposed portions of the stump (including root flare) shall be ground to a depth of 12 inches below the surrounding average grade.
 - 3. All grindings shall be removed from the site. The resulting hole shall be back-filled with dry soil free from stones, dirt clods, roots, root mats, and other unsuitable material.
 - 4. The resulting hole shall be back-filled in two six-inch lifts. The first six-inch lift shall be compacted to a 65% compaction. The final six-inch lift shall be hand tamped and graded to drain.
 - 5. Those that are affected by the stump grinding shall be seeded and mulched per Project Special Provisions, “SEEDING AND MULCHING”.

- J. Measurement:
 - 1. The stump grinding measurement will be the length measurement of the root flare added to the width measurement of the root flare and divided by two. All measurements will in inches. There will be no other measurement for payment. The PM/Engineer will determine the measurement for payment at each location.

SECTION 32 XXXX – FERTILIZATION OF EXISTING TREES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Related Documents:
 - 1. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

- B. Description of Work:
 - Work Included in this Section:
 - 1. Provide all supervision, labor, tools, equipment, and materials necessary to fertilize existing trees to remain as designated on the plans.

- C. Related Work Specified Elsewhere:
 - 1. Tree Planting (9320).
 - 2. Pruning and Removal of Existing Trees (5635).

- D. Quality Assurance:
 - 1. Provider of this service shall be individuals, partnership or corporation actively engaged in arboriculture, horticulture, or a related field.
 - 2. Contractor shall have in his possession or available by formal agreement at the time of bidding, all equipment and supplies necessary to perform the work as specified.

PART 2 - PRODUCTS

2.1 FERTILIZER

- A. All fertilizer shall have a minimum analysis of 30-9-4.

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- B. Eighty percent of all nitrogen will be slow release by means of organic breakdown
- C. All fertilizer shall be manufactured such that it can be applied in the fashion described.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Installation of the fertilizer will be the high-pressure liquid fertilizer method. A hydraulic pump capable of delivering an agitated fertilizer with water as the carrier (with the ability to pump the material at the pressure of 150 psi) will be utilized. A soil spear designed for fertilizing applications will be used.
- B. Injection of the fertilizer shall start 2 to 3 feet from the root flare and be 2 to 3 feet apart continuously to the edge of the limb spread or edge of construction, whichever is less.
- C. Injection will be 10 to 12 inches deep. Rate of application will be determined by a measurement of the diameter of the trunk 2 to 4 feet above ground line. Fertilizer will be applied at a rate of 2 pound per inch diameter of actual nitrogen.
- D. Soils must be moist prior to application.

SECTION 32 XXXX – TREE PRESERVATION AND PROTECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Related Documents
The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.
- B. Description of Work:
Purpose: The purpose of this section is to provide protection for existing trees on Campus property during University sponsored construction projects.
- C. Work Included in This Section:
Construction of Tree Protection Barricades, Replacement of Damaged Trees, Pruning, Curb and Gutter Repair Replacement and Construction, Sidewalk Repair and Construction
- D. Related Work Specified Elsewhere:
 - 1. Landscape Grading and Drainage (Section #____)
 - 2. Pruning and Removal of Existing Trees (Section #____)
 - 3. Fertilization of Existing Trees (Section #____)

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Woven Textile Fabric: Woven geotextile fabric with a minimum tensile strength of 200 lbs. shall be used under 6 inches of washed stone or suitable alternative whenever construction traffic must pass over the root systems of existing trees in unpaved areas.
- B. Tree Protection Barricades: Barricades shall be constructed of wood, in accordance with of these specifications. Orange safety fencing, 3 feet high or suitable alternative may be used in

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lieu of wood rails. The installation of orange construction fencing in the right of way shall not inhibit driver and/or pedestrian vision at driveways and/or street intersections.

PART 3 - EXECUTION

3.1 GENERAL

- A. Trees located on University property shall be protected from damage and/or removal and this includes the following: storm drainage, underground utilities, driveways, sidewalks, etc.
- B. The designer will provide the same level of protection for private property trees on all University funded and/or sponsored projects. The Landscape Architect or Grounds Superintendent must be consulted during the planning of the project to determine impacts to the trees based on proposed construction. Alternative alignments, construction methods, tree replacement, etc. shall be considered during that period.

C. Boring and Trenching:

- 1. Open trenching, including pilot and/or receiving holes:

TREES DIAMETER (D.B.H.) LESS THAN 6	RADIAL DISTANCE (FEET) LIMB SPREAD
6" - 9"	5'
10" - 14"	10'
15" - 19"	12'
20" - 30"	15'
Over 30"	20'

- 2. Holes or trenches closer to a tree than noted above will be considered harmful to the trees unless a boring construction method is performed. Any exceptions must be approved by Grounds Superintendent. Utilities may be tunneled in the root zone at a 24" minimum depth providing that plans are approved showing the location and method.

D. Curb and Gutter Repair and Construction:

- 1. When working within 20 feet of any tree (12 inches or larger in diameter), plywood forms or suitable alternative will be used. Clearing, grading, or digging will not be allowed beyond 6 inches from the proposed back of curb unless Grounds Superintendent has provided approval.
- 2. Root pruning will be in accordance with Section entitled Root Pruning. If any portion of the trunk and/or root flare extends over the section being replaced, it cannot be damaged during construction even if a small portion of the old structure must be left in place.

E. Sidewalk Construction /Repair

- 1. When working within 20 feet of any tree 12 inches or larger in diameter, plywood forms or suitable alternative will be used. Clearing, grading, or digging will not be allowed beyond 6 inches from the proposed edge of the sidewalk unless the Grounds Superintendent has provided approval.
- 2. Root pruning will be in accordance with Section entitled Root Pruning. If any portion of the trunk and/or root flare extends over the section being replaced, it cannot be damaged during construction even if a small portion of the old structure must be left in place.
- 3. Narrow sections of sidewalk will be constructed in accordance with directions from the Landscape Architect and no less than 40 inches in width. Bridging of large roots.

F. Barricades:

- 1. Barriers shall surround trees with a radius of not less than one foot (1') for every one inch (1") of trunk diameter (critical root zone) unless otherwise detailed.
- 2. Barricade will be a minimal of six feet (6'). Deviations from this must be approved on an individual basis by the Landscape Architect and the Grounds Superintendent.

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3. All tree protection barriers shall be installed prior to any grading or other land disturbing activity. They shall be constructed from any material substantial enough to designate the protected area and to protect the roots, trunk, and crown of the tree.
 - a. Example: 2 x 4 standards and 1 x 4 rails; three feet (3') high orange safety fencing, etc.
- G. Trunk Protection:
 1. Batter boards and sand bags will be installed when working within 20 feet of any tree 12 inches or larger. The purpose of these items will be to protect the trunk or root flare from drainage during construction.
- H. Temporary Access:
 1. It is recommended that when crossing a critical root zone, mulch 8 to 12 inches deep with woven geotextile fabric with a minimum tensile of 200 lbs. strength laid underneath shall be required in these areas to act as a cushion to prevent soil compaction. Mulch and fabric shall be removed after construction is complete.
 2. Do not store materials or machinery in any portion of the critical root zone.
- I. Fill Around Existing Trees to Remain:
 1. Fill dirt deeper than two inches (2") may be allowed over the critical root zone of the tree. This work shall be performed under the supervision of the Grounds Superintendent.
- J. Clearing Within Critical Root Zone:
 1. In the critical root zone, the removal of any portions of old sidewalk, driveway, and/or curb shall be done with extreme care so as not to damage any portion of the branches, trunk or roots.
 2. In the critical root zone any stumps, dead trees and shrub growth to be removed shall be cut flush or ground out. Stump grinding will be accomplished with equipment and methods acceptable in normal arboriculture operations.
 3. All holes will be backfilled completely the same day of the operation. Stumps to be ground out will be designated by the Grounds Superintendent. No grubbing is permitted in the root zone areas.
- K. Tree Damage:
 1. Climbing irons, spurs or spikes shall not be used on trees to be pruned.
 2. Any tree damage caused by the Contractor is to be repaired immediately at no additional expense and to the satisfaction of the University.
 3. Any damages resulting in the disfigurement and/or shortened life expectancy of a tree will be evaluated by the Grounds Superintendent. The entire value of the tree will be pro-rated by the loss of life expectancy and that value assessed to the Contractor.
 4. Trees damaged beyond repair, as judged by the Grounds Superintendent, are to be removed at no expense to the University, and replaced by trees of size and species designated at no additional expense to the University; or the dollar value of such damaged trees as determined by the Grounds Superintendent is deducted from the monies owed the Contractor.
 5. The tree values will be determined by using the guidelines in the Tree Evaluation Guide by The International Society of Arboriculture.
 6. A MINIMUM FINE OF \$50 WILL BE ACCESSED FOR EACH INCIDENT OF BARK AND CAMBIUM DAMAGE OF 4" WIDTH OR LESS WHERE RESTRICTIONS ARE VIOLATED. IF DAMAGE IS LARGER, DAMAGES WILL BE ASSESSED USING I.S.A. TREE EVALUATION GUIDE PROCEDURES.
- L. Discontinuance of Work:
 1. Any practice obviously hazardous to people or harmful to the trees, as determined by the University, shall be immediately discontinued by the Contractor upon receipt of either written or oral notice to discontinue such practice.
- M. Root Pruning:

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1. Root pruning shall be kept to an absolute minimum. In no case shall any root be pruned that is 1 ½ inches in diameter or greater without the express permission of the Grounds Superintendent.
2. All roots proposed to be cut shall be located in advance at a point 6-12" outside the proposed cut by using a shovel, a probe, a high-pressure stream of water, or other convenient method. The cut is to be made no more than 6" behind the back of the curb, wall, or other structure to be built. The cut shall be made only to the minimum depth required for the structure.
3. The roots shall be cut cleanly leaving a smooth surface.
4. Root pruning equipment shall be kept sharp to ensure that roots are cut cleanly and are not broken or torn by dull or unsuitable equipment.
5. Root pruning shall be done with the approval of the Landscape Architect or the Grounds Superintendent.

N. Pruning and Thinning of Existing Trees:

1. All pruning shall be in accordance with this manual.

O. Tree Preservation:

1. Large or rare trees shall be highlighted by the designer. The Grounds Superintendent must approve all tree removals.

P. Clean Up:

1. Remove all barriers upon completion of project and fill the holes with suitable soil restore area to original condition.

3.2 TREE PROTECTION

A. It is desirable to save 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.

1. All trees to remain shall 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 barriers shall be of substantial material.: 4 x 4 posts with 2 x 6 rails set at a minimum height of four feet. No construction material, debris, or excavated material shall be stored within the barricade area.
2. Protect root system from flooding, erosion, and noxious materials in solution from spillage of construction materials.
3. Excavation around trees:
 - a. Excavate within drip lines of trees only where indicated on plans.
 - b. If excavation will damage trees extensively, the trees should be removed.
 - c. 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 with a sharp pruning tool; do not chop or break.
 - d. Do not allow exposed roots to dry out while exposed; provide temporary earth or moist burlap cover.
 - e. 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.
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:
 - a. Where tree roots within the drip line will be covered with asphalt or concrete, feeders shall be installed as recommended by the National Arborist Association Standards.
 - b. Install extended feeders where construction of walls is required within drip line.

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- c. The design must provide a yard hydrant, irrigation system, or other convenient water source adjacent to trees that remain.
- d. The specifications shall define proper fertilization and the contractor will fertilize affected trees during construction.
- 6. Repairs to Damaged Trees:
 - a. Repairs to damaged trees shall be performed by a professional arborist following the preceding instructions for pruning.
 - b. 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.

3.3 TREE PRUNING

- A. For Grounds Maintenance Levels I, II & III. This is a highly skilled procedure that must be supervised by a qualified and professionally trained arborist. This will insure that all trees are pruned according to their natural growth habit to evenly form and balance the tree to promote proper health and growth, and prevent interference with pedestrian and vehicular traffic.
 - 1. Prune to remove dead, damaged, diseased or structurally weak limbs.
 - 2. Removes branches that extend over buildings, endanger roofs, eaves or windows, or hang over walkways, parking lots or driveways. Provide clearance for buses, moving vans, delivery trucks, and similar vehicles along streets.
 - 3. Cut back branches that overhang or grow into power lines. Anticipate the effects of wind on branches or trees which might fall on power lines and remove growth to prevent these problems; shapes entire tree through selective pruning rather than a “hat racking” method and prevents growth of small trees in front of windows and over entrance ways or walks which will obstruct vision at street intersection. Prune according to National Arborist Association standard for pruning and maintaining shade trees.
 - 4. Tree pruning shall be performed in accordance with the following specific requirements:
 - a. Remove crossed or rubbing limbs or branches.
 - b. Make all cuts close to parent stem to promote healing. All limbs, 2 inches in diameter and over must be precut to prevent splitting.
 - c. Lower to the ground with ropes all branches three inches or more in diameter and other branches being removed that would cause damage in falling.
 - d. Cut off all low hanging branches to a minimum clearance height of 14 feet over roads and to a minimum clearance height of 8 feet over sidewalks.
 - e. Cable and/or bolt any branches that are structurally weak, split crotches, or branches that are dangerous but worth saving. Guying shall be accomplished in accordance with National Arborist Association Standard for cabling, bracing, and guying for shade trees.

SECTION 32 XXXX– SOIL

Part 1 – General

A. Related Documents

The General Provisions of the Contract, including General and supplementary Conditions and General Requirements, apply to the work specified in this Section.

B. Description of Work:

Work Included in this Section:

Provide or create soil mixes for planting that meets or exceeds the standards contained herein.

Related Work Specified Elsewhere:

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- Landscape Grading & Drainage (Section # _____)
- Shrub and Groundcover Planting (Section # _____)
- Tree Planting (Section 32 9320)
- Seeding and Sodding Turfgrass (Section # _____)
- Structural Soil Mix for Turf Areas and Fire Lanes

Part 2 – Products

A. Soil Types:

Topsoil:

Native soil on site or natural soil harvested from another site that naturally has the texture and composition to meet the specification described below, and is free of noxious weed seed, shall constitute an Acceptable Planting Media. (APM)

Planting mix for Lawn, Turf or Seeding Areas:

A planting mix may be developed that will be an Acceptable Planting Media by amending the existing soil or by removing the existing soil and replacing it with new planting mix. The planting mix shall have uniform composition throughout, with a mixture of subsoil. It shall be free of stones, lumps, live plants and their roots, sticks, and other extraneous matter. It shall contain no man-made materials unless otherwise specified. Planting mix shall not be used while in a frozen or muddy condition.

Unless there are unusual circumstances with project and unless otherwise specified in the contract documents and approved by the Grounds Superintendent and/or designee, the Acceptable Planting Media shall contain the following specified percentages of constituents:

CLAY	Minimum 10%/Maximum 40%
SAND	Minimum 20%/Maximum 50%
SILT	Minimum 20%/Maximum 50%
ORGANIC MATTER	Minimum 5%/Maximum 10%

Organize Matter is defined as compost/humus such as sawdust or leaf mold that has completed the decomposition process. Percentage of organic matter shall be determined by loss on ignition of moisture free samples dried at 65 degrees.

APM shall have an acidity range of pH 6.5 to 7.0.

B. Planting mix for Tree and/or Bed/Shrub Planting Areas:

A planting mix may be developed that will be an Acceptable Planting Media by amending the existing soil or by removing the existing soil and replacing it with new planting mix. The planting mix shall have uniform composition throughout, with a mixture of subsoil. It shall be free of stones, lumps, live plants and their roots, sticks, and other extraneous matter. It shall contain no man-made materials unless otherwise specified. Planting mix shall not be used while in a frozen or muddy condition.

Unless there are unusual circumstances with project and unless otherwise specified in the contract documents and approved by the Grounds Superintendent and/or designee, the Acceptable Planting Media shall contain the following specified percentages of constituents:

CLAY	Minimum 10%/Maximum 40%
SAND	Minimum 20%/Maximum 50%
SILT	Minimum 20%/Maximum 50%
ORGANIC MATTER	Minimum 15%/Maximum 20%

Organize Matter is defined as compost/humus such as sawdust or leaf mold that has completed the decomposition process. Percentage of organic matter shall be determined by loss on ignition of moisture free samples dried at 65 degrees.

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APM shall have an acidity range of pH 6.5 to 7.0.

Soils can be placed on a pre-approved list by the Grounds Superintendent and/or designee, after a vendor has proved that they have the ability to provide the soils as described and be consistent with the mixtures. The Grounds Department retest soils and recompiles this list annually. Other soils can be tested throughout the year and placed on the list, if approved, at the contractor's or vendor's request. Thirty calendar days for approval is required. Grounds Management will collect the samples and submit the first soil samples for laboratory testing. Any sample that requires re-submittal for approval will be the contractor's or vendor's responsibility and must be tested by a reputable soil testing lab.

C. Soil Conditioner:

Work covered in this special provision includes supplying and applying composted soil conditioner. Soil conditioner is an organic soil additive that is mixed with the soil in order to improve its internal drainage, structure, nutrient holding capacity, nutrient holding capacity or to improve organic matter composition. Composted soil conditioner must be thoroughly mixed and tilled into the top 8" and 10" of the existing soil in all areas to be planted.

Soil conditioner shall be composted and aged pine bark, screened to be 9/16" size or smaller. It shall be black in color, not be fresh, have no pine bark smell and have an acidity of pH 5.8 to 6.0. A sample of the composted soil conditioner must be submitted to the Grounds Department for approval prior to installation.

D. Execution:

Soil Specifications:

Product supplied must meet the specification above as determined by soil testing at an approved lab or be supplied from a vendor on the Grounds Department's pre-approved list. Soil shall not be handled or spread when moisture content is excessively high.

SECTION 32 XXXX - STRUCTURAL SOIL MIX FOR TURF AREAS AND FIRE LANES

PART 1 – GENERAL

A. Provide a Structural Soil Mix using the three components below to meet ASTM Standards as follows:

1. The Structural Soil Mix shall be a special pre-mixed blend of 75% 5/16" graded Expanded Slate Aggregate and 25% approved sand-compost blend compacted to a minimum depth of eight inches.

5/16" Expanded Slate	75%
USGA Root Zone mix *	20% typical
Certified Compost*	5% typical

* Percentages may vary to meet testing requirements
Saturated Drained Weight: 66 pounds per Cubic Foot

2. Minimum finished depth shall be not less than 8" (eight inches) deep.

PART 2 – PRODUCTS

2.1 MATERIALS

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A. 5/16” Rotary Kiln Expanded Aggregate

1. ASTM C29 Unit Dry Weight loose (48 lb./cf to 55 lb./cf)
2. ASTM C127 Specific Gravity to meet 1.45 to 1.60, SSD
3. ASTM C330: ASTM Gradation 3/8” - #8 size

3/8” - #8 PermaTill Expanded Aggregate

Sieve Size	% Passing
1/2”	100
3/8”	80 - 100
#4	50 - 40
#8	0 - 20
#16	0 - 10

4. Test for degradation loss using Los Angeles Abrasion testing in accordance with ASTM C-131 modified method FM 1-T096. No more than 28% of the weight of the aggregate must be lost to degradation.

B. USGA Root Zone Sand

1. Grain Size Distribution

Sieve Size	% Retained
2.00 mm	<3%
1-2 mm	10% max
0.5 -1 mm	45% max
.25 -.5 mm	35% - 75%
.15 -.25 mm	15% max
.05 - .15 mm	5% max
organic matter	5% - 10%

C. Compost

1. Compost must be certified and derived from a non-sewage sludge feedstock source. The addition of yard waste to the composting process must also meet certification requirements.
2. Finished compost must be screened to minus 1/2”, protected, and free from any outside contaminants during and after screening and curing.
3. Metals and contaminants must meet or exceed US EPA Standard 40

PART 3 – EXECUTION

3.1 MIXING PROCEDURES

A. Structural Soil

1. Mechanically mix the sand and compost thoroughly.
2. Saturate the 5/16” Expanded Slate Aggregate with water and mechanically mix 3:1 with the dry sand-compost until the slate particles are completely coated.

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3. When stockpiling the finished mix, cover the pile with a plastic tarp to prevent drying out or soil separation from rain.
5. Install the mix within 48 hours after mixing.

PART 4 - PREPARATION

A. General

1. The contractor shall obtain necessary approvals before placing each SSM layer.
2. The contractor shall use adequate numbers of skilled workmen who are thoroughly trained in the necessary crafts and are completely familiar with the specified requirements and methods needed for proper performance of the work in this section.
3. The contractor must provide access for and cooperate with the testing laboratory.
4. Adequacy of the final compaction of all elements requiring compaction shall be determined in the field by the engineer by proof roll.

B. Preparing Subgrade

- A. The subgrade shall be prepared according to these procedures:
 - a. Remove all organic matter, debris, loose material and large rocks.
 - b. Dig out soft and mucky spots then replace with suitable material.
 - c. Loosen hard spots and uniformly compact the subgrade to 95% of its maximum dry density.

C. Optional Perforated Underdrain System

1. The underdrain system shall be installed, included with sock or soil separator fabric, according to drawing and specifications, and connected to the storm drain.

PART 5 - PLACING STRUCTURAL SOIL MIX (SSM) BY CONTRACTOR

A. General

1. Adequacy of the final compaction shall be determined in the field by the engineer by proof roll.
2. Place geo-tech mesh where specified.
3. The SSM shall be placed in approximately eight inch uniform lifts over the entire area of project and each lift compacted to provide a finished depth of 8". Construction equipment, other than for compaction, shall not operate on the exposed structural soil mix. Over-compaction should be avoided.
4. Final compacted depth of the material shall be not less than 8" deep.
5. Optional for grades steeper than 8% slope - Turf rings shall be installed immediately after the last lift is compacted and tested. No equipment traffic will be allowed on the compacted material until the sod has been placed.

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6. Irrigation systems are to be installed and tested prior to the root zone laying course installation to avoid disturbing the compaction of the mix.

B. Compacting

1. Use of portable vibratory plate compacting machine (Recommended).

a. Place structural soil mix in horizontal lifts not exceeding 8 to 10 inches of compacted depth. Use a minimum of four passes, of not less than 10 seconds per pass, before moving the vibratory plate to the next adjacent location. Additional passes may be required and should be determined in the field by the engineer to insure stability of the layer. Continue placing and compacting 8" lifts until the specified depth is reached.

2. Use of vibratory steel roller for large areas.

a. For large spaces, a vibratory steel roller weighing no more than 12 tons static weight can be used. Horizontal lifts should not exceed 10" compacted. The minimum number of passes is two and maximum number is four. Additional passes may be required and should be determined in the field by the engineer to insure stability of the layer.

PART 6 - OPTIONAL ROOT ZONE MIX INSTALLATION FOR SEEDING

A. Install mix as per drawings and specifications. Depth of root zone mix over the structural soil to be determined based on traffic requirements. Typically 1" to 2" on top of the fire lane applications.

B. No vehicles or heavy equipment are permitted on the root zone layer course until the turf is completely established.

PART 7 - SOD INSTALLATION

A. Only sod grown in a sand base soil may be used in this application. Use Bermuda sod/"Tifway 419" or "Grand Tif" or "Zoysia" sod – "Palisades." Other sod varieties as directed by Grounds Superintendent.

B. Place sod directly on the structural soil as specified by the Grounds Superintendent.

C. See cross-section detail – detail number _____

SECTION 32 9210 – SEEDING AND SODDING TURFGRASS & LAWNS

PART 1 - GENERAL - EXISTING OR ESTABLISHED LAWNS

A. Related Documents

1. The General Provisions of the Contract, including General and Supplementary conditions and General Requirements, apply to the work specified in this Section.

B. Description of Work

Work Included in this Section:

Seeding and sodding of new areas.

C. Substitutions: The species or varieties, materials, products or sizes specified herein by botanical and common name, shall be provided as specified. Substitutions will be permitted only upon written application by the Contractor to the PM/Engineer, and when approved by said PM/Engineer in writing. Request for permission to substitute will not be entertained unless

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adequate evidence substantiating the unavailability of the specified item accompanies the request for substitution.

D. WARRANTY

1. 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 three times and shows sufficient stand and cover as specified.

PART 2 - PRODUCTS

2.1 SEED

- A. Seed: All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act, and approved by the North Carolina Department of Agriculture. All seed shall be furnished in sealed standard containers. Seed which has become wet, moldy or otherwise damaged in transit or in storage will not be acceptable. The seed quality requirements for this project are as follows:
1. Seed shall be entirely free from bulblets or seed of Johnson Grass, Nutgrass, Sandbur, Wild Onion, Wild Garlic, Witchweed and Crotalaria.
 2. Seed shall not contain more than 2%, singly or collectively of crop seed other than the kind or kinds of seed specified.
 3. Minimum guaranteed germination rate for all seed shall be 85%.
 4. The Crop Seed quality requirements are: Minimum 80% pure live seed; maximum 1% total weed seed; maximum 2% total other crop seed; maximum 100 restricted noxious weed seed per pound.

2.2 SOIL AMENDMENTS

- A. Lime: Lime shall be ground limestone containing not less than 85% of total carbonates and shall be ground to such fineness that at least 50% will pass through a 100-mesh sieve and at least 90% will pass through a 20-mesh sieve. Coarser will be acceptable provided the specified rates of application are increased proportionately on the basis of quantities passing the 100-mesh sieve, but no additional payment will be made for the increased quantity.
- B. Superphosphate: Finely ground phosphate rock containing minimum 18% available phosphoric acid.

2.3 FERTILIZERS

- A. Fertilizer: Fertilizer shall be the product of an approved commercial fertilizer manufacturer and shall be 10-10-10 grade, uniform in composition, free-flowing material suitable for application with approved standard equipment. The fertilizer shall conform to the applicable State fertilizer laws and shall be delivered to the site in bags or other convenient containers each fully labeled and bearing the name, trademark and warranty of the producer.

2.4 SOILS/TOPSOIL

- A. Topsoil: - will conform to the "Soils" Section #_____
- B. A soil analysis shall be prepared by a testing agency approved by the designer. The contractor shall provide all elements recommended by the analysis.
- C. Soil samples must be submitted to the Grounds Superintendent or designee 30 days prior to installation for approval.

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2.5 MULCHES

- A. Mulch shall be a Polyacrylamide Powder, unless otherwise noted.
 - 1. Matting will only be used if approved on very limited basis and approved by Grounds Superintendent or designee.
 - 2. Matting: Plain open weave jute rolls, 18 inches wide. Jute yarn shall be loosely twisted construction not varying in thickness more than 1/2 its normal diameter, and having 76 to 80 warp ends per 18 inches width, 40 to 42 weft ends per yard length.
 - 3. Mat anchors: Baling twine and soft-wood pegs 1/2" x 1" x 12" long.
- B. Specifications/Compliances:
 - 1. ANSI/NSF Standard 60 Drinking water treatment chemicals.
 - 2. 48h or 96h Acute Toxicity Tests (*D. magna*, *P. promelas*, or *O. mykiss*).
 - 3. 7 day Chronic Toxicity Tests (*P. promelas* or *C. dubia*)
- C. Technical Information:
 - 1. Appearance: White granular powder
 - 2. Bulk Density: 40-50 lbs/cubic foot
 - 3. Percentage Moisture: 15% maximum
 - 4. pH 0.5% solution: 6-8
 - 5. Shelf Life: up to 5 years
- D. Coverage:
 - 1. 10-20 # powder/Acre – gentle to moderate slopes (flat to 4:1) Dry Spread Application
 - 2. 20-50 # powder/Acre – steep slopes (3:1 to 1:1) Dry Spread Application
 - 3. 3.5-5 # powder/1,000 gallons water per 1/3 Acre – Hydroseed Application
- E. Directions for Use:
 - 1. Dry Form: Polyacrylamide Erosion Control Powder may be applied by hand spreader, mechanical disc, or hand sowing. Slope or ditch application may require artificial support, such as double-shredded hardwood mulch, to reduce down slope movement. Areas of high water velocity will require benching or tier structuring to reduce velocity. Sheet flow applications are best.
 - 2. Liquid Form: Polyacrylamide Erosion Control Powder may be applied with hydroseeders, water trucks or other spraying devices. All spraying devices must have a mechanical agitator or mixing apparatus or hydraulic recirculation. **Caution-Do Not** mix powder into a spraying device that does not contain a mixing apparatus.
 - 3. Mixing: Sprinkle powder into the water with the mixing apparatus operating as the last material to be added to the mix. Three to Five minutes of mixing will be required after the powder is sprinkled into the water. **ADD THE POWDER SLOWLY**-adding the powder too fast will result in clumping resulting in poor performance. Longer mixing times will create high viscosity solutions possibly causing some types of spray equipment to undergo cavitation. **Caution-Do Not** exceed 8 lbs/1500 gallons as viscosity of the water may damage spraying equipment. (This will treat ½ acre).
- F. Clean-Up:
 - 1. Spilled powder should be cleaned up dry as best as possible using broom or vacuum. Extreme slippery conditions will result. In event of skin contact, wash powder from skin as soon as possible using soap and water.
- G. Precautions/Limitations:
 - 1. Prevent inhalation of the powder, use adequate dust mask.
 - 2. Clean up spills quickly. Do not use water unless necessary, extremely slippery conditions will result.
 - 3. Do Not add water to the Polyacrylamide Erosion Control Powder, add the powder (sprinkle) to the water slowly.
 - 4. Polyacrylamide Erosion Control Powder will remain viable on the soil surface for 60-90 days. Longer viability will occur when applied powder is covered with double-shredded hardwood mulch.

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5. Polyacrylamide Erosion Control Powder has been specifically tailored to specific soil types. Soil types in varying geographical areas will require testing.

PART 3 - EXECUTION

3.1 MAINTENANCE

A. Landscape Management:

1. Increased development of the campus creates the greater demand for efficient landscape planning. The introduction of new signage, plant materials, benches walks, lights, etc. into the landscape all effect long-term maintenance. Therefore it is necessary to develop guidelines that must be reviewed by anyone involved in the planning and design of elements. Long term plans for walkways, roads and buildings must be considered when locating signage, benches or plant materials in proposed designs.
 - a. Turf strips less than two feet between walkways, curbs or buildings will not be allowed.
 - b. Planting beds shall have large sweeping edges for ease of lawn mower cutting.
 - c. Place signs, lights and other permanently installed objects in mulch or planting beds when possible for ease of lawn maintenance. This will also protect these objects from mower and weed eater damage.
 - d. Select ground covers, shrubs and trees for natural size and habit for an area to avoid overgrowing and unnecessary pruning.
 - e. Do not plant low branching trees in turf areas.

B. Turf Maintenance

1. Level I. Turf maintained at this level is highly maintained turf which is mowed, fertilized, edged, with pre and post emergent herbicides utilized to prevent/eliminate all broad leaf weeds and weedy grasses. These areas exist at various locations throughout the campus proper. Mowing frequency is based on weather conditions.
 - a. Fescue turf is maintained at a mowing height of 3 to 3-1/2 inches.
 - b. Bermuda at " to 1" and over seeded rye at 1-1/2 to 2 inches.
 - c. Leaves are vacuumed, blown and removed from these turf areas during the Fall season.
 - d. Turf areas receive three applications of dry turf grade homogenous 18-5-9 or 23-5-9 fertilizer per year (March, June and October) at rate of 1 lb. Nitrogen/1000 sq. ft. All turf fertilizer is slow release nitrogen type 50% WSN, 50% WIN with minor elements. Over seeded rye lawns will be mowed twice monthly (Dec.-March)
 - e. Sidewalks and curbs are maintained by edging.
2. Level II. Turf maintained at this level is mowed weekly during the growing season, normally April 1 - December 1. These turf areas exist around residence halls, campus buildings, common campus areas, park areas, road shoulders and parking lots.
 - a. Leaves are vacuumed, blown and removed during the fall season.
 - b. Sidewalks and curbs are to be mechanically edged.
 - c. Turf areas to receive three applications of dry turf grade homogenous 18-5-9 or 23-5-9 fertilizer per year (March, June & October) at rate of 1 lb. Nitrogen/1000 sq. ft. Fertilizer type it as in TM Level I.
3. Level III. Turf maintained at this level relates to slopes and banks too steep to mow including fences guardrails, ditches and similar areas. These areas will be maintained using string trimmers.
 - a. Turf/ground cover height will be maintained at 3-4 inches.
 - b. Areas are to receive three applications of turf grade homogenous 18-5-9 fertilizer (March, June, and October) at rate of 1 lb. Nitrogen/1000 sq. ft. Fertilizer types it as in TM Level I. Adjacent walkways/curbs will be kept free from weeds, litter and other debris.

C. Edging

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1. Edging shall be performed in a manner that is free of scalping, rutting, bruising, and uneven and rough cutting.
 2. Vegetation shall not be cut back more than 1 inch from pavement.
 3. Edging of sidewalks, driveways, curbs, and other paved surfaces and around gardens and other cultivated areas shall be performed as follows:
 4. Level I, II & III: Edging shall be done so that there is no vegetation growing over pavement.
- D. Trimming
1. For Grounds Maintenance Level I and II, trimming shall be around trees, shrubs, cultivated areas, fences, poles, walls, fire hydrants, sprinkler heads, valves, and other similar objects. Trimming shall be done in such a way as to avoid damaging the trunk, bark or roots of trees and shrubs. After trimming, all cuttings and debris shall be collected and disposed of in a mulch pile/compost area. Trimming within any given parcel shall be completed within one day of each mowing.

SECTION 32 9220 – NEW LAWNS

PART 1 - GENERAL

- A. Related Documents:
1. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.
- B. Description of Work:
1. Work Included in This Section:
 2. Seeding, Sodding and Sprigging of new areas.
- C. Substitutions:
1. The species or varieties, materials, products or sizes specified herein by botanical and common name, shall be provided as specified.
 2. Substitutions will be permitted only upon written application by the Contractor to the Grounds Superintendent, and when approved by said LA in writing.
 3. Request for permission to substitute will not be entertained unless adequate evidence substantiating the unavailability of the specified item accompanies the request for substitution.

PART 2 - PRODUCTS

2.1 TOPSOIL:

- A. Topsoil will meet standard in section #____ “Soils
- B. Will meet standards under section ____ “Soils.” Unless otherwise specified in the contract documents the topsoil shall contain the following specified percentages of constituents:
- C. A sample of the proposed topsoil mix shall be submitted to the Grounds Superintendent or designee 30 calendar days prior to installation and be approved prior to delivery to the site.

2.2 SOIL AMENDMENTS: - UNLESS OTHERWISE SPECIFIED IN THE CONTRACT DOCUMENTS.

- A. Gypsum: Gypsum shall be pelletized Gypsum.
- B. Fertilizer: The following is a list of acceptable starter fertilizers for new seeding:

ANALYSIS	APPL.
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13-25-12

340 lbs./acre or 8
lbs/1000 ft.

1. Or, equal fertilizer (approved equivalent) approved by the Grounds Superintendent or designee.
2. Commercial fertilizer applied at seeding time shall be per analysis listed above in which 50% of the nitrogen is slowly available. All fertilizer shall be uniform in composition, dry, free flowing and shall be delivered to the site in the original unopened container, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged will not be accepted.

2.3 GRASS SEED:

- A. Grass seed shall be turf type tall fine fescue grass or other varieties approved by Grounds Superintendent and/or designee and as specified on plans with a 95% minimum purity and 85% minimum germination, and be free of noxious weed seeds, as certified by the North Carolina Co-op Improvement Association or its approved equivalent by the Grounds Superintendent or designee.
- B. Seed shall be delivered to the site in sealed standard size containers, showing weight, analysis, name of vendor and germination test. Seed, which has become wet, moldy, over one year old, or otherwise damaged, will not be accepted.
- C. Approved turf type tall fine fescue cultivars: 'Millennium' – or approved equivalent by Grounds Superintendent or designee.
- D. Approved annually by Grounds Superintendent or designee.
- E. New cultivars will be considered for review. Following test information from TCNC/N.C. State University/Extension Service or approved authority.

2.4 LAWN MULCH:

- A. Lawn mulch shall be Polyacrylamide powder or oat straw from the latest available harvest crop and shall be free of noxious weed seeds and foreign material.
- B. Specifications/Compliances:
 1. ANSI/NSF Standard 60 Drinking water treatment chemicals.
 2. 48h or 96h Acute Toxicity Tests (*D. magna*, *P. promelas*, or *O. mykiss*).
 3. 7 day Chronic Toxicity Tests (*P. promelas* or *C. dubia*)
- C. Technical Information:
 1. Appearance: White granular powder
 2. Bulk Density: 40-50 lbs/cubic foot
 3. Percentage Moisture: 15% maximum
 4. pH 0.5% solution: 6-8
 5. Shelf Life: up to 5 years
- D. Coverage:
 1. 10-20 # powder/Acre – gentle to moderate slopes (flat to 4:1) Dry Spread Application
 2. 20-50 # powder/Acre – steep slopes (3:1 to 1:1) Dry Spread Application
 3. 3.5-5 # powder/1,000 gallons water per 1/3 Acre – Hydroseed Application
- E. Directions for Use:
 1. Dry Form: Polyacrylamide Erosion Control Powder may be applied by hand spreader, mechanical disc, or hand sowing. Slope or ditch application may require artificial support, such as double-shredded hardwood mulch, to reduce down slope movement. Areas of high water velocity will require benching or tier structuring to reduce velocity. Sheet flow applications are best.
 2. Liquid Form: Polyacrylamide Erosion Control Powder may be applied with hydroseeders, water trucks or other spraying devices. All spraying devices must have a mechanical

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agitator or mixing apparatus or hydraulic recirculation. **Caution-Do Not** mix powder into a spraying device that does not contain a mixing apparatus.

3. Mixing: Sprinkle powder into the water with the mixing apparatus operating as the last material to be added to the mix. Three to Five minutes of mixing will be required after the powder is sprinkled into the water. ADD THE POWDER SLOWLY-adding the powder too fast will result in clumping resulting in poor performance. Longer mixing times will create high viscosity solutions possibly causing some types of spray equipment to undergo cavitation. **Caution-Do Not** exceed 8 lbs/1500 gallons as viscosity of the water may damage spraying equipment. (This will treat ½ acre).

F. Clean-Up:

1. Spilled powder should be cleaned up dry as best as possible using broom or vacuum. Extreme slippery conditions will result. In event of skin contact, wash powder from skin as soon as possible using soap and water.

G. Precautions/Limitations:

1. Prevent inhalation of the powder, use adequate dust mask.
2. Clean up spills quickly. Do not use water unless necessary, extremely slippery conditions will result.
3. Do Not add water to the Polyacrylamide Erosion Control Powder, add the powder (sprinkle) to the water slowly.
4. Polyacrylamide Erosion Control Powder will remain viable on the soil surface for 60-90 days. Longer viability will occur when applied powder is covered with double-shredded hardwood mulch.
5. Polyacrylamide Erosion Control Powder has been specifically tailored to specific soil types. Soil types in varying geographical areas will require testing.

2.5 TURF GRASS SOD:

Variety of sod, where shown, shall be as specified on plan. Sod shall be two years old minimum thickness of 1/2 to 5/8 inch depending on type plus thickness of top growth and thatch.

PART 3 - EXECUTION

3.1 TURF AND LAWN SEEDING:

- A. Soil Testing: Testing shall be requested 14 working days prior to delivery of topsoil or planting mix shall be corrected by the Contractor. Retesting cost shall be at the Contractor's expense.
- B. Preparation of Seed Bed: Unless otherwise approved by the PM/Engineer, all other site work required by this contract shall be complete and in place before grassing operations are begun.
- C. Work may be completed in parts if so requested by the Contractor and approved by the PM/Engineer. Prior to seeding operations, all proposed lawn areas shall be scarified to 6" depth and pulverized until the surface is smooth, friable and of a uniformly fine texture. Remove stones and foreign material over one inch in diameter and grade for positive drainage as required to prevent ponding of water. Finish grade will be made by hand raking (all seeded areas).
- D. Lime shall be broadcasted and worked into the soil at all areas at the rate dictated by the soil test that will provide a PH level of 6.5 to 7.0.

3.2 SEEDING AND FERTILIZING:

- A. The following schedule will be required for seeding.

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- | TYPE OF SEED | DATE |
|----------------------------|------------------------|
| Turf Type Tall Fine Fescue | See previous schedule. |
- B. Tall fine fescue may be seeded year round, however any variance in the above seeding schedule will require at least one over seeding application after September 15 to ensure 90% coverage. This over seeding is considered incidental and there shall be no separate measurement or payment for over seeding.
- C. Written requests for a variance must be approved by Grounds Superintendent or designee.
- D. At seeding time add fertilizer at a rate of 250 lbs. per acre to all areas.
- E. Apply tall fescue at the rate of 8 lbs. per 1000 square ft. for new areas, 3 to 5 lbs. per 1000 square ft. for overseeded areas.
- F. Mulch shall be spread uniformly at the rate of 1-2 bales (90 pounds) per 1,000 square feet.
- G. Tacking of mulch shall be necessary on all roadway projects using liquid asphalt applied at 150 to 300 gallons per acre depending on conditions. Refer to plan for specific details.

3.3 HYDROSEEDING

- A. Hydraulic Mulching: Hydraulic mulching shall consist of the mixing of wood fiber mulch, grass seed, fertilizer and/or other additives with water. It shall be mixed in standard hydraulic mulching equipment to form homogenous slurry. This slurry shall be sprayed, under pressure, uniformly over the soil surface at the material application rate recommended by the manufacturer. The hydraulic mulching equipment shall contain a continuous agitation system that keeps all materials in uniform suspension throughout mixing and distribution cycle.
- B. Application: Using standard hydraulic mulching equipment, the wood fiber mulch, seed and fertilizer slurry shall be applied evenly over the soil surface in a one-step operation.

TERRAIN	MULCH APPLICATION RATE
Flat soil surfaces	(minimum) 1,500 lbs. per acre
Slope 3 to 1 or steeper	2,000 lbs. per acre
Critical areas*	2,500 lbs. per acre

*Potential slope instability, extreme low moisture availability or high intensity of rainfall.

- C. The mulch material shall consist of virgin wood fibers manufactured expressly from whole wood chips. The chips shall be processed in such manner as to contain no growth or germination inhibiting factors. (Fibers shall not be produced from recycled material such as sawdust, paper, cardboard, or residue from pulp and research paper plants).
- D. The wood cellulose fibers of the mulch must maintain uniform suspension in water under agitation. Upon application, the mulch material shall form a blotter-like mat covering the ground. This mat shall have the characteristics of moisture absorption and percolation and shall cover and hold grass seed in contact with the soil.
- E. The wood fiber mulch shall conform to the following specifications:
- | | |
|-------------------------------------|--------------------------------|
| Percent moisture content | 10.0 % ± 3.0% |
| Percent organic matter (wood fiber) | 99.2 % ± 0.8% oven dried beans |
| Percent ash content | 0.8 % ± 0.2% oven dried beans |
| PH | 4.8 % ± 0.5 |
| Water holding capacity (minimum) | 1,000 |

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(grams of water per 100 grams of fiber)

3.4 SODDED / SPRIGGED AREAS:

- A. Soil Testing: Testing shall be requested 30 working days prior to delivery of topsoil or planting mix or the work site. Deficiencies in the topsoil or planting mix shall be corrected by the Contractor. Retesting cost shall be at the Contractor's expense.
- B. Preparation of Bed: Unless otherwise approved by the Grounds Superintendent or designee, all other site work required by this contract shall be complete and in place before grassing operations are begun.
- C. Work may be completed in parts if so requested by the Contractor and approved by the Grounds Superintendent or designee. Prior to planting operations, all proposed lawn areas shall be scarified to 6" depth and pulverized until the surface is smooth, friable and of a uniformly fine texture.
- D. Remove stones and foreign material over one inch in diameter and grade for positive drainage as required to prevent ponding of water.
- E. Pre-emergent Herbicide: A pre-emergent herbicide and fertilizer combination (oxadiazon + fertilizer, or approved equal) shall be broadcast according to label recommendations.
- F. Sod / Sprig Planting: Prepare sub-grade as specified above. Allow for thickness of sod to finished grade.
 - 1. Turf types for sod or sprigs to be used will be specific to that given job / project. To be approved by the Grounds Superintendent or designee prior to installation.
 - 2. Where Bermuda sod or sprigs are to be used – 'Tifway 419' Bermuda or approved equivalent will be used as specified by Grounds Superintendent or designee.
 - 3. Lay sod within 24 hours from time of stripping. Protect any sod stored on site from damage due to weather. Do not lay sod on frozen ground.
 - 4. Sprigs should be fresh used within 24 hours from digging.
 - 5. Soil should be moist, but not wet, prior to laying sod. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to sub-grade or sod. Tamp or roll lightly to ensure contact with sub-grade. Work sifted soil into minor cracks between pieces of sod, and remove excess to avoid smothering of adjacent grass.
 - 6. Anchor sod on slopes with wood pegs to prevent slippage. Lay sod perpendicular to slope directions.
 - 7. Sprigged areas will be rolled with 250pd. rolled weight. Sprigs must be pushed into the ground with a grooved roller.

3.5 MAINTENANCE / ESTABLISHMENT OF PLANT MATERIALS:

- A. Prior to acceptance:

The Contractor shall be responsible for all maintenance of plants, turf and facilities until final acceptance. This includes all necessary watering, application of appropriate fertilizer, based on planting season, and the appropriate application of fungicides and insecticides necessary to maintain plants free from disease and insect activity.
- B. Seeded Areas:
 - 1. Maintenance of seeded areas shall consist of fertilization, erosion repair, reseeding and incidental operations as necessary to establish a vigorous, healthy and uniform stand of specified grass. All areas which fail to show a uniform stand of grass for any reason shall be treated properly until a uniform stand of at least 90% coverage is attained with no bare areas.
 - 2. Grass mowing operations shall be performed by the Contractor until final acceptance of the work. Trash and debris shall be removed prior to mowing. Mowing shall be

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performed only when the grass is dry. Mowing of Fescue shall be performed whenever grass height is 5". It shall be cut to a height of 3" to 4". All maintenance performed prior to acceptance shall be considered incidental to the project and no separate payment shall be made.

C. Sodded / Sprigged Areas:

1. Contractor shall maintain Sodded / sprigged areas as follows:
 - a. Watering: Water sod / sprigs immediately after installation. Soak sod / sprigs thoroughly enough to penetrate soil below the newly installed sod / sprigs. Then water as follows:

0-14 day's	170 gallons/1,000 s.f. every day
15-28 days	225 gallons/1,000 s.f. every other day
29-42 days	340 gallons/1,000 s.f. every three days
43-84 days	680 gallons/1,000 s.f. once per week
After 84 days	As needed to maintain acceptable turf
 - b. In the event the project is accepted prior to the watering requirements being fulfilled, the contractor will be required to provide water up to 90 days after sodding / sprigging.
2. Fertilizing Sodded / Sprigged Areas: Fertilizing will be specific to the given job or as follows:
 - a. Fertilize sod 2 to 3 weeks after laying sod with high phosphorus fertilizer. Apply a complete nitrogen fertilizer every three weeks until the sod has achieved satisfactory establishment.
 - b. As a follow-up for Bermuda sod /sprigs, the contractor or University (applicator is to be specified in the contract) will apply ½ pd. of Nitrogen from Ammonium Nitrate (34-0-0) or Ammonium Sulfate (28-0-0) within 4 weeks of the initial installation.
3. Mowing Sodded / Sprigged Areas: Mowing will be specific to the given job or as follows:
 - a. Grass mowing operations shall be performed by the Contractor until final acceptance of the work.
 - b. Trash and debris shall be removed prior to mowing.
 - c. Mowing shall be performed only when the grass is dry.
 - d. Mowing of Fescue shall be performed whenever grass height is 5". It shall be cut to a height of 3" to 4".
 - e. All maintenance performed prior to acceptance shall be considered incidental to the project and no separate payment shall be made.
4. Fertilizer Top-Dressing: Where directed by PM/Engineer, Contractor shall top-dress lawn areas as described in Section 886 of NCDOT Standard Specification for Roads and Structures.

SECTION 32 9310 – EXTERIOR SHRUB AND GROUNDCOVER PLANTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Documents
 1. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.
- B. Description of Work:
 1. Work Included in This Section:
 - a. The work required under this Section consists of all preparation, planting and related items necessary to complete the work indicated as described in the

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Specifications, in addition to the supplying of all plants specified on plant list except those plants covered in Sections #_____ and# _____.

All planting shall be executed during the planting season (October 15 thru May 1), unless exceptions are made in writing by the PM/Engineer.

All plant species, sizes, forms, shapes and locations will be subject to approval by the PM/Engineer.

- b. Supply all plants specified on plant list.
- c. All planting shall be executed during the planting season (October 15 thru May 1), unless exceptions are made in writing by the Grounds Superintendent and/or designee.

C. Substitutions:

- 1. The species or varieties, materials, products or sizes specified herein by botanical and common name shall be provided as specified. Only upon written application by the Contractor to the Landscape Architect, and when such application is approved in writing by said Grounds Superintendent or designee in coordination with Grounds Superintendent, will substitutions be permitted.
- 2. Request for permission to substitute will not be entertained unless adequate evidence substantiating the unavailability of the specified item accompanies the request for substitution. The contractor must submit a list of a minimum of 10 sources of plant suppliers that have been contacted. The list must include the name of the plant supplier, contact name, date and time.
- 3. If proof is submitted, substantiated in writing, that any plant specified is not obtainable, a proposal will be considered for use of the nearest available size or similar variety with a corresponding adjustment of the contract price.

D. Energy And Water Efficient Landscaping:

- 1. Buildings shall be landscaped for energy efficiency and water conservation. Bushes and large trees provide shading and act as a wind breaks.

PART 2 - PRODUCTS

2.1 PLANTING MIX:

- A. Planting Mix will meet standards under section #_____ "Soils." Planting mix may be developed that will be an Acceptable Planting Media by following the standards under Soils #_____. The planting mix shall have uniform composition throughout, with a mixture of subsoil. It shall be free of stones, lumps, live plants and their roots, sticks and other extraneous matter. Planting mix shall not be used while in a frozen or muddy condition.
- B. Will meet standards under section _____ "Soils." Unless otherwise specified in the contract documents the Acceptable Planting Media shall contain the specified percentages of constituents shown under Soils #_____.
- C. A sample of the proposed planting mix shall be submitted to the Grounds Superintendent or designee 30 calendar days prior to installation and be approved prior to delivery to the site.

2.2 PLANT MATERIALS:

A. Plant Approval Process:

- 1. Representative samples of each plant type shall be submitted to the Grounds Superintendent or designee for approval. This approval process will require 7 working days. Clear, high quality photographs may be accepted in lieu of actual samples at the discretion of the Grounds Superintendent or designee.
- 2. No plants shall be delivered to the project site, except for required samples, until inspection has been made in the field or at the nursery, or unless specifically authorized in writing by the Grounds Superintendent or designee. Inspection of plants to be balled and burlapped must be made, and plants must be approved by the Grounds

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Superintendent or designee before they are planted. Inspection shall be for quality, size and variety only, and shall not in any way impair the right of rejection for failure to meet other requirements during progress of the work.

3. *PermaTill Manufacturer-Carolina Stalite Company, 217 Klumar Rd., PO Box 1037, Salisbury, NC 28144**Unless specific for that contract.
- B. Supply all plants as specified in plant list as shown on drawings. Plants shall be typical of their species and variety, have normal growth habits, have well-developed branches, be densely foliated, be vigorous, and have fibrous root systems.
 - C. No plants will be accepted unless they show healthy growth and satisfactory foliage conditions.
 - D. Size of plants, spread of roots and size of balls shall be in accordance with American Standard for Nursery Stock 260.1-1990 or latest revision, as published by the American Association of Nurseryman, Inc. All plants of each particular variety shall be uniform in size and configuration, and shall be labeled with correct plant name and size.
 - E. Balled and burlapped plants shall be nursery grown and freshly dug. Burlap shall be untreated and biodegradable. Nursery grown plants shall have been transplanted or root pruned at least once in the past three (3) years. No plants showing evidence of "made" root balls will be accepted.
 - F. Containerized plants shall have a root system sufficient enough in development to hold the soil intact when removed from the container. The root system shall not be root bound a condition where the root system is dense in mass, excessively intertwined, and has established a circular growth pattern.
 - G. Labels shall be attached securely to all plants, bundles and containers of plant materials delivered. Plant labels shall be durable and legible, stating the correct plant name and size in weather-resistant ink or embossed process lettering. These labels shall be removed by the Contractor after the final acceptance.
 1. Plants shall conform to measurements specified in the plant lists, except that plants larger than specified may be used if approved by Grounds Superintendent or designee.
 2. Use of such plants shall not increase the contract price. If larger plants are approved, the root ball shall be increased in proportion to the size of the plant in accordance with the American Standards of Nursery Stock.
- 2.3 SHIPMENT AND DELIVERY:
- A. The Contractor shall promptly notify the Grounds Superintendent or designee, at least three days in advance, when the approved plant material is to be delivered, the nursery source, and the manner of shipment. The Contractor shall furnish therewith an itemized list of the actual species, variety, quantity and sizes.
 - B. The Contractor shall deliver the necessary inspection certificates to accompany each plant or shipment prior to acceptance and planting.
 - C. When shipment is made by open truck, pack all plants material to provide adequate protection against climate and breakage during transit, and tie to prevent whipping. The tops shall be covered with tarpaulin to minimize wind-whipping and drying.
 - D. Exercise care at all times during handling operations to prevent damage to bark, branches, and root system. Employ a suitable method of handling to insure the careful, workmanlike delivery of heavy balled plants to preclude loose or crushed plant balls. All balled and burlap plants shall have wire baskets.
 - E. Plants shall be free from defects and injuries, and shall be certified by the State and Federal Departments of Agriculture to be free from plant diseases and insect infestations.

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2.4 LANDSCAPING DESIGN:

- A. Refer to the University Landscape Architect for assistance. Plant lists shall contain both common and technical names, quantities, and plant delivery method (B & B, bare roots, etc.)

2.5 PLANTS (SHRUBS AND TREES):

- A. Shall be provided as shown on the Drawings. All plant material furnished shall be well branched and proportioned, full-foliaged, and in a healthy condition, free of disease and insect infestation. There shall be no substitutions without express written permission of the Grounds Superintendent. The following requirements pertain to all plant material:
- B. Quality: Unless specifically noted otherwise, all plants shall be of specimen quality, exceptionally heavy, symmetrical, thickly branched, so trained or treated in their development and appearance as to be unquestionably of first quality in form, branch structure, buds, fruit, compactness and symmetry.
- C. Nomenclature: The scientific names of plants listed in the Plant List conform to that of "Standardized Plant Names" (the latest edition) prepared by the American Joint Committee on Horticultural Nomenclature.
- D. Standards: Requirements for definitions, grading tolerances, balling and burlapping, container grown plants and bare-root plants shall be in accordance with the "USA Standard for Nursery Stock," latest edition, adopted by the American Association of Nurserymen, Inc. Plants shall be measured before pruning with branches in normal position, and any necessary pruning shall be performed at time of planting. Where plant sizes are given in a range, the plants provided shall average the median of the range or better.
- E. Inspection: The Owner has the right to inspect the plants and trees at their place of growth, but such inspections shall not preclude the right of rejection at the site. The Owner shall be notified as to the location of plant material for inspection.
- F. Certificates of Inspection: The Contractor shall obtain all necessary certificates of inspection required by law for the transportation or shipments of plants to the project site, and shall maintain files of all certificates.
- G. Disease and Damage: All plants shall be free of disease, insect infestations, eggs or larvae; and shall have thickly developed, well proportioned and healthy root systems. Plant material shall be free from physical damage or conditions that prevent the desired quality appearance and growth characteristics; or inhibit the plants thriving ability, hardiness, or adaptability.

2.6 SOIL PREPARATION

Unless specified elsewhere, prior to completing the project, there shall be a 6-inch layer of organic top soil across the site in areas where any planting is to occur. If there is top soil on site, the Contractor may store it within the Project Limit or at a location away from the University. This work shall be included in the Base Bid.

2.7 SOIL AMMENDMENTS

- A. Shall be **any decomposed compost such as**, horticultural dehydrated cow manure composed of not less than 90% decomposed organic matter by weight on an oven dried basis. Organic matter shall be delivered in a workable condition, free of lumps, containing not more than 35% moisture or ash, by weight.

2.8 FERTILIZER

- A. Shall be commercial nursery slow-release granular fertilizer: STA-Green Nursery Special or approved equal. Fertilizer shall be delivered to the site in original bags bearing the

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manufacturer's guaranteed analysis of 12-6-6 or 14-7-7 of which 50% of the nitrogen is derived from urea formaldehyde.

- B. Fertilizer for Shrubs and Groundcovers:
 1. The fertilizer shall be one from the following listed below or equal fertilizer approved by the Grounds Superintendent or designee.
 2. The fertilizer shall have 50% water insoluble nitrogen. The chlorine content is not to exceed 5%.

- C. Shrubs and Groundcovers:

FERTILIZER PRODUCT	ANALYSIS	APPL.RATE
Ornamental plant fertilizer	12-6-6	2 lbs/100 Sq. Ft.
Ornamental plant fertilizer	14-7-7	2 lbs/100 Sq. Ft.

2.9 PLANTING SOILS

Will conform to standard in section # _____ "Soils"

- A. MULCH

Shall be free of debris and wood chips. It shall be aged Shredded Bark free of excess tannic acid. A sample of bark mulch shall be provided for the Grounds Superintendent's approval prior to delivering the mulch. The Owner reserves the right to reject any mulch which is considered to be unsuitable.

1. Mulch shall consist of pine bark mulch, double hammered pine bark, shredded hardwood bark or other mulch as specified on the plans.
2. All mulches shall be free of any foreign materials, pieces larger than 6 inches, and/or green wood.

2.10 WATER

- A. Water: Water shall be free from oil, acids, alkalis, salts or any other substance that is toxic or otherwise harmful to vegetation.

2.11 MISCELLANEOUS

- A. Anti-Transpirant: An emulsion which provides a protective film over plant surfaces, sufficiently permeable to permit controlled transpiration, and shall be administered according to the manufacturer's recommendations. Anti-transpirant shall be "Vapor-Gard" as manufactured by Miller Chemical and Fertilizer Corporation, Hanover, Pennsylvania, 17331, or Wilt-Pruf, or approved equal.
- B. Pre-emergence Herbicide
 1. "Eptam", granular form, as manufactured by the "Stouffer Chemical Company", or Ronstar "G", or Treflan granular, or approved equal, consistent with pesticide label for recommended plant material.
- C. Bracing Materials
 1. Utilize #9 gauge galvanized steel wire: 3/4" diameter reinforced rubber hose of suitable length; treated guy stakes 2" x 4" x 36" long, guy wire flags of yellow plastic standard surveyor's flagging, capable of lasting through the bracing period.

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PART 3 - EXECUTION

3.1 PLANTING PREPARATION

- A. Herbicides: Three (3) working days prior to the planting of shrubs and groundcovers, but subsequent to planting bed preparation, the Grounds Superintendent or designee shall be notified and be on hand when the pre-emergent is applied to the planting project. The first application of the chemical trifluralin, oryzalin, or approved substitute by the Grounds Superintendent or designee should be applied per labeled instructions. (See instructions under Mulching for Application Rate).
- B. Plant Protection on Site: Protect plants at all times from sun or drying winds. Plants that cannot be planted immediately on delivery shall be kept in the shade, well protected with soil, wet wood chips, or other acceptable material and shall be kept well watered.
 - 1. Plants remaining unplanted for longer than 3 days after delivery may be deemed unacceptable after inspection by Grounds Superintendent or designee. Plants shall not be bound with wire or rope at time so as to damage the bark or break branches. Plants shall be lifted and handled using suitable support of the ball to avoid damage to the root ball, trunk, or branches.
 - 2. Before excavations are made, cover the surrounding turf, if existing, in a manner that will satisfactorily protect all turfed areas that are to be driven over, and upon which soil is to be temporarily stacked pending its removal or reuse. Barricade existing trees, shrubbery and beds that are to be preserved in a manner that will effectively protect them during planting operations or as specified on the plans.
- C. Subsurface Improvements: The contractor shall observe proper precautions so as not to disturb or damage subsurface improvements.
 - 1. Prior to excavations, Contractor shall notify North Carolina One-Call-Center, Inc.
 - a. 1-800-632-4949 to ascertain locations of any locations not identified by the University such as gas lines. Notify the PM/Engineer should the above-mentioned subsurface improvements present an obstruction in locations designated for planting. In such situations, proceed after an alternate location has been approved by the Grounds Superintendent or designee. Damages caused by the Contractor shall be the responsibility of the Contractor to repair in a timely manner (not to exceed 48 hours) to the satisfaction of the Owner.

3.2 PLANTING PROCEDURE:

- A. Locations of Plants: The Contractor shall stake out or paint locations for plants and outlines of areas to be planted, and obtain approval of the Grounds Superintendent or designee before excavation is begun. A minimum of 30% total planting must be staked before inspection will be made.
- B. Excavation: No excavation or planting shall be done in soil that, in the opinion of the Grounds Superintendent or designee, is too wet, too dry or not properly conditioned as provided in these specifications. All excavations shall be in accordance with Typical Planting Detail Sheet included in the Landscape Construction Standards Manual or as otherwise specified. During working hours the Grounds Superintendent or designee may designate holes to be barricaded if holes are determined to present a pedestrian hazard.
- C. Detrimental Soil Conditions: The Contractor shall notify the PM/Engineer in writing of all soil and drainage conditions which the Contractor considers detrimental to growth of plant material. State condition and submit proposal in writing to the PM/Engineer for correcting condition.
- D. Obstructions: If rock, underground construction work, tree roots, or other obstructions are encountered in the excavation of plant pits, alternate locations may be selected by the Grounds Superintendent or designee. Where locations cannot be changed as determined by the Grounds Superintendent or designee, remove the obstructions to a depth of not less than 6

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inches below the required pit depth. Proceed with work after approval of the Grounds Superintendent or designee.

E. Plant Installation:

1. Planting Beds: The extent of the planting bed shall be as indicated on the construction plans. The planting bed for shrubs, groundcover plants, and trees shall be prepared wide enough to accommodate all roots without crowding or twisting.
2. Planting beds shall be prepared in accordance with Types 1, 2, 3 or 4, in accordance with the plans or specifications.
3. Backfilling of Balled and Burlapped Plants:
 - a. Backfilling shall be done in accordance with the following steps;
 - 1) Place root ball two inch (2") above adjacent grade- see detail 40.05 A&B
 - 2) When partially backfilled and compacted, cut away the ball ties and cut and improve any wire loops that may protrude above the surface of the soil at any time. Cut and remove all wires, rope, burlap, or other ball wrapping materials from the top 1/3 of the root ball. Cut or adjust to prevent the formation of air pockets. No burlap shall be pulled from under the balls.
 - 3) Backfill one-half (1/2) of remaining hole with planting mixture specified, and water thoroughly. Backfill rest of hole with planting mixture. Firm down, eliminating all air pockets. Do not pack.
 - 4) Build a four-inch (4") high berm around the edge of the root ball to form a basin for holding water. The bottom of the basin shall be at surrounding finish grade.
4. Watering: Containerized plants shall be watered thoroughly prior to planting so as to provide adequate moisture to the plant during the planting process.
 - a. The Contractor shall thoroughly water all plants immediately after planting. This shall mean full and thorough saturation of all backfill in the pits and beds during the same day of planting.
 - b. Apply water only by open-end hose at a very low pressure to avoid air pockets and injury to the roots. When planted, watered, and fully settled, the plants shall be vertical and the top of the root ball shall not be below the existing grade.
 - c. Fill basin with water, being careful not to break down berm with hose stream, or to gouge out holes in the backfill.
5. Pruning: No pruning is to done except to remove broken branches, street/sidewalk obstructions, and for correcting irregularities including removal of soft wood or sucker growth and/or broken or badly bruised branches.
 - a. This pruning shall be done at the direction of the Grounds Superintendent or designee.
 - b. Prune with harp tools; make cuts even and clean.
6. Mulching Applications: Within two (2) days after planting, mulch all planting areas, entire shrub and groundcover beds with a four-inch (4") layer of mulching material. Taper mulch to ground level at the trunk. Do not allow mulch to pile up against the trunk.
 - a. Prior to mulching, apply trifluralin, oryzalin pre-emergent herbicide or approved equal as specified by Grounds Superintendent or designee to surface according to label directions. Then apply a second application after mulching. Application shall not proceed without the presence of a representative of the Grounds Superintendent or designee.
7. Name Tag Removal: The contractor shall not remove nametags attached to installed plants prior to final inspection. The contractor shall remove all nametags from installed plants within 2 weeks after final inspection.
8. Abandoned Plant Pits: When utility lines or other unsuitable subsurface conditions are encountered in plant pits, the Grounds Superintendent or designee will direct that plants be relocated in satisfactory locations. The Contractor shall backfill-abandoned pits with suitable topsoil to compacted finished grade. Unsuitable material shall be removed from property by Contractor. These areas shall be reseeded as specified with the turf and lawn specifications contained herein.

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3.3 MAINTENANCE/ESTABLISHMENT OF PLANT MATERIALS:

A. Prior to acceptance:

The contractor shall be responsible for all maintenance of plants and facilities until final acceptance. This includes all necessary watering, application of appropriate fertilizer, based on planting season, and the appropriate application of fungicides and insecticides necessary to maintain plants free from disease and insect activity.

B. Watering After Acceptance:

In order to properly establish the plant material, watering of plant material shall be the responsibility of the Contractor until the expiration of the one-year warranty period. The Contractor shall perform watering operations only at intervals approved by the Grounds Superintendent or designee and shall notify the Grounds Superintendent or designee at least 24 hours prior to commencing watering operations so that a representative of the Grounds Superintendent or designee may be on hand.

1. The Grounds Superintendent or designee reserves the right to direct the schedule of watering operations. When so directed by the Grounds Superintendent or designee, the Contractor shall commence watering operations within 24 hours.
2. Watering shall be applied at a rate specified by the Grounds Superintendent or designee or in accordance with the contractor documents. The Contractor shall be responsible for all necessary traffic control during watering operations.
3. The quantity of the water to be paid for will be the actual number of 1, 000 gallon units of water which have been furnished and applied to plants during the establishment period. Measurements of water will be made by means of an approved metering device at the source of supply, or by determining the volumetric capacity of tank trucks used to deliver water to the project and recording the number of loads delivered by each truck.
4. The quantity of water, measured as provided above will be paid for at the contract unit price for "Watering after Acceptance."
5. Plant Materials shall be watered as described by the following ratios:

TREE CALIPER	GALLONS OF WATER
Under 1"	5
1 – 1½"	5 - 10
2"	10 - 15
2 - 2 ½"	15 - 20
3 – 3 ½"	25 - 30
3 ½" +	(Shall be monitored and receive water in an amount and frequency to maintain soil moisture).

6. Execution: watering is to be done a minimum of once per week. Watering shall begin approximately April 15 and continue until November 1, unless otherwise directed by the Grounds Superintendent or designee. A set weekly schedule is to be established and maintained by the contractor, and adequate notice given of any change. The PM/Engineer will notify the contractor to omit watering when he determines there has been adequate rainfall the previous week. The contractor shall notify the Grounds Superintendent or designee of the completion of each watering cycle.

GROUND COVER AND SHRUBBERY	GALLONS OF WATER
Per Square Foot (1" of Water)	1.6

C. Cleanup:

1. During the installation, the Contractor will be required to keep all areas clean.
2. At the time of final inspection of work and before issuance of the final payment, the Contractor shall clean paved areas thoroughly by sweeping and/or washing. Any defacement of stains caused by the work of this Section shall be removed.

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3. The Contractor shall remove construction equipment, excess materials, tools, and all debris and rubbish from the site. All dirt and debris shall be legally disposed of by the Contractor in areas approved by the Grounds Superintendent or designee.
- D. Final Acceptance:
 1. Upon completion of all planting operations, including cleanup, the Contractor shall notify the Grounds Superintendent or designee and accompany him or her on inspection of planting. Any items found to be unsatisfactory shall be corrected prior to approval for final acceptance. The one-year guarantee period shall begin on the date of final acceptance.
- E. Name Tag Removal: The contractor shall not remove the nametags attached to installed plants prior to final inspection. The contractor shall remove all name tags from installed plants within 2 weeks after final inspection.
- F. Guarantee and Replacement:
- G. The Contractor shall guarantee all plants (shrubs and ground covers) and all other materials and workmanship for a period of twelve (12) months from the date of final acceptance by the Grounds Superintendent or designee. The Contractor shall replace any plants that have more than one third die-back, or any other portion of the project that fails due to faulty materials or workmanship. All plants shall be insect and /or disease free. Plants damaged by pathogen activity through the warranty period shall be replaced. A six (6) month and eleven (11) month inspection will be held during the warranty period. Damage prior to final acceptance shall be the responsibility of the Contractor.
 1. Plant replacements shall be the same as specified in the plant list. Replacement plant sizes shall be the same as other existing plants of the same species on the project. Plants, plant soil mix, fertilizer and mulch etc., shall be replaced as originally specified.
 2. During the warranty period any plant that is dead or not in satisfactory growth, as determined by the Grounds Superintendent or designee, shall be removed from the site. These and any missing plants shall be replaced as soon as conditions permit, but during the normal planting season. If plant(s) is (are) not removed within five (5) days of notice from Grounds Superintendent or designee, the Owner will remove dead plant(s), dispose of it (them), and charge the contractor for the cost of removal and disposal.
 3. Plants and items repaired or replaced shall have an extended warranty period of twelve (12) months from the date of acceptance of the repaired item.

3.4 MAINTENANCE

- A. Landscape Management:
 1. Increased development of the campus creates the greater demand for efficient landscape planning. The introduction of new signage, plant materials, benches walks, lights, etc. into the landscape all effect long-term maintenance. Therefore it is necessary to develop guidelines that must be reviewed by anyone involved in the planning and design of elements. Long term plans for walkways, roads and buildings must be considered when locating signage, benches or plant materials in proposed designs.
 - a. Turf strips less than two feet between walkways, curbs or buildings will not be allowed.
 - b. Planting beds shall have large sweeping edges for ease of lawn mower cutting.
 - c. Place signs, lights and other permanently installed objects in mulch or planting beds when possible for ease of lawn maintenance. This will also protect these objects from mower and weed eater damage.
 - d. Select ground covers, shrubs and trees for natural size and habit for an area to avoid overgrowing and unnecessary pruning.
 - e. Do not plant low branching trees in turf areas.
- B. Levels Of Landscape Management:

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- a. Internal standards included to illustrate level of care required if contractor is responsible for if maintaining a landscaped area on campus for the duration of a project:
 - b. Level I:
 - 1) This designation is used for areas requiring the highest level of maintenance. Areas requiring this level of maintenance and landscaping will be limited to high visibility areas such as, but not limited to: Main entrance, Hwy. 29 entrance, North, East and West entrance, Belk Tower Quad, East Quad, West Quad, 49er Island, all Classroom buildings, Administration buildings, Residence Halls, Student Activity Center, Belk Gymnasium, Parking Decks, Belk Track & Field Pavilion and Wachovia Field House.
 - 2) Trees and shrubs planted at new and renovated landscaped sites are to be properly fertilized twice a year (March 1 and June 1) with a 12-6-6 slow release fertilizer with a urea form nitrogen source 50% WSH. and 50% WIN such as "STA-Green" brand. If soil tests are conducted fertilizer schedules and mixtures may be amended.
 - 3) Plant material is to be pruned in late February and early June and treated with necessary pesticides to maintain plant material insect and disease free and plant beds free of all weeds/grasses.
 - 4) Plant beds and trees are mulched in Spring (March - May) with approximately 3 inches of aged shredded pine bark. All plant beds will be maintained using a 4" depth "V" trench, border method edging to retain bark mulch neatly. Leaves are removed from beds in late Fall.
 - 5) Newly installed ground covers and shrubs are to be watered via irrigation systems if available, or hand watered weekly during the first year growing season, which include dry winter periods.
 - 6) Newly installed trees are to be watered via irrigation systems if available, or hand watered at least twice a week during dry periods the first year growing season, which includes winter.
 - c. Level II:
 - 1) This designation is used for areas normally defined as "semi-improved grounds" which include existing trees and shrubs around parking lots, some campus lawn areas, parks, natural areas and walkways.
 - 2) The lawns and shrubs/trees are fertilized in March and June similar to plant material in Grounds Maintenance Level I.
 - 3) Shrubs are pruned in same manner referred to in G.M. Level I and trees are pruned periodically as required to remove dead/diseased trees and limbs and maintain sound structural/aesthetic integrity. Shrubs and trees are fertilized in the same manner referred to in G.M. Level I.
 - d. Level III:
 - 1) This designation is used for areas normally defined as unimproved grounds. These areas will require only minimal levels of work that will include grass and weed control, perimeter fencing, immediate removal of dead trees, tree pruning, brush clearing and removal and other ground cover in low visibility areas or areas that impair safe sight distance for security or vehicular purposes.
- C. Ground Cover Cutting: (e.g., lawn areas, grass/weeds/other vegetation). Ground cover areas shall be maintained in a manner that promotes proper health, growth, rich natural green color and neat appearance.
- 1. Lawn areas are to be free of broad leaf weeds, weedy grasses that present an unsightly appearance, dead vegetation, and debris.
 - 2. All surface disruptions (e.g., rodent and insect mounds), are to be raked level and any resulting holes filled prior to mowing.
 - 3. Grass cutting is to be accomplished in a manner such that it is free of scalping, rutting, bruising, and uneven or rough cutting. Grass clippings shall be either mulched or

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- removed immediately after mowing. Where practical, each successive mowing shall be at approximate right angles to the previous mowing.
4. Prior to mowing, all refuse, debris, leaves, rocks, paper, and other portable objects shall be removed within the maintenance area lodged in shrubs, hedges, fences, and along foundation walls.
- D. Plant And Shrub Pruning: For Grounds Maintenance Level I and II, all shrubs, bushes, hedges, and other cultivated plants shall be pruned according to their natural growth habit, for proper health, attractive appearance and to prevent interference with pedestrian and vehicle traffic. Pruning is to be done in a manner that:
1. Prevents growth in front of windows, over entrance ways and walks; prevents obstructing vision at street intersections; removes dead, damaged, or diseased wood, and naturally forms and balances the shrub, bush or plant.
 2. With the exception of flowering plants, shrubs, and ornamentals, which shall be pruned to accommodate their flower cycle, pruning of the entire plant or shrub shall be performed not less than once per year to maintain their established shape and appearance.
 3. Prune to maintain the plants natural habit except for formal hedges. Prune back to an outward facing bud.
 4. Prune to prevent safety hazards, and to maintain pathways and walks.
 5. All pruning shall be performed according to applicable N.C. Cooperative Extension standards.

SECTION 32 9320 – TREE PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.
- B. Description of Work:
Work Included in This Section:
 1. The work required under this Section consists of all preparation, planting and related items necessary to complete the work indicated as described in the Specifications, in addition to supplying all plants specified on plant list.
 2. All planting shall be executed during the planting (October 15 thru May 1), unless exceptions are made in writing by the Grounds Superintendent or designee.
 3. All plant species, sizes, forms, shapes, and locations will be subject to approval by the Grounds Superintendent or designee.
- C. Substitutions:
 1. The species or varieties, materials, products or sizes specified herein by botanical and common name, shall be provided as specified. Only upon written application by the Contractor to the Grounds Superintendent or designee, and when such application is approved in writing by said Grounds Superintendent or designee in coordination with Grounds Superintendent or designee, will substitutions be permitted.
 2. Request for permission to substitute will not be entertained unless adequate evidence substantiating the unavailability of the specified item accompanies the request for substitution.
 3. If proof is submitted, substantiated in writing, that any plant specified is not obtainable, a proposal will be considered for use of the nearest available size or similar variety with a corresponding adjustment of the contract price.
If the specified plant(s) proves to be unavailable, the use of a substitute plant will be considered.

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PART 2 - PRODUCTS

2.1 TOPSOIL:

- A. Topsoil shall conform to standards under section #___ “Soils,” unless otherwise specified in the contract documents.

2.2 PLANTING MIX:

- A. Planting mix will meet standards under section #_____ “Soils.” Planting mix may be developed that will be an Acceptable Planting Media by following the standards under Soils #_____. The planting mix shall have uniform composition throughout, with a mixture of subsoil. It shall be free of stones, lumps, live plants and their roots, sticks and other extraneous matter. Planting mix shall not be used while in a frozen or muddy condition.
- B. Will meet standards under section _____ “Soils,” unless otherwise specified in the contract documents the Acceptable Planting Media shall contain the specified percentages of constituents shown under Soils #_____.

2.3 Plant Materials:

A. Plant Approval Process:

1. Representative samples of each plant type shall be submitted to the Grounds Superintendent or designee for approval. This approval process will require 7 working days. Clear, high quality photographs may be accepted in lieu of actual samples at the discretion of the Grounds Superintendent or designee.
2. No plants shall be delivered to the project site, except for required samples, until inspection has been made in the field or at the nursery, or unless specifically authorized in writing by the Grounds Superintendent or designee. Inspection of plants to be balled and burlapped must be made, and plants must be approved by the Grounds Superintendent or designee before they are planted. Inspection shall be for quality, size and variety only, and shall not in any way impair the right of rejection for failure to meet other requirements during progress of the work.
3. Supply all plants as specified in plant list as shown on drainage. Plants shall be typical of their species and variety, have normal growth habits, have well-developed branches, be densely foliated, be vigorous, and have fibrous root systems. No plants will be accepted unless they show healthy growth and satisfactory foliage conditions. Size of plants, spread of roots and size of balls shall be in accordance with American Standard for Nursery Stock 260-1-1990 or latest revision, as published by the American Association of Nurserymen, Inc. All plants of each particular variety shall be uniform in size and configuration, and shall be labeled with correct plant name and size.
4. Balled and burlapped plants shall be nursery grown and freshly dug. Burlap shall be untreated and biodegradable. Nursery grown plants shall have been transplanted or root pruned at least once in the past three (3) years. No plants showing evidence of “made” root balls will be accepted.

B. Tree Root Ball Specifications:

1. Trees supplied must have been properly planted and grown in the nursery. The original root crown (also called the trunk flare) shall be evident near the top of the ground. Any excess soil, up to and including 3 inches covering the root crown will have to be removed carefully by hand, in order to prevent root scrapes. The tree is then to be planted with the root crown in the proper relation to the surrounding grade. Any trees with more than 3 inches of soil on top of the root crown will be rejected. The nursery owners may dig oversize balls and remove the soil in order for the root system diameter (which is the required root ball diameter) to meet the specification for the trunk caliper required. (see detail 40.09).

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2. Ball and burlapped (B & B) plants must have firm, natural balls of earth, of diameter not less than recommended in the "Tree and Shrub Transplanting Manual", and be of sufficient depth to include the fibrous and feeding roots. Plants moved with a ball will not be accepted if the ball is dry, cracked, or broken before or during planting operations.
3. Containerized plants shall have a root system sufficient enough in development to hold the soil intact when removed from the container. The root system shall not be root bound a condition where the root system is dense in mass, excessively intertwined, and has established a circular growth pattern.
4. new trees must have straight trunks with a single leader intact, unless multi-stem trees are specified. Bark shall be free of abrasions, and all cuts shall be completely callused over. Trees will not be accepted which have had their branches shortened, leaders cut or which have leaders damaged so that cutting is necessary. Unless otherwise specified, large maturing trees shall be free of branches up to six feet (6') from top of ball, well branched, and have straight stems.
5. Labels shall be attached securely to all plants, bundles and containers of plant materials delivered. Plant labels shall be durable and legible, stating the correct plant name and size in weather-resistant ink or embossed process lettering. These labels shall be removed by the Contractor after the final acceptance. Plants shall conform to measurements specified in the plant lists, except that plants larger than specified may be used if approved by the PM/Engineer. Use of such plants shall not increase the contract price. If larger plants are approved, the root ball shall be increased in proportion to the size of the plant in accordance with the American Standards of Nursery Stock.

C. Shipment and Delivery:

1. The Contractor shall promptly notify the Grounds Superintendent or designee, at least three days in advance, when the approved plant material is to be delivered, the nursery source, and the manner of shipment.
2. The Contractor shall furnish therewith an itemized list of the actual species, variety, quantity and sizes. The Contractor shall deliver the necessary inspection certificates to accompany each plant or shipment prior to acceptance and planting.
3. When shipment is made by open truck, pack all plant materials to provide adequate protection against climate and breakage during transit, and tie to prevent whipping.
4. The tops shall be covered with tarpaulin to minimize wind-whipping and drying.
5. Exercise care at all times during handling operations to prevent damage to bark, branches, and root system. Employ a suitable method of handling to insure the careful, workmanlike delivery of heavy balled plants to preclude loose or crushed plant balls. All balled and burlap plants shall have wire baskets.
6. Plants shall be free from defects and injuries, and shall be certified by the State and Federal Departments of Agriculture to be free from plant diseases and insect infestations.

D. Fertilizer for Trees:

1. No fertilizer is to be applied at time of planting.
2. The tree fertilizer is to be applied at the 6 month or 12 month warranty inspection time; whichever is closer to early spring beginning of growth.
3. The fertilizer shall be one from the following listed below or equal fertilizer approved by the PM/Engineer.
4. The fertilizer shall have 50% water insoluble nitrogen. The chlorine content is not to exceed 5%.
 - a. Trees
 - 1) Application shall be at a rate .16 lb. minimum to .20 lb. maximum nitrogen/inch caliper of tree. Source of nitrogen shall be Urea Formaldehyde or a similar slow release source approved by the PM/Engineer. In addition to the nitrogen, the following shall be used, .05 lb. phosphorous and .05 lb. of pot ash per inch caliper.
 - 2) EXAMPLE OF TREE FERTILIZATION: 1 cup of 31-7-7 analysis fertilizer or 2 cups of 12-6-6-analysis fertilizer per inch caliper.

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- E. Mycorrhizal Fungi: All trees will be treated/inoculated at the root zone with mycorrhizal fungi for root growth stimulation using either ecto and/or endo mycorrhizal fungi: dependent on the particular tree species as approved by the Grounds Superintendent or designee, who may appoint a representative to oversee the inoculation of these rootballs.
- F. Mulch (Trees): Mulch shall consist of pine chips and bark or hardwood bark as specified on the plans. Pine bark chips shall be 1/8-inch nominal thickness with at least 50 percent having an area of not less than 1 square inch and no piece having an area of more than 6 square inches. All mulches shall be free of any foreign materials, pieces larger than 6 inches, and/or green wood.
- G. Water: Water shall be free from oil, acids, alkalis, salts or any other substance that is toxic or otherwise harmful to vegetation.
- H. Root Control Barricades: These general guidelines must be followed in all barrier installations. Use instructions based upon manufacturers recommendations. Review site-specific design plan with the Grounds Superintendent for all applications specifically for depth of barriers required and ESPECIALLY IF ROOT TRIMMING IS REQUIRED!

PART 3 - EXECUTION

3.1 PLANTING PREPARATION

- A. Plant Protection on Site: Protect plants at all times from sun or drying winds. Plants that cannot be planted immediately on delivery shall be kept in the shade, well protected with soil, wet wood chips, or other acceptable material and shall be kept well watered.
 - 1. Plants remaining unplanted for longer than 3 days after delivery may be deemed unacceptable after inspection by PM/Engineer. Plants shall not be found with wire or rope at any time so as to damage the bark or break branches. Plants shall be lifted and handled using suitable support of the ball to avoid damage to the root ball; trunk, or branches.
 - 2. Before excavations are made, cover the surrounding turf, if existing, in a manner that will satisfactorily protect all turfed areas that are to be driven over, and upon which soil is to be temporarily stacked pending its removal or reuse. Barricade existing trees, shrubbery and beds that are to be preserved in a manner that will effectively protect them during planting operations or as specified on the plans.
- B. Subsurface Improvements: Observe proper precautions so as not to disturb or damage subsurface improvements.
 - 1. Prior to excavations, Contractor shall notify North Carolina One-Call Center, Inc. at 1-800-632-4949 to ascertain locations of any locations not identified by the University, such as gas lines. Notify the PM/Engineer should the above-mentioned subsurface improvements present an obstruction in locations designated for planting. In such situations, proceed after an alternate location has been approved by the Grounds Superintendent or designee. Damages incurred by the Contractor shall be the responsibility of the Contractor to repair in a timely manner (not to exceed 48 hours) to the satisfaction of the Owner.

3.2 PLANTING PROCEDURE

- A. Locations of Plants: The Contractor shall stake out or paint locations for plants and outlines of areas to be planted, and obtain approval of the Grounds Superintendent or designee before excavation is begun. A minimum of 30% total planting must be staked before inspection will be made.
- B. Excavation: No excavation or planting shall be done in soil that, in the opinion of the Grounds Superintendent or designee is too wet, too dry or not properly conditioned as provided in these specifications. All excavations shall be in accordance with Typical Planting Detail Sheets

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included in the Landscape Construction Standards Manual or as otherwise specified. Tree pits shall not be excavated more than 24 hours prior to tree installation. Holes left open after working hours shall be completely barricaded and clearly marked by the Contractor. During working hours the Grounds Superintendent or designee may designate holes to be barricaded if holes are determined to present a pedestrian hazard.

- C. Detrimental Soil Conditions: The Contractor shall notify the PM/Engineer in writing of all soil and drainage conditions which the Contractor considers detrimental to growth of plant material. State condition and submit proposal in writing to PM/Engineer for correcting condition.
- D. Obstructions: If rock, underground construction work, tree roots, or other obstructions are encountered in the excavation of plant pits, alternate locations may be selected by the PM/Engineer. Where locations cannot be changed as determined by the PM/Engineer, remove the obstructions to a depth of not less than 6 inches below the required pit depth. Proceed with work after approval of PM/Engineer.
- E. Tree Installation:
 - 1. Planting Beds: The extent of the planting bed shall be as indicated on the construction plans. The planting bed for shrubs, groundcover plants, and trees shall be prepared wide enough to accommodate all roots without crowding or twisting.
 - a. Planting beds shall be prepared in accordance with Section # _____ Type 1, 2, 3 or 4 in accordance with the plans or specification.
 - 2. Backfilling of Balled and Burlapped Plants:
 - a. Backfilling shall be done in accordance with the following steps;
 - 1) Set rootball 2" (no more) above adjacent grade-see detail 40.01
 - 2) When partially backfilled and compacted, cut away the ball ties and cut and remove any wire loops that may protrude above the surface of the soil at any time. Cut and remove all wires, rope, burlap, or other ball wrapping materials from the top 1/3 of the root ball. Cut or adjust to prevent the formation of air pockets. No burlap shall be pulled from under the balls.*
 - 3) Backfill one-half (2) of remaining hole with planting mixture specified, and water thoroughly.
 - 4) Backfill rest of hole with planting mixture. Firm down, eliminating all air pockets. Do not pack.
 - 5) Build a four-inch (4") high berm around the edge of the root ball to form a basin for holding water. The bottom of the basin shall be at surrounding
 - 3. Watering: Containerized plants shall be watered thoroughly prior to planting so as to provide adequate moisture to the plant during the planting process.
 - a. The Contractor shall thoroughly water all plants immediately after planting. This shall mean full and thorough saturation of all backfill in the pits and beds during the same day of planting. Apply water only by open-end hose at a very low pressure to avoid air pockets and injury to the roots. When planted, watered, and fully settled, the plants shall be vertical and the top of the root ball shall not be below the existing grade.
 - b. Fill basin with water, being careful not to break down berm with the hose stream, wash away any mulch, or to gouge out holes in the backfill.
- F. Pruning: No pruning is to be done except to remove broken branches, street/sidewalk obstructions, and for correcting irregularities including removal of soft wood or sucker growth and/or broken or badly bruised branches. This pruning shall be done at the direction of the Arborist/Horticulturist. Prune with sharp tools; make cuts even and clean.
- G. Wrapping: There is to be no wrapping of the tree trunk. Any wrapping from the nursery to protect the trees in transit shall be left on the trunk until it is planted, and then all tree wrapping must be removed.
 - 1. Brown or gray plastic tree trunk protectors shall be installed on all single trees in turf areas as directed by the Grounds Superintendent or designee. Do not lock the ends together.

*Mycorrhizal fungi shall be placed in the root zone between the rootball and the backfill.

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- H. Staking: There is to be no staking until examination by the Grounds Superintendent or designee 2-3 weeks after planting, and then stake only the trees, which they specify. Staking, using as many stakes as necessary, will only be used to straighten a leaning tree. Use only $\frac{3}{4}$ inch green nylon strap with a slip knot and a stop knot 3-6 inches larger than the tree trunk to allow for growth. No cord, rope, wire, or hose will be allowed. Dig the root ball loose only if necessary. Do not stomp the root ball to straighten the tree.
1. If oversize planting pits are specified and the soil is loosed to 18 inches, use stakes long enough, up to 36 inches, to achieve a solid anchor. Drive the stakes in line with the strap, with the stake point directed away from the tree. In place of wood stakes, use #40 duck bill anchors for trees 2.50 inches in caliper and under. Use #68 duck bill anchors for trees larger than 2.50 inches in caliper. Set the anchors well before strapping to the tree. If trees begin to lean, within three weeks after staking is completed, turnbuckles will be required at the expense of the contractor.
 2. Where required, wrap or cover straps with fluorescent flagging.
- I. Mulching Application: Within two (2) days after planting, mulch all planting areas, individual tree pits, and entire shrub and groundcover beds with a four inch (4") layer of mulching material. Taper mulch to ground level at the trunk. Do not allow mulch to pile up against the trunk.
- J. Name Tag Removal: The contractor shall not remove name tags attached to installed plants prior to final inspection. The contractor shall remove all name tags from installed plants within 2 weeks after final inspection.
- K. Root Control Barriers: Where large maturing trees will be planted within closed proximity to brick paver sidewalks or other hardscapes, root control barriers will be installed. Closed proximity will be defined within eight feet of the sidewalks or other hardscapes from the side of the tree. These barriers are to hinder root growth from pushing up paver sidewalks or other hardscapes by the undermining of these hardscapes by root intrusion.
1. Review site-specific design plan with Grounds Superintendent and/or designee for all applications specifically for depth of barrier required and **ESPECIALLY IF ROOT TRIMMING IS REQUIRED!**
 2. Contact utility companies prior to digging or trenching if there are possibility service lines are present.
 3. Wear chemical resistant gloves when handling the barrier to prevent staining.
 4. See product label and MSDS sheet for further information.
 5. Do not allow gaps in fabric during installation or backfilling.
 6. Many severed roots can regenerate, so they should always be completely removed. If removal is not possible, a systemic herbicide must be applied to severed roots to prevent re-growth. The systemic herbicide should be carefully applied, according to manufacturer directions, insuring that it does not come in contact with existing tree roots. This could damage or kill the tree.
 7. In high organic soils (>10%) with aggressive root species in close proximity to olefin plastics, spray or saturate trench walls with liquid trifluralin.
 8. When joining two pieces of barrier, be sure they do not become separated at any point.
 9. Seaming can be accomplished by using construction adhesive and/or overlapping. If the latter is used, seams should be overlapped at least 3 inches (or 2 nodule widths). Sod pins may also be used for seams, but make sure there are no gaps.
 10. Barrier should not be left exposed to surface water or sunlight.
 11. Barrier products are for non-food uses only.
 12. Barrier stops roots within -1 inch of a nodule. Proper placement is very important. It is only effective where it is!
 13. SEE INSTALLATION DETAILS UNDER NO. _____

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3.3 RELOCATION OF TREES:

- A. Scope: Provide materials, equipment, and labor to relocate trees from areas to be cleared on site.
- B. Execution: Trees to be relocated shall be as shown on the drawings and specified herein. Trees are to be relocated in areas staked by the Grounds Superintendent or designee.
 - 1. Trees shall be removed with a root ball sized in proportion to their calipers. Root balls shall be 12" in diameter for each 1" of tree caliper. Trees 4" in caliper and smaller are to be measured 6" from the ground. Trees 4"-8" calipers are measured 12" from the ground, trees 8" caliper or larger are measured from breast height.
 - 2. Trees which are to be relocated in areas which do not require grading are to be placed directly into their new location and installed in accordance with the installation specifications contained herein.
 - 3. Trees transplanted off site in full leaf shall be covered entirely with a protective cloth covering prior to transporting. Trees transplanted on site do not require the covering.
 - 4. Trees which are to be relocated in areas to be graded are to be stockpiled in an area or areas identified by the Grounds Superintendent or designee. Stockpiled trees shall be well heeled in and protected from excessive wind and sun. Stockpiled trees shall be installed in their final position according to other provisions of Planting Preparation or Planting Procedure: The Contractor shall provide water to maintain a healthy condition.
 - 5. All transplanted trees shall be maintained and guaranteed throughout the project and until final acceptance. Replacement trees shall be provided by the Contractor at no additional cost to the City and shall be of the same caliper, species, and form. Exceptions for replacement stock from the site may be made by the Grounds Superintendent or designee.
- C. Abandoned Plant Pits: When utility lines or other unsuitable subsurface conditions are encountered in plant pits, the Grounds Superintendent or designee will direct that plants be relocated in satisfactory locations. The Contractor shall backfill-abandoned pits with suitable topsoil to compacted finished grade.
 - 1. Unsuitable material shall be removed from property by Contractor. These areas shall be reseeded as specified with the turf and lawn specifications contained herein.

3.4 MAINTENANCE / ESTABLISHMENT OF PLANT MATERIALS:

- A. Prior to Acceptance:

The Contractor shall be responsible for all maintenance of plants and facilities until final acceptance. This includes all necessary watering, application of appropriate fertilizer, based on planting season, and the appropriate application of fungicides and insecticides necessary to maintain plants free from disease and insect activity.
- B. Watering After Acceptance:
 - 1. In order to properly establish the plant material, watering of plant material shall be the responsibility of the Contractor until the expiration of the one-year warranty period. The Contractor shall perform watering operations only at intervals approved by the Grounds Superintendent or designee and shall notify the Grounds Superintendent or designee at least 24 hours prior to commencing watering operations so that a representative of the Grounds Superintendent or designee may be on hand. The Grounds Superintendent or designee reserves the right to direct the schedule of watering operations. When so directed by the Grounds Superintendent or designee, the Contractor shall commence watering operations within 24 hours.
 - 2. Watering shall be applied at a rate specified by the Grounds Superintendent or designee or in accordance with the contract documents. The Contractor shall be responsible for all necessary traffic during watering operations.
 - 3. The quantity of water to be paid for will be the actual number of 1,000 gallon units of water which have been furnished and applied to plants during the establishment period. Measurement of water will be made by means of an approved metering device at the

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source of supply, or by determining the volumetric capacity of tank trucks used to deliver water to the project and recording the number of loads delivered by each truck.

4. The quantity of water, measured as provided above will be paid for at the contract unit price per 1,000 gallons for "Watering after Acceptance".
5. All trees shall be watered to the following specifications after installation, as part of routine maintenance and Watering After Acceptance.
6. Trees shall be watered as described by the following ratios:

CALIPER	GALLONS OF WATER
Under 1"	5
1 - 1½"	5 - 10
2 "	10 - 15
2 - 2 ½"	15 - 20
3 – 3 ½"	25-30
3 ½" +	Shall be monitored and receive water in an amount and frequency to maintain soil mixture.

7. Execution: Watering is to be done a minimum of once per week. The beginning shall be approximately April 15 and continue until November 1, unless otherwise directed by the Grounds Superintendent or designee. A set weekly schedule is to be established and maintained by the contractor, and adequate notice given of any change. The Grounds Superintendent or designee will notify the contractor to omit watering when he determines there has been adequate rainfall the previous week. The contractor shall notify the Grounds Superintendent or designee of the completion of each watering cycle.

3.5 CLEANUP:

- A. During the installation, the Contractor will be required to keep all areas clean.
- B. At the time of final inspection of work and before issuance of the final payment, the Contractor shall clean paved areas thoroughly by sweeping and/or washing. Any defacements or stains caused by the work of this Section shall be removed.
- C. The Contractor shall remove construction equipment, excess materials, tools, and all debris and rubbish from the site. All dirt and debris shall be legally disposed of by the Contractor in areas approved by the Grounds Superintendent or designee.

3.6 FINAL ACCEPTANCE:

- A. Upon completion of all planting operations, including cleanup, the Contractor shall notify the Grounds Superintendent or designee and accompany him or her on inspection of planting. Any items found to be unsatisfactory shall be corrected prior to approval for final acceptance. The one-year guarantee period shall begin on the date of final acceptance.
- B. At the end of the one-year guarantee period, and upon written notice submitted by the Contractor at least ten days before the anticipated date, an inspection will be made by the Grounds Superintendent or designee and the Contractor. At this one-year inspection, the Contractor shall remove all tree guys, guy collars, and guy stakes from all guyed plants. Guys and staking may also be removed at any time after the 6-month warranty check, after approval by the Grounds Superintendent or designee.
- C. Name Tag Removal: The contractor shall not remove name tags attached to installed plants prior to final inspection. The contractor shall remove all name tags from installed plants within 2 weeks after final inspection.

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3.7 GUARANTEE AND REPLACEMENT:

- A. The Contractor shall guarantee all trees and all other materials and workmanship for a period of twelve (12) months from the date of final acceptance by the Grounds Superintendent or designee. The Contractor shall replace any plants that have more than one third die-back, or dead central leader if single stem tree, or any other portion of the project that fails due to faulty materials or workmanship. All plants shall be insect and/or disease free. Plants damaged by pathogen activity through the warranty period shall be replaced. A six (6) month and eleven (11) month inspection will be held during the warranty period. Damage prior to final acceptance shall be the responsibility of the Contractor.
- B. Plant replacements shall be the same species as specified in the plant list. Replacement plant sizes shall be the same as other existing plants of the same species on the project. Plants, plant soil mix, fertilizer and mulch etc., shall be replaced as originally specified.
- C. Any plant that is dead or not in satisfactory growth, as determined by the Grounds Superintendent or designee, shall be removed from the site. These and any plants missing shall be replaced as soon as conditions permit, but during the normal planting season. If plant(s), dispose of it (them), and charge the contractor for the cost of removal and disposal.
- D. Plants and items repaired or replaced shall have an extended warranty period of twelve (12) months from the date of acceptance of the repaired item.

SECTION 0600 – MISCELLANEOUS – SITE FURNITURE - ALL THE BELOW APPLIES TO ALL KINDS OF SITE FURNITURE (BENCHES, TRASH RECEPTACLES, ASH URNS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK:

The work in this section is the furnishing and installation of specially selected pieces of equipment.

1.3 SUBSTITUTIONS:

The Contractor shall bear the burden of proof for substitutions offered.

1.4 SUBMITTALS:

Contractor shall submit for approval three (3) sets of shop drawings, fully describing product and installation for all equipment. Prior to ordering any equipment, Contractor shall receive approval of shop drawings and any substitutions submitted.

PART 2 - PRODUCTS

2.1 BENCHES:

- A. Benches shall be as shown on the standard detail.
- B. Bench available from:
 - 1. Maglin MLB300-MH (powdercoat color RAL 6012)

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2. Or an Approved Equal by Owner

PART 3 - EXECUTION

3.1 INSTALLATION:

Manufacturer's installation instructions, as approved by the PM/Engineer and details in these documents shall be ordinated to complete the installation of the specified equipment.

SECTION 2
DIVISION 33
UTILITIES

DIVISION 33 - UTILITIES

Note: This is a guide for Designers only. Contents shall not be used in lieu of specifications as part of the Designer’s contract documents.

PRIMARY GUIDANCE

1.1 SUBSURFACE EXPLORATION:

A. Designer Responsibilities:

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 the UPM and submit a Request for Proposals for soils exploration. UPM will provide names of pre-qualified testing companies. This will include investigative work and surveyor reports, laboratory tests (incl. test borings), soil analysis (incl. 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 six copies of the site exploration report to the University.

B. 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 used or abandoned. Facilities Management will assist with identifying existing conditions and will provide drawings as available. Clearly indicate the project boundary.

SECTION 33 0500 – UTILITIES

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

- A. Coordination of Divisions of 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 31, regardless of who performs this work; therefore, in Divisions 23, 24, 25, and 26 the requirements of earthwork may be best specified by making reference to Division 31.
- B. Surveyor to review and coordinate survey to assure that the survey shows all utilities.**

PART 2 - PRODUCTS

2.1 MANHOLES

Manhole frame, cover, and grate castings shall include the name and location of the manufacturer. Covers shall have cast identification markings of “storm drain”, sanitary, “steam”, “electrical”, “telephone” etc. as appropriate. Masonry manholes shall be parge coated inside and out. Manholes are considered confined spaces and appropriate safety measures should be taken when entering them.

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2.2 VALVES

- A. All valves are required to have a valve lockout device (need donut for protection).
- B. All valve covers shall have concrete collars.
- C. All water valves to operate by turning the square nut clock-wise (right) to close and counter-clockwise (left) to open.
- D. Provide all valves with extensions when grade at location is altered.

SECTION 33 1150 – UTILITIES

PART 1 - GENERAL

1.1 UTILITY STANDARDS

- A. All underground piping and utilities (both metallic and non-metallic), except copper pipe, shall have a separate copper tracer wire and non-metallic warning tape installed above the utility line.
- B. The tracer wire shall be tested for continuity prior to backfill, immediately upon completion of backfill and compaction, and once again during final utility location/as-built at the end of the project. This also will include landscape irrigation mains to the points of the valves. All above ground utility features such as vaults, manholes, valves, handholds, etc shall be properly labeled. Contractor shall provide an inventory of all installed outdoor utility features including type and model.

1.2 IDENTIFICATION TAPE

The 1st stage of identification shall be a buried warning tape. This tape shall provide an early warning at shallow depth excavation. The tape shall be 6" wide, and buried approximately 18" to 30" above the service pipe, but a minimum of 10" below finished grade. It shall consist of multiple layers of polyethylene with an overall thickness of 3 to 5 mils. It shall be installed continuous from valve box to valve box or manhole to manhole, and shall terminate just outside of valve box or manhole wall. The black colored lettering on the warning tape shall be abrasion resistant and be imprinted on a color-coded background that conforms to APWA color code standards. The lettering on the tape should name the utility it is protecting. (i.e. Caution Buried Sewer Line Below).

1.3 TRACER WIRE

- A. The 2nd stage of identification shall be a buried tracer wire. This tracer wire shall provide pipeline identification, be fully detectable from above grade utility locators, and be able to provide a depth reference point to top of pipe.
- B. All pipe, including lawn irrigation lines, and metallic pipe with compression gasket fittings installed underground shall have a tracer wire installed along the length of the pipe. The wire shall be taped to the bottom of the pipe at a maximum of 10' intervals and not allowed to "float freely" within the backfill.
- C. Tracer wire shall be single-conductor, 12 gauge minimum, copper single-conductor wire with type "UF" (Underground Feeder) insulation, and shall be continuous along the pipeline passing through the inside of each valve box. A #12 AWG or heavier (smaller AWG number), solid, insulated (RHW, THW, or polyethylene insulation is recommended), copper wire shall be taped to pipe at 10 foot intervals. Do not wrap wire around pipe. The wire must be one continuous, unbroken length. Coil tracer wire at meter location and street end with enough wire to extend a minimum of two feet above grade.

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1.4 TRACER WIRE BOXES

Plastic gas and water services longer than 1000 feet in length from curb valve to meter riser must have tracer wire boxes installed in accordance with UNC Charlotte standards.

1.5 FINAL AS-BUILT SURVEY

- A. The As-Built Survey is a survey conducted several times during a construction project to verify, for the designer/project manager (not the contractor), which the work authorized, was completed to the specifications set on the Plot Plan or Site Plan. This entails a complete survey of the site to confirm that the structures, utilities, and roadways proposed were built in the proper locations authorized in the Plot Plan or Site Plan. As-builts are done a minimum of 2-3 times during the construction project; once after the foundation has been poured; once after the walls are put up; and at the completion of construction.
- B. Prior to project punch-list the engineer shall have the As-Built survey finalized by a licensed surveyor and locating company. Any problems found in the survey should be included in the punch-list. The final As-Built survey shall locate and inventory all utilities and also survey the existing conditions. The survey of the site shall also include 1' contours, manhole elevations, inverts, building footprint, and all aspects of the site.
- C. The surveyor will identify any untraceable utilities and relay missing information to designer/project manager in order to coordinate repairs with contractor. Surveyor shall relocate and resurvey missing data after repair. Survey will extend a minimum of 50' past site construction to tie data into existing campus utility plans. Digital (CAD) and stamped survey (1 PDF and 1 Mylar) to be delivered to UNC Charlotte within 20 business days of punch list acceptance.

SECTION 33 4100 – STORM DRAINAGE

PART 1 - GENERAL

- A. SUMMARY
 - 1. Drainage systems are to be designed with minimal visual impact.
 - 2. Surface Drainage
 - a. Surface drainage shall be designed to flow away from all buildings and entrance plazas. Drainage shall sheet flow away from the building and be collected in grass swales and drain to natural drainage-ways or drainage inlets.
 - b. Lawns and mulch areas are encouraged when possible around new building areas to increase natural percolation and decrease impervious run-off.
 - c. Surface drainage shall be directed away from planting areas when possible. Subsurface drainage may be required in new planting areas with poor soils.
 - 3. Natural Drainage
 - a. Natural drainage-ways shall be utilized and maintained where ever possible. The vegetative area 50 feet from each side the centerline of the swale or stream shall be maintained whenever possible to provide for greater natural percolation and pollutant filtering. When a natural drainage course is required to be diverted due to site improvements the following shall be considered,
 - b. The vegetative area adjacent to the new drainage course shall be re-planted to its original condition or improved with lawn and/or tree plantings.
 - c. If sub-surface drainage is required within lawn or landscape areas the outfall shall be to the nearest downstream existing drainage structure or into a natural drainage-way such as a creek.
- B. Sub-surface Drainage: Sub surface drainage shall be incorporated into the site improvement design to ensure that surface runoff is removed as quickly as possible. Ponding of water is not

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acceptable. Oversized grates can reduce the visual quality of the campus and are to be avoided.

1. The size of inlet shall be designed according to the drainage area. The minimum size grate acceptable shall be 8 inches square. Drainage grates in lawn areas within 25 feet of a walkway shall be designed to have a 2.0 percent slope from the edge of the walk to the storm drainage rim.
2. Drainage grates within brick walks and plazas shall comply with the campus standard. Alternative types of drainage grates must be submitted to the Facilities Landscape Architect for approval. The number of grates shall be determined by grading and storm drainage design.
3. New sub-surface drainage shall tie into existing storm drainage systems where possible following acceptable engineering practices. Flared end sections and headwalls should be avoided.
4. Bee-Hive type drainage grates shall be used in mulched planting areas.
5. In gathering areas such as plazas or quads small grates are preferred rather than large grates in order to reduce a negative visual impact.

1.2 QUALITY ASSURANCE

Erosion Control measures for new construction shall follow the North Carolina Department of Natural Resources Sedimentation and Erosion Control Manual.

PART 2 - PRODUCTS

2.1 FLARED END SECTIONS

1. If the new storm drain system cannot be tied into an existing drainage structure Flared End Sections shall be installed with the following criteria,
 - a. Outlet into natural drainage ways such as grassed swales or creeks.
 - b. At locations that are in remote areas away from heavy pedestrian or vehicle use.
 - c. The designer shall discuss with the Facilities Landscape Architect conditions that shall not allow the new storm drainage to be tied into an existing system and potentials for screening by grading or planting.
 - d. The use of riprap is to be avoided. The following are preferred methods to prevent erosion at Flared End Sections,
 - 1) Naturally weathered stone equal to NCDOT classified riprap.
 - 2) Vegetation with appropriate erosion control matting.
 - 3) The combination of 1 and 2 above.

2.2 HEADWALLS

- A. The appearance of exposed concrete headwalls in highly traveled areas can lessen the aesthetic value of the campus. Therefore the location and treatment of headwalls are to be considered carefully.
 1. Headwalls shall use brick or stone veneer and be determined on a case by case basis
 2. Slope and creek bed stabilization methods other than riprap should be considered in conjunction with veneered headwalls. (See DLS 404:P1)

2.3 DRAIN OPENING PROTECTION

- A. Install removable bars or grills at open end of culverts, drains, and pipes 10 inch diameter and larger.
- B. In stairwells, areaways and similar locations where leaf clogging of conventional drains would be expected provide scupper or dome type drains.

SECTION 3:
APPENDICES AND ANNEXES

APPENDIX A
DESIGN GUIDELINES
CLASSROOM PLANNING AND DESIGN

CLASSROOM PLANNING AND DESIGN

1.1 PURPOSE

This section describes the optimal physical design characteristics for 110 classrooms on the UNC Charlotte campus. Classroom renovations in existing buildings should be implemented as closely as possible to the intent stated herein."

1.2 PHYSICAL CHARACTERISTICS

- A. Classroom Types – The “110” category aggregates classroom facilities as an institution-wide resource, even though they may fall under different levels of organizational control. Thus, a “110 Classroom” is a room used for classes not tied to a specific subject or discipline by equipment in the room or the configuration of the room. NC State University 110 classrooms are defined as one of the following:
1. Seminar Room – General-purpose classroom designed for up to twenty students.
 2. Small Classroom – General-purpose classroom designed for a maximum of forty-nine persons inclusive of instructor(s).
 3. Large Classroom – General-purpose classroom designed for fifty to ninety-nine persons inclusive of instructor(s).
 4. Lecture Hall – Large classroom designed for one hundred or more student.
- B. Classroom Location
1. Locate 110 classrooms as close as possible to main entrance levels of buildings.
 2. Locate large-capacity 110 classrooms or lecture halls near the building entrances.
 - a. Classrooms on upper floors of buildings should be located as close to the building stairways and elevators as possible.
 - b. Locate classrooms away from indoor noise-generating equipment and activities, such as toilets and building systems, or away from labs where hazardous materials are used.
 - c. Locate student study / lounge areas near classrooms.
 - d. Provide corridor seating outside the lecture halls and along the hallways outside classrooms.
 - e. Classroom Footprint – The person in the least favored seat should have full visibility to all presented material, i.e. projection screen(s), dry erase marker and/or black boards.
 - f. The ideal configuration of seminar, small and large classrooms is nearly square. A rectangle with a length-to-width ratio of no greater than 1.5 to 1 is acceptable.
 - g. Classrooms that require a media (AV) closet should have a 24 sq. ft. (min) lockable closet.

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- C. Classroom Support Closet – Provide at least one lockable storage closet for classroom supplies, maintenance and support equipment, in each classroom building. Closet must have corridor access, be located on the same floor as and be as close as possible to the majority of the classrooms. Minimum size shall be 80 square feet.
- D. Classroom Space Requirements
1. Classroom Seating Capacity – The seating capacity for each new or existing classroom may be calculated by subtracting the required square footage of the Instructor Area and dividing the remaining square footage by the required square feet per chair of the type of seating planned for the space. The following rule-of-thumb square feet per chair amounts include circulation areas, and may be used in preliminary planning for a room.
 - a. Movable tablet-arm seats – 20 square feet per chair
 - b. Fixed seats with folding tablet arms – 17 square feet per chair
 - c. Movable tables and chairs – 24 square feet per chair
 - d. Fixed tables and chairs – 17 square feet per chair
 - e. Upholstered fixed auditorium seats with folding tablet arms – 17 square feet per chair
 - f. Where pedagogical style employs collaborative seating or use of computers, additional space may be required.
 2. Instructor Area – The instructor’s area should be easily visible from all student seating, and provide instructor seating, writing surface, and electronic controls to all audio/visual and lighting systems in the classroom. The following components and guidelines apply to all small classrooms, large classrooms, and lecture halls.
 - a. A minimum 8 feet clear space parallel to the instruction wall (10 feet is preferred) shall be provided in small and large classrooms.
 - b. The instructor’s lectern should be located to one side of the centerline of the instruction wall, and may be adjacent to the sidewall. Placement shall not block students’ views of the instruction wall nor the projection screen(s). A minimum three-foot clearance shall be provided to the front and three feet six inches to the rear of the lectern. Lecterns and smart classroom features shall be located at least 36 inches from the wall and should be fully accessible for faculty or guests with disabilities.
 3. Aisles, Spacing, and Clearances
 - a. Aisles
 - 1) The minimum aisle width in classrooms is 36 inches. Side aisles are preferred in lecture halls. The preferred minimum width for lecture hall aisles is 48 inches.
 - 2) In tiered classrooms and lecture halls, where stepped aisles and ramps are provided, they shall be separated with a half wall or handrail. Tiered lecture halls should have ramps, not stairs, and provide access to multiple levels in large tiered lecture halls to ensure accessibility compliance.
 - b. Spacing and Clearances
 - 1) The ideal viewing angle is no more than forty-five degrees from either side of the center axis of the teaching surface and from the center axis of each

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of the projection screen(s). Seating should be placed inside this viewing angle. The projections screen(s) may need to be angled to accommodate ideal viewing angles. Include wheelchair accessible seating in multiple locations (highest and lowest points in the room).

- 2) Minimum spacing between rows of movable tablet-arm chairs perpendicular to the teaching wall is 36 inches. Design classroom aisles with a turn space for wheelchairs.
- 3) Table leg or pedestal spacing shall not interfere with seating.
- 4) Offset rows of seats in rooms with flat or shallow sloped floors, to facilitate an unobstructed view of the instructor area.

E. Room Characteristics

1. Floor Design

- a. Seminar rooms shall have flat floors.
- b. Wood floor construction for risers is not permitted.

2. Doors

- a. The main entry to classrooms should be located at the rear of the classroom.
- b. Doors should be of solid construction for durability and sound control, and operate quietly.
- c. Doors should be equipped with delay action closures, kick plates, and clear glass vision panels or sidelights in accordance with applicable codes. The area of glass in doors should not exceed 100 square inches, with the vision panel base no higher than 42 inches from the floor and top at least 62 inches from the floor. Sidelights should be no wider than 12 inches.
- d. Doors to lecture hall shall open into alcoves and be located at the rear or sides of the classroom.
- e. Doors open out to the corridor but must be located so that they do not block corridor traffic. A recessed entrance may suffice.

3. Wall Construction

- a. Classroom walls shall have a Sound Transmission Class (STC) rating of 50.
- b. Walls separating classrooms from common spaces or restrooms must have an STC rating of at least 53.
- c. Wall separating classrooms from mechanical spaces or other areas with high noise levels must
- d. Extend non-structural partitions including drywall to the building structure above.

4. Windows

- a. Windows are recommended for all 110 classrooms.
- b. Windows should be placed in sidewalls or rear walls and avoided along instructional wall(s).
- c. Windows shall not swing into classroom.
- d. Windows shall have manual fabric shades rated “blackout”.

5. Ceilings

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- a. Ceilings should be a light color, with a minimum reflectance value of 80.
 - b. Minimum ceiling height shall be 9-0 feet AFF for all classrooms. Larger classrooms require proportionally higher ceilings. Rule of thumb for calculating ceiling height AFF:
 - i. Minimum ceiling height in feet at screen = $4' + (\text{Max. View Distance in feet} / 5)$
See Attachment E.
 - c. In classrooms with sloping or stepped floor systems, the ceiling height should be a minimum of 8'-0" AFF at the highest floor elevation.
 - d. 50-60 percent of the area of ceilings shall be acoustical panels.
 - e. The ceiling/floor assembly shall have a minimum sound transmission rating (STC) of 50.
 - f. The exposed grid acoustical ceiling system shall be 24" x 24" and the acoustical tiles shall have a Noise Reduction Coefficient (NRC) of .75 or better.
6. Acoustics - Walls and ceilings should be designed to evenly distribute sound throughout the classroom. The acoustic design must control the sounds and voices in the room so that they are heard easily and accurately. The following rules of thumb should be considered and applied as required in the design of a classroom:
- a. Ambient noise level in classrooms shall not exceed a NC-45 or 35dB. Impact noise levels in classrooms shall be less than 5dB above the ambient level.
 - b. Reverberation time (RT) shall be 0.4-0.6 seconds using the RT-60 method.
 - c. A flutter echo can occur between parallel hard surfaces and shall be avoided. Shape of room (i.e., square vs. rectilinear room) is not as significant, however, floor-ceiling and parallel solid walls are more likely to cause problems. Therefore, the following strategies shall be considered:
 - 1) Parallel walls of large classrooms and lecture halls may require angling.
 - 2) Variations in ceiling height and profile may be required.
 - 3) Floors may need to be sloped.
 - 4) Use acoustically absorbent ceiling material along sides and rear of large classrooms and lecture halls that result in a reverberation time less than 0.6 sec in an unoccupied classroom.
 - 5) A signal to noise ratio (S/N) of +10dB minimum is required (average hearing) +15dB is preferred (accessible for hearing impairment).
- F. Interior Finishes - Interior finishes for classrooms should be durable, easy to clean and repair. Finishes should be selected to avoid visual distraction. Avoid glossy finishes and very busy patterns. (See also Section 2 - Division 9 - Finishes)
1. Wall coverings
 - a. Color selection for a teaching wall with a whiteboard should contrast from adjacent neutral walls.
 - b. Provide acoustical wall panels where required.
 2. Flooring - A variety of finishes is acceptable in classrooms. Durability, maintenance and life-cycle cost analysis should guide the selection of the appropriate materials.

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- a. Carpet for classrooms should be commercial/institutional grade continuous-filament type 6,6 nylon, 100% solution dyed, tufted or fusion bonded level loop, anti-static, U.L. Class A.
 - b. Carpet shall have a lifetime warranty against edge raveling and delamination. Seams should not have to be sealed during the installation process. Chair pads shall not be required.
 - c. Carpet Wear: No more than 10% by weight of pile face fiber during the lifetime of the carpet.
 - d. Color and pattern shall be selected to help conceal dirt and stains. Carpet shall have 10-year warranty against fading.
 - e. An aluminum nosing strip mechanically fastened with a reflective strip is required on treads in tiered classrooms.
 - f. Resilient flooring should be commercial/institutional grade, with slight variegations that help conceal dirt and stains.
 - g. Other flooring materials, such as wood, or tile, should receive sealer. Painted concrete is unacceptable.
3. Wall Base
- a. Minimum 4" high rubber cove base is typical.
 - b. If wood is chosen for historic renovations, materials matching existing should be chosen.
4. Chair Rail [or Fiberglass Reinforced Plastic (FRP)]
- a. Classrooms with movable furniture shall receive a simple profile chair rail sufficient to protect walls from contact with sides and backs of tables, chairs, or desks.
 - b. Install chair rail at 25" to 33" above the floor. Verify mounting height and width with furniture specified.
 - c. Chair rail is not required on a teaching wall where it may interfere with mounting height requirements for dry erase marker boards.
5. Window Treatments
- a. Window Treatments shall be provided at all windows, exterior and interior.
 - b. All windows shall receive as a minimum:
 - 1) Manually controlled fabric blackout shades (3% for south and west elevations exposed to sun).
 - 2) For powered shades, provide low voltage systems and include low voltage shade interface that can be controlled from lectern.
 - c. Blackout shades shall only be installed where appropriate for the teaching needs of the College or department. Blackout shades shall be installed with light-blocking channels or must overlap the window opening to prevent light leakage.
- 1.3 Classroom Furnishings
- A. Instructor Lecterns
- Standardized lecterns will be used campus-wide, and specified to match the level of technology planned for the specific classroom. The typical lectern serves as both the instructor's desk and a locking cabinet for instructional technology components.

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1. All lecterns shall be accessible, properly vented, provide for rack mounted AV equipment, security and accessible control panels.
 2. All lecterns shall be ADA compliant.
- B. Student Seating and Writing Surface
1. Seating types that may be considered include, but are not limited to the following:
 - a. Movable tablet-arm chairs
 - b. Fixed seats with folding or fixed tablet arms
 - c. Movable tables and chairs
 - d. Fixed tables and chairs
 - e. Fixed auditorium seats with folding tablet arms
 2. Seating Specifications
 - a. Writing surfaces shall be durable, with a smooth, non-glare surface.
 - b. Auditorium style seats shall have a seat width of 22"-24".
 - c. Seats at table assemblies shall have a minimum seat width of 19".
 - d. Tablet-arms should be large or oversized (212 square inches minimum).
 - e. Tables should be sturdy, 18 - 24" deep units with a flat PVC or wood edge banding. The minimum table width for each student is 30 linear inches. Fixed tables must be anchored solidly to the floor system. Fixed classroom desks should meet ADA standards for height and leg space to maximize utilization (height: top 28 inches from finished floor with 27 inches of knee room) and should be adjustable. Insure that 36" clear behind table is maintained for access.
 - f. Accessible tables shall be adjustable.
 - g. Upholstered furnishings shall have heavy-duty stain repellent (e.g.: crypton, nanotex finish) fabric that meets or exceeds 80,000 double-rubs, per the Wyzenbeck method).
 - h. Ten percent of all seating must be suitable for left-handed use.
- C. Fixed Equipment - The following Items are required in all 110 classrooms:
1. Writing Surfaces - Writing surfaces (dry erase marker or chalk boards) shall be provided in all classrooms. Dry erase marker boards are preferred. All boards shall have the following minimum characteristics:
 - a. All boards shall be minimum 48" in height.
 - b. Boards shall extend across entire width of wall in instructor area and along side and rear walls for student use.

When projection is used, an instructor shall have no less than 6 contiguous feet of writing surface when the projection screen is down.
 - c. All boards shall be mounted with the top of the marker or chalk tray at 34" AFF.
 - d. Position board so vertical seam appearance is symmetrical. All seams or joints in board sections (if required) shall have no gap or are to be covered with a low profile spline connection of matching board.
 - e. Board shall be equipped with full-length, rounded end marker/chalk tray with open ends. There shall be no sharp edges or corners on tray.

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- f. Boards may slide vertically or horizontally.
 - g. Specific requirements relating to board type
 - h. Dry Erase Marker Boards
 - 1) Dry erase marker boards shall have a low-gloss white or off-white finish, and a minimum 50-year warranty.
 - 2) Dry erase marker boards shall be made of a balanced construction consisting of a “P3 ceramic steel” surface composed of porcelain enamel on 28-gauge steel bonded to a minimum ½” thick MDF core with an aluminum back. Bonding material shall be waterproof.
 - 3) Board shall have heavy-duty aluminum trim, with all necessary mounting hardware for installation provided. Boards shall be mechanically fastened in place and no glue shall be allowed.
 - i. Chalkboards
 - 1) Chalkboards shall have a black surface and have a 50-year warranty against “polishing”.
 - 2) Provide at least one dry marker board in the classroom.
2. Projection Screens - Each classroom shall be equipped with one or more projection screens positioned to maximize simultaneous use with board while providing optimal viewing angles. Exceptions to the specifications below shall be approved by Classroom Support Services.
- a. Minimum specifications
 - 1) Screens shall be seamless.
 - 2) Matte white finish.
 - 3) Screen gain shall be between 1 and 1.5.
 - 4) Glass bead or similar screen surface treatments shall not be used.
 - 5) Screens 8ft wide and larger shall be tab tensioned.
 - 6) Screen surface should be easily cleanable with soap and water.
 - b. Size
 - 1) Screen image height should follow the viewing distance formula of 1/5 the distance from the farthest or least favored viewer.
 - 2) The necessary screen height should be taken into consideration when planning ceiling heights.
 - 3) Screen aspect width-to-height ratio shall be 16:10.
 - 4) See Attachment E for recommended screen size matrix.
 - c. Mounting Location
 - 1) Bottom of viewable area shall be no lower than 48” AFF.
 - 2) Mount all screens to allow clearance between the screen and dry erase marker/chalk trays.
 - 3) A minimum of six linear feet of writable surface shall remain visible in the instructor area when the screen or screens are in use.
 - 4) All viewers shall fall within 45 degrees to either side of perpendicular from the center of the screen, forming a 90-degree viewing angle.

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5) See Attachment B for additional information.

d. Motorized Screens

- 1) All screens eight feet or more in width shall be motorized unless they are to remain open (i.e., fixed-frame screens).
- 2) Low voltage controls shall be provided with all motorized screens. If not integrated into projection screen housing, the low voltage control box shall be located next to the screen motor above the ceiling in an accessible location for integration with the A/V control system.
- 3) Provide a manual low-voltage wall-mounted switch that operates independently from the A/V control system. Locate the switch adjacent to the instructor area and outside of the screen hanging area.
- 4) Key operated switches are not allowed.
- 5) Motorized screens should not have trap doors.

1.4 MECHANICAL AND ELECTRICAL SYSTEMS

A. Mechanical (HVAC) systems

1. Air Distribution

- a. Mechanical systems supporting classrooms should generate a background noise of no more than NC 20-25 at diffusers.
- b. Locate supply air outlets and return air intakes away from lecterns and fixed microphones.
- c. There should be no air discharged onto projection screens.
- d. The preferred arrangement of supply air outlets is toward the front of the classroom, with return air intakes at the rear of the classroom.
- e. Where required, the media (AV) closet should also have supply air and proper venting.

2. Electrical and Instructional Technology Systems Infrastructure - The electrical items enumerated in this document do not include specifics for all equipment that may be included since those requirements will vary according to which equipment is chosen for a given space and in Attachment C, AV Conduit Riser Diagram. Additional infrastructure may be required to meet the functional needs of the classroom.

- a. Provide 120-volt branch circuit power for all classroom instructional technology system components.
- b. All conduit and electrical circuits shall have the same ground reference. It is preferable to have two separate grounds, one for telecommunications and one for the building.
- c. All audio, video, and control electrical circuits should be fed from “clean legs” from the transformer, free of high inductive loads. There must be NO elevator motors, compressor motors, blower motors, etc., on the side of the power transformer that feeds media equipment.
- d. Dedicated power circuit(s) for technology system infrastructure shall be on same phase for each classroom.

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- e. Minimum of one duplex outlet every 48" on all classroom walls excepting where there is an instructor wall. Where there is an instructor wall, there should be a minimum of three duplex outlets, with one of those being center of the instructor wall.
 - f. One quadruplex outlets on a dedicated circuit for the teaching lectern.
 - g. One duplex outlet on its own dedicated circuit at the ceiling-mounted projector on same phase as the teaching lectern.
 - h. Other outlets for ceiling mounted equipment whose cabling comes from above the ceiling and terminates below the ceiling should be cut into the ceiling tile and mounted on the same tile as the equipment.
 - i. Where motorized projection screen(s) are required, provide 120-volt power to an accessible junction box above the ceiling adjacent to the screen(s) and low voltage control interface(s). Connect power to the electric screen(s) via flex conduit. Provide cut off switch for screen.
 - j. If motorized shades are specified, provide 120-volt power to an accessible junction box above the ceiling to tie in with the shades and low voltage control interface.
3. Empty Conduits and Junction Boxes
- a. Provide an accessible AV junction box above the ceiling (preferred), in the wall, or in a closet in each classroom. Box shall be sized appropriately for the number of conduits being used.
 - b. Route one empty 1 1/4" conduit with pull string from each projector location to the AV box.
 - c. Provide a minimum of one 1 1/4" conduit from the AV box to the lectern.
 - d. Provide junction boxes above each location for speakers in the ceiling. Link the junction boxes with a 3/4" conduit with pull string and then link to the AV box.
 - e. If using motorized projection screen(s), route one 3/4" conduit with pull string from the low voltage control to the AV junction box.
 - f. If motorized shades are used in the room, route one 3/4" conduit with pull string from the low voltage control interface to the AV junction box.
4. Telecommunications Outlets
- a. Provide a minimum of one duplex network drop for the teaching lectern either in a floor box or on the teaching wall at the lectern location.
 - b. In large classrooms and lecture halls, additional telecommunication outlets may be required at back of room, at accessible student seating areas, or for wireless access points.
 - c. Refer to UNC Charlotte Design and Construction Manual, Section 2, Division 27 for ITS Telecommunications Standards.
5. Classroom Lighting
- a. All 110 classrooms shall be designed to meet a minimum of 350 lux of dimmable general room lighting at the working surfaces. Light readings in excess of 500 lux at the working surface will be considered excessive and may require correction.
 - b. Lighting design shall be zoned to allow for different light levels to be used simultaneously at the instructor's area and student seating with neither spilling

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onto the projection screen.

- c. Provide either dimmable parabolic lay-in or pendant mounted direct-indirect fixtures for general lighting applications.
 - d. Coordinate any pendant fixtures with ceiling mounted equipment and all projection paths. Section drawings including elevations are required for all pendant fixtures.
 - e. Wall switches must be easy to use and labeled to indicate lighting zone or preset.
 - f. Locate 3-way switches at entry door(s) to each classroom and provide additional switches at the instructor wall or lighting controls at the lectern.
 - g. Occupancy sensor technology shall be used in lecture halls.
6. Classroom Lighting Controls
- a. For rooms of capacity 80 or greater, provide a low voltage, dimmable, programmable lighting control system. The system shall accommodate a minimum of 3 scenes.
 - b. The lighting control system must support RS 232 or TCP/IP connectivity for remote management of classroom lighting.
 - c. The master lighting control units should not be accessible to users.
 - d. Locate lighting control system dimmer modules, boosters, etc. above accessible ceiling at the lighting zone served.

1.5 Instructional Technology

- A. Overview - Classroom design should accommodate current pedagogies and technologies while at the same time provide the opportunity for new techniques to be incorporated in the future. To help accomplish this goal, all new or renovated classroom facilities at UNC Charlotte will receive an infrastructure package based on the description provided herein and the AV Conduit Riser Diagram in Attachments C & D. This infrastructure must be laid out specifically for each space that requires or may require AV technology.
- B. The technology included in each classroom will be determined by UNC Charlotte.

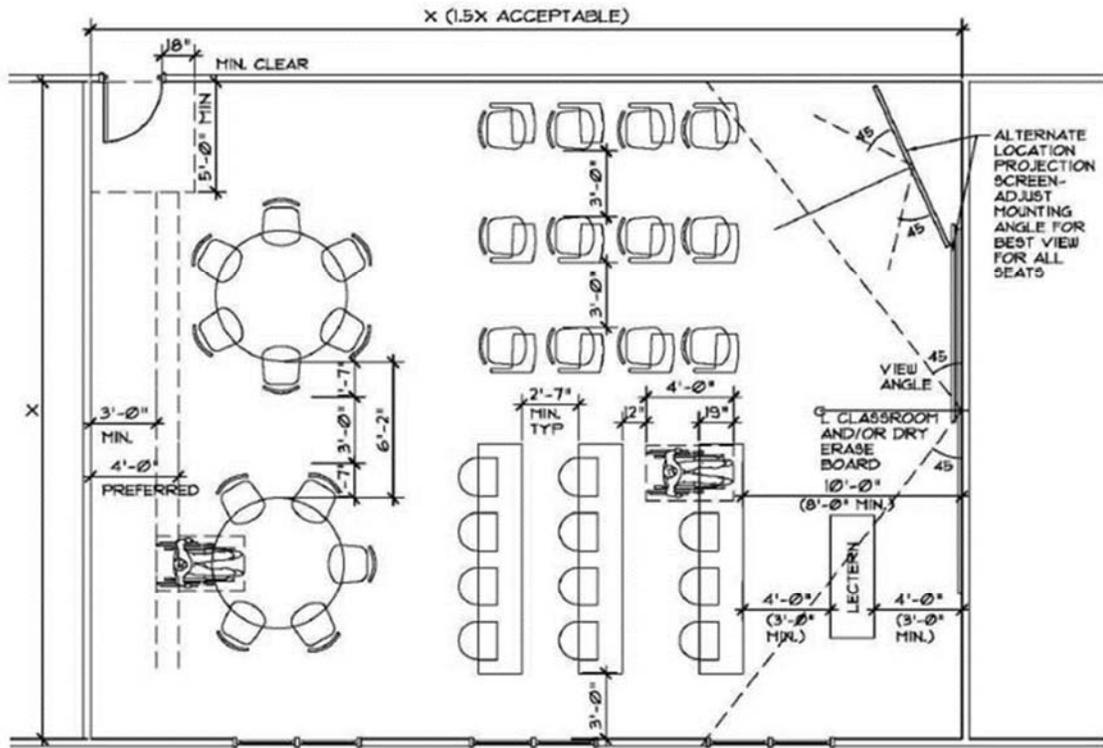
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Attachment A

Classroom Layout Diagram

This diagram illustrates typical spacing, view angles and design issues to be considered.

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CLASSROOM DIAGRAM
NO SCALE

THIS DRAWING INTENDED TO ILLUSTRATE VARIOUS CLASSROOM REQUIREMENTS, SPACING AND AISLE SIZES ETC. DRAWING FOR REFERENCE ONLY.

DIFFERENT SEATING STYLES SHALL NOT BE MIXED IN CLASSROOMS.

NOTE: AISLE FOR FIXED TABLES MAY BE LOCATED AT THE SIDE OR CENTER OF THE CLASSROOM

COLLABORATIVE/COMPUTER TEACHING METHODS MAY REQUIRE GROUP/FLEXIBLE SEATING ARRANGEMENTS. ADDITIONAL SPACE MAY BE REQUIRED TO ACCODATE CAPACITY AND REQUIRED AISLE SPACING ETC.

VIEW ANGLES FOR ALL DRY ERASE/BLACK BOARDS, PROJECTIONS SCREENS SHOULD BE CONSIDERED WHEN SELECTING SEAT LAYOUT AND SELECTION

TABLET ARM CHAIRS



FIXED TABLES AND MOVEABLE CHAIRS

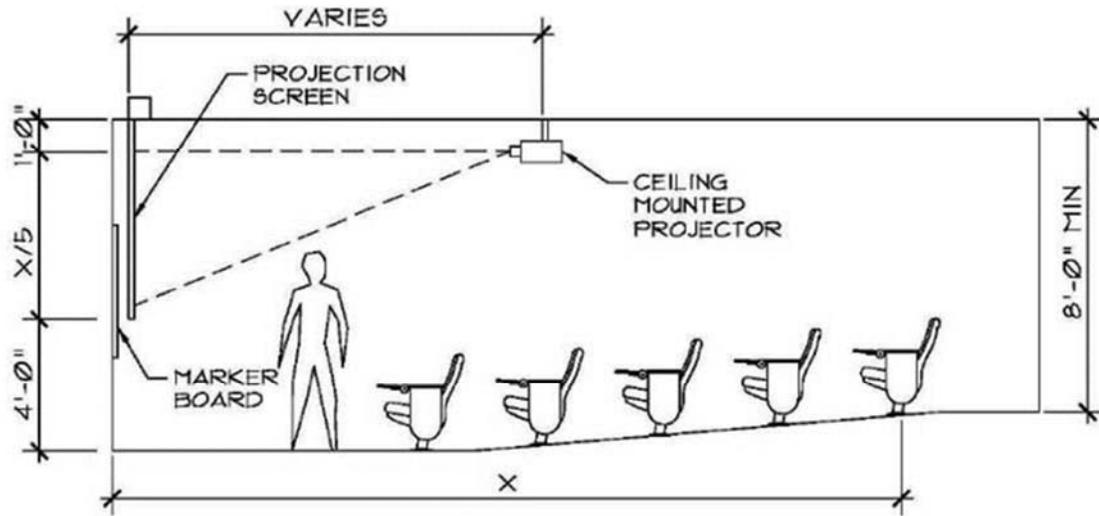


Attachment B

Classroom Section

This diagram illustrates typical layout and design issues to be considered.

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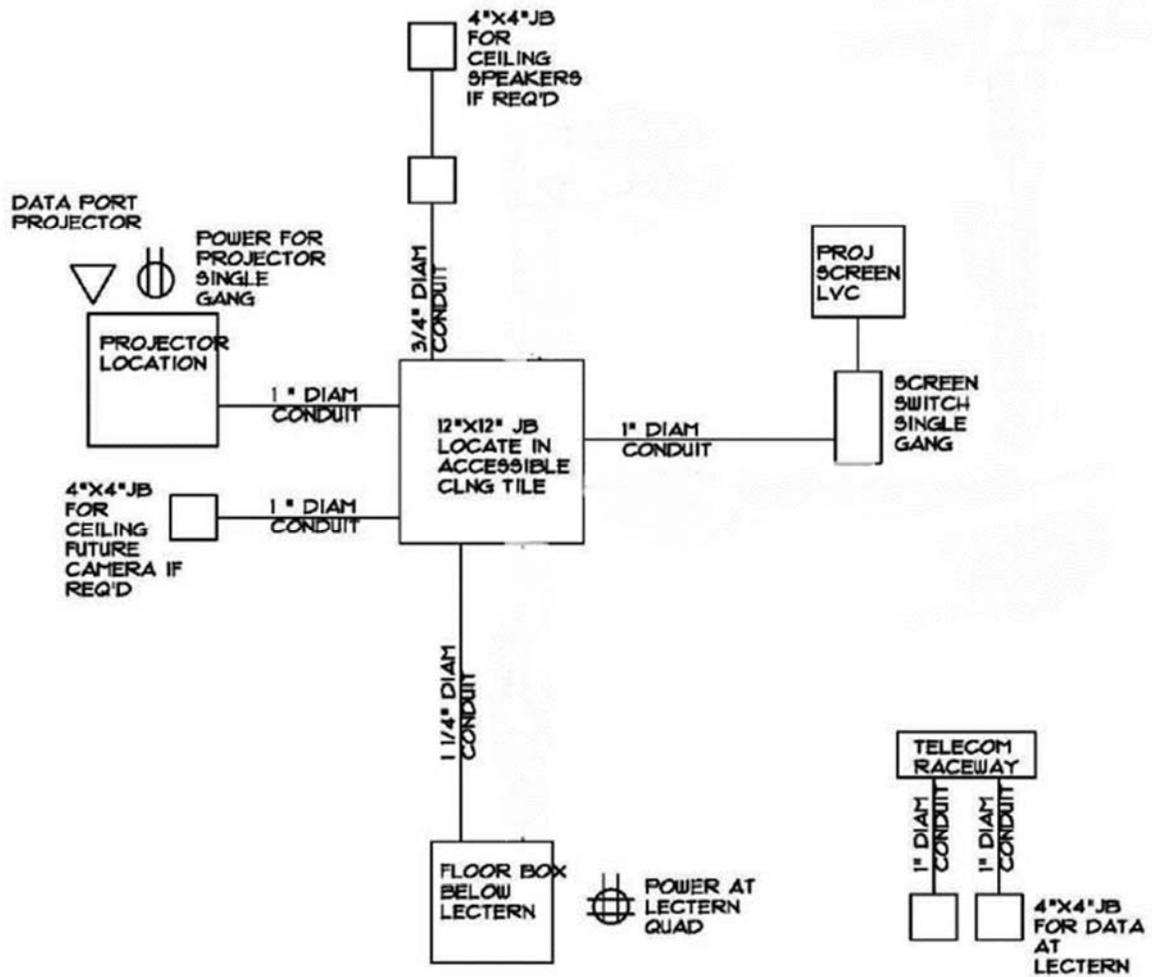


Attachment C

Typical Riser

These diagrams illustrate typical A/V conduit layout and design issues to be considered.

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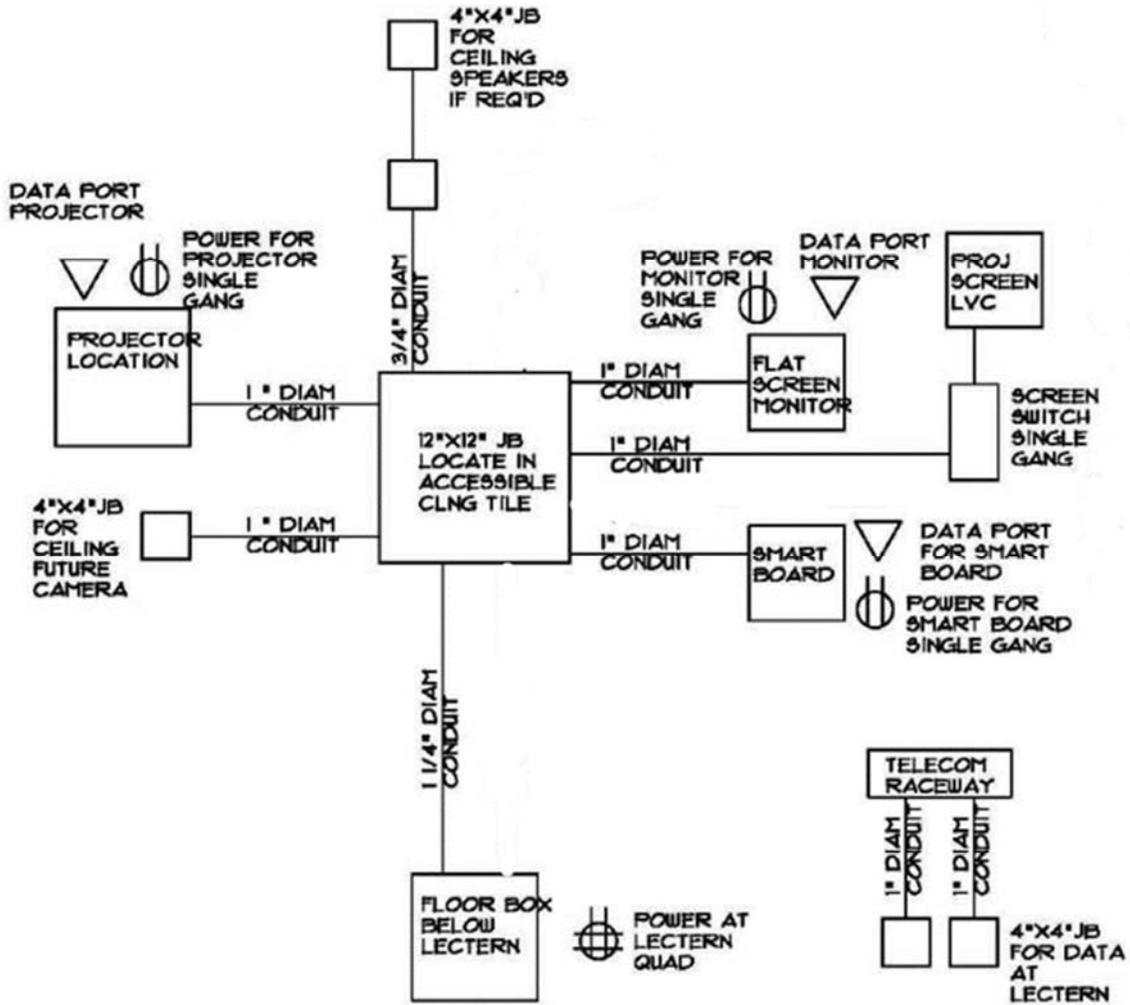
TYP RISER

Attachment D

These diagrams illustrate typical A/V conduit layout and design issues to be considered.

Riser with Interactive Board and/or Flat Panel Display

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RISER WITH SMART BOARD & FLAT SCREEN

Attachment E

Screen Size Matrix

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Least Favored Viewer	Minimum Image Height	16:9 Image Width	Screen Diagonal	Minimum Ceiling Height at Screen	Minimum Distance to Front Row Seat
10'	2'	3.56'	4.08'	6'	4'
15'	3'	5.33'	6.12'	7'	6'
20'	4'	7.11'	8.16'	8'	8'
25'	5'	8.89'	10.20'	9'	10'
30'	6'	10.67'	12.24'	10'	12'
35'	7'	12.44'	14.28'	11'	14'
40'	8'	14.22'	16.32'	12'	16'
45'	9'	16.00'	18.36'	13'	18'
50'	10'	17.78'	20.40'	14'	20'
55'	11'	19.56'	22.44'	15'	22'
60'	12'	21.33'	24.48'	16'	24'
65'	13'	23.11'	26.52'	17'	26'
70'	14'	24.89'	28.56'	18'	28'
75'	15'	26.67'	30.60'	19'	30'
80'	16'	28.44'	32.64'	20'	32'
85'	17'	30.22'	34.68'	21'	34'
90'	18'	32.00'	36.72'	22'	36'
95'	19'	33.78'	38.75'	23'	38'

Glossary

NC: Noise Criteria - noise levels at in each octave band that is plotted and compared to established NC curve.

NCIH: North Carolina Information Highway

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NRC: Measure of absorption or ability of a material to absorb sound

NR: Noise Reduction: % sound that passes through a wall/ceiling to an adjacent room.

RT: The amount of time used to determine sound decay - measured in Sabines using the RT-60 method of calculation. The RT of a space can be described as

- Lively where sound decay is long--e.g. Cathedral/Auditorium.
- Dead where the sound is absorbed quickly--e.g.: recording studio/bedroom.

RT- 60: RT60 the measurement of time it takes a signal to fall -60db. A sample calculator can be found at: www.trinitysoundcompany.com/rt60.html

STC: Sound Transmission Class: Single number that describes the average loss of transmitted sound through a partition/barrier (the higher the number the less transmission of noise).

S/N or SNR: Signal to Noise Ratio: Ratio that describes the intelligibility of the spoken word in a space compared to the ambient sound levels.

Screen Gain: A measurement of the reflectivity of any screen or projection surface. The gain number represents a ratio of the light that is reflected from the screen, when as compared to the light reflected from a standard white (magnesium oxide) board. A screen with a gain of 1.0 will reflect the same amount of light as that from a white board. A screen rated at 1.5 gain will reflect 50% more light as that from a white board, Screen gain measurements are taken from the brightest, generally center perpendicular to the screen. Gain drops off as you move to either side of the center.

APPENDIX B
CAMPUS STANDARDS FOR ACCESSIBILITY
AND INCLUSION

CAMPUS STANDARDS FOR ACCESSIBILITY AND INCLUSION

1.1 OVERVIEW

- A. Accessibility standards for UNC Charlotte are equal to, or in addition to, Federal ADA standards for Accessible Design. In some areas of design, campus standards are more stringent than ADA standards, but do not violate Federal or State standards.
- B. Designing accessible spaces requires planning that considers the needs of all users who may have low vision, blindness, a temporary or permanent mobility impairment, hearing loss, medical disorder, age related limitations, or several of these concerns.
- C. Utilizing a universal design perspective (design that provides access to all) when pre-planning campus buildings and pathways adds little cost in the planning stage, but saves countless dollars of expensive retrofitting later.

1.2 GENERAL CAMPUS STANDARDS

- A. Common use features, e.g., automatic door activator, card swipe, proximity readers for future use, elevator buttons, shall be placed at 34-36 inches from the finished floor
- B. Do not place common use building features within 24 inches of an interior corner.
- C. Features shall be 6-8 inches from any other common use feature.
- D. Common use features shall not be obstructed by trim or other building features
- E. Provide wheelchair accessible lab tables, lab sinks, podiums, electrical & gas connections, and access to all other necessary equipment in each classroom or research laboratory
- F. Classrooms and labs with fixed tables must have at least one adjustable table, placed in a visually unobstructed location near the front of the classroom
- G. Provide at least one accessible, family-friendly restroom on an egress level of newly designed or significantly renovated buildings. The door shall swing freely, rather than have spring or hydraulic closer.
- H. Provide ADA access to large tiered classrooms at multiple levels.
- I. Use ramps (not steps) to provide access for tiered feature or gathering areas

University of North Carolina at Charlotte Design and Construction Manual
Appendix B Campus Standards for Accessibility and Inclusion

1.3 ACCESSIBLE ROUTES AND PATHWAYS

- A. The hilly topography of the UNC Charlotte campus can be difficult to mediate and creates significant challenges for people with mobility disabilities. Accessible pathways benefit the whole campus body since people read text messages, roll equipment from or to classrooms, and ride bicycles while traversing the campus.

- B. Designing disability-friendly pathways requires:
 - 1. Accessible common campus pathways, whenever possible;
 - 2. Parallel accessible pathways when separate pathways are necessary;
 - 3. Sloped, rather than stepped common campus pathways;
 - 4. Pathways that provide excellent sight lines in all directions;
 - 5. Smooth, wide pathways with moderate slopes less than 5% when feasible.

- C. Include in Design:
 - 1. Multiple, direct, accessible pathways to nearby (especially adjacent) buildings;
 - 2. Accessible parking on the shortest, direct accessible pathway to an accessible entrance (North Carolina Building Code);
 - 3. Accessible pathways to transport modes from multiple building entrances
 - a. transport modes include:
 - 1) accessible parking areas
 - 2) shuttle stops
 - 3) bicycle/walking paths from other areas of campus
 - 4. Direct accessible paths to nearby specialty areas, such as outdoor picnic seating or cafeteria.

1.4 BUILDING FEATURES

- A. Entrances
 - 1. Place door actuators and card swipes 34-36 inches from the finished floor
 - 2. Space common use features at least 6-8 inches apart from other features (For example, a doorway that has a card swipe on the left side with an actuator on the right side is not functional)
 - 3. Avoid placing devices beneath thick, overhanging building trim

- B. Elevator buttons
 - 1. Avoid placing elevator buttons near the inside corners of a wall or within 24 inches of another feature, such as a water fountain, as this blocks access to both features.
 - 2. Place interior and exterior buttons 34-36 inches from the finished floor and unobstructed by trim

- C. Interior Signage

Signage within buildings should be

 - 1. At an accessible height determined by the ADA Accessibility Guidelines, clearly marking accessible egress paths.
 - 2. Large in size
 - 3. High contrast
 - 4. Consistently placed.
 - 5. Emergency and directional signage must be placed at an accessible height and should be unobstructed by ancillary signage
 - 6. Areas of rescue assistance must be clearly marked on floors without direct egress.

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Appendix B Campus Standards for Accessibility and Inclusion

- D. Classrooms, Laboratories and Internal Spaces
1. Fixed classroom desks should meet ADA standards for height and leg space to maximize utilization
 - a. Height: top 28 inches FFF
 - b. 27 inches of knee room
 2. Classrooms and labs with fixed tables should have at least one adjustable table, placed in a visually unobstructed location near the front of the classroom
 3. Provide access to multiple levels in large tiered lecture halls to ensure accessibility compliance
 4. Podiums and smart classrooms features shall be located at least 36 inches from the wall and should be fully accessible for faculty or guests with disabilities.
 5. Provide access to multiple levels in tiered classrooms (lowest and highest points in the room);
 6. Include wheelchair accessible seating in multiple locations;
 7. When including separate tiered space use ramps to provide inclusive access
 8. Provide wheelchair accessible lab tables, lab sinks, podiums, electrical & gas connections, and access to all other necessary equipment in each classroom or research laboratory
 9. The minimum aisle width in classrooms is 36"
 10. The preferred minimum width for lecture hall aisles is 48".
- E. Restrooms
1. Place towel dispensers on the wall away from the sink to allow wheelchair access;
 2. Avoid corner entrances to restrooms that are difficult for wheelchair users to maneuver.
- F. Stairs
1. Provide visual contrast with 2" stripe on the tread of all interior and exterior stair locations on the stair tread beside the nosing. Confirm campus location to follow based on design material being provided (brick, concrete, rubber treads, etc.).

University of North Carolina at Charlotte Design and Construction Manual
Appendix B Campus Standards for Accessibility and Inclusion

PRINCIPLES OF UNIVERSAL DESIGN

1.5 EQUITABLE USE:

The design does not disadvantage or stigmatize any group of users.

1.6 FLEXIBILITY IN USE:

The design accommodates a wide range of individual preferences and abilities.

1.7 SIMPLE, INTUITIVE USE:

Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

1.8 PERCEPTIBLE INFORMATION:

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

1.9 TOLERANCE FOR ERROR:

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

1.10 LOW PHYSICAL EFFORT:

The design can be used efficiently and comfortably, and with a minimum of fatigue.

1.11 SIZE AND SPACE FOR APPROACH & USE:

- A. Appropriate size and space is provided for approach, reach, manipulation, and use, regardless of the user's body size, posture, or mobility.

1.12 WEBSITE

http://www.ada.gov/2010ADASTstandards_index.htm

[NCSBC Chapter 11 Accessibility](#)

APPENDIX C
CONTRACTOR SAFETY PROGRAM
ENVIRONMENTAL HEALTH & SAFETY OFFICE



Contractor Safety Program

Environmental Health & Safety Office

Please refer to webpage for Contractor Safety Program
<http://safety.uncc.edu/contractors>

APPENDIX D

This section is no longer in use. The information previously contained in this section can be found in Section 2, Division 27 “ITS Telecommunications Standards – Specifications Manual for Construction and Renovations.”

APPENDIX I
RFI, COST OF CHANGE WORKSHEET, ATTIC STOCK
FORM

University of North Carolina at Charlotte Design and Construction Manual
Appendix I – RFI, Change of Worksheet, Attic Stock Form

RFI – Request for Information

RFI# _____

Sheet 1 of 1

Date: _____

Project _____

INITIATED BY: _____

DRAWING No. _____ SPEC. SECTION _____

TOPIC: _____

RESPOND BY: _____

DESRPITION: _____

ATTACHMENTS: _____

Reason(s) for RFI and any expedited response time: _____

INITIATOR'S SIGNATURE & TITLE: _____ **DATE:** _____

RESPONSE: _____

ATTACHMENTS: _____

RESPONDANT'S SIGNATURE & TITLE: _____ **DATE:** _____

RFI# _____

Sheet 2 of 2

Date: _____

Project _____

Upon receipt of response, please check the appropriate statement and return to the project expeditor within 7 calendar days.

_____ This RFI **Does Not** affect the Contract Price or Completion date.

_____ This RFI **May** affect the Contract Price or Completion date.

CONTRACTOR'S SIGNATURE & TITLE: _____ **DATE:** _____

- NOTE:**
1. Designer or Contractor may initiate RFI form.
 2. If RFI affects Contract price or Completion date the contractor is to provide cost within 14 calendar days of receipt of this RFI.

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Appendix I – RFI, Change of Worksheet, Attic Stock Form

QUOTATION FORMAT FOR CHANGES IN THE WORK

This format shall be used to request changes in the Work in accordance with Article 19.

Where unit prices shown on the Form of Proposal apply, they shall be used to determine the amount of addition to or deduction from the Contract price as called for in Article 19, Paragraph C (1) and not in this format.

All additions and deductions to the Contract price not covered by unit prices resulting from changes in the Work shall be determined by the following format:

Please submit an itemized quotation within 14 days for the proposed modification to the Contract. Documents described herein, indicating changes in the contract sum and/or time incidental to this request. **THIS IS NOT AN AUTORIZATION TO PROCEED WITH WORK DESCRIBED NOR A CHANGE ORDER.**

(1) FOR THE _____ CONTRACT WORK

Description of items (breakdown including quantity, labor, and materials)

(2) Rent of equipment (list separate)

Performance Bond adjustment _____

Worker's Compensation Insurance _____

Social Security and Old Age Benefits _____

Pro rata charges for foremen _____

Sub-total _____

(3) Subcontract work (when required) _____

Sub-total _____

(4) Contractor's overhead and profit _____

Sub-total _____

Sales tax (on Material and
Equipment only)

Total Quotation _____

- (1) Insert type of Contract such as General, Electrical, Plumbing, Mechanical, etc.
- (2) Shall be in accordance with AED schedule - submit copy.
- (3) When work is to be performed by a Subcontractor, a like breakdown shall be included.
- (4) See Article 19 for percentage and when overhead and profit is allowed.

ATTIC STOCK SUMMARY

SPEC. SECTION & PARA.	MATERIAL TYPE / DESCRIPTION	TOTAL SQ. FT. INSTALLED	% OF TOTAL REQUIRED	CERTIFIED BY DESIGNER	RECEIVED BY UNIVERSITY

Note: This form is to be filled out by the contractor and submitted to the University and Designer prior to the final inspection

SECTION 3
ANNEX A
LEED CHECKLIST

University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex A – LEED Checklist



LEED for New Construction and Major Renovation 2009
Project Scorecard

Project Name:
 Project Address:

Yes	?	No	Sustainable Sites	26	Points
-----	---	----	--------------------------	-----------	---------------

<input checked="" type="checkbox"/>	Prereq 1	Construction Activity Pollution Prevention	Required
<input checked="" type="checkbox"/>	Credit 1	Site Selection	1
<input checked="" type="checkbox"/>	Credit 2	Development Density & Community Connectivity	5
<input checked="" type="checkbox"/>	Credit 3	Brownfield Redevelopment	1
<input checked="" type="checkbox"/>	Credit 4.1	Alternative Transportation , Public Transportation Access	6
<input checked="" type="checkbox"/>	Credit 4.2	Alternative Transportation , Bicycle Storage & Changing Rooms	1
<input checked="" type="checkbox"/>	Credit 4.3	Alternative Transportation , Low-Emitting & Fuel-Efficient Vehicles	3
<input checked="" type="checkbox"/>	Credit 4.4	Alternative Transportation , Parking Capacity	2
<input checked="" type="checkbox"/>	Credit 5.1	Site Development , Protect or Restore Habitat	1
<input checked="" type="checkbox"/>	Credit 5.2	Site Development , Maximize Open Space	1
<input checked="" type="checkbox"/>	Credit 6.1	Stormwater Design , Quantity Control	1
<input checked="" type="checkbox"/>	Credit 6.2	Stormwater Design , Quality Control	1
<input checked="" type="checkbox"/>	Credit 7.1	Heat Island Effect , Non-Roof	1
<input checked="" type="checkbox"/>	Credit 7.2	Heat Island Effect , Roof	1
<input checked="" type="checkbox"/>	Credit 8	Light Pollution Reduction	1

Yes	?	No	Water Efficiency	10	Points
-----	---	----	-------------------------	-----------	---------------

<input checked="" type="checkbox"/>	Prereq 1	Water Use Reduction , 20% Reduction	Required
<input checked="" type="checkbox"/>	Credit 1.1	Water Efficient Landscaping , Reduce by 50%	2
<input checked="" type="checkbox"/>	Credit 1.2	Water Efficient Landscaping , No Potable Use or No Irrigation	2
<input checked="" type="checkbox"/>	Credit 2	Innovative Wastewater Technologies	2
<input checked="" type="checkbox"/>	Credit 3	Water Use Reduction	2 to 4
		30% Reduction	2
		35% Reduction	3
		40% Reduction	4

Yes	?	No	Energy & Atmosphere	35	Points
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<input checked="" type="checkbox"/>	Prereq 1	Fundamental Commissioning of the Building Energy Systems	Required
<input checked="" type="checkbox"/>	Prereq 2	Minimum Energy Performance : 10% New Bldgs or 5% Existing Bldg Renovations	Required
<input checked="" type="checkbox"/>	Prereq 3	Fundamental Refrigerant Management	Required
<input checked="" type="checkbox"/>	Credit 1	Optimize Energy Performance	1 to 19
		12% New Buildings or 8% Existing Building Renovations	1
		14% New Buildings or 10% Existing Building Renovations	2
		18% New Buildings or 12% Existing Building Renovations	3
		18% New Buildings or 14% Existing Building Renovations	4
		20% New Buildings or 18% Existing Building Renovations	5
		22% New Buildings or 18% Existing Building Renovations	6
		24% New Buildings or 20% Existing Building Renovations	7
		26% New Buildings or 22% Existing Building Renovations	8
		28% New Buildings or 24% Existing Building Renovations	9
		30% New Buildings or 28% Existing Building Renovations	10
		32% New Buildings or 28% Existing Building Renovations	11
		34% New Buildings or 30% Existing Building Renovations	12
		36% New Buildings or 32% Existing Building Renovations	13
		38% New Buildings or 34% Existing Building Renovations	14
		40% New Buildings or 36% Existing Building Renovations	15
		42% New Buildings or 38% Existing Building Renovations	16
		44% New Buildings or 40% Existing Building Renovations	17
		46% New Buildings or 42% Existing Building Renovations	18
		48% New Buildings or 44% Existing Building Renovations	19
<input checked="" type="checkbox"/>	Credit 2	On-Site Renewable Energy	1 to 7
		1% Renewable Energy	1
		3% Renewable Energy	2
		5% Renewable Energy	3
		7% Renewable Energy	4
		9% Renewable Energy	5
		11% Renewable Energy	6
		13% Renewable Energy	7
<input checked="" type="checkbox"/>	Credit 3	Enhanced Commissioning	2
<input checked="" type="checkbox"/>	Credit 4	Enhanced Refrigerant Management	2
<input checked="" type="checkbox"/>	Credit 5	Measurement & Verification	3
<input checked="" type="checkbox"/>	Credit 6	Green Power	2

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LEED for New Construction and Major Renovation 2009
Project Scorecard

Project Name:
 Project Address:

Yes	?	No			
			Materials & Resources		14 Points
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prereq 1	Storage & Collection of Recyclables	Required
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1	Building Reuse	1 to 3
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.1	Maintain 55% of Existing Walls, Floors & Roof	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.2	Maintain 75% of Existing Walls, Floors & Roof	2
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.3	Maintain 95% of Existing Walls, Floors & Roof	3
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.4	Building Reuse , Maintain 50% of Interior Non-Structural Elements	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 2.1	Construction Waste Management , Divert 50% from Disposal	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 2.2	Construction Waste Management , Divert 75% from Disposal	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 3.1	Materials Reuse , 5%	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 3.2	Materials Reuse , 10%	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.1	Recycled Content , 10% (post-consumer + 1/2 pre-consumer)	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.2	Recycled Content , 20% (post-consumer + 1/2 pre-consumer)	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 5.1	Regional Materials , 10% Extracted, Processed & Manufactured Regionally	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 5.2	Regional Materials , 20% Extracted, Processed & Manufactured Regionally	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 6	Rapidly Renewable Materials	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 7	Certified Wood	1
			Indoor Environmental Quality		15 Points
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prereq 1	Minimum IAQ Performance	Required
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1	Outdoor Air Delivery Monitoring	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 2	Increased Ventilation	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 3.1	Construction IAQ Management Plan , During Construction	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 3.2	Construction IAQ Management Plan , Before Occupancy	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.1	Low-Emitting Materials , Adhesives & Sealants	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.2	Low-Emitting Materials , Paints & Coatings	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.3	Low-Emitting Materials , Flooring Systems	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.4	Low-Emitting Materials , Composite Wood & Agrifiber Products	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 5	Indoor Chemical & Pollutant Source Control	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 6.1	Controllability of Systems , Lighting	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 6.2	Controllability of Systems , Thermal Comfort	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 7.1	Thermal Comfort , Design	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 7.2	Thermal Comfort , Verification	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 8.1	Daylight & Views , Daylight 75% of Spaces	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 8.2	Daylight & Views , Views for 90% of Spaces	1
			Innovation & Design Process		6 Points
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.1	Innovation in Design : Provide Specific Title	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.2	Innovation in Design : Provide Specific Title	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.3	Innovation in Design : Provide Specific Title	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.4	Innovation in Design : Provide Specific Title	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.5	Innovation in Design : Provide Specific Title	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 2	LEED® Accredited Professional	1
			Regional Priority Credits		4 Points
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.1	Regional Priority Credit : Region Defined	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.2	Regional Priority Credit : Region Defined	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.3	Regional Priority Credit : Region Defined	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.4	Regional Priority Credit : Region Defined	1
			Project Totals (Certification Estimates)		110 Points
Not Certified			Certified: 40-49 points Silver: 50-59 points Gold: 60-79 points Platinum: 80+ points		

ANNEX B
WASTE REDUCTION & RECYCLING GUIDELINES

WASTE REDUCTION & RECYCLING GUIDELINES

This section represents the supporting documentation for general Requirements Section 2 Point D. Site Construction & Demolition Waste Management

WASTE MANAGEMENT

1.1 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Commingling: Mixing recyclable C/D material in one waste container. Materials Recovery Facilities (MRF) exists to sort and recycle commingled materials off-site.
- C. Construction and Demolition Waste: Includes all non-hazardous solid wastes resulting from construction, renovations, alterations, repair, and demolition.
- D. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitability, corrosiveness, toxicity or reactivity.
- E. Material Recovery Facility (MRF): A processing facility designed to sort and separate recyclables based on market needs and material components.
- F. Non-hazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitability, corrosiveness, toxicity, or reactivity.
- G. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- H. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- I. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste. Can be conducted on-site (as in the grinding of concrete and reuse on-site).
- J. Return: To give back reusable items or unused products to vendors for credit.
- K. Reuse: To reuse a construction waste material without altering its form on the project site or elsewhere.
- L. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- M. Sediment: Soil and other debris that has been eroded and transported by storm or well production runoff water.
- N. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste in order to reuse or recycle them.
- O. Toxic: Poisonous to humans either immediately or after a period of exposure.
- P. Trash: Any product or material unable to be reused returned, recycled, or salvaged.
- Q. Volatile Organic Compounds (VOCs): Chemical compounds common in and emitted by many building products over time through off gassing: solvents in paints and other coatings; wood preservatives; strippers and household cleaners; adhesives in particleboard, fiberboard, and some plywood; and foam insulation. When released, VOCs can contribute to the formation of

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smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.

- R. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.
- S. Waste Management Plan: A project-related plan for the collection, transportation, and disposal of the waste generated at the construction site. The purpose of the plan is to ultimately prolong the useable life of waste materials and reduce the amount of material being landfilled.
- T. Waste Management Report: A monthly report completed by the contractor describing actual waste disposal of materials, including methods, types of waste, destination and quantities. All weight tickets must be attached to waste management report.

1.2 RESOURCE EFFICIENCY

- A. The Contractor shall use resources as efficiently as possible, in completion of the project. Namely Owner shall require the Contractor to:
 - 1. Use techniques that minimize waste generation
 - 2. Reuse and renovation of existing structures in lieu of demolition
 - 3. Salvage of existing materials and items for reuse/resale
 - 4. Reuse materials on site where possible
 - 5. Recycling of waste generated during the demolition and construction process

1.3 ADDITIONAL INFORMATION/RESOURCES

- A. Build America Beautiful Program
National Association of Home Builders
1201 15th Street, NW, Washington DC 20005, (800) 368-5242
- B. Designing With Vision: Public Building Guidelines for the 21st Century
Chris Stafford, AIA, Stafford-Harris, Inc., 1992
1916 Pike Pl., Seattle WA 98101, (206) 682-4042
- C. Environmental Building News
A bimonthly newsletter on environmentally sustainable design and construction.
Yearly subscription
RR 1, Box 161, Brattleboro, Vermont 05301, (802) 257-7300
- D. The Environmental Resource Guide
A collection of detailed material assessments, articles, and case studies connecting environmental awareness with building construction
Quarterly: \$200/year
- E. The American Institute of Architects
1735 New York Ave, NW, Washington DC 20006
(202) 626-7331 (800) 365-ARCH
- F. "Green Building" Performance Standard Guide
American Society for Testing Materials (ASTM), 1992
- G. The Healthy House
An in-depth look at the construction of a "healthy house" especially with respect to chemical sensitivity. Chapters are broken down into stages of building (i.e., planning, location, etc.) and building components (i.e., foundation systems, steel framing, windows and doors, etc.) Good lists of organizations and suppliers.
John Bower
Carol Communications 1989.

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- H. Sustainable Construction: Proceedings of the First International Conference of the International Council for Building Research Studies and Documentation Task Group 16
Covers a wide range of topics. Over 800 pages.
University of Florida College of Architecture,
Center for Construction and Environment, 1994, (904)392-7502
107
E-1 APPENDIX E - GREEN BUILDING RESOURCES
TRIANGLE J COUNCIL OF GOVERNMENTS **Waste Spec**
APPENDIX E - GREEN BUILDING RESOURCES E-2
- I. Sustainable Building Guidebook for the New State Office Building: A Preliminary Overview
Center for Maximum Potential Building Systems, Inc
February 1993
- J. Architectural/Engineering Guidelines
Comprehensive specifications covering energy efficiency and other life cycle and sustainable provisions
About 110 pages
State of Texas General Services Commission, Office of Facility Planning, 1993 Austin, Texas
- K. Demolition for Salvage and Reuse: Prototypical Demolition Specifications
A summary of background and specifications used on a demolition project in Portland
About 25 pages
Metro Solid Waste Department, 1993
600 NE Grand Avenue, Portland, Oregon, (503) 797-1650
- L. Waste Reduction Specifications 1993
A collection of examples of waste reduction specifications
About 50 pages
Metro Solid Waste Department
600 NE Grand Avenue, Portland, Oregon, (503) 797-1650
- M. URBAN PLANNING/LAND USE/COMMUNITIES
A Pattern Language: Towns-Buildings-Construction
A design classic, illustrating patterns that work on all scales, from the reading nook to the whole city
Christopher Alexander, Sara Ishikawa, and Murray Silverstein
Oxford University Press
Design with Nature
Ian L. McHarg
John Wiley & Sons, Inc., 1991
605 3rd Avenue, New York NY 10158 (212) 850-6000 or from the AIA Bookstore (800) 365-2724
- N. Land Use Strategies for More Livable Places: A Guidebook for Local **Governments**
Clear and concise guidelines for land use planning to reduce automobile use.
California emphasis, but nationwide applicability
Have sample drafts of a resolution and other documents for use by local governments or community groups
Steve Weissman and Judy Corbett, Local Government Commission, 1992
909 12th Street, Suite 205, Sacramento CA 95814, (916)448-1198
(916) 448-8246 (fax).
108 TRIANGLE J COUNCIL OF GOVERNMENTS **Waste Spec**
- O. Sustainable Communities: A New Design Synthesis for Cities, Suburbs, and Towns
Essays by these two leading planners and several others provide a good overview to the theory of ecologically appropriate land use.
Sim Van der Ryn and Peter Calthorpe

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Sierra Books, 1986
 2034 Fillmore Street, San Francisco CA 94115, (415) 291-1600 or from the AIA
 Bookstore (800) 365-2724

1.4 INDUSTRY EXAMPLES SUCCESS STORIES

Record-Setting Program	Project Type	Project Highlights	Recovery Strategy	% Debris recovered (by weight)
Bagley Downs Apartments Eugene, OR	Demolition and construction	This project created 30 affordable housing units, saved the University of Oregon demolition costs, and preserved a community landmark.	Entire buildings saved by moving them to a new location.	73%
Erickson's Diversified	New construction	Erickson's planned to incorporate materials recovery efforts during the construction of	Source separation of materials during	69%
Corporate Headquarters Hudson, WI	Its new corporate headquarters even though it expected to pay more than if it disposed all materials generated. In fact, the company diverted 69% of the project debris and saved money.	Construction by all subcontractors.		
Four Times Square New York, NY	Demolition and construction	Materials recovery was included in plans from the beginning. The contract included requirements that subcontractors reduce disposal and, as an incentive, they were allowed to retain savings earned through avoided disposal costs and materials revenues	Pre-demolition salvage, construction materials sorted off-site because of space limitations.	58%
Marion County Senator Block Salem, OR	Demolition	Marion County and Salem Area Transit saved over \$160,000 by diverting demolition materials from disposal while using the project as a tool to educate the public on recycling. The county placed ads on TV and radio and placed banners illustrating the project recycling rate around the project site.	Salvage of usable items before demolition. Hand and mechanical sorting of materials after demolition to recover metals, concrete, and asphalt.	82%
Ridgehaven Green Office Building San Diego, CA	Renovation	The city of San Diego wanted to reduce, recycle, and reuse renovation materials from this project in order to comply with California's 50%	Many existing materials refurbished and reused. Materials sorted into labeled dumpsters for recycling	51%

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		recycling goal and reduce materials going to the city-owned landfill. In addition to recycling, diverting 51% of the renovation materials from disposal, the city also saved \$92,000.		
Stowe Village Hartford, CT	Deconstruction	This demonstration project not only recovered 50% of the materials from six public housing units, it also trained nine public housing residents in deconstruction techniques.	Buildings hand-dismantled to recover maximum usable materials	50%
Whole Foods Market Corporate Headquarters Austin, TX	Renovation	Recovery of renovation materials saved Whole Foods over \$32,000. Reuse of materials, such as ceiling tiles, light fixtures, and doors, helped the company avoid the purchase of nearly \$25,000 worth of supplies. The company was also able to take an \$8,000 tax deduction for donating salvaged goods to non-profit organizations	Contracts required recycling and reuse. Materials stockpiled and moved about site for storage due to limited space.	42%

1.5 REQUIRED RECYCLING INCLUDES: (NOT AN EXHAUSTIVE LIST)

- A. Used beverage containers—banned from all North Carolina landfills (NC SB111. p. 1345)
- B. Cardboard—banned from Mecklenburg County Landfills
- C. Clean wood wastes
- D. Scrap metal
- E. Asphalt
- F. Gypsum
- G. Ballasts
- H. Fluorescent bulbs containing mercury— banned from North Carolina landfills
- I. White goods—banned from North Carolina landfills (major household appliances such as stoves and refrigerators that are typically finished in white enamel)
- J. Yard waste – Banned from North Carolina Landfills
- K. In addition to required recyclables/recycling, encourage:
- L. Log and sell timber from land-clearing operations any ground timber will be used on campus as mulch
- M. Excess clean earth may be used/needed by UNC Charlotte
- N. Inert materials such as stumps, brick, concrete, block and rock cannot be disposed of in sanitary landfills and must go to a permitted Construction/Demolition landfill.

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- O. Bricks and blocks
 - P. Doors and windows
 - Q. Plumbing fixtures and pipes (provided they don't contain lead)
 - R. Electrical fixtures and wiring
 - S. Metals
 - T. Cardboard
 - U. Aluminum
 - V. Concrete
- 1.6 SAMPLE WASTE MANAGEMENT PLAN (DRAFT & FINAL)
- 1.7 SAMPLE MONTHLY WASTE MANAGEMENT REPORT
- 1.8 STIPULATIONS
- A. The Contractor shall remove all generated trash, recycling, and debris (including, for example, old carpeting) at his or her expense. **The Contractor may not place this trash and debris in University dumpsters.** The Owner, acting through the Designer, shall retain the right to direct the disposal of salvageable equipment (such as metals, cardboard, plastics, paper, glass, and blueprints).
 - B. For all demolition or renovation work which removes serviceable, repairable, or otherwise recoverable equipment or materials (such as metals, cardboard, plastics, paper, glass, and blueprints), the Contractor shall certify that he or she has exercised every practical means of recovery or salvage. (Note: this would be in addition to the required recyclables).

ANNEX E

STANDARD OPERATING PROCEDURE #2

SELECTION AND PLACEMENT OF

RECYCLING & TRASH CONTAINERS ON CAMPUS

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1. **Purpose:** To provide a process for selection and placement of trash and recycling containers on campus.
2. **Scope:** This Standard Operating Procedure (SOP) standardizes the method of selecting and placing trash and recycling containers on campus to ensure that containers meet the needs of the University and are serviceable. This applies to interior and exterior recycling and trash containers and is intended to work in conjunction with the University Design Manual, University Policy Statement #110, and the Environmental Health & Safety Office Policy Statement #38.
3. **Responsibilities:**
 - a. The following parties will be involved in the process of approving, siting, and installing recycling containers and trash cans on campus:
 - I. Recycling Section
 - a. Determines where exterior recycling containers should be sited.
 - b. Determines where interior recycling containers in academic and administrative buildings should be sited.
 - c. Works with Grounds and Housekeeping Sections to ensure that trash and recycling containers will be sited together.
 - d. Researches containers to find the ones that best suit servicing requirements while maintaining aesthetic appeal and fiscal responsibility.
 - II. Grounds Section
 - a. Determines where exterior trash containers should be sited.
 - b. Works with Recycling Section to ensure that trash and recycling containers will be sited together.
 - c. Researches containers to find the ones that best suit servicing requirements while maintaining aesthetics and fiscal responsibility.
 - III. Housekeeping Section (NOTE: This refers to the Housekeeping group that is responsible for the particular building – Facilities Housekeeping, Residence Life Housekeeping, etc.)
 - a. Determines where interior trash containers should be sited.
 - b. In residence halls, Housing and Residence Life Housekeeping staff will also be responsible for the duties of the “Recycling Section” in (I) above.
 - IV. Design Group/Capital Projects, if included as part of a project
 - a. Incorporate built-in recycling/containers in all new construction and in renovations.
 - b. Include funding in projects to cover costs for purchasing necessary recycling and trash containers.
 - V. Real Estate and Land Use (RELU)
 - a. Provide feedback on criteria for aesthetically acceptable trash/recycling containers.
 - b. Provide feedback on preferred locations for siting containers.
4. **General Requirements:**

Recycling containers and trash cans must be placed in combination. Trash cans must be placed with a recycling container, and recycling containers must be placed with a trash can.

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a. **EXTERIOR CONTAINERS:**

I. The Customer:

- a. Contact Recycling Section and Grounds Section for help determining appropriate sizes, types, and locations for containers.
- b. Provide funding account to Recycling Section for ordering.

II. Grounds Section

- a. Provides input on size/number of trash cans needed.
- b. Identifies acceptable locations for container placement.

III. Recycling Section

- a. Provides input on size/number/type of recycling containers needed.
- b. Identifies acceptable locations for container placement.
- c. Orders agreed-upon number of containers.
- d. Assembles containers and places them in agreed-upon location(s).
- e. Notifies Grounds Section that containers are placed so service can begin.

b. **INTERIOR CONTAINERS:**

I. The Customer:

- a. Contact Recycling Section and Housekeeping Section for help determining appropriate sizes, types, and locations for containers.
- b. Provide funding account to Recycling Section for ordering (when built-in/cabinet style containers agreed upon).

II. Housekeeping Section

- a. Provides input on size/number of trash cans needed.
- b. Identifies acceptable locations for container placement.
- c. Cleans locations designated for trash/recycling containers.
- d. Places trash containers (if unable to use cabinet-style).

III. Recycling Section

- a. Provides input on size/number/type of recycling containers needed.
- b. Identifies acceptable locations for container placement.
- c. For built-in/cabinet-style containers, works with FM Shops to have containers built to specifications.
- d. Places rigid plastic liners inside cabinets when cabinets are complete and notifies Housekeeping Section when trash container(s) are ready to be serviced.

c. **DESIGN SERVICES:**

It is the goal of the University to replace existing stand-alone recycling and trash containers with sectional built-in or cabinet-style recycling/trash containers as space and funding allow. All projects should consider replacing these stand-alone containers with built-in or cabinet-style containers whenever possible.

I. The Customer:

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- a. Project will not be treated any differently from the customer standpoint, although the cost estimate will provide a line item for container replacement.

II. Design Group

- a. Work with Customer and Recycling Section to find potential locations for built-in or cabinet-style recycling/trash collection.
- b. Include costs to add built-ins/cabinet-style containers with project costs.

III. Recycling Section

- a. Work with Customer, Housekeeping Dept, and Design Group to find potential locations for built-in or cabinet-style recycling/trash collection.
- b. Work with FM Shops/contractor to provide measurements and specifications whenever built-ins/cabinets are approved.

d. CAPITAL PROJECTS:

It is the goal of the University to incorporate “built-in” recycling and trash containers in all new buildings. By building recycling and trash containers into the structure, the owner can ensure that containers match building décor and do not detract from aesthetics.

I. Capital Projects

- a. Work with Designer, Housekeeping Section, and Recycling Section to find potential locations for built-in or cabinet-style recycling/trash collection.
- b. Coordinate with Recycling Section to include proper measurements and style(s) for containers.
- c. Ensure that funding for interior recycling/trash bins (deskside bins, etc.) is included in Project Budget.
- d. Coordinate with Grounds Section to make sure that funding for exterior bins is included in the Project Budget.

II. Recycling Section

- a. Work with Housekeeping Section and Capital Projects to find potential locations for built-in and exterior recycling/trash collection and ensure that enough funding is included.

III. Grounds Section

- a. Work with Capital Projects to designate locations for exterior recycling/trash collection and ensure that enough funding is included.

5. Specific Procedures:

a. Placement of containers:

- I. Trash and recycling are always placed together.
- II. Containers that are improperly placed or do not meet safety and serviceability requirements may be removed or relocated by the servicing section (Recycling, Grounds, or Housekeeping).
- III. A minimum of one set of publicly accessible trash/recycling containers will be located on every floor of the building (lobby, dining areas, etc.)

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- IV. A set of trash/recycling containers (minimum of four sections, but prefer five sections) should be within sight of each main entrance to a building.
- V. All departments must have a designated area accessible by recycling staff for use as a “central recycling area” for that department. This may be a mail room, copy room, break room etc., and must have space for a minimum of four containers (trash, cans/bottles, office paper, mixed paper).

b. Selection of containers:

- I. Containers must meet serviceability requirements as specified in the University Design Manual. Requirements include (but are not limited to):
 - i. Access to interior containers via the front. This allows heavy bags to be pulled out sideways rather than lifted above waist height. As a result, minimizing the risk of injury while allowing employees to maintain a more ergonomically correct position. (reference EH&S Policy Statement #38).
 - ii. Volume of exterior recycling containers is between 32-gallons (minimum) and 38-gallons (maximum) to allow staff to safely handle full bags and prevent bags from tearing due to weight.
 - iii. Volume of exterior trash containers is a minimum of 32-gallons.
 - iv. Restrictive cut outs on the top of the containers to prevent contamination of recycling containers (i.e. slots for paper containers, 6” diameter circles for can and bottle containers)
 - v. Function and affordability should be primary considerations.
- II. Containers that do not meet serviceability requirements will not be serviced and may be removed by the servicing section (Recycling, Grounds, or Housekeeping).
- III. Final approval of selection and placement of recycling and trash containers on campus rests with the Associate Vice Chancellor for Facilities Management.

c. Inquiries:

- I. All inquiries about recycling/trash will be addressed to the Recycling Section.

SECTION 3, ANNEX D
CAMPUS EXTERIOR SIGNAGE STANDARDS

DIVISION 3, ANNEX D – CAMPUS EXTERIOR SIGNAGE STANDARDS

Note: Please contact the Project Manager for all campus signage information.

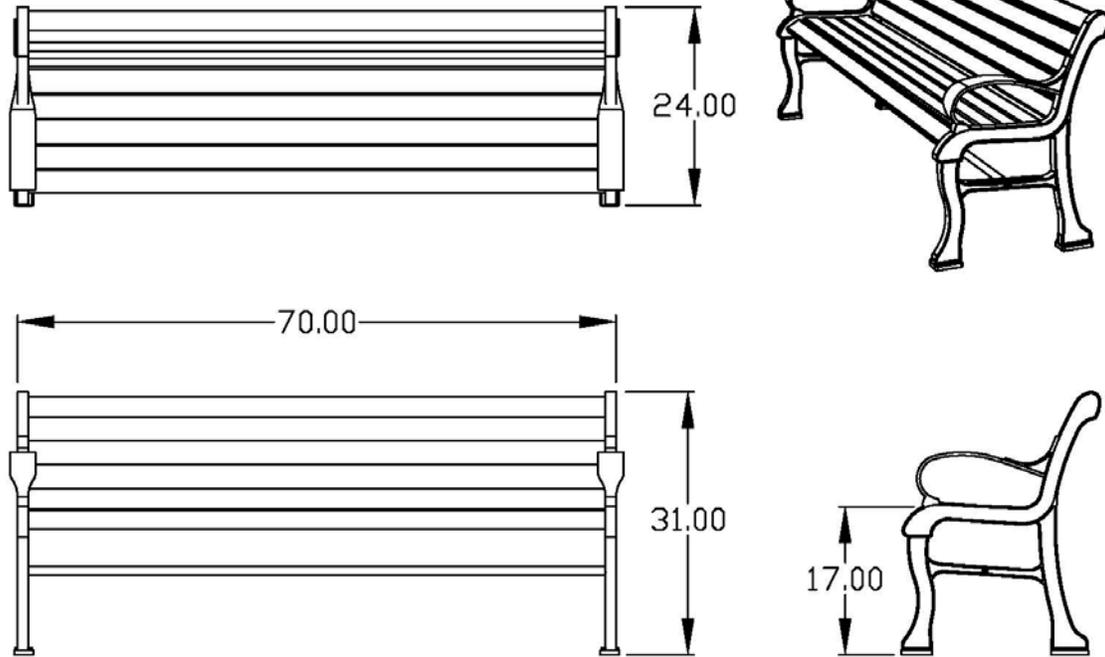
SECTION 3, ANNEX D
CAMPUS INTERIOR SIGNAGE STANDARDS

DIVISION 3, ANNEX D – CAMPUS INTERIOR SIGNAGE STANDARDS

Note: Please contact the Project Manager for all campus signage information.

ANNEX F
DESIGN GUIDE ILLUSTRATIONS

University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex F

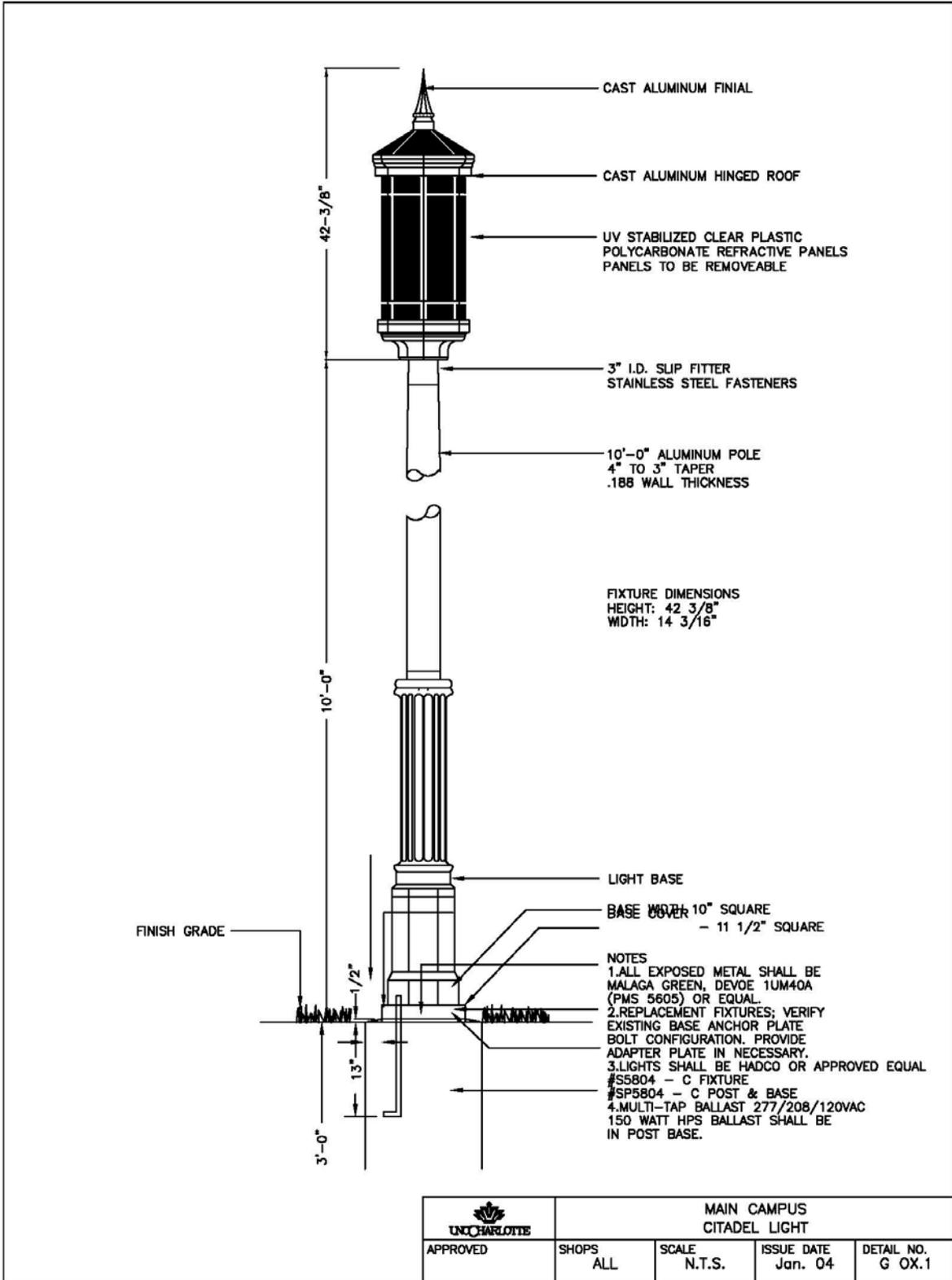


BENCH SHALL BE MAGLIN MLB300W
 COLOR SHALL BE RAL 6012
 APPROVED EQUAL BY OWNER

BENCH TO BE SECURELY FASTENED TO
 WALKWAY AS INSTRUCTED BY PROJECT
 MANAGER.

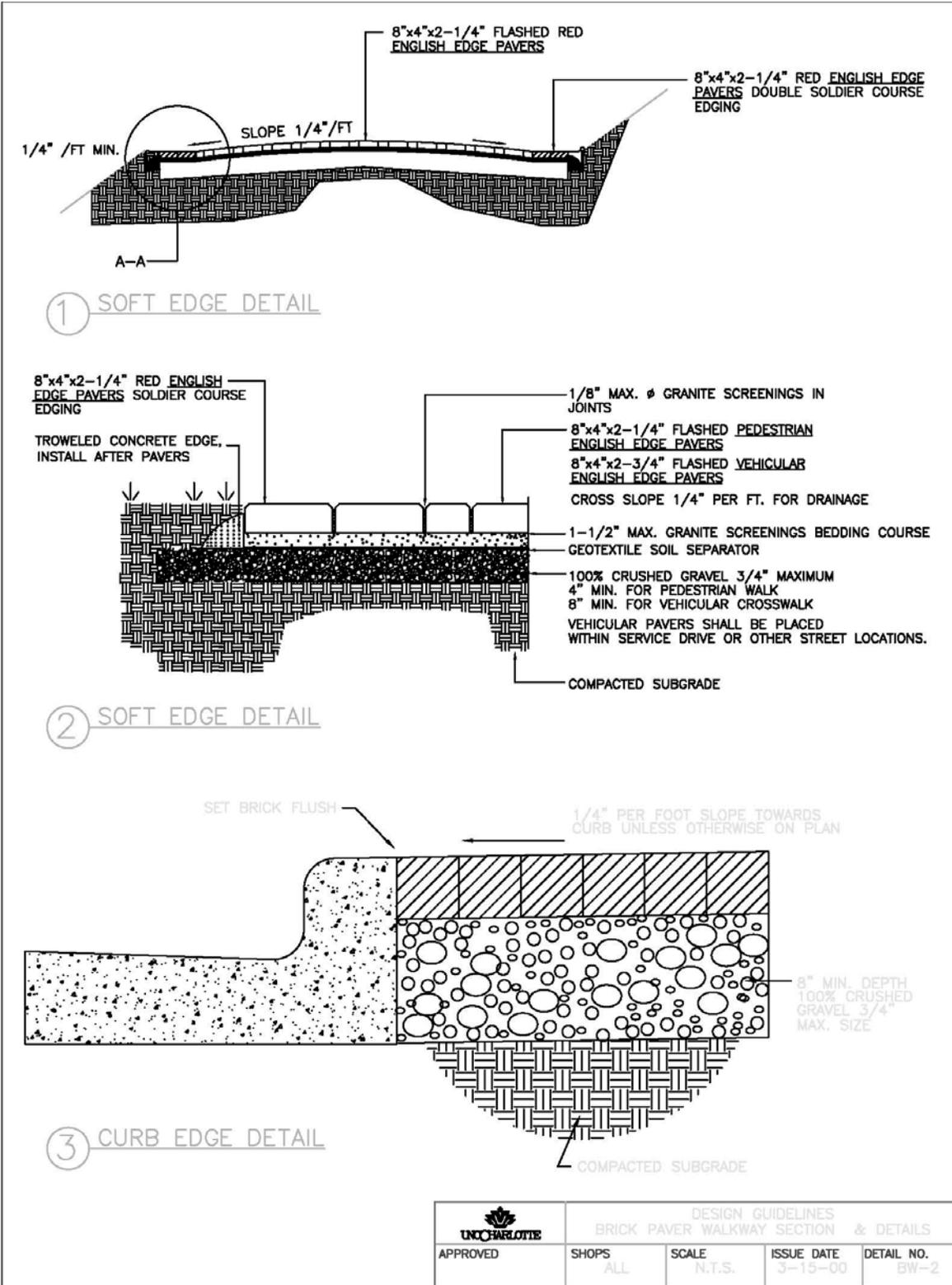
			
DESIGN GUIDE ILLUSTRATION METAL BENCH			
APPROVED	SCALE NTS	ISSUE DATE 07/05/07	DRAWING B-2

**University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex F**

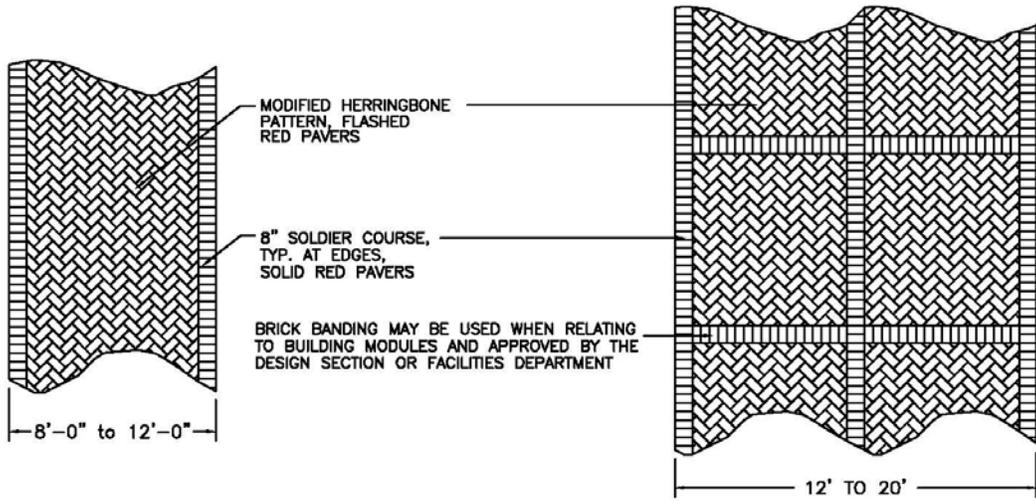


	MAIN CAMPUS CITADEL LIGHT			
APPROVED	SHOPS ALL	SCALE N.T.S.	ISSUE DATE Jan. 04	DETAIL NO. G OX.1

University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex F

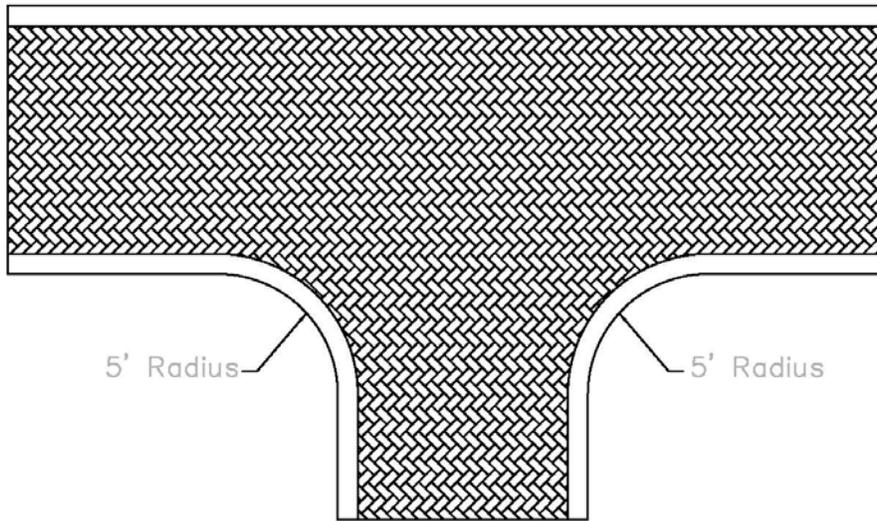


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A NARROW WALKWAY

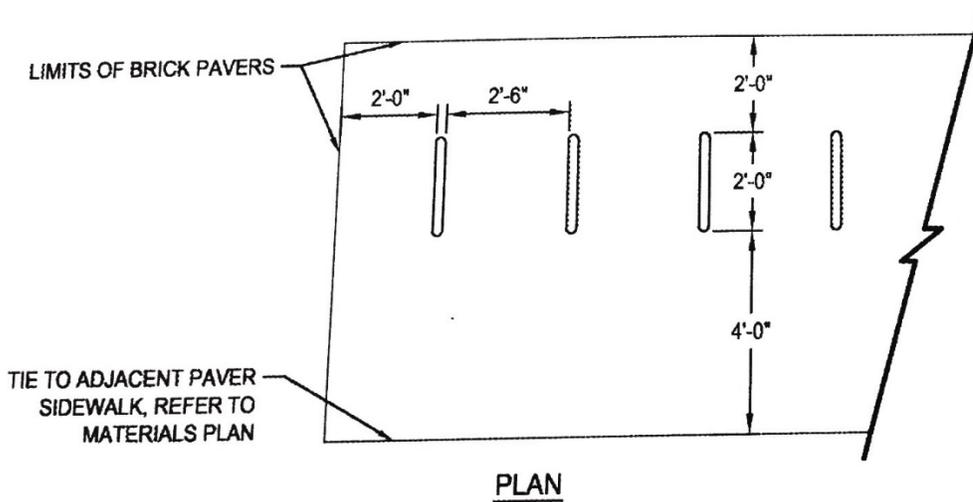
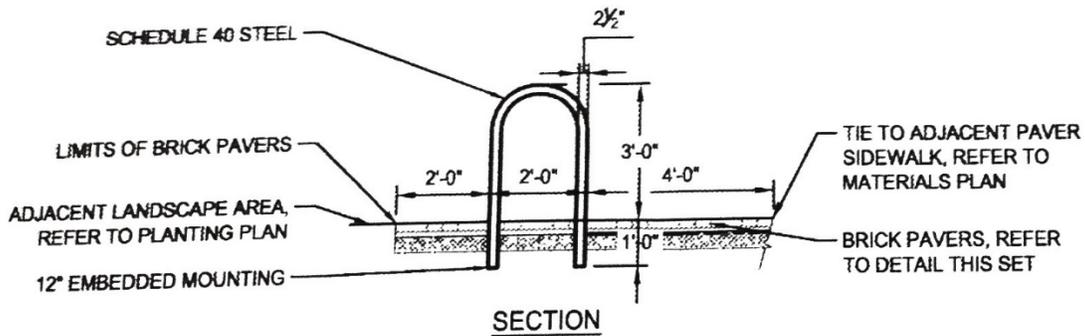
B WIDE WALKWAY



C Brick Walk Intersections

 UNCCARLOTTE	CONSTRUCTION AND MAINTENANCE STANDARDS BRICK WALKWAY PATTERNS			
APPROVED	SHOPS ALL	SCALE N.T.S.	ISSUE DATE 3-15-00	DETAIL NO. ?

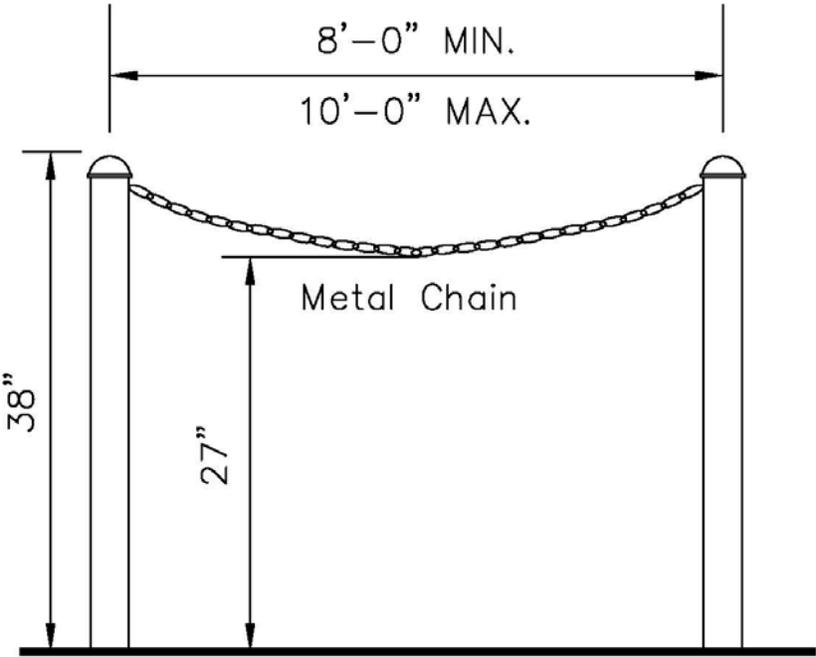
University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex F



NOTES:

1. BIKE RACKS SHOULD BE INSTALLED AS PER MANUFACTURER'S RECOMMENDED INSTALLATION PROCEDURES.
2. ALL DIMENSIONS SHOWN ARE MINIMUM.
3. LOOP TYPE BIKE RACK (2 BIKES PER RACK).
4. BIKE RACK TO BE MOUNTED BELOW GRADE.
5. COLOR TO BE MALAGA GREEN FROM DEVOE (1UM40A), PMS 5605 OR EQUAL SUCH AS TIGER DRYLAC 'RAL 6012'.
6. SPACE BIKE RACKS A MIN. OF 2'-6".

University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex F

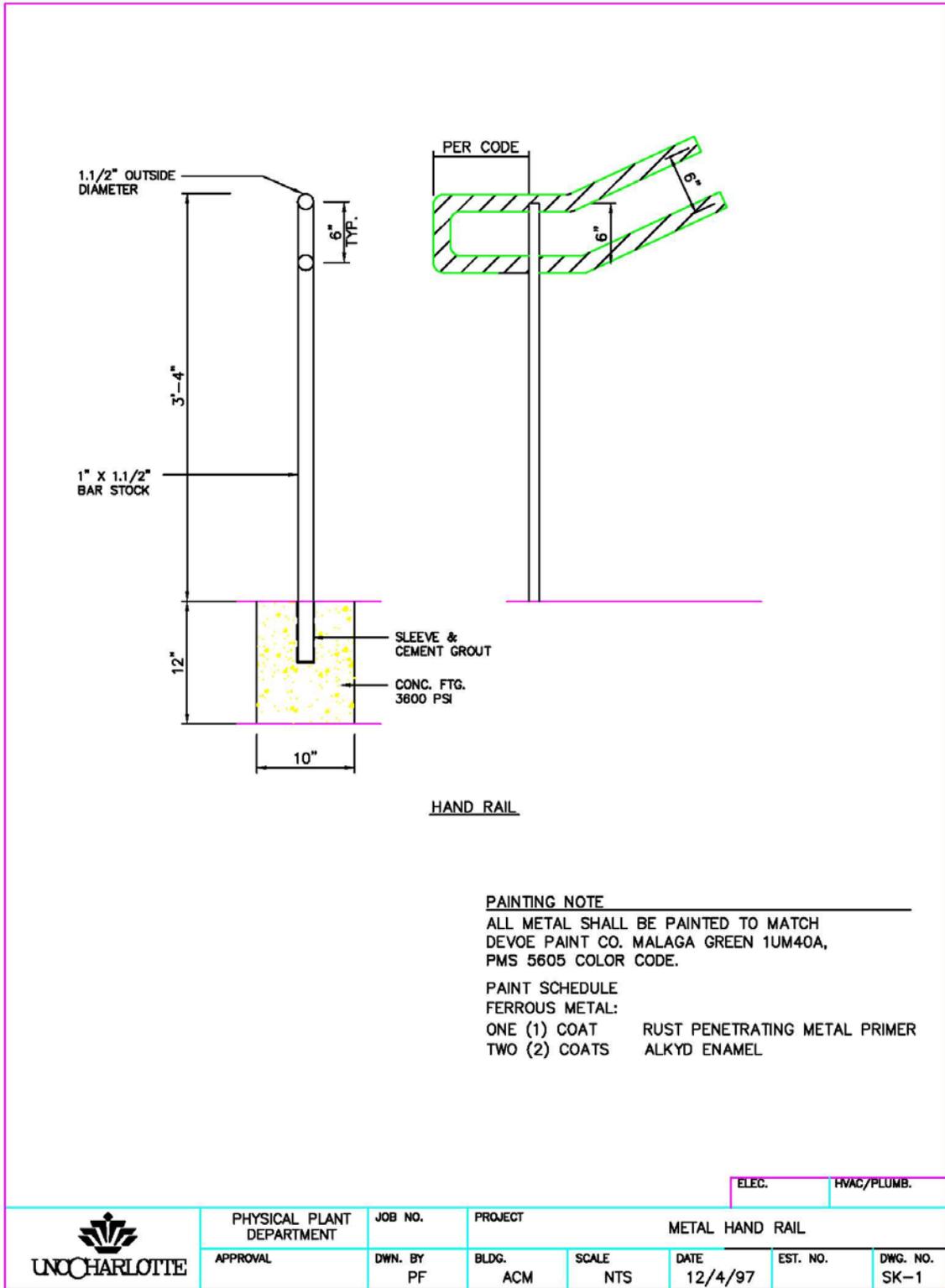


- Posts Shall Be 3" O.D. Metal Pipe
- Post and Chain Shall Be Painted Malaga Green
- Align Posts With Brick Paving Bands

Final Layout shall be prepared by the Facilities Planning Department prior to installation.

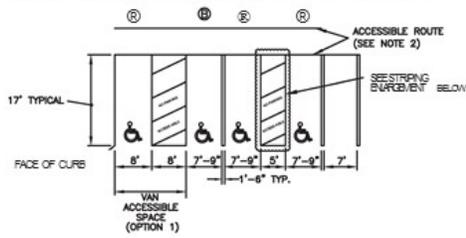
 DESIGN GUIDE ILLUSTRATION POST AND CHAIN			
APPROVED	SCALE NTS	ISSUE DATE 9/19/97	DRAWING PC-1

**University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex F**

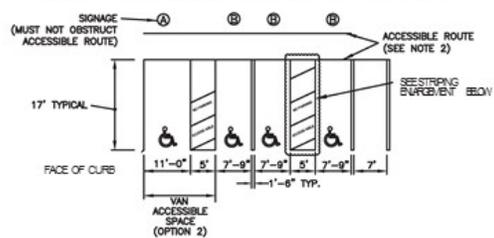


**University of North Carolina at Charlotte Design and Construction Manual
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PARKING SPACE PAVEMENT MARKINGS (8'-0" VAN SPACE)

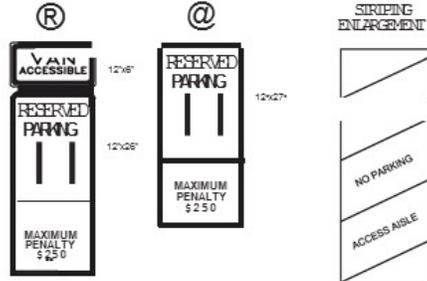


PARKING SPACE PAVEMENT MARKINGS (11' VAN SPACE)



NOTES:

1. ALL 12x27" ACCESSIBLE SIGNS SHALL BE MOUNTED AT 7 FEET FROM GRADE TO BOTTOM EDGE OF SIGNFACE (MTCO). MOUNTING HEIGHT CAN BE REDUCED TO 5 FEET IF MOUNTED IN AN AREA BETWEEN SIDEWALK AND BUILDING FACE IN WHICH PEDESTRIANS ARE NOT EXPECTED TO USE.
2. IF ACCESSIBLE ROUTE IS A RAISED SIDEWALK AREA, THEN TRAMPS ARE REQUIRED AT LOADING ZONE AREA. MAINTAIN MIN. 4" WIDE CONTINUOUS PASSAGE.
3. ALL DIMENSIONS ARE STANDARD UNLESS CALLED OUT OTHERWISE ON THE PLANS.
4. VERTICAL CLEARANCE FOR VANS MUST BE GREATER THAN 99-INCHES.
5. STRIPING "NO PARKING ACCESSIBLE" TEXT SHALL BE 6" IN HEIGHT.
6. SLOPE SHALL NOT EXCEED 1" IN 30' IN ANY DIRECTION WITHIN VAN SPACE OR ACCESSIBLE.
7. THIS DETAIL TO PROVIDE GENERAL GUIDANCE FOR PARKING LAYOUT AND DESIGN. REFER TO MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MTCO), U.S. DEPARTMENT OF TRANSPORTATION AND NORTH-CAROLINA DEPARTMENT OF TRANSPORTATION SUPPLEMENT AND NC BUILDING CODE FOR ADDITIONAL INFORMATION.
8. CONTRACTOR MAY PROVIDE CONCRETE IN LIEU OF ASPHALT AT VAN SPACES AND ACCESSIBLES.



NOT TO SCALE



DEPARTMENT:
PATS
DATE:
12/2016

**ACCESSIBLE PARKING AND
SIGNAGE DETAIL**

DETAIL NO.
7

Charlotte Research Institute



Design Standards

University of North Carolina at Charlotte Design and Construction Manual
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Introduction

The Charlotte Research Institute is envisioned as a partnership between corporate Charlotte and UNC Charlotte. It will provide a clear opportunity to address a compelling need of the region and the state. Leveraging Charlotte's existing strengths and better positioning UNC Charlotte as a major research university are crucial if Charlotte is to develop and attract the high-technology and research interests it desperately needs. (Advantage Carolina)

This Design Guideline serves as an outline of site features for the Charlotte Research Institute Campus. The Master Plan is establishing a campus that will have an urban atmosphere. The architectural style, brick walks, lighting signage and other amenities will be traditional in design. The intent is to create a visual identity that will leave a lasting impression on those who visit and work at the campus.

The following pages provide the product names and sources. Consultants who wish to make substitutions must submit photographs, specifications and justifications to the Facilities Planning Department for review early in the design process.



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Brick Walk
Pine Hall Brick
English Edged Paver with Flashed Fields and Red Border
Refer to Campus Sidewalk Master Plan
Herringbone Pattern
See UNC Charlotte Sidewalk Master Plan 1997



Brick Walks

University of North Carolina at Charlotte Design and Construction Manual
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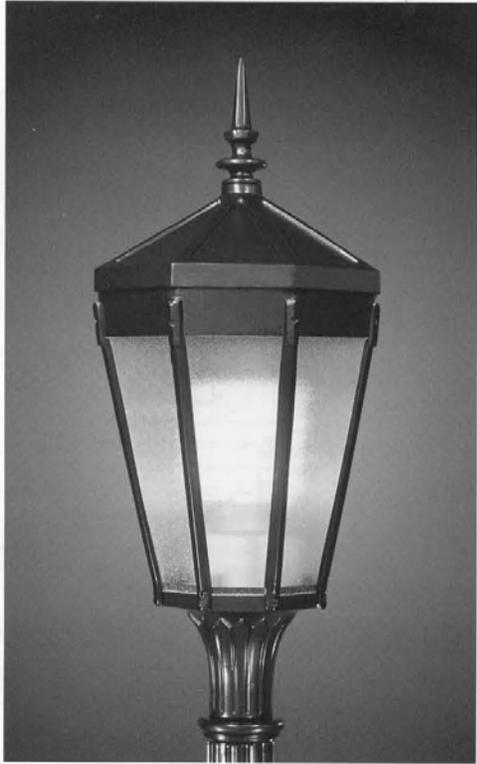


3. Maglin Metal Bench: Color: Malaga Green



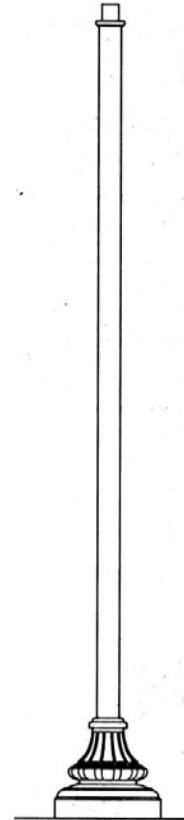
3. Metal Bench: Color: Malaga Green

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Pedestrian Light Fixture

Antique Street Lamps
LT30K 150S MOG ACT GR3 TV Multi-Tap Color Fixture
Color to be Malaga Green



Pedestrian Light Post

Antique Street Lamps
PX W19 12 S4 Color Aluminum
Post
Color to be Malaga Green

Pedestrian Lights

University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex F



Stop Sign / Street Name Sign Options

Other sign types can also be mounted on posts

All Signs shall use Antique Street Lamps

Washington Series:

Post PX W17 6 F4

Stop Sign: Frame STO30P

Yield Sign: Frame STT30P

Traffic Circle: Frame STD30P

One Way: STR3612P



Post Mounted Building Sign



Signs

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Similar to Decorative Ash Urn
Creates Continuity



Maglin 32 G. Receptacle



Decorative Ash Urn (\$550 each)

Receptacles/Ash Urns

SECTION 3:
ANNEX I
FIRE DEPARTMENT REQUIREMENTS AND FORMS

CITY OF CHARLOTTE, NORTH CAROLINA

FIRE DEPARTMENT 2 WAY RADIO COMMUNICATION SYSTEM

Section 1.

Public Safety Radio Coverage in Buildings

1.1 Building Radio Coverage. Except as otherwise provided no person shall maintain, own, erect, or construct, any building or structure or any part thereof, or cause the same to be done which fails to support adequate radio coverage for public safety entities, including, but not limited to, firefighters, emergency medical services and police officers. "Agency" as used in this code means the local governmental authority enacting this code.

Exceptions:

1. This section shall not apply to single family residential buildings; any building constructed of wood frame; any building twenty-five (25) feet high or less; as long as none of the aforementioned buildings make primary use of metal or concrete construction or contain below grade storage or parking areas. For purposes of this section, parking structures are included in the definition of building, and stair shafts are included in the definition of all parts of a building, but elevators may be excluded.
2. Buildings constructed prior to the implementation of this section shall not be required to comply with public safety radio coverage provisions of this section. However, should exempted structures undergo renovation, restoration, or significant modification to the original structure, exemption from the provisions of this Ordinance shall not apply.

1.2 Minimum Radio Coverage into building. A minimum voice quality of DAQ 3.4 (see TSB-88-B) (for Digital radio systems) and Circuit Merit 3 (for Analog systems) be present in all areas of the building when transmitted from the agency's radio system. For purposes of this section, 95% building coverage is considered to be all areas of the building.

1.3 Minimum Signal Strength out of building. A minimum signal strength of 20 db \pm 5 db above the noise floor shall be provided to and from the agency's radio system when transmitted or received from all areas of the building. For purposes of this section, 95% building coverage is considered to be all areas of the building.

1.4 Technical criteria maintained by the Agency. The agency shall maintain a document of technical information specific to their requirements. This document shall contain as a minimum; the frequencies required, the location and effective radiated power (ERP) of radio sites used by the in-building system, the maximum propagation delay (in microseconds) and other supporting technical information.

1.5 Amplification Systems Allowed. Buildings and structures which cannot support the required level of radio coverage shall be equipped with a radiating cable system and/or a distributed antenna system (DAS) with FCC certified Bi-Directional Amplifier (BDA)s (aka bi-directional amplifiers), or systems otherwise approved by the agency in order to achieve the required adequate radio coverage.

1.6 Battery Systems. The active components of the installed system or systems shall be capable of operating on an independent battery system for a period of at least twelve (4) hours without external power input. The battery system shall automatically charge in the presence of external power input.

1.7 Bi-Directional Amplifier (BDA) requirements. If used, Bi-Directional Amplifier (BDA)s shall meet the following requirements as well as any other requirements determined by the agency;

- a. All Bi-Directional Amplifier (BDA) components shall be contained in one NEMA4 type water proof cabinet. Permanent external filters and attachments are not permitted.
- b. The battery system shall be contained in one NEMA4 type water proof cabinet.
- c. The system shall be capable of providing automatic alarming of malfunctions of the Bi-Directional Amplifier (BDA) and battery system. Any resulting alarm shall be transmitted to the agency's designated recipient by means specified by the agency, including, but not limited to, automatic standard telephone dial-up circuit, TCP/IP network circuit, RS232 interface, etc.
- d. Products used in such systems must have FCC Certification prior to installation. Pending FCC certification is not acceptable.
- e. All Bi-Directional Amplifier (BDA)s must be compatible with both analog and digital communications simultaneously at the time of installation.

1.8 Additional frequencies and change of frequencies. The building owner will be required to modify or expand the public safety in-building system at their expense in the event frequency changes are required by the FCC or additional frequencies are made available by the FCC. This is an advisory statement that the building owner may select equipment and distribution components that are capable of such changes. Prior approval of an in-building system on previous frequencies does not exempt this section.

1.9 Approval Prior to Installation. No amplification system capable of operating on frequencies licensed to the agency by the FCC shall be installed without prior coordination and approval of the agency. This is a FCC requirement.

2.0 Engineering and Design. The Bi-Directional Amplifier (BDA) system(s) shall be designed by a professionally licensed Engineering Firm with a currently certified electrical engineering professional in its employ.

2.1 Implementation. The Bi-Directional Amplifier (BDA) systems shall only be implemented by professional system integrator certified and trained by the manufacturer of the Bi-Directional Amplifier (BDA).

2.2 Documentation. As-built drawings consisting of a system block diagram, layout drawings and data settings, shall be provided electronically in AutoCAD format on CD and in paper copies (2) to the agency.

2.3 Testing and Proof of Compliance. Each owner shall submit at least one in-building coverage test:

1. Acceptance testing prior to occupancy of any newly constructed building.
2. Whenever structural changes occur including additions to buildings that would materially change the original field performance tests
3. Annually
4. When repairs or alterations are made to amplification systems, the performance test shall demonstrate that adequate radio coverage is available in all required areas of the building. At the conclusion of the testing a report shall be submitted to the agency which shall verify compliance with Section 1.2.

2.4. Acceptance Test Procedure. When an in-building radio system is required, and upon completion of installation, it will be the building owner's responsibility to have, the radio system tested to ensure that two-way coverage on each floor of the building is a minimum of 95 percent.

2.4.1 Each floor of the building shall be divided into a grid of approximately 40 equal areas. A maximum of two nonadjacent areas will be allowed to fail the test.

2.4.2 In the event that three of the areas fail the test, in order to be more statistically accurate, the floor may be divided into 40 equal areas. A maximum of four nonadjacent areas will be allowed to fail the test. After the 40-area test, if the system continues to fail, it will be the building owner's responsibility to have the system altered to meet the 95 percent coverage requirement.

2.4.3 The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency's radio communications system.

2.4.4 A test location approximately in the center of each grid area will be selected for the test, then the radio will be enabled to verify two-way communications to and from the outside of the building through the agency's radio communications system. Once the test location has been selected, prospecting for a better spot within the grid area will be permitted within 3' in any direction of the original selected test location.

2.4.5 Isolation Testing. As part of the installation a spectrum analyzer or other suitable test equipment shall be utilized to insure spurious oscillations are not being generated by the subject Bi-Directional Amplifier (BDA) due to coupling (lack of sufficient isolation) between the input and output antenna systems. This test will be conducted at time of installation and subsequent annual inspections.

2.5 System Settings. The gain and power values of all Bi-Directional Amplifier (BDA)s shall be measured. The test measurement results shall be recorded on as-built drawings and kept on file with the building owner so that the measurements can be verified each year during the annual tests. In the event that the measurement results become lost, the building owner will be required to rerun the acceptance test to reestablish the gain values.

2.6 Annual Tests. When an in-building radio system is required, it shall be the building owner's responsibility to have all active components of the system, such as Bi-Directional Amplifier (BDA)s, power supplies and backup batteries tested to a minimum of once every twelve (12) months. Bi-Directional Amplifier (BDA)s shall be tested to ensure that the gain and power are the same as it was upon initial installation and acceptance. Backup batteries and power supplies shall be tested under load of a period of one hour to verify that they will properly operate during an actual power outage. If within the one hour test period, and in the opinion of the agency's representative, the battery exhibits symptoms of failure, the test shall be extended for additional one hour periods until the integrity of the battery can be determined. All other active components shall be checked to determine that they are operating within the manufacturers specifications for the intended purpose.

2.7 Field Testing. Police and Fire Personnel shall at any time have the right to enter onto the property to conduct its own field-testing to be certain that the required level of radio coverage is present.

2.8 Minimum qualifications of personnel. The minimum qualifications of the system engineer and integration organization shall include

- a. A Valid Professional Engineering Certification
- b. Certification of in-building system training issued by the manufacturer of the equipment being installed.

2.9 Other code compliance. The in-building system installation and components shall comply with all applicable local codes, including but not limited to, Federal Communications Rules (47 CFR 90.219), NEC, NFPA, IBC, IFC, TIA/EIA etc.

Version 9-18-07



Charlotte Fire Department Building Details

Pre-Incident / Prevention Building Survey

Building Name: _____ Building Phone: _____

Address: _____

General Information

Property/Land Use: _____ Fire Demand: _____ High Rise: _____

Occupancy Use: _____ Grid Number: _____ Still Alarm: _____

Inspection

Inspection District: _____ Permitted Occupancy: _____ Frequency: _____

Last Inspection Date: _____ Total # of Inspections: _____

Inspector: _____ # of Active Permits: _____

CO Inspector: _____ Occupancy Load: _____

Fire Educator: _____ Last Building Survey: _____

Fire Alarm

Type: _____ Test Date: _____ Monitoring Agency: _____

Annunciator Location: _____

Control Panel Location: _____

Other Extinguishing System Title: _____ Location: _____ Test Date: _____

Sprinkler System

Type: _____ Test Date: _____ Standpipes: _____ Standpipes Test Date: _____

Standpipe FDC Location: _____

FD Connection Location: _____

Post Indicator Location: _____

Riser #1 Location: _____

Riser #2 Location: _____

Riser #3 Location: _____

Backflow Preventer: _____ Test Date: _____

Fire Pumps: _____ # Pumps: _____ Test Date: _____

Utilities

Electrical Panel Location: _____

Gas Meter Location: _____

Water Shut Off Location: _____

Emergency Generator: _____



Charlotte Fire Department Building Details

Pre-Incident / Prevention Building Survey

Knox Box

Knox Box Location: _____

Knox Box Serial #: _____

Haz Mat

Health: ___ Fire: ___ Reaction: ___ Other: ___ # Haz Mats: ___

Fire Protection Considerations

Fire Load: _____ Defensive Ops Only: _____ Fire Flow Required Available: _____

Common Attic: _____ Building Length: _____ Fire Flow Required : _____

Roof Operations: _____ Building Width: _____

Exposures: _____

Risk Assessment

<u>Vertical Open:</u>	<u>Stairway:</u>	<u>Basement:</u>	<u>Floor:</u>	<u>Roof:</u>
Elevator: _____	Open: _____	Exterior Entrance: _____	Unsafe: _____	Unsafe: _____
Dumbwaiter: _____	Enclosed: _____	Interior Entrance: _____	Crowded: _____	Wood Truss: _____
Laundry/Trash: _____	NA: _____	NA: _____	Open Pit: _____	Truss: _____
NA _____		# Floors Below : _____	High Pile: _____	Concrete: _____
			NA: _____	Bar Joist: _____
<u>Roof Attachments:</u>	<u>Walls:</u>	<u>Tanks:</u>	# Floors: _____	Steel Truss Deck: _____
Cooler: _____	Unsafe: _____	Above Ground: _____		Other: _____
Tank: _____	Cracked: _____	Underground: _____	<u>Exits:</u>	
A/C: _____			#Exit Doors: _____	
Sign: _____	<u>See Remarks:</u> _____	<u>High Risk:</u> _____		

Remarks: _____

Other

MST Notes: _____

Critical Facility: _____ Vital Facility: _____

Property Contacts

First Name:	Last Name:	Primary Phone #:	Calling Sequence:
-------------	------------	------------------	-------------------

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

ANNEX K
49ER CARD SYSTEMS

UNC CHARLOTTE 49ER CARD SYSTEM INSTALLATION AND CONTRACTOR REQUIREMENT SCOPE OF WORK:

The following information pertains to the installation and contractor requirements to install the UNC Charlotte 49er card system devices.

The 49er Card devices to be installed on this project will encompass the following:

- Door Access at all residence halls:
2 Belden 8723 cables, 1 to card swipe, 1 to 4x4 box as shown on illustration #3
- Laundry Centers at all residence halls:
2 CAT 6 Network drops per Laundry Reader, Belden 8723 cables required in each of these rooms also. Quantity determined by amount of machines required in each laundry room.
- Vending at all locations:
2 CAT 6 Network drops per machine
- Cash Registers at all locations:
4 CAT 6 network drops per register location

DOOR ACCESS REQUIREMENTS (at all residence halls):

The door access module enclosure for the SA3000 to be mounted in the telecom rooms for this facility will require the following infrastructure:

- 1: A minimum 3/4" home run conduit installed from the card swipe location ("CR" location) to the closest telecommunications cable tray system as shown in illustration # 2.
- 2: Card swipe mounting locations will require a minimum of a single gang back box with proper extension mounting rings installed flush to face of exterior finish where card swipes are to be mounted. All height for the box locations should be installed to comply with ADA standards and UNCC's more stringent mounting height.
- 3: A minimum of a 1" conduit from the SA3000 door access controller enclosure (to be located in telecom room) to the 4 X 4 junction box shown in illustration # 3. This conduit does not have to be run in a home run fashion. The conduit can leave the telecom room and go to the cable tray outside the telecom room. Then from the 4 X 4 junction box located at door hardware control devices back to the closest cable tray. Preferably by the 3/4" conduit for the card swipe cable.
- 4: In telecom rooms where the SA3000 door access controller enclosures are to be installed will require a 120 Volt circuit installed to this enclosure. This electrical circuit will need to be a dedicated 20 AMP circuit, no emergency power required. This is shown in illustration # 4. The power will need to be landed on the SA 3000 power supply by the contractor.

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Section 3, Annex K, 49er Card Systems

CONTRACTOR REQUIREMENTS for 49er Card door access controller:

- 1: UNC Charlotte will place the order to purchase the SA3000 door access controller and enclosures in quantities approved by housing when they are notified of the date needed. The 49er card office requires a three month notice to place orders for 49er associated enclosures and devices. This will allow sufficient time for the devices to be delivered to the GC or CM at risk for installation when they are ready based on the building schedule. The enclosures with power supplies will be turned over to the GC or electrical contractor on the project for mounting in the telecom rooms. This is necessary so the electrical contractor can install the required conduits and power into the enclosure. And to also terminate the power circuit on the power supply located in the 49er door access controller enclosure as shown in illustration # 4.
- 2: The telecommunications or electrical contractors will be responsible for installing two (2) Belden 8723 cables from the SA3000 enclosure located in the telecom rooms to the card swipe and door control electronics as shown in illustration # 3. Contractor is responsible for connections to all ADA systems
- 3: The Belden 8723 cable to the door opening electronics enclosure will be utilized as an open/close (Make contact) relay cable from the SA3000. This will interface to the electronics card for the door opening hardware and will be the responsibility of the door hardware installer to make this termination on their electronics card.

NOTE: Some door access points in facilities require an ADA access system to be installed. The door hardware installer will be responsible for making all necessary connections so the SA3000 will work in conjunction with the exterior ADA door opener paddle. The SA3000 Card swipe will have to activate the door lock release first before the exterior ADA door opener paddle can be energized. If not and the exterior ADA paddle is energized all the time without a valid card swipe it would operate and try to open a locked door causing damage to the ADA opening system.

All that will be provided from the SA3000 is an open/close, dry contact, to unlock the door with a valid card swipe. It will be the responsibility of the door hardware installer to provide all equipment, electronics, contact closures, dual time relays, etc... to make the doors function properly utilizing a card swipe. This would include ADA doors and non ADA doors.

Some telecom rooms may require more than one SA3000 door access controller enclosure. The 120 volt circuit that is required to feed each enclosure can be multiplied up to three enclosures. If more than three enclosures become necessary then the fourth enclosure would require a dedicated 120 volt circuit that could then be multiplied to another two enclosures, and so on.

UNC CHARLOTTE ITS RESPONSIBILITIES for 49er Card door access readers:

- 1: The UNC charlotte ITS technician will install the card swipes at all doors specified to have 49er Card access. The ITS technician will terminate the contractor installed Belden 8723 cable to the card swipe.

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- 2: The ITS technician will install the electronics circuit board into the contractor Mounted SA3000 enclosure in each telecom room after the 110 volt circuit has been installed and terminated on the power supply in the enclosure. The ITS technician will be responsible for terminating the Belden 8723 cables and network cables on the electronics card that will be installed in the SA300 enclosure located in the telecom rooms.
- 3: The ITS 49er Card technician, when it becomes available, will coordinate delivery of all required SA3000 equipment with the GC
A three month notice is necessary to order this equipment from Bb to insure there will be no problems with backorders or delivery.

Some telecom rooms may require more than one enclosure depending on how many doors that particular telecom closet may serve. Each controlled door requires one SA3000.

- 4: The ITS 49er Card technician will suggest coordinate, and advise and provide Bb documentation to contractors as required for proper installation of the required contractor installed components of the 49er card system.

The 49er technician will also be responsible for bringing all 49er card devices on line and testing for proper operation. If there are issues beyond the 49er technician responsibilities that cause a device to not function it will be the responsibility of the contractor that installed the components under their scope of work to address any issues. The 49er technician will be available to test the 49er equipment once any issues have been determined and repaired by contractor if this becomes necessary.

LAUNDRY CENTER REQUIREMENTS (at all residence halls):

Infrastructure requirements:

- 1: Within each laundry room a deep device double gang back box with double gang plaster ring will be required behind where each Laundry Room 49er card controller would be mounted. In this box a splitter will be required because both a 110 volt circuit has to be brought thru this box to the power supply in the controller and all the Belden 8723 cables from each laundry machine have to be brought into the controller enclosure. See illustrations 5 and 6.
- 2: A minimum of a 1-1/4" conduit is to be installed into the split double gang back box to bring the Belden 8723 cables from each machine thru the back box and into the laundry controller enclosure. Each Belden 8732 cable needs to be labeled at each at the controller and machine end in legible text so it can easily be identified by the installer. This conduit is to be stubbed above the accessible ceiling within the laundry room. Do not take this conduit out to the hallway cable tray system.

The conduit for the 120 volt circuit will have to be sized as required by the electrical contractor to be installed into the split double gang back box.

- 3: Behind each laundry machine a single gang back box with a single gang plaster ring is to be installed. A single gang outlet is required behind each machine. Do not try to

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multiple individual machines from one outlet. These outlets are to be at the same height as the power outlets will be installed. Typically these outlets are installed higher on the wall behind each machine than a standard electrical outlet. Roughly 30" AFF.

- 4: A ¾" conduit is required from each of the single gang back boxes to be stubbed to above accessible ceiling within the laundry room. Do not install these conduits to the cable tray system in the hallways.
- 5: A single gang stainless steel faceplate with a minimum of a ¾" LFNC conduit attached with a 90 degree connector to the face of the wall faceplate is be installed behind each laundry machine. The laundry machine end of the LFNC will have a straight fitting. The LFNC should be a minimum 6.5' end to end and the Belden 8723 cable should extend 4' beyond the end of LFNC connector. The LFNC conduit will be attached to each laundry machine by the laundry machine installer. The LFNC is used to protect and convey the Belden 8723 cable from the outlet to the laundry machine.

CONTRACTOR RESPONSIBILITIES:

- 1: The project is responsible for installing all infrastructure items listed above in infrastructure requirements.
- 2: The electrical contractor will be responsible for installing the 110 volt circuit thru the split double gang back box located behind the laundry room 49er card controller. Electrical contractor responsible for mounting the laundry room 49er controller enclosure over the double gang split back box and terminating the 110 volt circuit on the power supply that is located within the enclosure. See illustrations 5 and 6.
- 3: The telecommunications or electrical contractor will be responsible for installing all Belden 8723 cabling within each laundry room. Each laundry machine will require one Belden 8723 cable. Leave a slack coil of no less than 4' out of the end of each LFNC conduit that is to be installed behind each laundry machine. See illustration 7.
- 4: Bring all the Belden 8723 cables from each laundry machine down the 1-1/4" conduit installed to the split double gang back box. Route the cables thru the back box and into the laundry room controller enclosure. Leave a 10' slack coil on the cables. See illustration 5 and 6. These illustrations show the larger knock out in the enclosure where the Belden 8723 cables are to be brought into the enclosure from the double gang back box mounted behind the enclosure.
- 5: Telecommunications contractor to install two CAT 6 network drops from the nearest telecom room to the laundry room 49er card controller enclosure. These cables are to be terminated on the UNCC data patch panels to be located in the telecom rooms.

At the laundry room 49er card controller enclosure the CAT 6 cables are to be brought down the same 1-1/4" conduit as the Belden 8723 cables installed within the laundry room. Leave approximately 1' of slack on the CAT 6 cables and terminate a CAT 6 jack on the end of the cables. Leave the cables hanging out of the enclosure with the other Belden 8723 cables. Test the CAT 6 cables same as all other network drops within the facility. Provide a label on the cables as industry standards dictate for proper identification of the cables.

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UNC CHARLOTTE RESPONSIBILITIES for laundry rooms:

- 1: The 49er technician will provide the laundry room 49er card controller enclosures with power supplies to the electrical contractor for installation in each laundry room.
- 2: 49er technician will terminate all Belden 8723 cables to the electronics card that will be installed in each laundry room controller.
- 3: 49er technician will connect the network drops to the electronics card in each laundry controller.
- 4: 49er technician will be responsible for coordinating with the laundry equipment installer to connect the ¾" flex conduits from the outlets behind each laundry machine to the machines.
- 5: 49er technician will be responsible for coordinating with the laundry equipment installer to bring the contractor installed Belden 8723 cables into each laundry machine and make the appropriate connections within each machine.
- 6: 49er technician will be responsible for bringing the laundry room 49er card controller on line. And to also coordinate with the laundry equipment installer to test each machine tied to the reader for proper operation.

If a machine will not operate properly and the trouble is deemed to be in any contractor installed portion as required in contractor responsibilities. It will be the responsibility of the contractor that performed the install of the component to repair. The 49er technician will be available to test after repairs have been made by contractor.

VENDING and CASH REGISTERS (at all locations):

Vending (Snack, Drink) use a regular CAT 6 jack but require the data and 120 v receptacles be 78" AFF. The readers are pre mounted in each vending machine by the vending machine providers. The cash registers are installed by the 49er technician where required on any specific project and should be coordinated with the 49er Card Office.

Drawings for Bb Laundry and Secure access Wiring

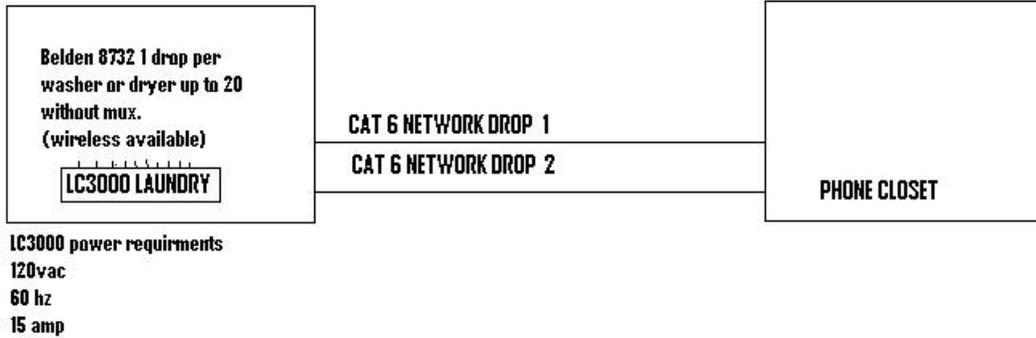
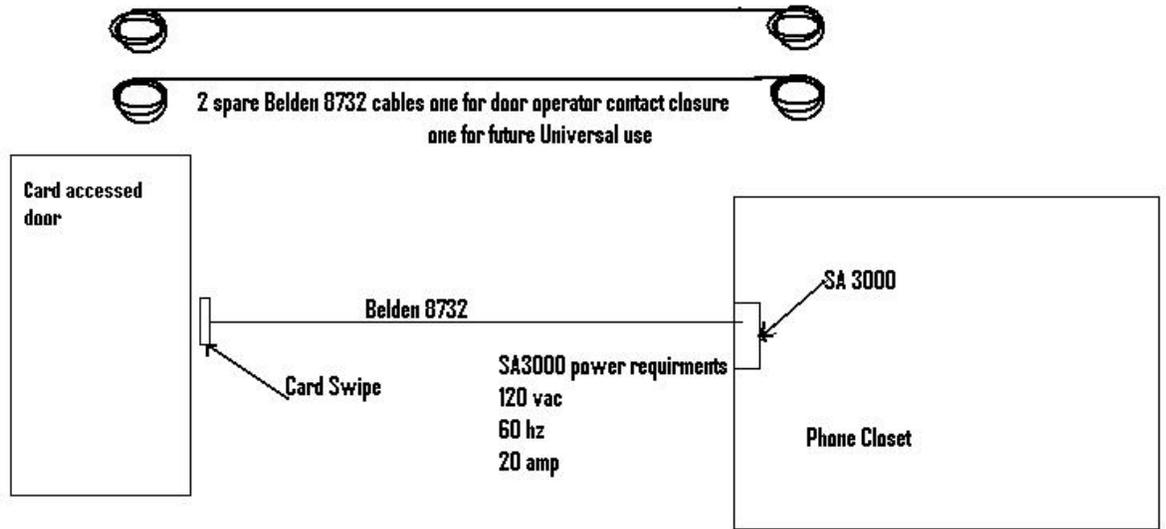


Illustration #1



Note: SA3000 mounted in Phone closet to aid in conversion to Universal

Belden

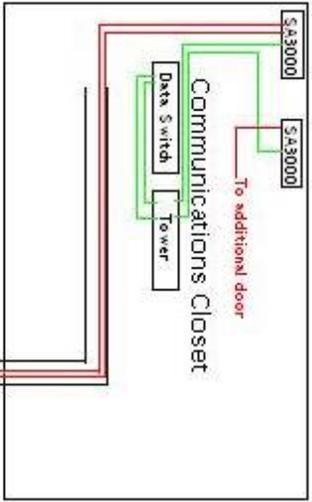
Bb Door Access SA30XX

Illustration #2

Block diagram

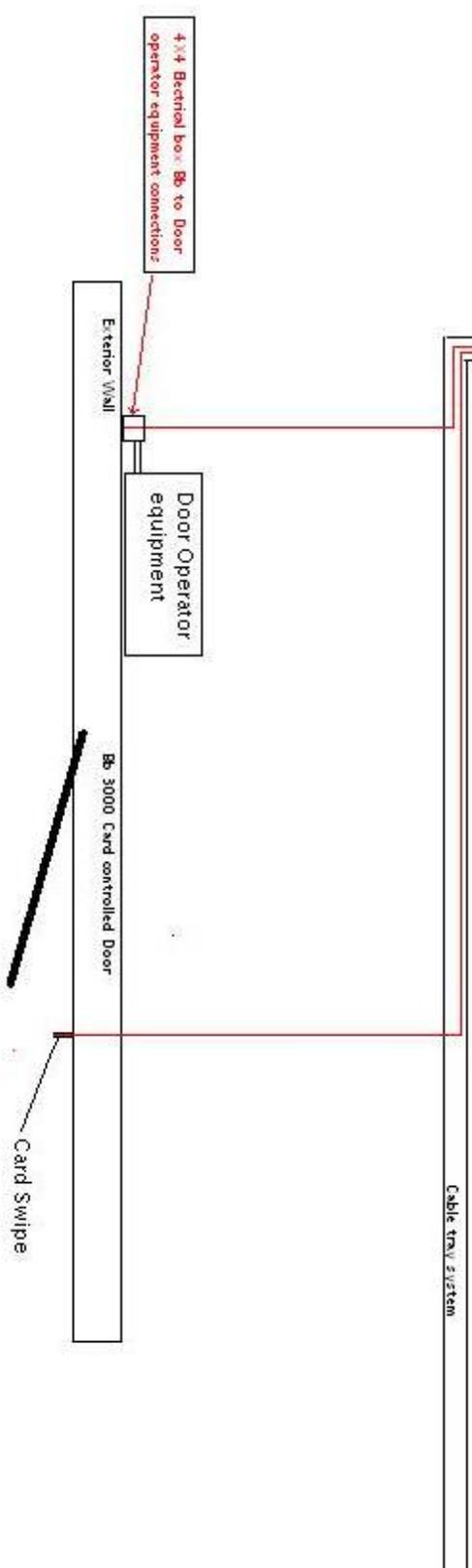
Green = Campus Network, Cat 6 cable 25ft.

Red = Belden 9723, 5502UE or equivalent (400' max.)



Note; all card swipes must be installed ADA compliant access and height
 Conduits must be installed, where necessary for support, back to Cable Tray System.
 SA 30XX Power should be separated as much as possible from low voltage wiring. Keep
 dividers intact. Do not make electrical junction points in this box.

The Belden cable at the door operator equipment may end in a 4x4 metal electrical box.
 The box shall be placed where a flex may be used to connect it to the Door operator
 equipment. This run should be as short and strait as possible



4x4 Belden box. Bb to Door operator equipment connections

Exterior Wall

Door Operator equipment

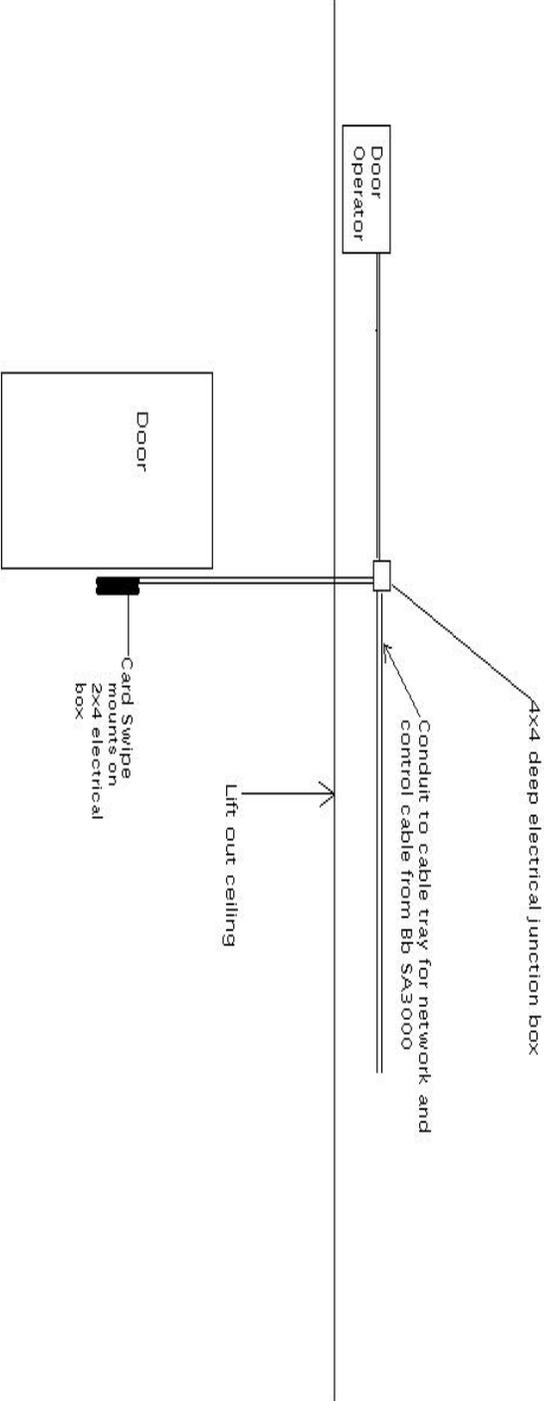
Bb 3000 Card controlled Door

Card Swipe

Cable tray system

SA3000 Door Access

Illustration # 3



SA3000 INSTALLATION

Illustration #4

Mount the Power Supply/Enclosure

- 1 Protect Power Supply from debris while mounting the enclosure.
- 2 Remove knockouts from the Enclosure that will be used for wiring.

AC Power should enter the Enclosure's upper-left corner to help provide 1/4" separation from other wiring.

- 3 Secure the Enclosure to a wall using hardware appropriate for the wall material.

Mounting holes accept up to 1/4" hardware.

Install Conduit and Pull Wire

- 1 Install conduit from Controller for Power, Card Readers, Door Accessories, and network communications.
- 2 Pull wire through conduit.

Connect Power to Power Supply/Enclosure

Disconnect external AC power when installing any wiring.

Connect to 120 VAC @ 60 Hz. Connect only to a 20A maximum branch circuit protection or equivalent.

- 1 Strip back the insulation on the AC wire .28" so no bare wire is exposed when installed in the AC terminal block.
- 2 Install the appropriate wires into the AC terminal block, as shown in Figure 4, and tighten the screws to 5 - 7 in-lbs.
- 3 Re-connect external AC power.

Maintain 1/4" separation from AC wiring to other wiring.

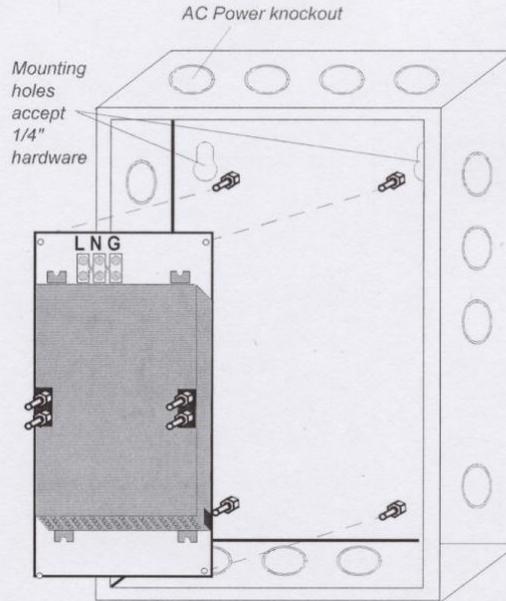


Figure 3: Power Supply Installation

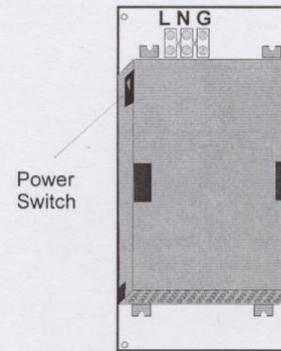


Figure 4: Power Supply Assembly

LC3000 LAUNDRY READER INSTALLATION Illustration #5

The LC3000 Laundry Reader must be mounted on a wall in a location that is convenient to cardholders and wiring requirements.

LC3000 Mounting Location Considerations

- 120 VAC power availability
Connect to 120 VAC @ 60 Hz. Connect only to a 15A maximum branch circuit protection or equivalent. Use a circuit breaker or switch to disconnect power when installing or removing the LC3000.
- Network communications availability (RS-485 or 10/100 Base T)
- Wiring distance limitations
 - RS-485 Communications 4000' total per loop
 - 10/100 Base-T Communications 300' from the network switch port
- Ease of cable routing to laundry machines (if wired configuration)
- Installation height regulations
- Cardholder convenience

Mounting hardware required: .25" appropriate to surface.

Prepare Enclosure

The Reader can be mounted flush to the wall with wiring behind the wall; or it can be surface-mounted with wiring in conduit exterior of the wall. Before mounting the enclosure, remove knockouts necessary for routing wires and/or attaching conduits. Remove only the knockouts required for your installation.

- AC power knockouts accept 1/2" conduit fittings.
- All other knockouts accept 3/4" conduit fittings.
Flush-mount: route machine wires, if wired, through the 3" x 3" cutout.
Surface-mount: Remove conduit knockouts on the top and bottom of the enclosure for routing wire to machines.
- Two power knockouts are provided in the upper right.
Flush-mount: Remove the knockout on the back side.
Surface-mount: Remove the knockout on the top.

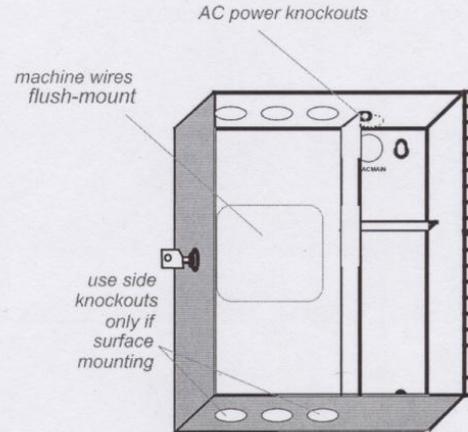


FIGURE 3: Mounting & Knockouts

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Install the LC3000 Enclosure

Illustration #6

- 1 Inside the LC3000, remove the power supply cover to access the upper right mounting hole.
Protect power supply from debris while mounting the enclosure.
- 2 Secure enclosure to a wall using hardware appropriate to wall material.
Mounting holes accept up to 1/4" hardware.

Disconnect external AC power when installing wiring.

- 3 Strip back insulation on AC wire .28" to prevent bare wire exposure when installed in AC terminal block.

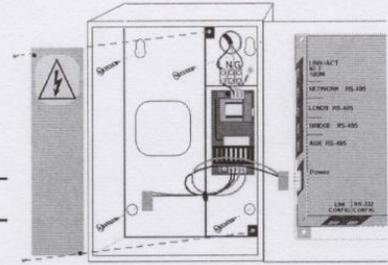


FIGURE 4: Power Installation

- 4 Install wires into the AC terminal block as shown in Figure 5, tighten the screws to 5 - 7 in-lbs., and replace power supply cover.

Ensure 120VAC wiring is confined within power supply compartment when cover is reinstalled to maintain UL compliance.

- 5 Reconnect external AC power.

- 6 Connect to Network.

The LC3000 provides for both 10/100 Base-T, TCP/IP and RS-485 BbTS network connections.

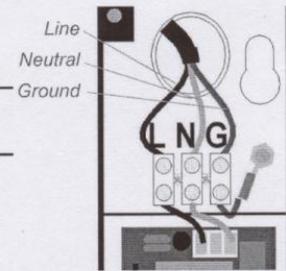
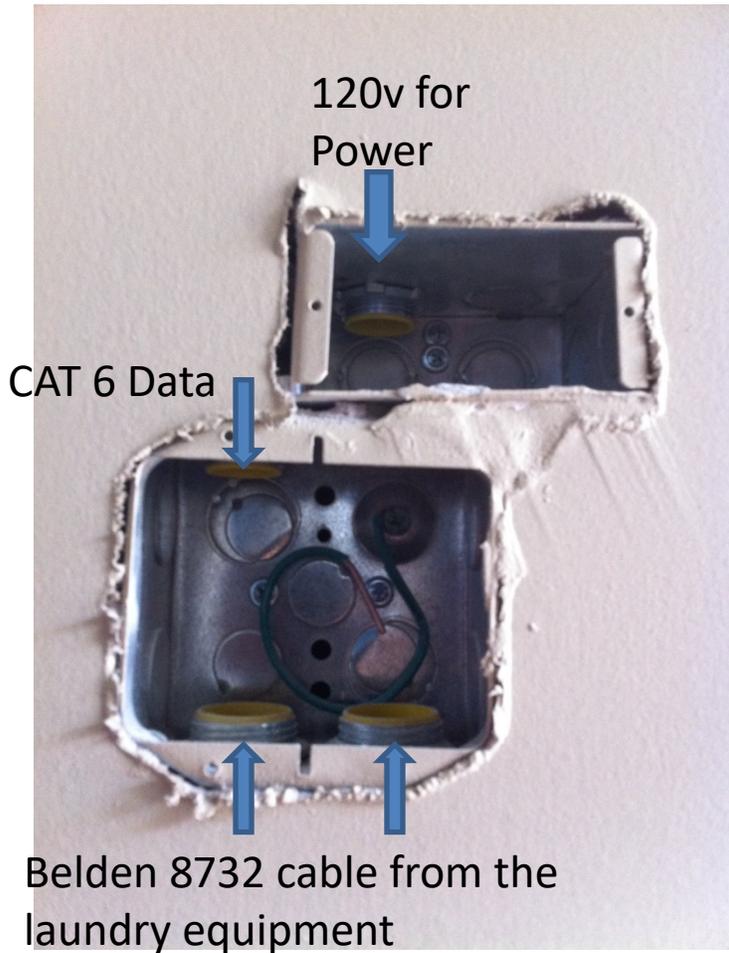


FIGURE 5:Power Connections

Once you connect the LC3000 to the network, configure the LC3000 for the network (LC3000 Laundry Reader Configuration (page 7).)

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Conduit and box layout behind the LC3000 laundry controller
Installed to comply with ADA standards



LC3000 installed over the conduit



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LFNC conduit from wall to laundry machine



Bb Laundry Center LC30XX

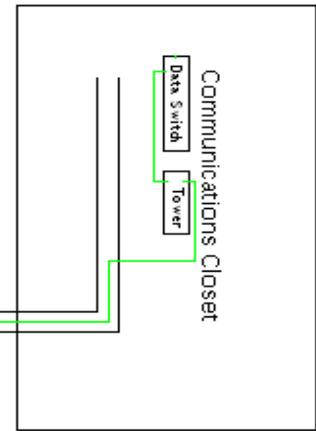
Illustration #7

Block Diagram

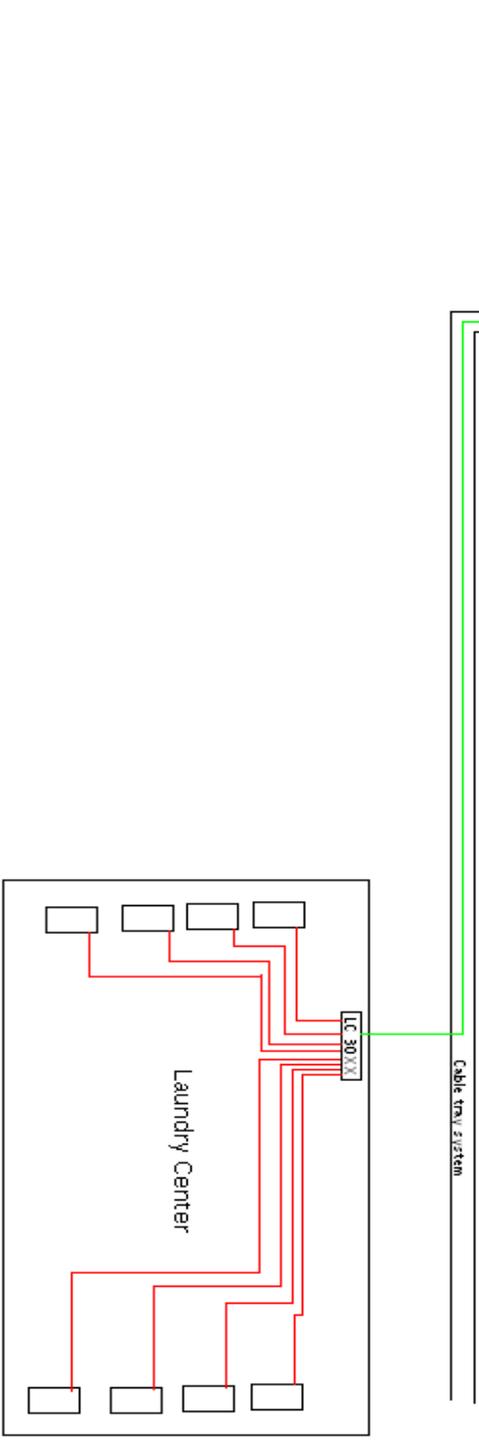


Green = Campus Network Cat 6 cable 25% per Laundry Center

Red = Belden 8723, 5502UE or equivalent (400' max.)



Note; all card swipes must be installed ADA compliant access and hight
Conduits must be installed, where necessary for support, back to Cable Tray System.
LC3000 Power should be separated as much as possible from low voltage wiring. Keep
dividers intact. Do not make electrical junction points in this box.
Belden cable may be stubbed behind washers / dryers to a deep single gang metal box approx
36" above floor. Belden cables shall be clearly marked or tagged .8' coil shall be left at Laundry
machines, 3' coil shall be left in LC3000 enclosure. Large knockout in rear of LC 3000 may be used
for lowvoltage access to enclosure, or appropriate size conduit stub may be used



Exterior Views

Installed to comply with ADA standards



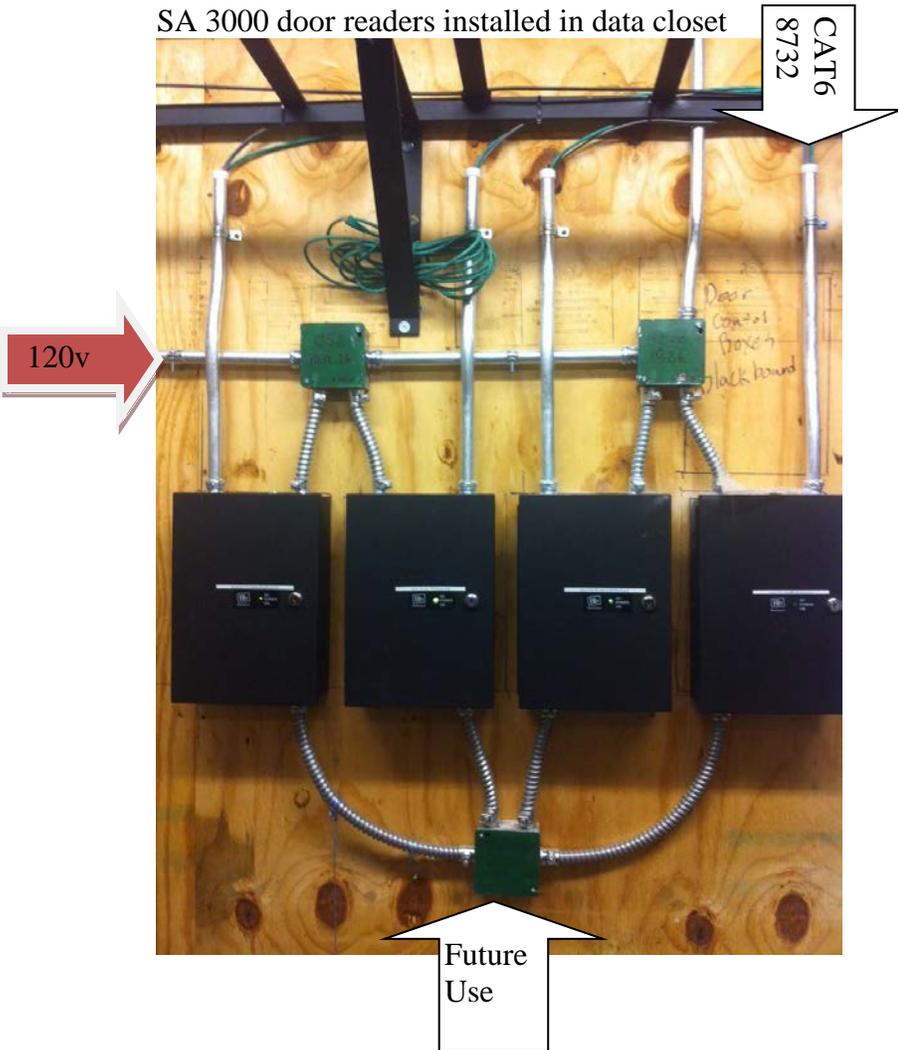
Exterior door swipe Belden 8732 control wire

Completed installation



Interior in data closet

SA 3000 door readers installed in data closet



ANNEX L

UNCC FMCS DDC NIAGARA AX / 4

CONTROL SYSTEM GRAPHICS

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Attachments

- B 1. Acronyms and Abbreviations /
- B 2. Glossary of Terms
- B 3. Standard for Screen Graphic Abbreviations.
- B 4. Definitions of Display Names, Point Names and Facets.
- B.5– Default Building Occupancy Schedule.

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1.0 Introduction and Overview

These standards are intended to describe the minimum requirements for the Niagara^{AX} control system screen graphics and programming as implemented at UNC, Charlotte, North Carolina. When a change to the implementation of these standards is required (i.e., delete a program feature from the graphics) or a feature is not addressed in this standard and needs to be added, the contractor shall request written authorization from UNCC prior to making the change.

These standards shall be implemented for all graphics developed using Niagara^{AX} version 3.7 or later and shall apply to anyone implementing projects that require operator screen graphics and/or programming using Niagara^{AX}.

The Contractor shall develop the operator screen graphics and control system programming so that the look and feel of the graphics is consistent with this standard and the example screen graphic figures included in this standard.

Note all new installations to be Niagara 4.1 or better. Check with Facilities Information Systems for latest revision. All JACEs to be Vykon due to compatibility issues.

2.0 Color Palette for Screen Graphics

2.1 Default Colors

All color selections shall be the Niagara^{AX} default standard unless specifically called out below.

Default Background Color – Silver (Tridium color code: #cbc8c8) except for status, setpoint, alarm, and other data cells.

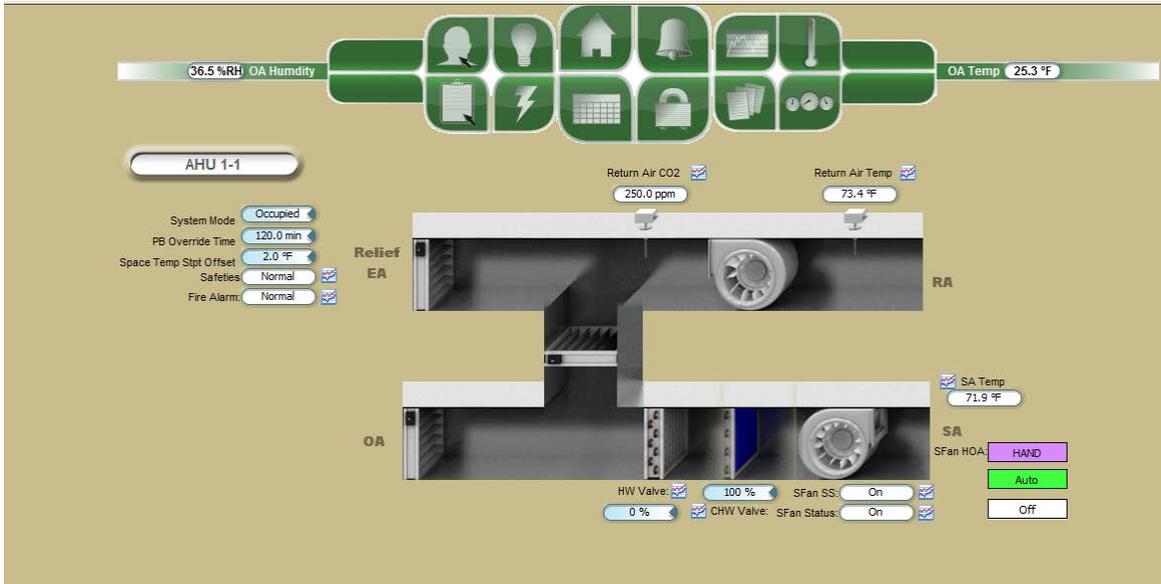
Default Text – Black

Alarms – Red background (Tridium color code: #ffff0000) background with black text (no flashing).

Operator Override (Active) – Burnt orange (Tridium color code: #ff8000) background with black text

Operator Override (Not Active) – White (Tridium color code: #ffffff) background with black text

Figure 1 – Example Air Handler Screen Graphic



2.2 General Information

General information includes descriptions or names of points such as Mixed Air Temp, Cold Water Valve, Return Air CO₂, etc. This information shall be shown as back text on a gold background (Tridium color code: c 9 b d 8 d). Upper and lower case text shall be used with the first letter in each word capitalized. Examples of this are shown in Figure 1.

2.3 Process Status and Data

Process information and data includes temperatures, concentrations, status, and other process parameters that the operator cannot set or override. This process information shall be black text on a white background. The process data cells shall have a black border. All temperatures shall be reported with 1 decimal point. For example the temperature would be displayed as 72.6°F.

All CO₂ sensor values shall be displayed with no decimal point. For example the CO₂ concentration would be displayed as 537 ppm. All percentages shall be displayed with 1 decimal point. For example, a valve would be 100.0%. All supply air pressures that are measured in inches of water column shall be displayed with 2 decimal points. For example, 3.51 iwc.

2.4 Point Status

The Niagara^{AX} colors for point status shall be the standard default for the system as listed below.

Point Status	Background Color (Tridium color code)	Foreground Color (Tridium color code)
Alarm	Red #ffff0000	Black #ff000000
Disabled	Light gray #d6cbae	Coalish gray
Fault	Orange (ffaa26)	Black
Down	Yellow (ffff00)	Black
Stale	Reddish gray (d6cbae)	Black
Overridden	Purple (d88aff)	Clear
Unacknowledged alarm	Clear	Clear

2.5 Alarms

All alarms shall be shown as black text on a Red background. (Note: Red is not used in screen graphics except to designate an alarm condition.) Where the alarm box includes text, the text is black. No other colors are used for alarms. Alarms do not flash. Alarms shall be shown with a black outline. See Return Fan Command in Figure 1.=

2.6 Set points

All set points that the operator can adjust are shown as black text on a white background with a triangle in the right hand side, similar to all other process data. The border of the setpoint cell changes to blue when the mouse pointer scrolls over the cell and is right clickable. Once an override value is entered for the setpoint the background color shall change to a purple Tridium color code; d88aff) with black text. The cell containing the override value shall have a black border. See SFan HOA in Figure 1. And below



Occupancy Schedule

The button used to access the building occupancy schedule is shown as black text on a white background with a triangle in the right hand side indicating the operator can change or adjust this parameter. See AHU 1 Schedule in Figure 1.

2.7 Override Values

All fields that contain an active override value have black text on a burnt orange background. The cell shall have a black border. Examples of this are shown for the Return Fan Override and Cold Water Valve overrides

in Figure 1.

2.8 Headers

The header as shown in Figure 1 is located in the px file/CustomHeader of the Sample station given to the Contactor by UNCC Controls Dept or FIS. The Alarm icon will turn red if an Alarm is present and each alarm console and alarm class will include the building name. The as builts and sequence of operation need to be in a HTML format and linked to the documents icon. The home paged is to be linked to the Home icon. Also See Figure 7 on page 20.

2.9 HOA Switch

The local hand-off-auto (HOA) switch for air handlers, fans, pumps, etc. shall be connected to the DDC to show the position of this switch. The screen graphics colors to use for the HOA switch are listed below:

Hand – Magenta (Tridium color code: #ffff00ff) background with black text, with black border.

Off – White (Tridium color code: #ffffff) background with black text, with black border.

Auto – Green (Tridium color code: #40ff40) background with black text, with black border

Examples of the possible HOA indications is shown in Figure 1 above for the Return Fan HOA Status (OFF) and for the Supply Fan HOA Status (HAND).

2.10 Air Flow Arrows

The flow direction of the air on the air handler screen graphic shall be indicated via green arrows. An example of the arrows indicating the air flow direction is provided in the Figure 1 example air handler screen graphic.

3.0 Fonts and Font Size

The fonts used to create the graphics shall be as listed below:

Main Headings – Aerial 18 point (white)

All other Text – Tahoma 12 point (black)

4.1 Standard Building Graphics Screens

The standard screen graphics for each building shall include the following (where appropriate). See Figure 1a below

Floor Plans; Mini Maps if needed (See Graphic example 2&3) and all floor plans need to hyperlink to each other. All Vavs associated with that floor are put into a sub folder for that floor.

VAV Summary; Summaries should be keep to just one particular area and not made too large so loading time is not a factor. Use additional px's instead of a large summary (See Figure 4 for example)

Chilled Water/Hot Water Equip; This page will show the building's Chilled Water and Hot Water equipment as installed in the building where applicable.

AHU/RTU; this page will show the building's AHU and RTU equipment as installed in the building where applicable.

Metering; all building Meters including but not limited to Electric, Water, Gas and BTU meters, use separate px pages as tabbedpane take a longer time to load.

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This page will show the building's Chilled Water and Hot Water equipment as installed in the building where applicable.

Schedules; All Equipment schedules are to be set up according to UNCC specifications.

Alarms; there will be a minimum of 4 Alarm Classes, Each Alarm Class will have the building name and then the alarm class ie: **Friday Critical Alarms.** The 4 alarm classes will be BldgNameCriticalAlarms, BldgNameNonCriticalAlarms, BldgNameMaintenanceAlarms and BldgNameNetworkAlarms. There will be 5 Alarm consoles one for each class and one where all four alarm classes come together with corresponding names along with the building name

Figure 1a. Example Building Navigation page



Figure 2. Example Floor Plan Screen Graphics

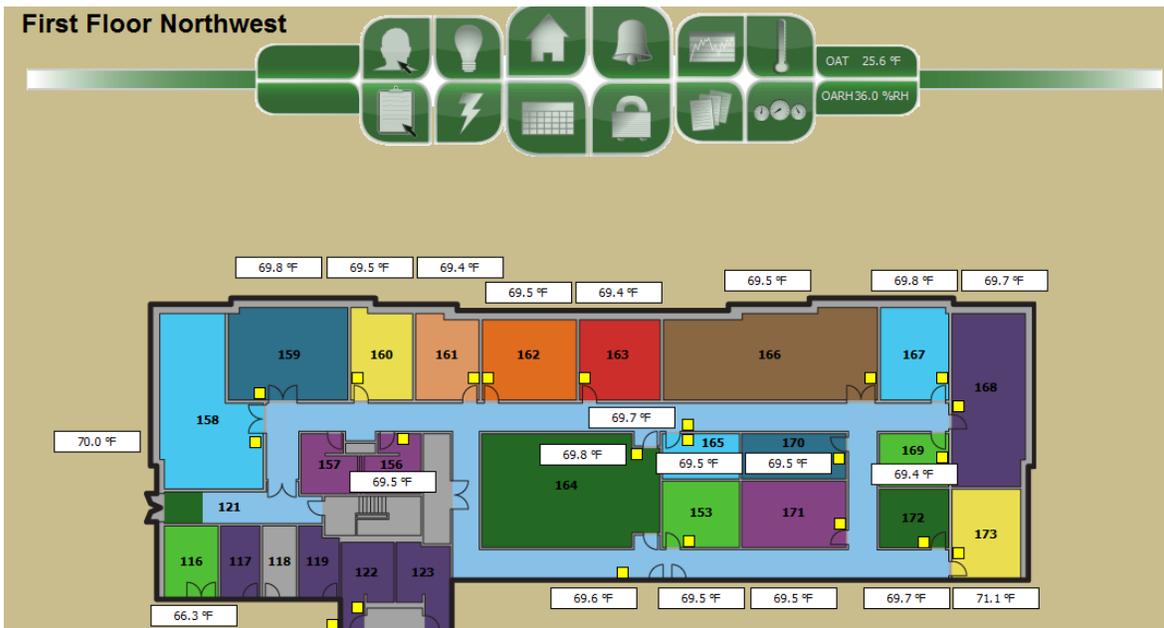
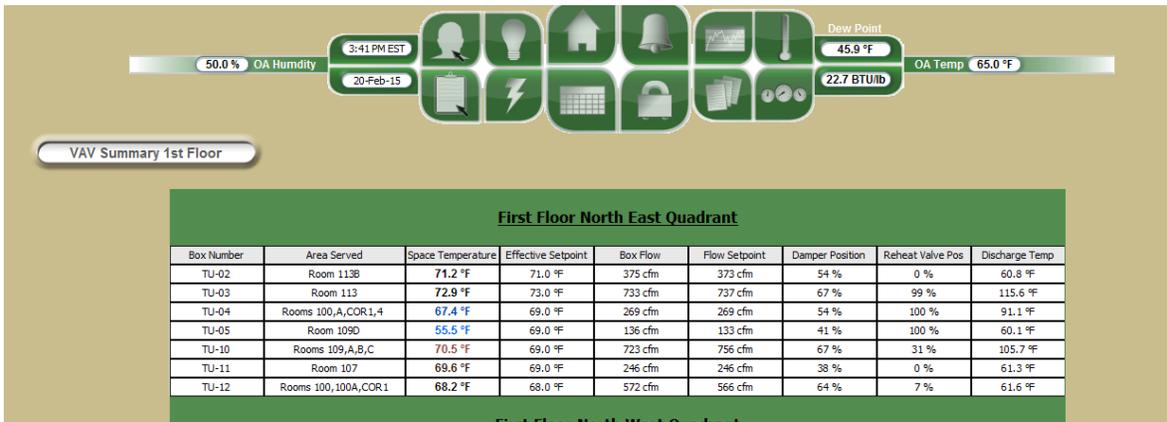


Figure 3. Example Mini Map Floor Plan Screen Graphics



Figure 4. Example VAV Summaries Plan Screen Graphics



5.0 Screen Titles - Header

Each screen graphic shall display the building number and name. It is not required to display “UNCC” on each screen graphic. Additionally the screen title should include for example the air handler and its zone. If no distinct zone is identified for the air handler it is not required to include this information in the title. An example header is shown in Figure 1 for Building 101. Also see Figure 7 on page 20.

6.0 Standard Buttons

Each screen graphic will be programmed to include “standard” buttons (where appropriate) to quickly navigate to other graphic screens associated with that building. These standard buttons shall be located in the secondary header near the top of the screen graphic.

6.1 Niagara Main Menu

This button will display a summary of all buildings that are integrated into the FMCS control system. The “Niagara Main Menu” is a summary screen that shows all of the buildings that are tied into the FMCS DDC (Building name and number) along with an icon with web link that when selected will bring up the summary page screen graphic for that building. **Note: The Niagara Main Menu will be located on the Niagara^{AX} server when available.**

Building Summary

This button will bring up the summary screen for this building. The summary screen shall include key information about the building’s mechanical systems. The building summary will differ from building to building based on the mechanical systems in that building.

6.2 As Built Drawings

This button provides a link to the as-built drawings files for this building. The as-built drawings will be stored as HTML files on the NiagaraAX server. See Figure 7 on page 20.

6.3 Navigation Buttons

Navigation buttons shall be programmed into the secondary header to access other screens associated with the building such as VAVs, Boilers, Chillers, etc. See Figure 7 on page 20.

7.1 Equipment Operational Status

In general the operational status of equipment shall be displayed on the screen graphics using standard Niagara^{AX} animations. Text and text status blocks shall not be used to display the equipment status unless an operational animation is not available for the equipment. On summary screens where there are no depictions of the equipment, the operational status will be displayed as described in the summary screen section of this standard.

Animations should be used for the following equipment items to display status.

1. Fans (supply and return)
2. Pumps
3. Cooling Towers
4. Chillers
5. Dampers (Outside Air, Return Air, Exhaust/Relief, Mixed Air, Bypass/Face, Zone, Zone Hot Deck/Cold Deck)
6. Valves/Coils (Cooling, Heating, Dual Temperature, Preheat, Reheat, Hot Deck/Cold Deck)

The building summary screen will indicate via colors, the status of the air handler systems. A colored circle in

front of the air handler ID indicates the operational status of that air handler.

-  Green – air handler is ON (not in alarm)
-  White – air handler is OFF (not in alarm)
-  Red – air handler is in Alarm (status is different from command)

8.1 Building Summary Screen

A summary screen shall be provided for each Building. Layout and content of the summary screen should be similar to the Building 101 summary screen. The order in which the information and data is to be presented on the summary screen is important and shall be as listed below and not be rearranged without approval. Items at the top of the list should appear before items beneath it. Note that not all information listed below will apply to every air handler. Note also that the actual condition (temperature, pressure, etc.) appears in the summary before the set point for that condition. Multiple summary screens may be necessary for certain buildings due to their size. Clicking on the air handler ID will bring up the screen graphic for that air handler.

Because of space limitations, the contractor shall use judgment to determine which information to show on the summary screen but the order in which the information is listed in the summary table shall be in accordance with the listing below.

- Supply Air Fan Status (colored circles)
- Air handler ID (AHU-1, AHU-2, etc.)
- HOA Status
- Freeze Stat Status
- Smoke Sensor Status
- CO₂ Concentration
- Supply Fan Command
- Supply Air Temperature
- Supply air Temperature Set Point
- Space Air Temperature
- Space Air Temperature Set Point
- Return Air Fan Command
- Return Air Fan Status
- Return Air Temperature
- Return Air Temperature Set Point
- Static Pressure
- Static Pressure Set Point
- Dual Temperature Valve Position
- Chilled Water Valve Position
- Hot Water Valve Position

- Filter Status

9.1 Occupancy Schedules

A separate occupancy schedule shall be programmed for each air handler in a building (unless otherwise directed by the UNC Charlotte Project Coordinator). A button shall be programmed in the upper right corner of the air handler screen graphic that will take the operator to the schedule input screen. The text shall be black on a white background with a black border as shown below. The rollover color for the background shall be cyan (Tridium color code #ff00ffff).

The occupancy schedules shall be programmed in accordance with the default occupancy schedule as listed in Attachment E to this standard unless otherwise directed in writing from the UNC Charlotte Project Coordinator.

10.0 Schedule Status

The occupancy schedule status of the air handler will be shown on the screen graphic for the air handler in the upper right corner of the screen, just below the “Air Handler Occupancy Schedule” button. The text shall be labeled “Occupancy Status”. The schedule options text (“Occupied” or Unoccupied”) shall be displayed either adjacent to or directly beneath the “Occupancy Status” as shown in Figure 1.

11.0 Outside Air Temperature

The outside air temperature shall be displayed in the UNC Charlotte approved header, in upper right hand corner of the screen graphic. The text shall be “OAT”. The temperature value shall be black text on a white background with a black border.

12.0 Screen Graphic Text Descriptions

In general, abbreviations should not be used on the screen graphics. Where because of space limitations a word must be abbreviated the abbreviation must be in accordance with the approved abbreviation list. All text descriptions shall be consistent (avoid using synonyms) and in accordance with the approved list. A copy of the approved screen graphics abbreviations list is provided in Attachment D.

13.0 Air Handler Status and Controls

The air handler screen graphics should be programmed and displayed similar to the examples shown in Figure 1 for the supply air fan and return air fan.

13.1 Fan Command

The fan command text will be either “ON” or “OFF”. If the fan command is different from the fan status, the Fan Command field will be in alarm (black text with red background). If not in alarm the fan command field will be black text with a white background.

13.2 Fan Status

The fan status is displayed graphically with the rotating fan wheel and the fan discharge air movement. When the fan status is off the graphic will indicate no fan movement.

13.3 Fan Override Status

The fan can be overridden to either ON or OFF. Therefore the override status will be either:

- True – indicating that the fan is in override (ON or OFF) or
- False – indicating that the fan is not in override (ON or OFF).

When the fan is in Override the background color will be burnt orange as shown for the return air fan in Figure 1.

Right clicking on the fan mode status field will bring up a pop-up window with the standard Niagara^{AX} override options.

14.0 Pump Status and Controls

All pump screen graphics should be programmed and displayed similar to an air handler (fan) with the following three fields:

- Pump Command
- Pump Override
- Pump HOA Status

14.1 Pump Command

The pump command will be either “ON” or “OFF”. If the pump command is different from the pump status, the Pump Command field will be in alarm (black text with red background). If not in alarm the fan command field will be black text with a white background.

14.2 Pump Status

The pump status is displayed graphically with the rotating pump impeller. When the pump status is off the graphic will indicate no pump movement.

14.3 Pump Override

The pump can be overridden to either ON or OFF. Therefore the override status will be either:

- True – indicating that the pump is in override or
- False – indicating that the pump is not in override.

When the pump is in Override the background color will be burnt orange as shown for the return air fan in Figure 1. Right clicking on the pump mode status field will bring up a pop-up window with the standard Niagara^{AX} override options.

15.1 FMCS Operator Override Capabilities

The screen graphics will be programmed to allow the operator to override certain operating parameters. For those operating parameters where the operator can access and override, the cell background color will change to cyan (Tridium color code #ff00fff) when the mouse pointer scrolls over the cell. Once an override value is

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entered for the setpoint the background color shall change to a burnt orange with black text and a black border. Those parameters that the operators may override are listed below.

1. Occupancy Schedule
2. Dampers (Outside Air, Return Air, Exhaust/Relief, Mixed Air, Bypass/Face, Zone Hot Deck/Cold Deck, Zone)
3. Damper Operating Mode (Economizer, Minimum Outside Air)
4. Supply Air Temperature Set Points
5. Return Air Temperature Set Points
6. Space Air Temperature Set Points
7. Zone Space Temperature Set Points
8. VAV Space Temperature Set Points
9. Global Zone Space Temperature Set Points
10. Global VAV Space Temperature Set Points
11. Hot Deck Temperature Set Points
12. Cold Deck Temperature Set Points
13. Boiler/Chiller Enable Set Points
14. Dual Temp Heating Set Points
15. Hot Water Return Set Points
16. Static Pressure Set Points
17. Economizer Set Points
18. Summer/Winter Change Over
19. Outside Air Flow Set Points
20. DX unit
21. Chiller System Enable Override
22. Boiler System Enable Override
23. Valves (Dual Temp, Cooling, Heating, Preheat, Reheat, Hot Deck/Cold Deck, Loop Bypass, Loop, Chiller/Boiler Flow Valves)
24. Fans (Supply, Exhaust, Return)

25. Supply/Return Fan VFD Commands
26. Domestic Hot Water Boiler Commands
27. Chiller Commands
28. Boiler Commands
29. Fan Overrides/Damper Overrides
30. Steam Boiler Commands
31. VFD/VSD Speed Commands
32. Pumps (Chilled Water, Hot Water, Dual Temperature, Domestic Hot Water, Booster, Runaround Pump)
33. Schedules (Building, Air Handler Unit, School Crossing Lights, Field Lights)
34. School Crossing Lights
35. Field Lights
36. Fan Mode/Air Handler Mode
37. Air Handler Schedule Mode (Building/AHU)
38. VAV (Min, Max, Fan Flow Set Points for Heating/Cooling)

16.0 Alarms

16.1 Summary Screen - Supply Air Fan Status Alarm

The Building Summary Screen will indicate when an air handler is in alarm. This alarm will be indicated when the fan command is different from the fan status and will be shown as a red circle in front of the AHU. See section 7.0.

16.2 Summary Screen – Sensor Alarms

The alarm is indicated for that temperature sensor on the screen graphic (black text on red background). Other colors shall also be used to indicate status conditions of the temperature sensor as provided for in Section 2.4 of this standard. These point status conditions include disabled, fault, down, stale, and null. Similar alarms and status conditions of all sensors (temperature, pressure, humidity, CO₂, etc) shall be provided on the screen graphics.

Alarms shall be provided for control loops in accordance with the following criteria unless otherwise directed by the sequence of operations or IJO Project Coordinator:

Temperature:	Greater than +/- 3.0°F from setpoint.
Air pressure:	Greater than +/- 0.30 iwc from setpoint
Water pressure:	Greater than +/- 5.0 psi from setpoint
Humidity:	Greater than +/- 10% RH from setpoint

16.3 Summary Screen Filter Alarm

The filter status will be shown on the graphics. The text label for the filter status shall be “Filter Status”. The text for the filter status will be either “Clean” or “Dirty”. An example (non-alarm) filter status is shown in Figure 1.

- Clean – Black text, white background with black border.
- Alarm – Black text, red background, black border.

16.4 Freeze Stat Alarm

The freeze stat will be shown on the graphics. The text label for this alarm shall be “Freeze Stat”. The text for the freeze stat status will be either “Normal” or “Alarm”. An example (non- alarm) freeze stat is shown in Figure 1.

- Normal – Black text, white background with black border.
- Alarm – Black text, red background, black border.

16.5 Smoke Sensor Alarm

The smoke sensor will be shown on the graphics similar to a freeze stat. The text label for this alarm shall be “Smoke Sensor”. The text for the smoke sensor status will be either “Normal” or “Alarm”.

- Normal – Black text, white background with black border.
- Alarm – Black text, red background, black border.

16.6 Detail Mechanical Screen Alarms (Air handlers, Chillers, Boilers)

Similar alarms and point status information shall be provided on the detail mechanical screens for the air handlers, pumps, boilers, chillers, VAVs, etc. as was described for the Building Summary Screen graphic in Section 17.2.

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17.1 VAV Data

The following information shall be provided on the screen graphic for each VAV. An example VAV summary screen graphic is shown in Figure 2.

- Space Temperature
- Space Temperature Set point
- Supply Air Temp (from air handler)
- Flow Set point
- Actual Flow
- Flow Minimum
- Flow Maximum
- Damper % Open
- Reheat

18.0 Freeze Protection

All buildings integrated into the FMCS shall be programmed to prevent the building plumbing from freezing. Freeze protection shall be accomplished by the DDC using the unoccupied night setbacks preprogrammed functions in the control system. This function will turn on the air handler and maintain the space temperature to the night setback temperature setpoint which shall be no less than 55°F.

The screen graphics shall be configured to provide indication to the FMCS operator when the air handler is in the freeze protection mode. When in the freeze protection mode the screen graphics shall display the unoccupied night setback temperature set point.

19.0 Point Naming and Numbering Convention

All points that are tied into the Niagara^{AX} control system shall be in accordance with the UNC Charlotte Niagara^{AX} Point Naming Convention. A listing of the point names, abbreviations and facets for the points is provided in **Attachment B**.

20.0 Drawings and Documentation

The building summary screen graphic shall have a button in the header titled “As Built” that is programmed to load a HTML file of the building control schematics. The HTML files will eventually be stored on the Niagara^{AX} server but until this server is installed and operational, the as-built drawings will be stored on the Niagara R2 server.

21.1 Floor Plans

Floor plans shall be developed for each building that allows the FMCS operator to view pictorially the building floor plan. The floor plan shall be appropriate to the type building and building function. Links between the

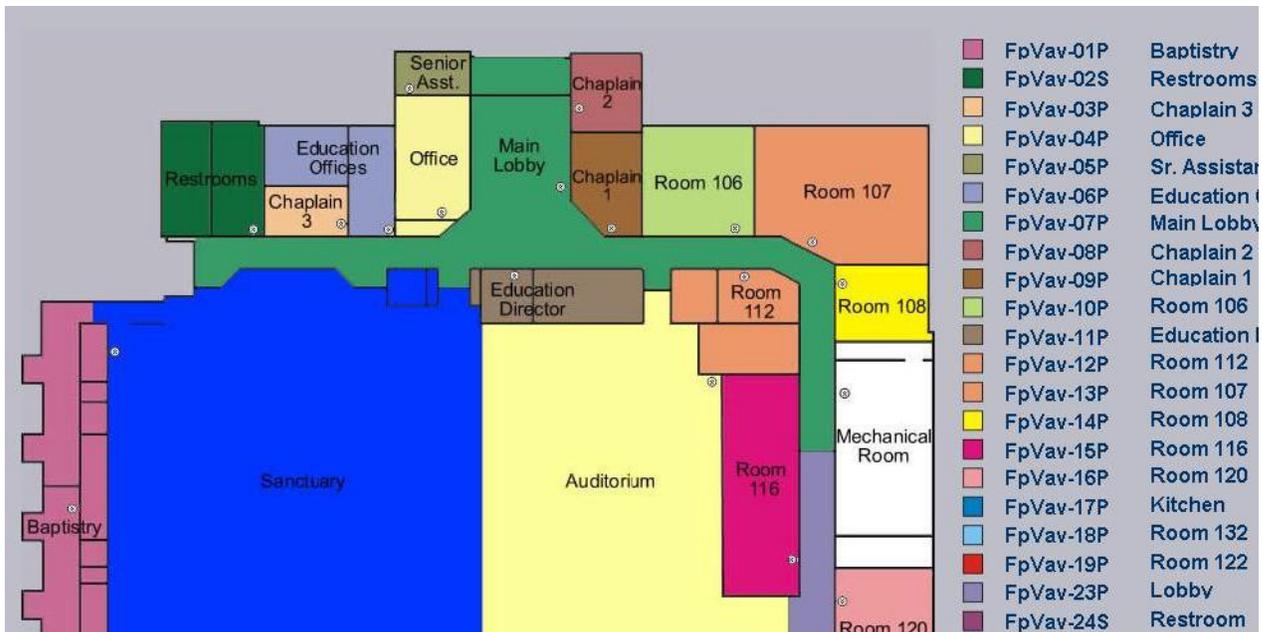
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room and it's associated air handler or VAV shall be configured into the floor plan graphic. The floor plan shall clearly depict the following information:

- Room numbers or names
- Thermostat locations
- Air handler locations
- Mechanical rooms
- IT Rooms
- Meters
- Lighting

Where the building is zone controlled, the floor plan shall indicate by colors, each zone. This includes using colors to different the zones controlled by each air handler and/or by each VAV. The intent of this requirement is to allow the operator to identify on the floor plan the location of the temperature problem and then to be able to click on the floor plan affected area which would then be linked from the floor plan graphic web page to the related VAV or AHU screen graphic web pages. An example floor plan showing the building 1680 layout along with names, room numbers, and colors representing different VAV zones is shown below. The floor plan graphic shall also show the location of all space temperature sensors (thermostats) along with the temperature being measured by the sensor.

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Note that the floor plan screen shall have the same headers and buttons as all other screens.

22.1 Photocell Operated Lights

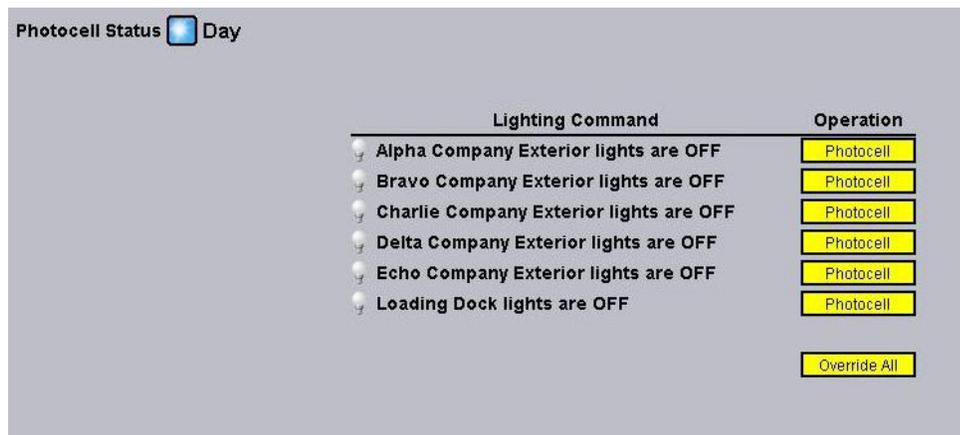
Buildings that are equipped with light circuits that can be controlled from the DDC and that have local light control photocells shall have the following information displayed on the screen graphics:

- When the lights are directed to be on from the DDC the screen graphic shall show “ON”.
- When the lights are directed to be off from the DDC the screen graphic shall show “OFF”

When the lights are controlled from the local photo cell the screen graphic shall show “PHOTOCELL”. Each light circuit shall be identified on the screen graphic. The yellow shown in the lighting control column indicates that the operator has override capability for these fields. A burnt orange color indicates the light circuits that are in override. The status of the photocell (night or day) shall also be shown on the light control screen graphic. The following is an example of how the screen graphic for light controls should be designed:

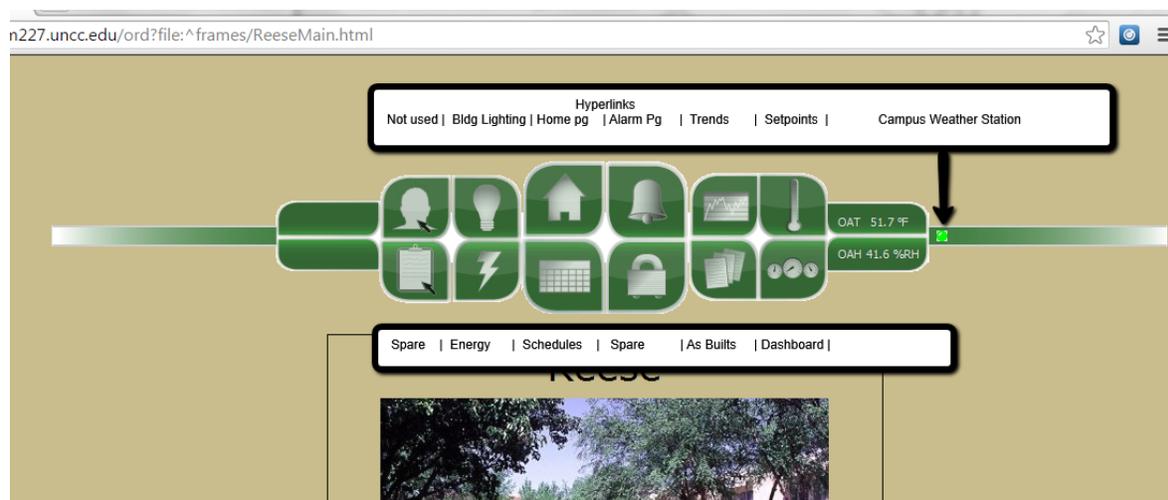
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Figure 5. Example Building Photocell Lights Screen



Note that the lighting control screen shall have the same headers and buttons as all other screens.

Figure 6. Example Building Header



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Attachment B
Programming Standards
And
Acronyms and Abbreviations

1. Acronyms and Abbreviations

A/E	Architect/Engineer
AHU	(AHU1, AHU-2, etc.) – Air handler unit
ALX	Activelogix
ANSI	American National Standards Institute
ASC	Application Specific Controller
BAS	Building Automation System
BPOC	Building Point Of Connection
CO	Carbon monoxide
CO2	Carbon dioxide
DDC	Direct Digital Control
DHCP	Dynamic Host Configuration Protocol
DITSCAP	Dod Information Technology Security Certification And Accreditation Process
ECIP	Energy Conservation Investment Program
EIA	Electronic Industries Alliance
ESPC	Energy Savings Performance Contract
FAQ	Frequently Asked Questions (Faqs)
FMC	Energy Management Control System
FMCS	Facility Management And Control System
FMD	Facilities Maintenance Division
FPC	Freely Programmable Lon Controllers
GPPC	General Purpose Programmable Controller (Gppc)
GUI	Graphical User Interface
HOA	Hand-off-auto
HTML	Hypertext Markup Language
HVAC	Heating, Ventilating, And Air Conditioning
I/O	Input/Output
IANA	Internet Assigned Numbers Authority
ID/IQ	Indefinite Delivery Indefinite Quantity
IDC	Indefinite Delivery Contract
IDC	Interoperable Digital Lon Controller
IDG	Installation Design Guide
IM	Instant Messaging
IP	Internet Protocol
IT	Information Technology
IWC	(iwc) – Inches of water column
JCI	Johnson Controls, Inc.
LAN	Local Area Network

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LDAP	Lightweight Directory Access Protocol
LDP	Local Display Panel
LNS	Lonworks® Network Services
MAT	Mixed air temperature
MOU	Memorandum Of Understanding
MS	Microsoft®
NAC	Network Area Controller
NC	North Carolina
NCT	Network Configuration Tool
NOx	Nitrogen oxides
NTP	Notice To Proceed
O&M	Operations And Maintenance
OI	Operator Interface
OOT	Object Oriented Technology
OSI	Open Systems Interconnection
OWS	Operator Workstation
PC	Personal Computer
PDA	Personal Digital Assistant
PDF	Portable Document Format
PICS	Product Interoperability Compliance Statement
PMI	Power Measurement Interface
POC	Point Of Contact
POT	Portable Operator's Terminal
PPM	(ppm) – Parts per million
PVT	Performance Verification Test
QC	Quality Control
QV	Quality Verification
RAT	Return air temperature
RFP	Request For Proposal
SAT	Supply air temperature
Si	Système Internationale (The “Metric System”)
SNMP	Simple Network Management Protocol
SNVT	Standard Network Variable Type
SOW	Statement Of Work
SPA	Space air temperature
TCP	Transmission Control Protocol
TCS	Temperature Control System
TP/FT	Twisted-Pair/Free Topology
TR	Technical Report
UDP	User Datagram Protocol
UMC	Utility Management Control System
UMCS	Utility Monitoring And Control System
URL	Universal Resource Locator
VAV	Variable air volume
VLAN	Virtual Local Area Network

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VPN	Virtual Private Network
VSD	Variable speed drive
VVT	Variable volume and temperature
WAN	Wide Area Network
WBI	Web Browser Interface
WWW	World Wide Web
XIF	External Interface File
XML	Extensible Markup Language

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2. Glossary of Terms

10Base-T 100Base-T 100Base-FX 1000Base-T 1000Base-SX 1000Base-LX 10GBase-T	Ethernet media and communication speeds. The number is communication speed in Megabits per second (Mbps) or Gigabits per second (Gbps). "T" is twisted pair wire usually Cat-6 or better), while "FX", "SX", and "LX" are fiber optic cable. Note that 10 Gigabit Ethernet is (as of 2006) an IEEE standard and 100 Gigabit Ethernet is in development.
AGC	Application Generic Controller. A controller that comes from the factory with a limited built-in application. It is programmed for the application (VAV box, fan coil, etc.). It can be programmed through an LNS plug-in. It can be thought of as a cross between an ASC and GPPC. These controllers should be certified by Lon Mark. An AGC has a fixed program ID.
ASC	Application Specific Controller. A controller that has a built-in, fixed program to execute a sequence for a specific hardware system, e.g. a VAV box controller. An ASC has a fixed program ID.
BPOC	The Building Point of Connection (BPOC) is the point of connection between the FMCS network backbone (an IP network) and the building control network backbone. The hardware at this location that provides the connection is referred to as the BPOC Hardware. In general, the term "BPOC Location" means the place where this connection occurs, and "BPOC Hardware" means the device that provides the connection. Sometimes the term "BPOC" is used to mean either and its actual meaning (i.e. location or hardware) is determined by the context in which it is used.
Closed	The opposite of Open. A standard/protocol/specification where important details of its implementation are not available to all interested parties. Closed standards are closely controlled by the developing party and implementation of devices based on them is generally limited to a small number of vendors.
Device	A piece of hardware. See also 'Node'
DDC	Direct Digital Control, defined as control consisting of microprocessor based controls with the control logic performed by software.
DDE	Dynamic Data Exchange, an inter-process communication (IPC) system built into the Macintosh®, Microsoft® Windows®, and OS/2® operating systems. DDE enables two running applications to share the same data.
DHCP	Dynamic Host Configuration Protocol is a protocol for automatically assigning IP configuration information to clients from a central server.

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FTP	File Transfer Protocol is a common protocol used on the Internet for sending files.
Gateway	A device (usually a combination of software and hardware) that connects networks using different communication protocols so that information can be passed from devices on one network to the other. Gateways perform protocol conversion to translate this information from one protocol to another.
GPPC	General Purpose Programmable Controller. A controller that can be programmed to run any (within hardware limits) sequence and can be set up as a controller for different hardware systems. Changes to the program result in a different Program ID.
GUI	Graphical User Interface. A program interface that takes advantage of the computer's graphics capabilities to make the program easier to use. A true GUI includes formats for representing text and graphics.
HMI	Human-Machine Interface. The means by which an operator interacts with an automation system, often a GUI.
HTTP	HyperText Transfer Protocol, is the underlying protocol used by the World Wide Web. HTTP defines how messages are formatted and transmitted, and what actions Web servers and browsers should take in response to various commands.
Interoperability	The ability to integrate products from multiple vendors into flexible, functional systems without the need to develop custom hardware, software, or tools.
Interoperable	This is closely related to Open standards and refers to the level of difficulty of integrating components (or systems) from multiple vendors into a single system. Interoperability needs to be considered from the perspective of hardware installation (will the parts physically fit and interconnect?), communications (do the devices “speak the same language”?), configuration and programming (is the same software tool used for different vendor components?), maintainability (do the components have similar maintenance procedures and requirements?), and operation (do the components have similar functionality/ sequences and utilize the same operator interface?). Open standards enhances/encourages interoperability because it allows multiple vendors to utilize a common standard. A caveat: In many (if not all cases), when vendors use the term interoperable, they do not mean <i>interchangeable</i> (in the sense of swapping out a VAV box for an identical VAV box).
IP	Internet Protocol. IP is a protocol on the Internet and is concerned with addressing and routing of data packets from their origin to the destination. Many other protocols are used in the Internet (TCP, HTTP, etc), but IP is the key protocol the others run on top of.
LAN	Local Area Network, is a network for transferring data between computers or other digital devices.

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LNS®	LonWorks Network Service , is the database architecture that resides on the computer attached to the LonWorks Network that is used to install and manage the Network. LNS is a database that can be accessed by any LNS-based Network Configuration Tool and by multiple users simultaneously.
LON	Local Operating Network . Also used as a shorthand reference to the term LonWorks.
LonTalk®	A networking protocol developed by Echelon Corporation and recognized by ANSI/CEA as ANSI/CEA-709.1-B. LonTalk implements layers 1-6 of the OSI reference model.
LonWorks®	A networking platform (created by Echelon Corporation) that provides solutions to numerous problems of designing, building, installing, and maintaining control networks.
LonWorks Router	A piece of equipment that allows ANSI/CEA-709.1-B communication and routing of network variables over an ANSI/CEA-709.1-B network. See “Router”.
LonWorks LON to IP Router	A piece of equipment that allows ANSI/CEA-709.1 communication and routing of network variables over IP. Also known as an ANSI/CEA-852 router. See “Router”.
Network	A group of devices (computers, controllers, or other digital units) that are connected by communication facilities, such as twisted-pair cabling, COAXIAL cable, fiber-optic cable, or wireless means
Network Configuration Tool	Software used to perform network management functions such as adding, removing or relocating devices and establishing communication between devices.
Neuron® C	A derivative of the C programming language specifically designed for developing applications for the Neuron chip.
Neuron® chip	A chip that implements the ANSI/CEA-709.1 protocol. This chip is used by most LonWorks devices for communication on the network. Many LonWorks devices also use this chip for control functionality.
Node	A device (such as a computer or a controller) on a network that is capable of communicating with other network devices via a networking protocol such as ANSI/CEA-709.1.
Open system	An Open system is characterized by the ability for any qualified third party entity to readily modify, operate, upgrade, and perform retrofits on the system.
OWS	Operator Work Station , a type of computer-based GUI. An OWS is designed for use by an operator whereas a technician or maintenance worker might have a different computer and GUI with a different “look and feel”.
Peer-to-Peer	A type of network where each node has equivalent capabilities and responsibilities for network communication.
Plug-in	Software used to configure an ASC that is run/executed from within a Network Configuration Tool.

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Proprietary	Privately owned and controlled. Proprietary is the opposite of public domain.
Proprietary – Government procurement	In Government procurement regulations, a proprietary product is one that requires sole source procurement.
Router	A device that connects two or more LANs. Routers are devices that provide network-independent packet filtering and forwarding. They may also include bridge functionality.
SNMP	Simple Network Management Protocol
SNVT	Standard Network Variable Type ; Pronounced 'snivet'. A standard format type (maintained by LonMark International) used to define data information transmitted and received by the individual LonWorks nodes. The term SNVT is used in two ways. Technically it is the acronym for Standard Network Variable Type, and is sometimes used in this manner. However, it is often used to indicate the network variable itself (i.e. it can mean "a network variable of a standard network variable type"). In general, the intended meaning should be clear from the context.
SOAP	Simple Object Access Protocol : A lightweight protocol for exchange of information in a decentralized, distributed environment. It is an XML based protocol that consists of three parts: an envelope that defines a framework for describing what is in a message and how to process it, a set of encoding rules for expressing instances of application-defined data types, and a convention for representing remote procedure calls and responses.
SQL	Structured query language , defined as a standardized query language for requesting information from a database. There is an ANSI standard for SQL
Standard, De-facto	De-Facto standards are 'standards of fact', that is, standards that have been adopted by an industry or a market. An example of a de-facto standard is Microsoft Word. While it has not been adopted by a recognized standards organization, its market dominance makes it the de-facto standard for word processing. Gray areas arise here over market share and industry recognition.
Standard, De-jurie	De-Jurie standards (literally, 'standards of law') are those that have been adopted and approved by some recognized standards organization, such as ASHRAE, IEEE, ASTM, ISO, etc. ANSI/CEA-709.1 is an example of a de-jurie standard. Gray areas can arise here over what constitutes a standards body.

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Standard, Proprietary	Proprietary standards are those that are owned and controlled by an organization not generally recognized as a 'legitimate' standards body (they are often owned by a for-profit organization). They frequently are considered to be, or to contain, intellectual property of value to the owning body. Proprietary standards may be Open, closed, or somewhere in between, though they tend to be more closed. The Microsoft Word document format (.doc files) is an example of a closed proprietary standard
Transceiver	A component or circuit that enables a hardware device to communicate on a network.
VLAN	Virtual Local Area Network. A common means of keeping different networks separate while existing on the same basewide LAN. Most modern Ethernet switches support VLANs where the different ports on the switch are divided into separate logical groupings. Ports in the same group can communicate with each other, while ports in separate groups can't. The ports in a common group form a VLAN within the larger physical network. A single physical network may support many distinct VLANs.

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3. Screen Graphic Abbreviations

The following abbreviation convention should be used for all screen graphics where appropriate.

- a. Supply Air Temperature – SAT
- b. Supply Air Temperature Set Point – SAT SP
- c. Supply Air Flow - SAF
- d. Space Air Temperature – SPAT
- e. Space Air Temperature Set Point – SPAT SP
- f. Set Point – SP
- g. Occupancy Status – OS
- h. Air Handler Unit – AHU
- i. Outside Air – OA
- j. Outside Air Temperature – OAT
- k. Direct Expansion – DX
- l. Domestic Hot Water – DHW
- m. Boiler – BLR
- n. Hot Water – HW
- o. Hot Water Valve – HWV
- p. Chilled Water – CHW
- q. Chilled Water Valve – CHWV
- r. Fan Command – FAN CMD
- s. Fan Status – FAN STAT
- t. Fan Override – FAN OVRD
- u. Set Point Override – SP OVRD
- v. Freeze Protection – FREZ PROT
- w. Hot Water Supply Temperature – HWST
- x. Hot Water Return Temperature – HWRT
- y. Chilled Water Supply Temperature – CHWST
- z. Chilled Water Return Temperature – CHWRT
- aa. Command – CMD
- bb. Status – STS
- cc. Fan Start/Stop Control Switch – FAN S/S
- dd. Temperature – Temp

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4. Definition of Display Names, Point Name and Facets

Display Name	Point Name	Facets
Actual Cooling Setpnt	ACSP	units=°F precision=1
Actual Htg Setpnt	AHSP	units=°F precision=1
Air Handling Unit	AHU	units=null precision=0
Air Quality	AirQ	units=ppm,precision=2,min=0.0,max=5000.0
Air Quality Flag	AirQStatus	truetext=On falsetext=Off
Airflow	AirFlw	units=cfm precision=1
Airflow Setpoint	AirSet	units=cfm precision=1
Alarm	Alm	truetext=true falsetext=false
Auxillary Space Temp	AuxSpaceT	units=°F precision=1
Auxillary Temp	AuxTemp	units=°F precision=1
Auxillary Temp	AuxT	units=°F precision=1
Average Temperature	AvgT	units=°F precision=1
Average Zone Temperature	AvgZnT	units=°F precision=1
Bearing Oil Return Temp (# if needed)	BrngOilRT(#)	units=°F precision=1
Bearing Oil Supply Temp	BrngOilST	units=°F precision=1
Bldg	Bldg	units=null precision=0
Bldg Diff Press	BDP	units=psi precision=1
Bldg Flow (#)	BldgFlow (# if needed)	units=gpm precision=1
Bldg Static Press	BStcPr	units=in/wc precision=2
Bldg Static Press Setpoint	BldStatPrSp	units=in/wc precision=2
Boiler	Blr	units=null precision=0
Boiler Alarm	BlrAlm	truetext=ALARM falsetext=Normal
Boiler Command	BlrCmd	truetext=On falsetext=Off

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Display Name	Point Name	Facets
Boiler Flame Fail	BlrFlameFail	truetext=ALARM falsertext=Normal
Boiler Flow Switch	BlrFlowStat	truetext=Flow falsertext=NoFlow
Boiler Modulating Valve	BlrVlv	units=% precision=0
Boiler Plant Enable	BlrPlantEna	truetext=Enabled falsertext=Disable
Boiler Pump Status	BlrPStatus	truetext=Running falsertext=Stopped
Boiler Status	BlrStatus	truetext=On falsertext=Off
Boiler Supply Temp	BlrST	units=°F precision=1
Boiler Valve	BlrVlv	truetext=Open falsertext=Closed
Boiler Water Temp	BlrWT	units=°F precision=1
Boilers Enabled Status	BlrPlantStat	truetext=Enabled falsertext=Disable
Booster Pump Speed	BostrPO	units=% precision=0
Booster Pump Status	BostrPStatus	truetext=Running falsertext=Stopped
Box Supply Temp	DAT	units=°F precision=1
Building Differential Pressure	BDP	units=in/wc precision=2
Building Differential Pressure Low Limit	BDPLL	units=^in/wc precision=2
Building Pump # (number) Status	BP#Status	truetext=Running falsertext=Stopped
Building Pump Flow Switch	BFlwStat	truetext=Flow falsertext=NoFlow
Building Water Return Temp	BldgRT	units=°F precision=1
Building Water Supply Temp	BldgST	units=°F precision=1
Bypass Valve Command	BypVlv	truetext=Open falsertext=Closed; units=% precision=0
Calculated Cooling Setpoint	ClgStPnt	units=°F precision=1
Charge GPM	ChrgFlow	

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Display Name	Point Name	Facets
Chemical Treatment # Alarm	ChemTrt#Alm	
Chilled Water	CHW	units=% precision=0
Chilled Water Bypass Valve	CHWBypVlv	units=% precision=0
Chilled Water Bypass Valve Output	CHWBypVlvO	units=% precision=0
Chilled Water Differential Pressure	CHWDP	units=psi precision=0
Chilled Water Differential Pressure Average	CHWDPAvg	units=psi precision=0
Chilled Water Differential Pressure Setpoint	CHWDPSetP	units=psi precision=0
Chilled Water Pump # VFD	CHWP#VFDO	units=% precision=0
Chilled Water Pump Cmd	CHWPCmd	truetext=On falsetext=Off
Chilled Water Pump Status	CHWPStat	truetext=Running falsetext=Stopped
Chilled Water Return Flow	CHWRFI	units=gal/min precision=1
Chilled Water Return Temp	CHWRT	units=°F precision=1
Chilled Water Setpnt	CHWSP	units=°F precision=1
Chilled Water Setpnt (Leaving)	LvCHWSetP	units=°F precision=1
Chilled Water Supply Flow	CHWSFI	units=gal/min precision=1
Chilled Water Supply Temp	CHWST	units=°F precision=1
Chilled Water Valve	CHWVlv	units=% precision=0
Chiller	CH	truetext=Enabled falsetext=Disabled
Chiller # Chilled Water Differential Pressure	CH#CHWDP	units=psi precision=0
Chiller # Chilled Water Differential Pressure Switch	CH#CHWDPSw	truetext=Closed falsetext=Open
Chiller Alarm	CHAlm	truetext=ALARM falsetext=Normal
Chiller Amps	CHAmps	units=ampere (A) precision=2

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Display Name	Point Name	Facets
Chiller Cmd	CHCmd	truetext=Enabled falsertext=Disabled
Chiller Cond Press	CHCndPr	units=psi precision=1
Chiller Enable	CHEna	truetext=Enabled falsertext=Disabled
Chiller KW	CHKW	units=kW precision=1
Chiller Plant Enable	CHPlantEna	truetext=Enabled falsertext=Disabled
Chiller Setpoint Reset	CHWStPntRst	units=null precision=0
Chiller Status	CHStatus	truetext=Running falsertext=Stopped
Chiller Volts	CHVolts	units=volt (V) precision=2
CO Level	COLvl	units=ppm precision=1
CO2 Alarm	CO2Alm	units=ppm precision=1
CO2 Level	CO2Lvl	units=ppm precision=1
Cold Deck	ColdDeck	
Cold Deck Humidity	ColdDeckHum	units=%RH precision=0
Cold Deck Temp	ColdDeckT	units=°F precision=1
Coldest Zone Temp	ColdestZnT	units=°F precision=1
Common Setpoint (Base)	CmnStPnt	units=null precision=0
Communication Lost Alarm	CommLostAlm	truetext = Comm Lost falsertext=Comm Normal
Communication Lost Alarm	CommAlm	truetext=Comm Lost falsertext=Comm Normal
Communication Status	CommStatus	truetext=Normal falsertext=No Comm
Compressor	Comp#Status(#=Stage number)	truetext=On falsertext=Off
Compressor # Safety	Comp#Safety (#=Stage number)	truetext=ALARM falsertext=Normal
Compressor Command	Comp#Cmd(#=Stage number)	truetext=Run falsertext=Off

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Display Name	Point Name	Facets
Compressor Lockout	CompLckOut	truetext=LockedOut falsertext=Normal
Compressor Protection Circuit	CompProtCrt	truetext=Normal falsertext=Alarm
Condensate Switch Status	CondensateStat	truetext=true falsertext=false
Condenser Water	CW	
Condenser Water Pressure	CWPress	units=psi precision=1
Condenser Water Pump # Alarm	CWP#Alm	truetext=ALARM falsertext=Normal
Condenser Water Pump # Cmd	CWP#Cmd	truetext=On falsertext=Off
Condenser Water Pump # Runtime	CWP#RunT	units=nullprecision=1
Condenser Water Pump # Status	CWP#Stat	truetext=On falsertext=Off
Condenser Water Pump # VFD	CWP#VFDO	units=% precision=0
Condenser Water Pump Cmd	CWPCmd	truetext=On falsertext=Off
Condenser Water Pump Status	CWPStat	truetext=On falsertext=Off
Condenser Water Pump VFD	CWPVFDO	units=% precision=0
Condenser Water Return Flow	CWRetFl	units=gal/min precision=1
Condenser Water Return Temp	CWRT	units=°F precision=1
Condenser Water Setpnt	CWStPnt	units=°F precision=1
Condenser Water Supply Flow	CWSFl	units=gal/min precision=1
Condenser Water Supply Temp	CWST	units=°F precision=1
Condenser Water Valve	CWVlv	units=% precision=0
Control Setpoint	CtrlSp	units=°F precision=1
Control Temp	CtrlTemp	units=°F precision=1
Controller Alarm	CtrlAlm	truetext=Alarm falsertext=Normal
Controller Status	CtrlStat	truetext=Online falsertext=Offline
Cool Switch	ClgSw	truetext=Auto falsertext=Off

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Display Name	Point Name	Facets
Cooling	Clg	truetext=Clg falsetext=Off OR units=% precision=1
Cooling # Command	Clg#Cmd (#=Stage number)	truetext=On falsetext=Off
Cooling Capacity (%)	ClgCap	units=% precision=1
Cooling Cmd	ClgCmd	truetext=On falsetext=Off
Cooling Face & Bypass	CCByp	units=% precision=0
Cool Flag	ClgStatus	truetext=On falsetext=Off
Cooling Lockout Setpoint	ClgLckSp	units=°F precision=1
Cooling Master Reference	ClgMstrRef	
Cooling Mode	ClgMode	truetext=On falsetext=Off
Cooling Request	ClgReq	truetext=ClgReq falsetext=NoClgReq
Cooling Setpoint - Unoccupied	UnoccClgSp	units=°F precision=1
Cooling Setpoint Offset	ClgSetPOff	
Cooling Stages	ClgStgs	units=null precision=0
Cooling Tower	ClgTwr	truetext=On falsetext=Off
Cooling Tower # Fan Cmd	ClgTwr#FCmd	truetext=On falsetext=Off
Cooling Tower # Fan Status	ClgTwr#FStat	truetext=On falsetext=Off
Cooling Tower # Isolation Valve Command	ClgTwr#IsoVlvCmd	truetext=Open falsetext=Closed
Cooling Tower # VFD	ClgTwr#VFDO	units=% precision=0
Cooling Tower Bypass Valve Output	ClgTwrBypVlvO	units=% precision=0
Cooling Tower Damper	ClgTwrDpr	units=% precision=0
Cooling Tower Hi Speed	ClgTwrHiSpd	truetext=HiSpeedOn falsetext=HiSpeedOff
Cooling Tower Lo Speed	ClgTwrLoSpd	truetext=LoSpeedOn falsetext=LoSpeedOff

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Display Name	Point Name	Facets
Cooling Tower Pump Cmd	ClgTwrPCmd	truetext=On falsetext=Off
Cooling Tower Pump Status	ClgTwrPStat	truetext=On falsetext=Off
Cooling Tower Return Temp	ClgTwrRetT	units=°F precision=1
Cooling Tower Sump High Limit	ClgTwrSmpHL	truetext=HL-ALARM falsetext=Normal
Cooling Tower Sump Low Limit	ClgTwrSmpLL	truetext=LL-ALARM falsetext=Normal
Cooling Tower Sump Temp	ClgTwrSmpT	units=°F precision=1
Cooling Tower Supply Temp	ClgTwrSupT	units=°F precision=1
Cooling Tower Vibration Alarm	CT#VibeAlm	truetext=VIB-ALARM falsetext=Normal
Cooling Valve	ClgVlv	units=% precision=0
Cooling Valve Command	ClgVlvOut	units=% precision=0
Current Limit	CurrLim	units=non precision=1
Damper	Dpr	
Damper Cmd	DprCmd	truetext=On falsetext=Off
Damper Command	DprCmd	truetext=On falsetext=Off
Damper Enable	DprEna	truetext=On falsetext=Off
Damper Manual Pos	DprManPos	units=% precision=0
Damper Mode (Manual Auto)	DprMode	1=Manual 2=Auto
Damper Pos (VAV)	DprPos	units=% precision=0
Damper Status	DprStat	truetext=On falsetext=Off
Day Night Mode	DayNtMode	truetext=NIGHT falsetext=DAY
Deadband	Db	units=null precision=0
Differential Pressure	DiffPr	units=psi precision=1
Differential Pressure Setpoint	DiffPrSp	units=psi precision=1
Disch Air	DA	

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Display Name	Point Name	Facets
Disch Air Dew Pnt	DADewPnt	units=°F precision=1
Disch Air Flow	DAFlow	units=cfm precision=1
Disch Air Humidity	DAHum	units=%RH precision=0
Disch Air Static Press	DASStaticPr	units=in/wc precision=2
Disch Air Vel Press	DAVelPr	units=in/wc precision=2
Discharge Air Cooling Setpoint	DaClgSp	units=°F precision=1
Discharge Air Duct Pressure Setpoint	DADPSP	units=in/wc precision=2
Discharge Air Heating Setpoint	DaHtgSp	units=°F precision=1
Discharge Air Setpoint	DATSp	units=°F precision=1
Discharge Air Smoke Detector Status	DASmkDetStat	truetext=Alarm falsetext=Normal
Discharge Air Temp	DAT	units=°F precision=1
Discharge Air Temp Low Limit	DATLL	units=°F precision=1
Dom Water Press	DomWtrPr	units=psi precision=1
Dom Water Pump Status	DomWtrPStat	truetext=On falsetext=Off
Drain Valve	DrainVlv	truetext=Open falsetext=Closed
Duct Smoke Det	DuctSmokeDet	truetext=ALARM falsetext=Normal
Duct Static Press	DSPr	units=in/wc precision=2
Economizer	Econ	truetext=Open falsetext=Closed
Economizer Status	EconStat	truetext=Enabled falsetext=Disabled
Economizer Switchover Setpoint	EconSwSp	units=°F precision=1
Effective Setpoint	EffSetP	units=null precision=0
Element Communication Status	ElemtCommStatus	truetext=No falsetext=Yes
Emergency Lighting	EMLTG	truetext=On falsetext=Off
Emergency Shutdown	EMShutdown	truetext=ALARM falsetext=Normal

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Display Name	Point Name	Facets
Emergency Stop	EMStop	truetext=Alarm falsertext=Normal
Enable	Ena	truetext=true falsertext=false
Energy Recovery Unit Command	ERecovCmd	truetext=Enables falsertext=Disabled
Energy Recovery Unit Command	HRecovVlv	truetext=Open falsertext=Closed
Enthalpy	Enth	units=btu/pound (BTU/lb)
Enthalpy Switch	EnthSw	truetext=true falsertext=false
Exh Air Damper	ExAirDpr	units=% precision=0
Exh Air Flow	ExAirFlow	units=cfm precision=1
Exh Fan	ExF	truetext=On falsertext=Off
Exh Fan Cmd	ExFCmd	truetext=true falsertext=false
Exh Fan Status	ExFStatus	truetext=true falsertext=false
Exhaust Fan Control **	ExFCmd	truetext=On falsertext=Off
Exhaust Fan Status **	ExFStatus	truetext=On falsertext=Off
Exhaust Fan VFD Speed Output	ExFVFDO	units=% precision=0
Face & Bypass Damper	FaceBydDpr	units=% precision=0
Failure	Fail	truetext=ALARM falsertext=Normal
Fan	Fan	truetext=On falsertext=Off
Fan # Cmd	Fan#Cmd	truetext=On falsertext=Off
Fan # VFD Alarm	Fan#VFDAIm	truetext=ALARM falsertext=Normal
Fan Cmd	FanCmd	truetext=On falsertext=Off

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Display Name	Point Name	Facets
Fan Coil Unit	FCU	truetext=On falsertext=Off
Fan Control Offset	FanCntOffst	units=none precision=1
Fan Mode	FanMode	truetext=On falsertext=Off
Fan Occupied Mode Select	FanOccModeSlT	truetext=On falsertext=Off
Fan Speed	FanSpd	units=% precision=1
Fan Speed High	FanSpdHi	truetext=On falsertext=Off
Fan Speed Low	FanSpdLo	truetext=On falsertext=Off
Fan Status	FanStatus	truetext=On falsertext=Off
Fan Switch	FanSw	truetext=Auto falsertext=On
Fan Unoccupied Mode Select	FanUnoccModeSlT	truetext=On falsertext=Off
Fan VFD	FanVFDO	units=% precision=0
Filter Runtime	FilterRunT	units=hrs
Filter Status	FilterStat	truetext=true falsertext=false
Final Filter Status	FinFilterStat	truetext=true falsertext=false
Fire Alarm	FireAlm	truetext=true falsertext=false
Flow Override	FlowOvrd	Enum range(AUTO=1,OPEN=2,CLOSED=3,MIN-4,Max=5)
Fluid Cooler Tower Fan 1 Command	ClgTwrF1Cmd	truetext=On falsertext=Off
Fluid Cooler Tower Fan 1 VFD Output	ClgTwrVFD1O	units=% precision=0
Fluid Cooler Tower Fan 2 Command	ClgTwrF2Cmd	truetext=On falsertext=Off
Fluid Cooler Tower Fan 2 VFD Output	ClgTwrVFD2O	units=% precision=0
Fluid Cooler V-2 Isolation Valve	ClgTwr1Vlv	units=% precision=0
Fluid Cooler V-2 Isolation Valve	ClgTwr1Vlv	units=% precision=0
Fluid Cooling Tower Fan 1 Status	ClgTwrF1Stat	truetext=On falsertext=Off

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Display Name	Point Name	Facets
Fluid Cooling Tower Fan 2 Status	ClgTwrF2Stat	truetext=On falsertext=Off
Freeze Protection Circuit	FrzProtCrt	truetext=Alarm falsertext=Normal
Freeze Stat	FrzStat	truetext=Alarm falsertext=Normal
Frequency	Frq	
General Element Alarm	GenlAlm	truetext=Alarm falsertext=Normal
GPM	Flow	
Group Fan Occ Mode Sel	GrpModeOccMode	trueText=Auto,falseText=On
Group Mode Select	GrpModeSel	units=null,precision=2,min=0.0,max=4.0
Group Name	GrpName	
Group Number	GrpNumber	
Group Occupied Schedule	GrpOccSched	
Hand	Hnd	range=<0=Off, 1=InHand/Manual, 2=Auto>
Heat Ex	HX	truetext=On falsertext=Off
Heat Ex Bypass Valve	HXByPVlv	truetext=Open falsertext=Closed
Heat Ex Valve	HXVlv	units=% precision=0
Heat Flag	HtgStatus	truetext=On falsertext=Off
Heat Switch	HtgSw	truetext=Auto falsertext=Off
Heating	Htg	truetext=true falsertext=false or units=% precision=1
Heating Capacity (%)	HtgCap	units=% precision=1
Heating Command	Htg#Cmd (#=Stage number)	truetext=On falsertext=Off
Heating Enable	HtgEna	truetext=On falsertext=Off
Heating Lockout Setpoint	HtgLckSp	units=°F precision=1
Heating Master Reference	HtgMstrRef	

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Display Name	Point Name	Facets
Heating Mode	HtgMode	truetext=HtgReq falsertext=NoHtgReq
Heating Request	HtgReq	truetext=HtgReq falsertext=NoHtgReq
Heating Setpoint	HtgStPnt	units=°F precision=1
Heating Setpoint Offset	HtgSetPOff	
Heating Stages	HtgStgs	units=null precision=0
Heating Stages In Total	HtgStgsTot	units=null precision=0
High DA Temperature Alarm	HiDaTempAlm	Normal,Alarm
High Zone	HiZone	
Hot Deck Humidity	HDeckHum	units=%RH precision=0
Hot Deck Temp	HDeckT	units=°F precision=1
Hot Water Diff Press	HWDiffPr	units=psi precision=1
Hot Water Flow	HWFlow	units=gal/min precision=1
Hot Water Pump Status	HWPStat	truetext=On falsertext=Off
Hot Water Pump VFD Output	HWPVFDO	units=% precision=0
Hot Water Return Flow	HWRFl	units=% precision=0
Hot Water Return Temp	HWRT	units=°F precision=1
Hot Water Supply Flow	HWSFl	units=gal/min precision=1
Hot Water Supply Temp	HWST	units=°F precision=1
Htg Valve	HtgVlv	units
Htg/Clg Valve	HtgClgVlv	units=% precision=0
Humidifier Cmd	HumCmd	truetext=On falsertext=Off
Humidity Setpnt	HumStPnt	units=%RH precision=0
HVAC Mode	HvacMode	Enumerated point
Isolation Valve	IsoVlv	units=% precision=0

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Display Name	Point Name	Facets
Make Up Air Unit	MAU	truetext=On falsertext=Off
Make Up Air Unit 1 Command	MAU1Cmd	truetext=On falsertext=Off
Make Up Air Unit 1 Status	MAU1Stat	truetext=On falsertext=Off
Make Up Air Unit 2 Command	MAU2Cmd	truetext=On falsertext=Off
Make Up Air Unit 2 Status	MAU2Stat	truetext=On falsertext=Off
Max Clg Setpnt	MaxClgSp	units=°F precision=1
Max Flow Setpoint	MaxFlowSp	units=none precision=1
Max Htg Setpnt	MaxHtgSp	units=°F precision=1
Max Zone Temp	MaxZnT	units=null,precision=2,min=-inf,Max=+inf
Mechanical Cooling Setpoint	ClgStPnt	units=°F precision=1
Min Clg Setpnt	MinClgSp	units=°F precision=1
Min Flow Setpoint	MinFlowSp	units=none precision=1
Min Heating Flow Setpoint	MinHtgFlow	units=none precision=1
Min Htg Setpnt	MinHtgSp	units=°F precision=1
Min Zone Temp	MinZnT	units+null,precision=1,min=-inf,Max=+inf
Mixed Air Damper	MaDprOut	units=% precision=0
Mixed Air Damper Positional	MaDprPos	units=% precision=0
Mixed Air Damper Setpoint	MADMinPos	units=% precision=0
Mixed Air Dew Pnt	MaDewPnt	units=°F precision=1
Mixed Air Enthalpy	MaEnth	units=btu/pound (BTU/lb)
Mixed Air Humidity	MaHum	units=% RH precision=0

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Display Name	Point Name	Facets
Mixed Air Smoke Detector	MASmodeDetStatus	units=°F precision=1
Mixed Air Temp	MAT	units=°F precision=1
Mixed Air Temp Low Limit Setpoint	MATLL	units=°F precision=1
Mixed Air Temp Setpoint	MATSp	units=°F precision=1
Modular Small Cabinet Fan	MSCF	truetext=On falsertext=Off
Morning Warmup Differential	MrngWrmupDiff	units=°F precision=1
Morning Warmup Set Point	MrngWrmupSetP	units=°F precision=1
Morning Warmup Temperature	MrngWrmupT	units=°F precision=1
Motor Winding Temperature (#)	MotWinT#	units=°F precision=1
Net Sensor Temperature	NetSensorT	units=°F precision=1
Night Setback Setpnt	NightSetback	units=°F precision=1
Night Setup Setpnt	NightSetupSp	units=°F precision=1
Occup Mode/Status	OccStatus	occupied, unoccupied, standby *varies with manufacturer
Occupancy Command	OccCmd	occupied, unoccupied, standby *varies with manufacturer
Occupied Clg Setpnt	OccClgSp	units=°F precision=1
Occupied High Humidity	OccHiHum	units=% precision=0
Occupied Htg Setpnt	OccHtgSp	units=°F precision=1
OK to Economize	EconEna	truetext=Enabled falsertext=Disabled
On/Off	OnOff	truetext=true falsertext=false
Operational Mode (i.e. Cool/Heat)	OpMode	occupied, unoccupied, standby *varies with manufacturer
Outdoor Air Damper Position	OADmpPos	units=% precision=0

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Display Name	Point Name	Facets
Outdoor Air Temperature	OAT	units=°F precision=1
Outside Air Damper (2 Position)	OADmpCmd	truetext=Open falsetext=Closed
Outside Air Damper Minimum Position	OADMinPos	units=% precision=0
Outside Air Dew Pnt	OADewPnt	units=°F precision=1
Outside Air Enthalpy	OAEnth	units=btu/pound (BTU/lb)
Outside Air Fan Start Stop	OAFanCmd	truetext=true falsetext=false
Outside Air Flow	OAFlow	units=cfm precision=1
Outside Air Flow Setpoint	OAFlowSp	units=cfm precision=1
Outside Air Humidity	OAHum	units=% RH precision=0
Outside Air Lockout Setpnt	OATLckOut	units=°F precision=1
Outside Air Minimum Flow Setpoint	OAMinFlowSp	units=cfm precision=1
Override Command	OvrCmd	occupied, unoccupied, standby *varies with manufacturer
Override Duration (User Defined Time)	OvrDuration	units=min precision=1
Override Status	OvrStat	truetext=On falsetext=Off
Override Time Remaining	OvrTmRemain	units=min precision=1
Phase # Run Load Amps	Phase#RLA	units=amps precision=2
Photo Cell	PTC	truetext=true falsetext=false
Power Fail Status	PwrFailStat	truetext=PF falsetext=Normal
Pre Filter Status	PreFilterStat	truetext=Dirty falsetext=Clean
Pressure	Press	units=psi precision=1
Pri/Primary	Pri	units=null precision=0
Primary Air Flow	PriAirFlw	units=cfm precision=1
Primary Air Temperature	PriAT	units=°F precision=1

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Display Name	Point Name	Facets
Primary Pump Start Stop	PPmp#Cmd	truetext=On falsetext=Off
Pump # (number) Control	P#Cmd	truetext=On falsetext=Off
Pump # (number) Status	P#Status	truetext=On falsetext=Off
Pump # (number) VFD Output	P#VFDO	units=% precision=0
Refrig Exhaust Fan	RefExFan	truetext=On falsetext=Off
Refrig Monitor Alarm	RefMonAlm	truetext=ALARM falsetext=Normal
Refrig Shutdown	RefShutdown	
Reheat Temp	RhtT	units=°F precision=1
Relative Humidity	RH	units=% RH precision=0
Relative Humidity Flag	RHStatus	truetext=ON falsetext=Off
Reliability of Inputs/Network	Reliable	truetext=Ok falsetext=Error
Relief Fan Command	RLFCmd	truetext=On falsetext=Off
Relief Fan Status	RLFStat	truetext=On falsetext=Off
Remote Adjust	RemAdj	truetext=On falsetext=Off
Remote Command	RemCmd	truetext=ON falsetext=Off
Return Air Damper	RADpr	units=% precision=0
Return Air Dew Pnt	RADewPnt	units=°F precision=1
Return Air Enthalpy	RAEnth	units=btu/pound (BTU/lb)
Return Air Flow	RAFlow	units=cfm precision=1
Return Air Humidity	RAHum	units=% RH precision=0
Return Air Temp	RAT	units=°F precision=1
Return Air Vel Press	RAVelPr	units=psi precision=1
Return Fan	RetF	truetext=On falsetext=Off
Return Fan Cmd	RetFCmd	truetext=On falsetext=Off

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Display Name	Point Name	Facets
Return Fan Damper	RetFDpr	units=% precision=0
Return Fan Inlet Vanes	RetFInletVn	units=% precision=0
Return Fan Inlet Vanes Pos	RetFInletVnPos	units=% precision=0
Return Fan Smoke Det	RASmokeDet	truetext=ALARM falsetext=Normal
Return Fan Status	RFSstatus	truetext=On falsetext=Off
Return Fan VFD	RFVFDOut	units=% precision=0
Return Valve	RetVCmd	truetext=On falsetext=Off
Reversing Valve	RevVlv	units=% precision=0
Reversing Valve Command	RevVlv	units=% precision=0
Reversing Valve Command	RevVlv	units=% precision=0
Roof Top Unit	RTU	truetext=On falsetext=Off
Room	Rm	units=null precision=0
Room Dew Pnt	RmDewPnt	units=°F precision=1
Room Dew Pnt	ZnDewPnt	units=°F precision=1
Room Humidity	RmH	units=%RH precision=0
Room Humidity	ZnHum	units=%RH precision=0
Room Static Press	RmStPr	units=in/wc precision=2
Room Static Press	ZnStaticPr	units=in/wc precision=2
Room Temp	RmT	units=°F precision=1
Room Temp Alarm	RmTAlm	truetext=ALARM falsetext=Normal
Room Temperature	RmT	units=°F precision=1
Room TemperatureSetpoint	RmTSp	units=°F precision=1
Secondary Chilled Water Diff Press	SCHWDiffPr	units=psi precision=1
Secondary Chilled Water Flow	SCHWFlow	units=gal/min precision=1

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Display Name	Point Name	Facets
Secondary Chilled Water Pump Status	SCHWPStat	truetext=On falsetext=Off
Secondary Chilled Water Return Temp	SCHWRT	units=°F precision=1
Secondary Chilled Water Supply Temp	SCHWST	units=°F precision=1
Secondary Condensor Pump Speed	SCWP#Sp (#=pump #)	units=Hz precision=1
Secondary Condensor Pump Speed Out	SCWP#SO (#=pump #)	units=Hz precision=1
Secondary Condensor Water Return Temp	SCWRT	units=°F precision=1
Secondary Condensor Water Supply Temp	SCWST	units=°F precision=1
Secondary Pump Diff Press High Setpoint	SPDPHSetP	units=psi precision=1
Secondary Pump Diff Press Low Setpoint	SPDPLSetP	units=psi precision=1
Secondary Pump Ramp Timer	SPRmpTmr	units=null precision=0
Secondary Pump Start Stop	SPmp#Cmd	truetext=On falsetext=Off
Setpoint	SetP	units=null precision=0
Setpoint Adjust	SetPAdj	units=null precision=0
Setpoint High Limit	SpHiLim	units=°F precision=1
Setpoint Low Limit	SpLoLim	units=°F precision=1
Setpoint Offset Enable	SpOffsetEna	truetext=On falsetext=Off
Shut Down Status	ShutDWNStat	truetext=On falsetext=Off
SL Filter 1 Flow Switch Status	SndFilter1Stat	truetext=Error falsetext=Ok
SL Filter 2 Flow Switch Status	SndFilter2Stat	truetext=Error falsetext=Ok
SL Fliter 2 Command	SndFilter2Cmd	truetext=On falsetext=Off
SL Fliter Command	SndFilter1Cmd	truetext=On falsetext=Off
Smoke Damper Status	SmokeDprStat	truetext=Open falsetext=Closed

**University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex K, UNCC FMCS DDC Niagaraax Control System Graphics**

Attachment B

Display Name	Point Name	Facets
Smoke Det	SmokeDet	truetext=ALARM falsetext=Normal
Smoke Detector Status	SmokeDetStat	truetext=Error falsetext=Ok
Space Temp	SpaceT	units=°F precision=1
Standby Clg Setpnt	SbyClgSp	units=°F precision=1
Standby Htg Setpnt	SbyHtgSp	units=°F precision=1
Static Press	StaticPr	units=in/wc precision=2
Static Press Setpoint	StaticPrSp	units=in/wc precision=2
Status	Stat	truetext=Error falsetext=Ok
Sump Pump Alarm	SmpPAlm	truetext=ALARM falsetext=Normal
Supply Air Dew Pnt	SADewPnt	units=°F precision=1
Supply Air Flow	SAFlow	units=cfm precision=1
Supply Air Humidity	SAHum	units=%RH precision=0
Supply Air Reset	SAReset	units=°F precision=1
Supply Air Static Press	SASStaticPr	units=in/wc precision=2
Supply Air Temp	SAT	units=°F precision=1
Supply Air Temp Alarm	SATAIm	truetext=ALARM falsetext=Normal

**University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex K, UNCC FMCS DDC Niagaraax Control System Graphics**

Attachment B

Display Name	Point Name	Facets
Supply Air Vel Press	SAVelPr	units=in/wc precision=2
Supply Fan Alarm	SFAlm	truetext=Alarm>falsetext=Normal
Supply Fan Alarm	SFAlm	Normal,Alarm
Supply Fan Cmd	SFCmd	truetext=On>falsetext=Off
Supply Fan Cmd (2 Position)	SFDprCmd	truetext=On>falsetext=Off
Supply Fan Command	SFCmd	truetext=On>falsetext=Off
Supply Fan Damper (Linear)	SFDprOut	truetext=On>falsetext=Off
Supply Fan Inlet Vanes	SFInletVn	units=% precision=0
Supply Fan Modulation	SFVFDO	units=% precision=0
Supply Fan Smoke Det	SaSmokeDet	truetext=Alarm>falsetext=Normal
Supply Fan Status	SFStatus	truetext=On>falsetext=Off
Supply Fan VFD Output	SFVFDO	units=% precision=0
System Enable	SysEna	truetext=Enabled>falsetext=Disabled
Tank Temp At Ft #	TnkTmpFt#	units=°F precision=1
Temperature	Temp	units=°F precision=1
Terminal Load	TermLoad	units=% precision=0
Timed Override	TimedOvrride	truetext=Yes>falsetext=No
Thermo On/Off State_1(Mitsubishi)	ThermoSt(Bit#)	truetext=On>falsetext=Off
Tower	Twr	truetext=On>falsetext=Off
TRACER Control(Trane)	TRACER	truetext=Tracer>falsetext=Local
Transfer	Transfer	truetext=On>falsetext=Off
Unit Alarm	UnitAlm	truetext=Alarm>falsetext=Normal
Unit Heater #	UH	truetext=On>falsetext=Off
Unit Ventilator	UV	truetext=On>falsetext=Off

**University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex K, UNCC FMCS DDC Niagaraax Control System Graphics**

Attachment B

Display Name	Point Name	Facets
Unocc Clg Setpnt	UnoccClgSp	units=°F precision=1
Unoccupied Dehumidification	UnoccDeHum	truetext=Yes falsertext=No
Unoccupied High Humidity	UnoccHiHum	units=% precision=0
Unoccupied Status	UnoccStatus	truetext=On falsertext=Off
Unoccupied Status	UnoccStatus	truetext=On falsertext=Off
Valve Position	VlvPos	units=% precision=0
Valve Status	VlvStat	
Variable Frequency Drive	VFD	units=% precision=0
Variable Frequency Drive Alarm	VFDAlm	units=% precision=0
Variable Frequency Drive Frequency	VFDFrq	units=% precision=0
Variable Frequency Drive Output	VFDO	units=% precision=0
Ventilation Mode	VentMode	
VVT Box	VVT	
Warm/Cool Adjust	WCAdj	units=null precision=0
Warmest Zone Temp	WarmestZnT	units=°F precision=1
Water Differential Pressure	WDP	units=psi precision=1
Water Flow	WtrFl	units=gal/min precision=1
Zone	Zn	units=null precision=0
Zone Damper	ZnDprCmd	units=% precision=0
Zone Damper Pos (Linear)	ZnDprPosOut	truetext=On falsertext=Off
Zone Damper Status	ZnDprStat	truetext=On falsertext=Off
Zone Demand	ZnDmd	DeltaF
Zone Humidity Setpnt	ZnHumStpnt	units=%RH precision=0
Zone Reheat Valve	ZnRhtVlv	units=% precision=0

University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex K, UNCC FMCS DDC Niagaraax Control System Graphics

Attachment B

Display Name	Point Name	Facets
Zone Setpnt	ZnTStpt	units=°F precision=1
Zone State	ZnState	
Zone Temp	ZnT	units=°F precision=1
Zone Temp Alarm	ZnTAlm	truetext=ALARM falsetext=Normal
Zone Temp Low Alarm	ZnTL0Alm	truetext=ALARM falsetext=Normal
AC Start Sequence	StrtSeq	truetext=On falsetext=Off

**University of North Carolina at Charlotte Design and Construction Manual
Section 3, Annex K, UNCC FMCS DDC Niagaraax Control System Graphics**

Attachment B

5. Default Building Occupancy Schedule

Default Building Occupancy Schedule: The following occupancy schedules shall be programmed into the FMCS DDC unless otherwise directed by the UNCC.

Building Use	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Administrative	0730-1800	0730-1800	0730-1800	0730-1800	0730-1800	By Appointment	By Appointment
Type X	0600-2000	0600-2000	0600-2000	0600-2000	0600-2000	0600-2000	0600-2000
Type Y	0530-2130	0530-2130	0530-2130	0530-2130	0530-2130	0530-2130	0530-2130
Type Z	By Appointment	By Appointment	By Appointment	By Appointment	By Appointment	By Appointment	By Appointment
Dorms	Heating	Heating	Heating	Heating	Heating	Heating	Heating
	0600-1700 65°F	0600-1700 65°F	0600-1700 65°F	0600-1700 65°F	0600-1700 65°F	0600-1700 65°F	0600-1700 65°F
	1700-0600 72°F	1700-0600 72°F	1700-0600 72°F	1700-0600 72°F	1700-0600 72°F	1700-0600 72°F	1700-0600 72°F
	Cooling	Cooling	Cooling	Cooling	Cooling	Cooling	Cooling
	0600-1700 80°F	0600-1700 80°F	0600-1700 80°F	0600-1700 80°F	0600-1700 80°F	0600-1700 80°F	0600-1700 80°F
	1700-0600 74°F	1700-0600 74°F	1700-0600 74°F	1700-0600 74°F	1700-0600 74°F	1700-0600 74°F	1700-0600 74°F

ANNEX G

DRAWING AND BIM STANDARDS

DRAWING TECHNOLOGY REQUIREMENTS:

- 1.1 Drawing Technology Specifics: Do not send AutoCAD files in pdf format.
 - A. All drawings shall be in 2013 AutoCAD format (.dwg).
 - B. All BIM models shall be in Revit 2017 format (.rvt) or older or (IFC).
 - C. Microstation drawings will need to be saved as (.dwg) format. BIM software other than Revit shall be saved as IFC files.
 - D. Plot style table (ctb files) shall come with the drawings.

- 1.2 UNC Charlotte reserves the right of refusal of CAD drawings and BIM files that are not conforming with UNCC's CAD and BIM standards outlined in this document.

- 1.3 Drawing Types:
 - A. As-built drawings must be sent in an AutoCAD format and .rvt or IFC.
 - B. Shop drawings specific and or custom to UNC Charlotte must be sent in an AutoCAD, rvt or IFC format.
 - C. General shop drawings, not specific to UNC Charlotte may be sent in other standard digital formats such as pdf, doc, and tiff.
 - D. This applies to all designers, contract designers, contractors and subcontractors. If designers subcontractors are not in direct contract with UNC Charlotte it is the designer's responsibility to get the drawings to UNC Charlotte in the correct format.

- 1.4 All X-REFS shall be attached to the AS-BUILT base files.
 - A. Most designers forget to include the X-REF because it is merely a ghost background which typically resides on the company's server.

- 1.5 During preliminary design and construction phases CAD construction documentation along with any amendments will be provided in an AutoCAD 2013 format to UNC Charlotte as they become available.

- 1.6 If renderings are to be prepared for a project they should also be sent to UNC Charlotte in the original source file and pdf.

- 1.7 In paper space setup all drawings with a rectangle indicating the edge of paper based upon the plot scale and sheet size. Place the rectangle on a layer named "border". The bottom left corner is the drawings "lower limits" and will be at 0,0. The upper right corner of the rectangle is the "upper limit. Set the "units" command to architectural. Do not draw any entities outside of the limits set up by the rectangle on the layer "border". All surveys should be compiled in North American Datum 83 using North Carolina State Plane Coordinate System. 14) In model space designers/drafters should use the North Carolina State Plane Coordinate

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System (from the survey) to orient objects and buildings. All pages should reflect the survey orientation.

- 1.8 Paper space drawings should be setup to be plotted at 1:1 scale. If other page sizes are required add additional layout pages.
- 1.9 Only one (1) line type per layer and only (1) color per layer is permitted. Set line type and color to by layer.
- 1.10 Use only those line types provided with AutoCAD. Do not use third party line types.
- 1.11 The use of standard AutoCAD and BIM Software fonts and shapes is required. Nonstandard FONTS and SHAPES must be transmitted with the drawings in their original file format as separate files in a separate FONTS subdirectory.
- 1.12 Do not draw any entities on layer 0. Leave this layer clean.
- 1.13 All vector graphics shall be created at 1:1 scale. Scaling of drawings is not allowed. Paper space shall be used for creating/printing scaled drawings.
- 1.14 If the use of X-REF is required then upon transmittal of CAD drawings all X-REF's must be bound (using AutoCAD X-REF Bind/Insert command).
- 1.15 The use of Model and Paper space is required for all CAD drawings. No title block should be located in Model Space. Title blocks shall be located and used only in paper space.
- 1.16 Title blocks should not be X-REF'ed. Title blocks should be created using blocks and sheet/title block information should be entered using the edit attributes command.
- 1.17 There should only be 1 page per layout. Each file can have multiple Paper space layouts as long as they are labeled correctly.
- 1.18 Plot styles (.ctb), file names and layer naming conventions will conform to the latest US National Cad Standards and NBIMS-US (National Bim Standards-US) or National CAD Standards and the American Institute of Architects (AIA).
- 1.19 A text file (readme.txt) describing the indexing and organization of the Project and each files shall be located in the root directory. The file shall contain a listing of all files being distributed.
- 1.20 AutoCAD & BIM files will be submitted for preliminary review to the BIM Manager when the project is sent out for bid. The CAD and/or BIM files will be sent for final review within 30 days of

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project is completion. If the building is occupied and further coordination needs to be done for CAD and/or BIM files, these files should be turned in 30 days after occupation of the building.

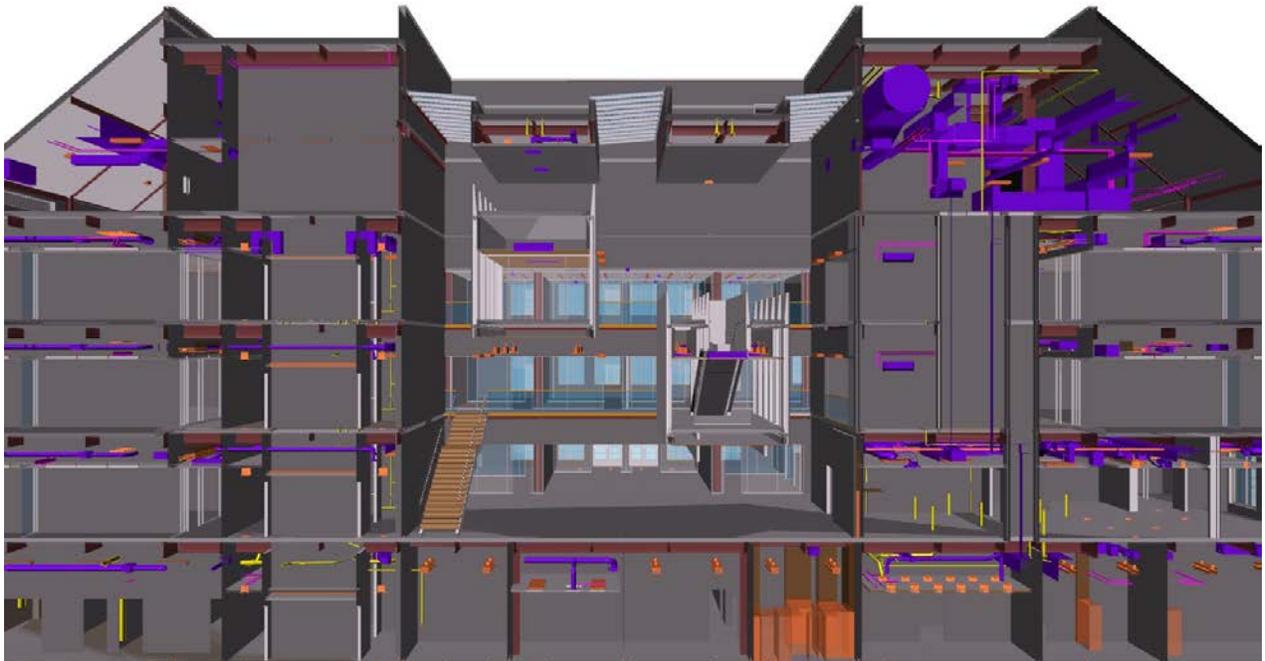
- 1.21 If the data provided to the UNC Charlotte is not of adequate quality, it will be remitted to the Consultant for the necessary adjustments.

- 1.22 100% of all design manuals, warranty information, and paper documentation provided to UNC Charlotte will be in a digital format to facilitate storage. Acceptable file types are pdf, doc, xls, tiff, jpg, and dwg.

- 1.23 All design details shall include a back reference to the drawing from which it was taken.



UNC CHARLOTTE



INTEGRATED LIFECYCLE MANAGEMENT
BIM/VDC REQUIREMENTS
IMPLEMENTATION PLAN

Manual for VDC, BIM/VDC and Lifecycle Data for design and construction projects at UNC Charlotte.
February 2018



February 1, 2018

Integrated Lifecycle Management (ILM) helps Owners manage the project and post-project related information with these five goals: **Communication, Centralization, Documentation, Standardization** and **Automation**.

This document is to assist in the development of Lifecycle Management through BIM, the VDC process and Data Management resources.

To achieve this vision, The University of North Carolina Charlotte (UNC Charlotte) has issued these guidelines to be a required part of the contract for all campus design and construction projects.

Throughout the design and construction, various UNC Charlotte departments will review the BIM/VDC, Project Metadata and associated documentation for verification, accuracy and delivery. These departments and their involvement are as follows:

- **UNC Charlotte FO BIM/VDC Manager**
 - Coordinate development of BIM and Metadata within various UNCC departments.
 - Receives, reviews and is the final sign-off on BIM Execution Plan-Design (BXP-D) and BIM Execution Plan-Construction (BXP-C).
 - Provide UNC Charlotte Capital Project Manager with Site Code and Building ID for Revit project information.
 - Provide UNC Charlotte Capital Project Manager with Revit Template and Digital Management Exchange Guidelines Structure.
 - Ensures that BXP-D and BXP-C are adhered to for the duration of the project.
 - Provide access to Project Collaboration Cloud.
 - FO defines FM metadata, documentation, clearances to mechanical equipment and equipment naming standards. They will also verify that the systems and zones are defined correctly.
- **UNC Charlotte Facilities Information Systems (FIS)**
 - Specifies nomenclature for data to be collected, see Exhibit 5.
 - Specifies IT data collection tools, i.e. BIM 360 Field.
- **UNC Charlotte 3rd Party Consultants**
 - Any 3rd party viewer in conjunction with the above listed UNC Charlotte departments to validate models, documentation, deliverables and overall BIM/VDC requirements.

If you have any questions about the BIM/VDC Requirements Implementation Plan please contact the Capital Project Manager and they will route all inquiries to appropriate University personnel for response.



February 1, 2018

Update Schedule

Release	Date	Brief Update Description
1	10/2013	Initial public release
2	1/2018	Full plan revision #1, v2.0



February 1, 2018

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Glossary

AEC

Architectural/Engineering/Construction

ARCHIBUS

IWMS used for Space Planning and Facilities Maintenance

As-Built Documents

As-built documents are the collection of 2D hard copy documents and/or electronic drawing files from the Contractor/CM that contain markups, annotations, and comments about changes that have been made to the Contract Documents during the construction phase.

As-Built Model

This is a collection of models that have been collected and updated throughout the construction process by the Construction Manager/Contractor. These changes and updates have been communicated from the Contractor and Sub-Contractors through comments, annotations, markups and design changes; model showing how a building is actually assembled and delivered. (Also see Section 7.6.3)

Building Information Modeling (BIM)

An integrated process aimed at providing coordinated, reliable information about a building project throughout different project phases—from design through construction and into operations. BIM gives architects, engineers, builders, and owners a clear overall vision of the project—to help them make better decisions faster, improve quality, and increase the profitability of the project.

BIM Execution Plan (BXP)

The BXP helps to define the BIM roles and responsibilities for the Design and Construction Team during the project.

Cx

Commissioning Agent

Clash Detection

The process of checking for clashes and interferences in one or more BIM models. May also be referred to as model coordination.

Construction Documents

The Construction Documents are a set of written and graphic documents prepared for communicating the project design for construction and administering the construction contract." They consist of the drawings, specifications, contracting requirements, procurement requirements, modifications and addenda, and resource drawings.

Construction Model

The model used during construction to simulate and analyze the construction of a building for constructability, pricing, etc. within an authoring software. (Also see Section 7.6.1)

Coordination Model

A federated model created from two or more models used to show the relationship of multiple building disciplines such as architectural, civil, structural, and MEP (mechanical, electrical, and plumbing) for constructability and coordination. (Also see Section 7.6.2)



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Core Collaboration Team

The group of people—which should include someone from each party working on the project, such as the owner, architect, contractor, consultants and trade contractors—responsible for completing a BIM and Building Energy Simulation (BES), creating the document management file folder structure and permission levels in the collaborative project management system, and enforcing the action plan set out in that document throughout design and construction of the project.

Design Team

The Design Team is considered to be the Architect and all of the consultants that provide design services for a project. These design services can be rendered at any time during the project.

Design Model

The model used to communicate the design intent of a building as is the single source for construction document development.

.DWF

.DWF is a file type that was developed by Autodesk to be locked file for drawing sheets and model data. It can be used as a file transfer for estimating data, markups, and other third party software. It can be a combination of 3D and 2D information within the same file.

FM

Facility management is a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology.

Integrated Lifecycle Management (ILM)

A management process that improves collaboration and optimises efficiency between the AEC team and Owner through standardization and refinement of business structures and facility practices into a process that collaboratively optimises efficiency through all phases of design, fabrication, construction and lifecycle management.

Integrated Workplace Management System (IWMS)

A workplace management system characterized by an enterprise-class software platform that integrates five key components of functionality operated from a single technology platform and database repository: real estate management, project management, facilities and space management, maintenance management, and environmental sustainability.

MEP

Mechanical, Electrical and Plumbing. MEP/FP is Mechanical, Electrical, Plumbing and Fire Protection

Metadata

The term refers to "data about data". For this document, it refers to individual instances of application data, the data content, or "content about content". This content can be authored in a field, stored and managed in one database and transfer to yet another database. Data necessary to allow a repository to manage information objects, such as when, how and by whom a resource was created and how it can be accessed.

Model Manager

The project team member(s) responsible for managing the collaboration and sharing of electronic files during the project. Model managers are also responsible for maintaining the integrity of BIM models, which can include gathering, linking, and uploading updated models.



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Navisworks

Navisworks is software that allows for the viewing of multiple model formats. This ability to “view” these files also allows for Navisworks to simulate the interaction between model files. That includes collision reporting, time lining, and coordination.

NWC

This file is a Cache File that is used by Navisworks to quickly read many other file types.

These files can only be read in Navisworks and Navisworks cannot export out or be saved as an NWC. NWC is the format that is typically created (exported) from products like Revit and AutoCAD, and also is created automatically when Navisworks opens up a DWG directly.

NWD

This is the equivalent of a DWF or PDF. Typically the project file NWF is published to NWD which removes all links and keeps everything in the NWD. This allows the ability to share a project with someone externally without having to send all of the linked/append files. An NWD can be opened with any Navisworks program, specifically Freedom Viewer.

NWF

This is the project file. The NWF contains all of the Navisworks data and pointers to the files that are loaded. The content that is saved in an NWF are things like red lines, saved viewpoints, materials, etc. Project/working file used daily to update info and reload updates from the linked/append files.

O&M

Operations and Maintenance

Operations and Maintenance Support Information (OMSI)

Comprehensive data to properly operate, maintain and repair the facility and its systems. OMSI, also referred to as “Technical Operating Manuals,” provides a process and a product that captures and organizes key information produced during the design, construction and final acceptance of new facility acquisition or major rehabilitation. The OMSI Scope of Work helps ensure that virtually all as-built architectural and technical product and system information will be available in a standardized, user-friendly format for use over the life cycle of the facility.

Parametric

The relationships among and between all elements of a model that enable coordination and change management. These relationships are created either automatically by the software or manually by users as they work.

Record Drawings

The capturing of As-Built Document’s annotation, comments, and markups into an updated drawing set. This is a collection of 2D hard copy documents and/or electronic drawing files from team members assigned to producing and providing the documentation to the Owner.

Record Model

A model containing all Contractual and As-Built conditions used to depict an accurate representation of the physical conditions, environment, and assets of a facility within an authoring software. (Also see Section 7.6.3)

.RVT

An .RVT file is a Revit native file type. It is also the deliverable file format for all projects. This includes all of the Design Team’s models.



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Single Line Diagrams

A 2D simplified diagram illustrating the inter-relationship of pieces of a system or other elements. These are not to scale.

Schematics

Similar to a Single Line Diagram, a Schematic Diagram illustrates the interrelationship of components but incorporates more of a spatial context of the elements, i.e. locations. Generally, these are not to scale.

Virtual Design and Construction (VDC)

The management of integrated multidisciplinary performance models and metadata of design-construction projects, including the product (i.e., facilities), work processes and organization of the design-construction-operation team in order to support explicit and public business objectives

End of Glossary



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Integrated Lifecycle Management

1.1 Objectives

Integrated Lifecycle Management (ILM) is a management process by the Owner to improve collaboration and optimize efficiency between the AEC team and Owner through standardization and refinement of business structures and facility practices into a process that collaboratively optimises efficiency through all phases of design, fabrication, construction and lifecycle management.

This BIM/VDC (Building Information Modeling /Virtual Design and Construction) Requirement and its corresponding guidelines are intended to act as the standard for the AEC Team to follow and develop their Project Execution Plans. Project Plans written to execute these guidelines should allow the facility to be compliant with UNC Charlotte's BIM/VDC and Lifecycle Data requirements. All drawings, schedules, simulations, and services required for assessment, review, and construction shall be extractions from the model and support electronic data and metadata. Moving this collected design and construction data into an Integrated Workplace Management System (IWMS) is critical to UNC Charlotte meeting its intended Lifecycle requirement.

UNC Charlotte's BIM/VDC Requirement is a living document and will continually be reviewed for applicability with current methods and technology. Also, review section 01 78 23-Digital Management Exchange Guidelines (DMEG) in the Project Manual for information associated with these requirements. UNC Charlotte welcomes feedback from the AEC Teams and internal staff regarding the performance of these processes is critical to keeping it relevant.

1.2 BIM/VDC Vision

UNC Charlotte understands that BIM/VDC represent both an enhanced technology and process change for the architecture-engineering-construction-facilities management industry. UNC Charlotte is committed to moving both the organization and its service providers to BIM/VDC as efficiently as possible, and to integrate BIM/VDC process methodologies into its delivery requirements. The information model shall include geometry, physical characteristics and metadata needed to describe the project, its construction and provide UNC Charlotte with needed Facilities Management Data.

UNC Charlotte will describe in this BIM/VDC Requirement how the modeling requirements need to be developed and how they can be used by their internal teams during and after construction. These requirements are split into the following categories

- Model use during design
- Construction requirements for modeling
- Metadata and data use after project completion

Modeled elements shall be of a Level of Development described within to support an integrated design process that coordinates critical systems for proper building function, performance and IWMS integration.

1.3 Lifecycle Vision

UNC Charlotte's goal is to maximize lifecycle building performance with detailed facility information and metadata, electronic building data improves the design and management across the lifecycle. This should occur from concept design through construction and beyond into operations and eventually to renovations and/or salvage and demolition.

To achieve this, UNC Charlotte has looked internally to its own workflows and processes to strategically align them with a BIM/VDC workflow. Changes have been made to assets and other electronic information within their IWMS system to better match BIM/VDC processes from the AEC industry. Therefore, UNC Charlotte is asking all AEC providers to use compliant BIM/VDC authoring tools for all major construction and renovation projects over \$500,000. This requirement shall apply to design and construction by the architects, engineers, other consultants, and other contractors hired for UNC Charlotte projects.



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1.4 General Responsibilities

BIM/VDC authoring tools, data integration, and collaborative team workflow environments shall be used to develop and produce project information and documentation as required for completion of construction. Both geometry and data information from BIM/VDC is to be used to maximize project reviews, decision support, design analysis, and quality assurance during all phases of the project.

It is the responsibility of all AEC Team members to provide the hardware, and software needed to successfully use BIM/VDC and Data Management processes for the project. The use of BIM 360 can be purchased using UNC Charlotte's license. A quote will be provided upon request and payment can be made directly to the software provider.

1.5 Goals

UNC Charlotte has set the following goals for the use of BIM during the design phase, construction phase and Handover/Facilities Operation.

Design

- Space Requirements
- Early Energy Information Modeling (EIM)
- START data entry for equipment

Construction

- Clash Detection & Resolution
- Model Integrity Checks (Depends on BIM Assure purchase per contract)
- Document equipment data & CONTINUE data entry
- Place Barcode on installed equipment

Handover/Facilities Operations

- Develop preventive maintenance procedures before building handover
- As-built model and data, such as O&M Manuals
- Push data into Archibus

1.6 Reuse

It is important for UNC Charlotte to own, reuse, and properly manage building data throughout the facility lifecycle. Consequently, UNC Charlotte will place significant importance on the accurate creation, management, and stewardship of building information during project creation and expects that data created during design and construction to be reused throughout construction and into facility management. Record Model(s) in the authoring software shall be provided at the end of construction to further the lifecycle and development efforts.

--- END OF SECTION ---



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BIM/VDC Execution Planning

UNC Charlotte requires a BIM/VDC Execution Plan (BXP) developed to provide a master information/data management plan and assignment of roles and responsibilities for model creation and data integration at project initiation. The BXP shall align the project needs and requirements from this BIM/VDC Requirement with the Design and Construction team skills, capabilities, and technology maturity.

For Design-Bid-Build or GMP projects, a separate BXP for Design and Construction shall be developed and submitted to UNC Charlotte with specific attention to model and data handover from the design team to the construction team to Facilities. If a Construction Team is involved during Design and information is available during the design phase, a single BXP can address both Design and Construction activities.

2.1 Design BXP (BXP-D)

The Design Team shall submit to UNC Charlotte's BIM/VDC Manager their BXP-D during schematic design. Within thirty [30] days of submission, the BXP-D will be reviewed for approval by UNC Charlotte. BXP-D should identify the entire Design Team including all consulting engineers and specialty consultants, roles and responsibilities of the team(s), even if that party has not yet been identified, should be included in the BXP-D. The BXP-D will be a part of the final contract documents. This document will be due to the UNC Charlotte BIM Manager at Schematic Design deliverable.

See Exhibit – 1 BIM Execution Plan-Design for more details.

2.2 Construction BXP (BXP-C)

The Construction Team shall submit to UNC Charlotte's BIM/VDC Manager their BXP-C within sixty [60] days of pre-construction contract award for CMR firms and within thirty [30] days from bid award for General Contractors. The BXP-C shall outline the strategy and schedule for utilizing BIM/VDC Technology to execute construction related activities and project coordination. Within thirty [30] days of submission, the BXP-C will be reviewed for approval by UNC Charlotte. BXP-C should identify the entire Construction Team, subcontractors and specialty trades and design team. Roles and responsibilities of the team(s), even if that party has not yet been identified, should be included in the BXP-C. The BXP-C will be a part of the final contract documents and to make this a collaborative process the Construction Team needs to involve the Design Team in their VDC workflow when creating their BXP-C. This document will be due to the UNC Charlotte BIM Manager 90 days after the contract has been signed.

See Exhibit – 1 BIM Execution Plan-Construction for more details.

2.3 Information Exchange

UNC Charlotte Facilities Management (FM) is working to develop Digital Management Exchange Guidelines (DMEG) to eliminate hard-copy drawings, DWG electronic files, boxes of specs and basic electronic documents turned over to the Owner at close-out. It is evolving into an ongoing information delivery exchange process integral to the entire Team. UNC Charlotte seeks to advance the quality, timeliness and cost-effectiveness of the collection, input and maintenance of that facility information. Further aiding this process is a deliverable standard that produces all design & construction documentation in a consistent format the Owner understands and receives on all projects. This electronic workspace is established for efficient and timely exchange of documents, models and database files.

UNC Charlotte will provide the Contractor/CM with a template file structure to populate all Record Documentation for the Owner during construction. This folder structure has a direct relationship to the Digital Management Exchange Guidelines outlined in the appendix. UNC Charlotte will utilize a cloud based document management process for collecting the required deliverables listed in the appendix.

--- END OF SECTION ---



Process Responsibilities

3.1 General Responsibilities

The AEC Team should involve the owner’s key personnel as directed by the UNC Charlotte Capital Project and BIM Manager to provide information during design and construction as needed. Their involvement should continue all the way through commissioning & close out. The UNC Charlotte BIM Manager will perform Model Health Checks at each milestone during the design process.

Documentation reviews at the end of all Design Phases will be performed paperless via a Bluebeam Studio Session set up by the UNC Charlotte Project Manager or the Architect of Record. The free viewer Bluebeam Vu can be downloaded for access and markup of files. All comments, markups, and suggestions for documentation and design changes should be made with this session as part of the contract. All markups need to be reviewed by each parties’ respective lead prior to changes being made to the documents.

Tracking markups and/or comments during design or construction documents review:

Mark Color	Description
Black	Original Document
Red	Corrections to documents. Edits in this color provide direction for revisions, additions, or deletions to the documents that are to be included in the updated documents.
Blue	Notation from document editor. Edits in this color provide direction that is NOT to be specifically added or deleted from the documents.
Green	Questions from design team members picking up markups or comments back to the originator. This is to seek clarification or direction. (Note: utilize this work method only when comment originator is not available for immediate clarification)
Orange	Reviewers Acceptance to marks and comments in the document. This is for the Markups list color only
Yellow	Corrections to documents have been incorporated and design team has back checked their work. This can be highlighted in the document, but should also be added as a reply to the markup in the markups list.

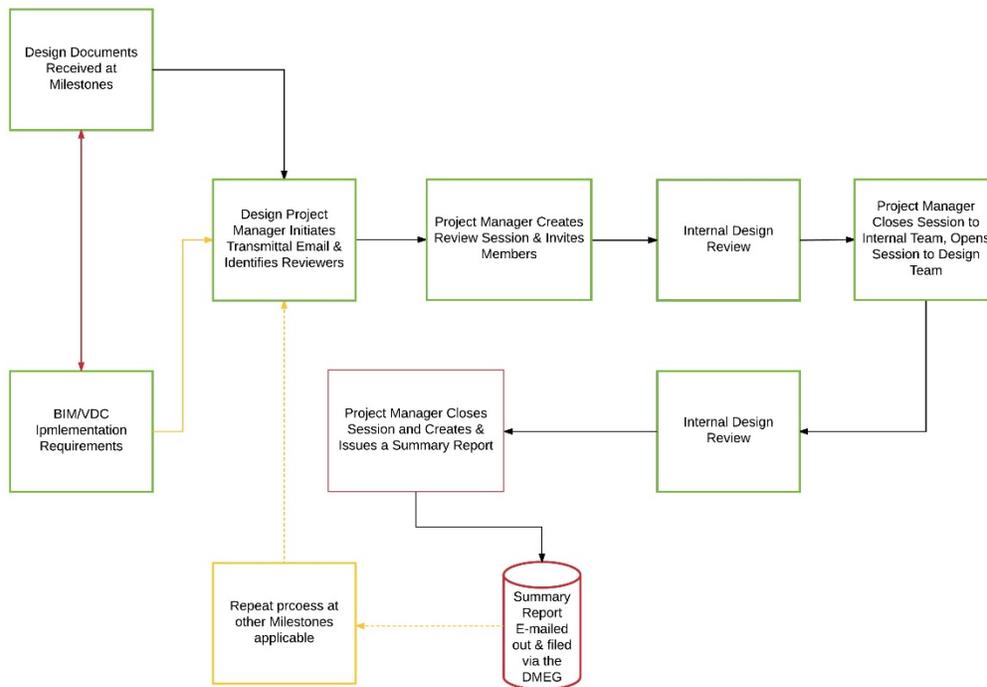
During construction, updated Documentation sheets and information should be made in accordance to the BXP-C and unincorporated markups and revised sheets will be transferred to the latest sheet. The BXP-C will be maintained by the construction team in a Bluebeam Studio Session during construction.

During construction, updated Documentation sheets and information should be made in accordance to the BXP-C and unincorporated markups and revised sheets will be transferred to the latest sheet. The BXP-C will be maintained by the construction team in a Bluebeam Studio Session during construction.

Please see the flow diagram on the next page.



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3.2 BIM/VDC Leads

As part of the execution of the BXP-D and BXP-C, the Design and Construction Team shall assign an individual to the role of Design Team and Construction Team BIM/VDC Manager. The individual shall have sufficient BIM/VDC experience for the size and complexity of the project and shall have relevant proficiency in the proposed BIM/VDC authoring and coordination software. The individual shall serve as the main point of contact for UNC Charlotte and the Design/Construction Team for BIM/VDC related issues.

3.3 Schematic Design

UNC Charlotte encourages the Team to take advantage of data exchanges and/or validations with BIM/VDC during Schematic Design, especially when it comes to Program and Space validation. The design team can start providing a spatial design based on input from the Pre-Design phase; provide an initial design for building systems and attributes including architectural, structural, and MEP; identify initial coordination issues among building systems. All information needed to describe the schematic design can be graphically or alphanumerically included in and derived from BIM/VDC by the end of Schematic Design. The Architectural model can show the general design and layout of the building structure and act as the baseline for all other subsystem designs, such as MEP and Structural models. The subsystem designs can be used to show the layout of building components with the combined model showing the spatial relationship of the Architectural model and subsystem design models. UNC Charlotte will require the design teams to upload any Schematic Design models to a specified location for QA/QC checks by the UNC Charlotte BIM/VDC Manager.

3.4 Design Development

Development of BIM/VDC should commence with an increased Level of Development (LoD) based on an approved Model Development Specification (MDS) and building systems. The model should now include parametric links to enable automatic generation of all plans, sections, elevations, custom details and schedules as well as 3D views. The Architectural model should continue to act as the baseline for all other subsystem designs. The subsystem designs will be modified accordingly to represent the enhanced design. The combined Design model will continue to show the spatial relationship of the Architectural model and consultant models. During Design Development



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and for the remainder of the Design Phase the Design Team is to use BIM/VDC for conflict checking and the coordination of individual and specialized Design models. The conflicts report should be developed and show any outstanding coordination issues between the Design Team members as resolved.

UNC Charlotte's BIM/VDC Manager will require the design teams to upload their Design Development models via a specified process for QA/QC checks. Items being checked will be the use of the UNC Charlotte [Revit Template](#), UNC Standards around Room and Equipment Naming, Finish and Equipment Scheduling, Level of Development (LoD) and general model health checks.

3.5 Construction Documents

During the Construction Document phase, the design should be finalized for the building and all building systems while preparing documentation for code review. All information needed to describe the "Contract Documents" shall be included in and derived from these models only. At this point, no documentation of the models should happen outside of the BIM/VDC Authoring software. As described later in this BIM/VDC Requirements document all model elements should be modeled and to their required Level of Development (LoD) outlined in the teams Model Development Specification (MDS).

It is the Design Team's responsibility to conduct and manage an adequate and thorough Clash Detection process so that all major interferences between building components will have been detected and resolved at the completion of Construction Documents.

3.6 Construction

The Design Team shall continue development of their BIM/VDC(s) throughout construction in conjunction with the Contractor/CM based on submittals, RFIs, or owner-directed changes. Maintaining the model based on construction activities and coordinating all updates for the individual and specialized models and databases will ensure completeness and accuracy of the overall project model. All information needed to describe the ongoing "detailed design" shall be graphically or alphanumerically included in and derived from these models only. Documentation of the models shall not happen outside of the BIM/VDC Authoring software.

By direction of the Design Team Lead the Consulting Engineers' models shall also be revised throughout construction based on submittals, RFIs, or owner-directed changes. The models shall always reflect the revised contract documents. At an agreed upon interval, and outlined in the BXP-C, during construction the updated design models shall be published in the approved collaboration format and posted for the Contractor/CM's coordination. If native authoring model files are needed by the Contractor/CM, separate copies of each technical disciplines model in the original format shall be provided.

Contractor/CM will have the Design Model(s) available at the start of construction to update and house data as established by the bid documents and specifications as necessary to support construction and UNC Charlotte's facility management objectives. Regardless of the Legal status of the model (Binding, Informational, Reference, Reuse), these electronic files are provided to the Contractor/CM solely for the uses related to this project. In the event of a conflict between the Contract Documents and the Electronic Model Files, the CMR shall immediately contact the architect to get clarification and make no assumption on which version might be correct.

It is the Contractor/CM's responsibility to assure that all major trades are modeled and used for clash detection, construction phasing, and installation coordination. Fabrication models shall be coordinated with the design model and any conflicts need to be resolved prior to fabrication and construction. Those conflicts shall be reported to the Design Team in the form of a Request for Information (RFI). Minor changes that have not been officially executed in the design models and that are considered As-Built changes will be documented by the Contractor/CM during construction. As listed in the BXP-C, those Mark-Ups shall be shared and coordinated with the Design Team so the changes can be incorporated into the Design model(s). All changes in the authoring software shall be published to the Contractor/CMs collaboration model to keep them up to date.



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If the Contractor/CM uses Concurrent Construction Modeling in authoring software they should submit an action plan to UNC Charlotte and the Design Team for review prior to the start of construction that outlines the process for concurrent As-Built documentation and outline this process in the BXP-C.

3.7 Commissioning

Commissioning data including but not limited to design intent, performance criteria and operations data shall be recorded in Electronic form within the described Field Management or UNC Charlotte approved application. Unlike traditional paper-based systems, an electronic application for mobile Commissioning can capture systems and equipment information electronically, right in the field, which saves time, reduces errors and develops Real-Time Data Capture. This should reduce the time required for commissioning, improve the speed of re-commissioning and validate requirement or deliverables related to equipment issues or documentation. Dynamic reporting can show the statuses of all systems and equipment, enabling commissioning agents and other responsible parties to better manage project status and workflows. It shall be the Contractor/CM and Commissioning Agents responsibility to coordinate the information sources and integrate this information into the electronic application into a format for transfer at the completion of the project, or before.

If Commissioning is to reside in the Contractor/CM's electronic platform, the Commissioning Agents shall provide the Contractor/CM with their traditional documentation that would be used for Commissioning Construction Checklists, Pre-Commissioning, Functional Testing and any other documentation typically used by the Commissioning Agent. The Construction Manager/Contractor or UNC Charlotte BIM/VDC Manager will, in turn, create that documentation in an electronic version inside their system for Commissioning and Sub-trade coordination.

During the building commissioning processes, Facilities Operations (FO) staff shall be involved and coordinated through the Capital Projects CM to see how all building systems are designed to function and that they are being installed, balanced and verified to perform as designed. There should be an orientation and training program for FO staff to review the contents of the O&M manuals for major systems and equipment, including building mechanical, automation controls, plumbing, electrical, fire detection and protection, security, elevators, systems, etc. Any specialized training in building automation software should not be 'generic training' but should be performed using the actual project building graphics, controls sequences and data. All OMSI required documentation that is filed per the Digital Management Exchange Guidelines (DMEG) in the appendix should be reviewed for compliance by the Commissioning Agents.

--- END OF SECTION ---



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Coordination & Collaboration

The success of an ILM enabled project is highly dependent upon the level at which the entire Design/Construction Team can communicate and work collaboratively for the duration of the project and with UNC Charlotte. This section documents collaboration procedures for effectively managing this process.

4.1 Kickoff Orientation

After award of the project, the Contractor/CM, shall facilitate a Project Kickoff Orientation Meeting, which will review all UNC Charlotte BIM/VDC and data requirements and answer questions from the Project Team. While reviewing the Primary Systems in BIM/VDC, the BXP-D should be reviewed and coordinated while developing the BXP-C.

Primary Architectural Systems include, but may not be limited to:

Partition systems with structure, flooring systems, partition systems with bulkheads, partition systems with expansion control, vertical transportation systems with primary engineering systems, millwork and casework systems with power and data outlets, horizontal ceiling systems with window openings, bulkheads, partitions, lighting, fire protection and HVAC outlet locations, exterior skin systems with window openings, structure, roof edge conditions, parapets, roof penetrations, and equipment locations.

Primary Engineering Systems include, but may not be limited to:

Structural framing, primary HVAC duct runs, primary fire protection main runs, primary electrical conduits, ceiling grids layouts, primary data, audio visual, security and communication distribution systems (cable trays, etc.).

4.2 Consultants/Sub-trades

Prior to installation, the Contractor shall hold trade coordination meetings with subcontractors and review clashes and report them back to the team. The coordinated model will be used to review and optimize scheduling and field installation. Sub-trades should be expected to have individuals attend who can actively engage in the subcontractor coordination process and make schedule commitments.

This collaborative process is to ensure that the deep knowledge and associated efficiencies of the fabricator are embedded into the Construction Model(s). The following construction trades (at a minimum) should provide 3D fabrication models:

- Structural Steel
- Mechanical System Duct MEP subcontractors (incorporate vendor models if available)
- Curtain Wall
- Building Envelope Systems (rain screens, pre-cast panels, glazing systems)
- Casework and furniture systems
- Additional fabrication models generated by subcontractor

4.3 Clash Issues

The Contractor/CM is required to coordinate models between design team disciplines, subcontractors and specialty trades to perform clash detection in order to assure constructability and help reduce RFI and Change Order submissions before construction begins. Contractor/CM shall require subcontractors, fabricators, suppliers, and manufacturers to submit all models to the contractor as outlined in the BXP-C. These model(s) should be updated after each project coordination meeting or as changes occur in the field during construction.

- On a multistory project, the models may need to be split on a level-by-level basis for MEP/F coordination. If a floor is particularly large, it may also need to be split into zones to reduce file size. Typically, 3D clash detection/coordination continues on a single floor until building systems are fully coordinated, and then continues on the next floor up.



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- The team shall review the model and the Clash Reports in coordination meetings outlined in the BXP-C
- Internal Clash Resolution – Design Consultants and Subcontractors who are responsible for multiple scopes of work are expected to coordinate the clashes between those scopes prior to providing those models to the Construction BIM/VDC Manager for overall spatial and system coordination.
- Spatial Coordination Verification: Verification and tracking of resolved conflicts of all trade coordination issues which could result in change orders or field conflicts shall be provided to UNC Charlotte during project milestone dates, and should be fully resolved before build out.

Collision Reports

Collision reports can be published in a standard XML, HTML, or Text format. These reports shall include the following information at a minimum:

- Description of Collision Report
- Date of Collision Report Run
- List of all Collisions detected their status and their proposed solution

Contractor/CM shall submit a Collision Report schedule to the UNC Charlotte BIM Manager and Design Team as outlined in the BXP-C for further reference or clarification if needed. Static Coordination Model files should be created at all critical coordination milestones; this model should be archived with the date of the clash report at each instance, providing a record document at this point and time during construction.

4.4 Field Management

Field Management applications and their connected web-based workflow for in field point-of-construction data solutions, Issues Tracking and Punchlist is to be utilized by the Contractor/CM in conjunction with the Design Team, Sub-trades and UNC Charlotte for project coordination and data entry. Linked documents, photographs and model data between BIM and the Field Management application can be utilized to collaborate during construction and in preparation for data exchange to UNC Charlotte. Commissioning tests and checks, as-installed data, O&M manuals and start-up procedures are some of the items the Field Management application can be used to track, test and validate during construction. UNC Charlotte highly recommends utilizing BIM 360 Filed for the Equipment Asset Registry at minimum by the Contractor/CM.

--- END OF SECTION ---



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Technology

5.1 Authoring Software

All architects, engineers, and specialty consultants are required to use the following design authoring software. Projects will remain on the same software release throughout the life of the project unless approved by the entire team and University. This should be outlined and coordinated in the BXP-D and BXP-C for UNC Charlotte's BIM Manager to review.

- Autodesk Revit (.rvt)
- AutoCAD MEP* (on the trade side only if necessary due to fabrication, equipment naming and tagging must be carried over from the original model)
- Review Specialty Sub-Trade modeling applications with UNC Charlotte's BIM/VDC Manager

Architectural, Structural, M.E.P., Energy, Life Safety and Fire Protection Models – These Autodesk Revit (.rvt) Model(s) are Central Revit Files with Worksets enabled. If there will be more than one model per discipline and/or Interior models please outline and describe in the BXP-D.

*AutoCAD MEP and propriety software add-ons are welcomed to develop, coordinate and fabricate the project. Where modeling for coordination and constructability is done outside of Revit or recreated as an entirely new model, all the Equipment, System and Zone Naming conventions developed in the Design model must be imported over to these models for data integrity and reliability. Changes made through these platforms; be it placement, geometry or metadata must make its way back into the original authoring software model and Record Model.

5.2 Coordination Software

Coordination software shall be used for assembling the various design models to electronically identify, collectively coordinate resolutions, and track and publish interference reports between all disciplines. The technical disciplines shall be responsible for updating their models to reflect the coordinated resolution. All internal and external model coordination and conflict detection are required to use the following software in its native file format in its current version. Confirm version with UNC Charlotte in the BXP-C for the project.

- Autodesk Navisworks Manage (.nwd)
- Autodesk BIM/VDC 360 Glue (optional)

5.3 Field Asset Management

A Secure, cloud-based, web and mobile Field Asset Management application that delivers a complete field management solution shall be used. This system will electronically enable workflows for quality, commissioning and document management processes in the field and in the office; proven to reduce rework, delays and eliminate paper. Modules required by the UNC Charlotte on their projects are Issues, punch-list, commissioning and equipment tracking.

- Autodesk BIM 360 Field
- KTrack

5.4 Additional BIM/VDC Tools

The Design and Construction Teams are encouraged to explore options to use the BIM/VDC and other electronic tools to enhance the project quality and delivery times, including quantity take-offs, cost estimating, overall project scheduling, subcontractor coordination, off-site fabrication, and other BIM/VDC benefits. UNC Charlotte is interested in fostering and supporting innovation and encourages bold steps toward trying new ways to improve business process efficiency, design, and project outcomes.



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Following are some of the discretionary areas that UNC Charlotte may support for further development and the use of BIM/VDC; other ideas may also be proposed by the AEC Teams:

- 5D – Material take-offs & cost estimating
- Integrating information, e.g., electronic specifications that are tied to the BIM/VDC
- Achieving automated code checking
- Repeatable prefabrication components to speed construction erection time
- Off-site fabrication

Virtual Mockups

The contractor may want to utilize this process to which software is used to design and analyze the construction of a complex building system (e.g. curtain wall, form work, design element, tie-backs, etc.) in order to increase awareness and planning. Any physical mock-ups listed in the specifications can first be developed virtually, but without written approved authorization from UNC Charlotte, the Virtual Mockups do not take the place of the Physical Mockups per the specifications.

Energy Requirements

The Design Team may also establish an energy modeling method including local weather data within the BXP-D that will detail how energy modeling will be accomplished for the project.

Potential software to perform the energy modeling for the project may be: Insight 360, Sefaira and eQuest

--- END OF SECTION ---



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Model Format & Data Collection

The models shall consist of objects and elements that represent the actual dimensions of the building elements and the building equipment that will be installed on the project. Before modeling begins, the Contractor/CM and Subcontractor BIM/VDC Managers will work with the Design Team to develop the model, and model view extraction structure for all the construction document files to assure coordination between disciplines. This structure shall be provided to UNC Charlotte so that the models can be reconstructed at a later date. BIM/VDC coordination requires the following model structure and features:

- The Architect's BIM/VDC Manager shall establish the floor elevation protocol so that the Technical Discipline/Trade BIM/VDCs will be modeled at the correct elevation.
- Clearance Reservations: All models shall include required clearances for all mechanical equipment for repair, maintenance, and replacement, light fixture access, overhead cable tray access, etc.
- All 3D model files submitted for clash detection shall be "clean;" all extraneous 2D references and/or 3d elements must be stripped from the model files.
- Revit deliverables should not have imported or linked 2D AutoCAD files associated with them.

6.1 General Requirement

6.1.1 Origin Point

All models must be in the correct location in 3D Space (x, y, and z coordinates). Models should be inserted by Auto-Origin to Origin. All models should contain their own grids and levels as a QC method to assure correct location. The correct insertion point is critical and ensures that each model will align properly without modification when linking and coordinating.

6.1.2 Tolerances

Model(s) must be within construction tolerances of the element in question – use 1/16" if unsure. Tolerances for specific items and systems will be determined as necessary. Set precision to 1/256". Globally set the precision to 1/256" and look for odd dimensions, the intent is to model at the highest accuracy as not to start out with errors built in.

6.2 Model Structure

All elements of the building must be coordinated into one file and should be modeled by their specific trade.

Examples:

- Architectural models should not include any of the structural elements contained in the structural model.
- Lights should be modeled by the electrical engineer, and not be the architect
- Plumbing Fixtures should be modeled by the Plumbing Engineer and not the Architect
- Architectural ceilings should contain information for openings for lights, registers, etc. as required by design
- All models should include 3D representations of required clearances and/or access requirements for equipment

Models will be separated by the following disciplines for design and construction coordination by all project participants throughout the construction process.

- Architectural -Deliverable-
- Mechanical -Deliverable- (This may coordinate into a single MEP model)
- Electrical -Deliverable- (This may coordinate into a single MEP model)
- Plumbing -Deliverable- (This may coordinate into a single MEP model)
- Structural -Deliverable-



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- Construction Based on Contractor/CM authoring capabilities
- Coordination Required during Construction, only Clash Reports are a required deliverable.
- As-Built -Deliverable-
- Record -Deliverable-

6.3 File Naming

Model deliverables should have a file name that consists of three [3] distinct sections delineated by the following format: Facility ID _Discipline _Published Date.xxx

Final As-Built Model:

As-Built	Facility ID _AsBuilt_YYYYMMDD.nwd
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Final Record Model:

Architectural Model(s)	Facility ID_ARCH_YYYYMMDD.rvt
Interiors/Furniture Model(s)	Facility ID_FURN or INTR_YYYYMMDD.rvt
MEP Model(s)	Facility ID_MEP or [DISCIPLINE]_YYYYMMDD.rvt
Structural Model(s)	Facility ID_STRL_YYYYMMDD.rvt
Life Safety and Fire Protection	Facility ID_LSFP_YYYYMMDD.rvt

6.4 Data Modeling Requirements

6.4.1 Room Name & Numbers

Use the Room Numbering convention outlined by UNC Charlotte in their Design Manual for all new construction projects, coordinate existing Room Numbers with UNC Charlotte. This system provides a consistent method for identifying and managing building space and shall be adhered to unless approval is documented in writing by the UNC Charlotte. This Room Numbering structure will be reviewed and approved at the end of Design Development and cannot be changed without written approval from UNC Charlotte - Capital Projects, FIS, and Space Management.

The Room Numbers shall be assigned to the Number Parameter in Revit for each individual room or space. This process gives the room/space a Unique Identifier understood by UNC Charlotte while also allowing the developed space to be connected to complex space standards and regulations inside UNC Charlotte’s IWMS once connected. This serves as the Primary Connector for Room Data between Revit and the IWMS.

6.4.2 Room Finishes

Using the UNC Charlotte Revit Template a base Room Finish Schedule has been prepared so finishes can be tracked at the individual Room. This will provide detailed metadata to UNC Charlotte’s Facilities Maintenance software on the type of finishes used in each Room. The means in which to populate this schedule is up to design team, but the finish data required per the template must end up residing at the Room level as well as a schedule produced in the documentation process.

Built in Revit Finishes should be used for the Room Finish Material for floor, base, wall and ceiling. Additionally the Finish Code, Color and Manufacturer need to be filled in for each Room as well as the Ceiling Height.

6.4.3 Room Category

All Rooms are assigned a Room Category and listed in *Exhibit 3-Space Asset Codes*. An additional Shared Parameter of Room Category will be assigned to Rooms and will be available once transferring the Project Standards from the *UNCC ARCHIBUS Shared Parameters File Template*. Populate this field when placing a Room with the Category assigned to that Room Type per the Exhibit provided in this document.



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6.4.4 Occupancy

UNC Charlotte has two fields relating to Occupancy they would like populated. The first one being the Standard Room field of “Occupancy” which is the maximum number allowed per code. Second is the additional “Fixed Occupancy” field for those spaces that have fixed seating or built in work stations within the space.

6.4.5 Area Calculation

UNC Charlotte has a fundamental method of measuring Room Square Footage that synchronizes in a practical way with their IWMS. The area bound by the inside faces of surrounding walls, minus the area bound by the outside faces of contained full height columns will be the net area of a space. Revit should automatically delineate this based on the footprint of surrounding walls.

6.4.5 Equipment Category

All UNC Charlotte defined Equipment Assets should be assigned one of ten available Equipment Categories in the MEP Design Model, you can find these listed in *Exhibit 5-Equipment Asset Naming*. A Shared Parameter field for Equipment Category will be assigned to MEP Equipment and will be available once transferring the Project Standards from the *UNC_C VDC-BIM/VDC Lifecycle Revit Template*. Populate this field when placing a piece of Equipment in the Design Model with the Standards provided in the attached Exhibit.

6.4.6 Equipment Type

All UNC Charlotte defined Equipment Assets should be assigned an Equipment Type at the Family Level in the MEP Design Model, you can find these listed in *Exhibit 5-Equipment Asset Naming*.

6.4.7 Equipment ID (Unique Project ID)

Developing Asset Management during Design aids during Construction and UNC Charlotte in more efficient maintenance and operation procedures of a facility. By having data in the model early, it allows the FM team to start planning for building startup and tracking of building operations instead of spending time doing data entry or trying to find O&M documentation.

Each individual piece of building equipment shall include the following attributes and be maintained throughout Design and Construction. The Mark field in Revit serves as the Projects Unique Identifier and is a derivative of UNC Charlotte’s Portfolio based Equipment Code. Those associated equipment tags shown on the documents lend a relationship to the metadata collected elsewhere in the VDC process. The Equipment Code will serve as the Primary Connector for Equipment Data between Revit and UNC Charlotte’s IWMS and is to be authored in the model during Design when the equipment is placed. Those Equipment Codes can be found in *Exhibit 5-Equipment Assets*.

6.4.8 Equipment Code (Unique Portfolio ID)

All UNC Charlotte defined Equipment Assets are to be assigned an Equipment Code in the MEP Design Model, you can find these listed in *Exhibit 5-Equipment Asset Naming*. A Shared Parameter field for Equipment Code will be assigned to MEP Equipment and will be available once transferring the Project Standards from the *UNC_C VDC-BIM/VDC Lifecycle Revit Template*. Populate this field when placing a piece of Equipment in the Design Model with the Standards provided in the attached Exhibit.

Using the UNC Charlotte Revit Template a base Equipment Schedule has been prepared so all Equipment can be tracked in a single schedule for QA/QC purposes. This provides metadata to UNC Charlotte’s Facilities Maintenance software using its required data structures. Data developed from items 6.4.5-6.4.7 are tracked in that boiler plate schedule.

6.4.9 Equipment Standard

After or during the equipment submittal process all UNC Charlotte defined Equipment Assets are to be assigned an Equipment Standard during construction in the Field Equipment Registry software, you can find



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the data structure described in *Exhibit 5-Equipment Asset Naming*. The Equipment Standard is driven from the portfolio level, these are multiple quantities of like Equipment Components. The Equipment Standard is associated with the Category, Manufacturer and Model Number level allowing for bulk lookup or updates to equipment data.

6.4.10 CSI MasterFormat Number

All Equipment in the MEP Design Model is to be assigned its equivalent MasterFormat Level 3, and when available Level 4, CSI Number. An additional Shared Parameter for CSI Number will be assigned to MEP Equipment and will be available once transferring the Project Standards from the *UNC_C VDC-BIM/VDC Lifecycle Revit Template*. Populate these fields when placing a piece of Equipment in the Design Model with the appropriate number.

6.4.10 Doors

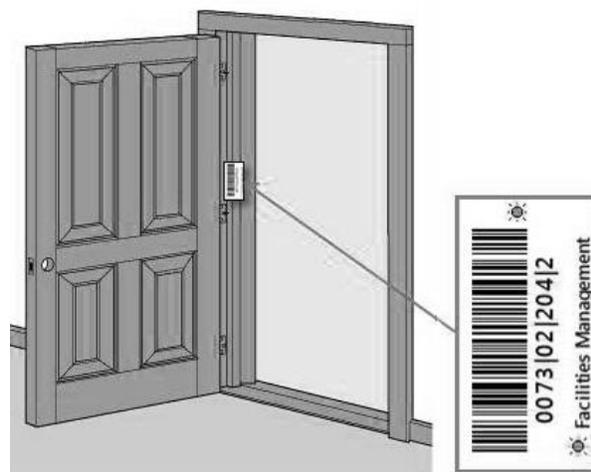
Door types are to be created to accurately reflect each kind of door in regards to type, size and information. The door symbol is a result of the view that is created from the model. Because of this, 3-D doors shall be used throughout the construction documents process and be built into the door schedule and parameters. Each door is also to receive a barcode over the second (middle) hinge of each door frame.

Door Details Tracked in Model during Design

- Door Number (Mark)
- Door Width
- Door Height
- Door Thickness
- Door Hand (Shared Parameter)
- Door Material
- Frame Material
- Frame Type
- Fire Rating
- Side Light or Transom
- Emergency Egress
- Hardware Code (Shared Parameter)

Door Details Tracked During Construction

- Interior or Exterior
- Lock Brand
- Lock Design
- Lock Finish
- Lock Back Set
- Cylinder Brand
- Cylinder Part Number
- Cylinder Material
- Cylinder Finish



Barcode information:

- Example barcode ID: 0055|02|232|2
- ID Breakdown: Building ID|Floor ID|Room ID|Door ID
- Barcodes are to face the door they are associated with.
- Doors are associated with Rooms by the following rules:
 - The lock faces opposite of the room that the door is associated with. Example: When you unlock a room 120 from hallway 100, the door is associated with room 120.



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- If the panic hardware is installed on a door then the direction the panic hardware is facing is the room the door is associated to.
- In the instance of a corridor where both doors swing in either direction, it's the discretion of the installer to decide which room the doors are associated with.

6.4.11 Wall Partitions

A different Partition type is to be created for each type of wall used in the project per UNC Charlotte approval and constructed in 3-dimensional form. These will be based on University standards opposed to project standards. The Fire Rating, Fire Rating UL# and STC Rating # all need to be Parameters associated with each Partition type.

Partition Type Mark/Tag Example: G5a

G=Partition Type
5=Sequence Number
a=Fire/Smoke Rating

Partition Types:

C = Concrete
E = Exterior
S = Shaft
F = Furring
G = Gypsum
D = Demountable

Fire Ratings:

G5 = No Rating
G5a = Smoke Rated
G5b = 1 Hour Fire Rating
G5c = 1 Hour Fire and Smoke Rated
G5d = 2 Hour Fire Rated
*Continue progression as needed above 2 hours+.

6.5 Types of Model Elements

Model elements should be derived from inherent Parameters and specific Shared Parameters for Room and Equipment. The Spared Parameters will be issued by the UNC Charlotte via a Revit Template file so those Instance Parameters can be transferred to the Design and Construction models. Facilities Data will need to be entered into these fields during Design and Construction and eventually be passed to the Record Model. These Shared Parameters will exist at the Instance Level, not the Family Level. So if data requested by the UNC Charlotte exist at the Family Level for the Manufacturer's Elements or Custom Elements, that metadata will have to be duplicated at the Instance Level as well. Please refer to the attached Exhibits for the Shared Parameter fields being added.

- Manufacturer's Model Elements - elements created by and acquired from manufacturers often have more information than is prudent to keep in the model; the *appropriate* level of detail should be retained for the design element. However, embedded performance data shall remain for analysis and specification purposes.
- Custom Created Model Elements - custom model elements that are created must utilize appropriate BIM/VDC Authoring tool templates to create custom elements. Custom models components need to be assigned as a part and part of a family or group.



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6.6 Model Systems and Components

- BIM/VDC shall be used for all building systems design, development, and analysis, including but not limited to architectural, structural, mechanical, and electrical, plumbing, and fire suppression, etc.
- During Concepts, SD and DD Phases, BIM/VDC technology shall be used to develop and establish building performance and the basis of design in accordance with UNC Charlotte standards.
- Elements, objects and equipment shall be tagged with unique identifiers Globally Unique Identifier (GUIDs).

6.6.1 Architectural Systems

Model the following architectural elements to a level that defines the design intent and accurately represents the design solution.

- Architectural Site plan
- Exterior wall systems
- Interior wall systems
- Fire rated walls
- Architectural floor slabs
- Roofing systems
- Equipment including owner provided equipment
- Reflected ceiling plans
- Vertical circulation – including elevators, stairs, escalators, and railings
- Doors and door frames
- Glazing – windows, interior glazing, curtain wall, and storefront
- Millwork and Casework
- Finishes – Including all room paint codes, flooring codes, and other finish items
- Toilets and accessories
- Toilet Partitions
- Specialties
- Must meet BOMA Standards
- Furnishings, fixtures, and equipment if not provided by others and integrated into the architectural model for coordination and document generation.
- Specialty equipment (food service, etc.)
- Clearance zones for access, door swings, service space requirements, gauge reading, and other operational clearance must be modeled and checked for conflicts with other elements. These clearance zones should be modeled as invisible solids within the object.

6.6.2 Structural Systems

Model the following structural elements.

- Foundations, including foundation walls
- Columns, beams, and joists
- Column grid
- Load bearing structural walls
- Brace frames and shear walls
- Structural slab
- Specialties
- Misc. structural components.
- Miscellaneous Steel
 - Angles for openings, deck bearing, etc.
 - Channels for mechanical units coordinating between mechanical
 - Lintels (unless considered a major member)



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- These items may be modeled at the Design Team's option:
 - Steel reinforcing in concrete
 - Embeds in concrete

6.6.3 HVAC Systems

Model the following HVAC elements at a minimum. Model all HVAC components into Supply Air, Return Air and Exhaust Air Systems. Create Zones and assign all Rooms served to its corresponding Zone.

Systems should be named as followed: Category-System-Component, i.e. HVAC-SupplyAir-AHU1
Zones should be named as followed: Equipment Type-Rooms in Zone, i.e. VAV1-100,102,103

- Equipment
 - Fans, VAV's, compressors, chillers, cooling towers, air handlers etc.
- Distribution
 - Supply, return, exhaust, relief and outside air ductwork modeled to outside face dimension or duct insulation (whichever is greater)
 - Duct Joints
 - Diffusers, grilles, louvers, hoods, radiant panels, perimeter units, wall units
- Pipes sized at and over 3/4" diameter, include any insulation in model
- Clearance zones for access, door swings, service space requirements, gauge reading, and other operational clearance must be modeled as part of the HVAC equipment and checked for conflicts with other elements. These clearance zones should be modeled as invisible solids within the object.

6.6.4 Electrical systems

Model the following electrical elements at a minimum. Model all Electrical components into Lighting, Power, Telecommunications and Fire Alarm Systems.

- Power and Telecommunications
 - Interior and exterior transformers, emergency generators, and other equipment
 - Main and distribution panels and switchgear including access clearances
 - Main IDF's
 - Feeders and conduit at and over 1" diameter, and all large conduit bundles
 - Outlets, Switches, Junction Boxes
- Light Fixtures
- Lighting Controls
- Fire Alarm and Security Systems
 - Input devices
 - Notification devices
 - Associated equipment and access clearances
 - Permanently mounted fixtures
- Building Controls
- Clearance zones for access, door swings, service space requirements, gauge reading, valve clearances and other operational clearance must be modeled as part of the electrical equipment for collision checking. These clearance zones should be modeled as invisible solids within the object.



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6.6.5 Plumbing and Fire Protection Systems

Model all Plumbing components into Domestic Hot Water, Domestic Cold Water, Sanitary and Sprinkler Systems. Sprinkler Systems are divided into multiple styles of suppression, these suppression systems must be identified.

- Model the following plumbing and fire protection elements at a minimum.
- Waste and Vent Piping sized at and over 2" diameter, includes any insulation in model
- Roof and floor drains, leaders, sumps, grease interceptors, tanks, water treatments and other major items.
- Supply Piping sized at and over 3/4" diameter, includes any insulation in the model.
- Domestic Booster Pumps
- Fixtures (sinks, toilet fixtures, water tanks, floor sinks, etc.)
- All fire protection Sprinkler lines
- Sprinkler heads, Fire Protection Pumps
- Stand pipes, wall hydrants, fire department connections, risers, including valve clearances
- Clearance zones for access, service space requirements, gauge reading, valve clearances and other operational clearance must be modeled as part of the plumbing and fire protections system and checked for conflicts with other elements. These clearance zones should be modeled as invisible solids within the object.

6.6.6 Specialty Consultants

- Specified or provided equipment by consultants should be outlined in the BXP-C.
- If questionable, pose to UNC Charlotte for further direction.

6.6.7 Civil & Site

- Grading, contours (proposed and existing), site structures to nominal dimensions, all new utilities will be modeled.
- Existing utilities and points of connection, only as applicable and available from existing owner as-built information. Include all structures and utilities to be demolished.
- Pads and other accommodations for buildings will be modeled. Floor slabs, decks and other structural surfaces will be modeled by the architecture team.
- Landscape items, benches, etc. will be modeled by the architecture team to the extent that they are required for overall project coordination.

6.7 Construction Modeling

6.7.1 Construction Model

Objective: Construction Models are the models being developed during construction in an authoring software package (i.e. Revit, AutoCAD MEP, Sprinkler CAD) by the Contractor/CM and/or Sub-trades. Depending on the Contractor/CM and the BXP-C, model authoring by the Contractor/CM may not occur but is required by the Sub-trades for coordination. Any Construction Modeling should reflect the exact geometric properties of the materials and/or systems being submitted. In addition to the items mentioned in Section 7, these models could include fabrication, shop drawing and other models for coordination. Once federated with all the Design, Construction, Sub-trade, etc. models this is to be referred to as the Coordination Model.

Responsibilities: The Contractor/CM's BIM/VDC Manager will work with the Design Team and Sub-trades to answer the RFIs and submittals and adjust the Construction Models accordingly while also using it for constructability analysis. If so determined in the BXP-C the Contractor/CM's Construction Model may replace the Architect's Design model during construction and within the Coordination



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Model. Sub-trade models are to be analyzed based on the Design and be incorporated into the Coordination Model.

6.7.2 Coordination (Federated) Model

Objectives: Update Coordination based on submittals, RFIs, or owner-directed changes; maintaining the model during construction based on construction activities and developed to reflect the actual fabrication of the building. These models are to include fabrication, shop drawing and other models developed during coordination and constructability reviews. The model is to always reflect the revised contract documents and can be used for scheduling analysis, construction sequencing if so desired.

Trade Constructability/Coordination Colors:

HVAC Pipe: Lime Green	Electrical: Cyan
Lights: Yellow	HVAC Duct: Blue
Fire Sprinklers: Red	Plumbing: Magenta
Ceilings: Orange	Framing: Purple
Steel: Maroon	Concrete: Gray

Responsibilities: The Architect's BIM/VDC Manager will work with the Architect's Consultants to answer the RFIs and submittals and adjust the Design model accordingly. The Contractor's BIM/VDC Manager will update this model throughout construction with the supplier and sub-trade models.

6.7.3 As-Built (Federated) Model

Objectives: The As-Built model serves as the final model based on updated Coordination models including all field changes and data requirements and represents the actual assembly of the building. These models will be issued per floor of the building at the close of construction as both a Navisworks NWD file and PDF file.

Responsibilities: The Contractor/CM's BIM Manager will work with all Consultants and Sub-trades to finalize this Coordination Model into an As-Built model. This model will then be handed over to the Design Team. Designer should take the model from the contractor, including any hand-written notes or other material, and produce a record model and specifications for the project. Original as-built mark-ups should be given to UNC Charlotte.

6.7.4 Record Model

Objective: Record models shall be provided for the project. Two files should be made available for each drawing. One file type should be the authoring software file and the other is IFC, for the owner to use as a basis for future project drawings. Model in the original authoring software format containing all Contractual and As-Built conditions used to depict an accurate representation of the physical conditions, environment, and assets of a facility. The Record Model contains information relating to the main architectural, structural, and MEP elements, coordinated to match that of the As-Built model conditions as well as the Sub-trade models. It is the culmination of the BIM process for the project including As-Built conditions back into the Authoring Software Platform for use by the Owner and Facility Management Team.

Responsibilities: The Design Team is responsible for providing UNC Charlotte this Record Model deliverable. These Revit RVT file models are to be delivered to the University within 90 days of Substantial Completion.



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6.7.5 Closeout Documents

Objective: The closeout documents, required upon acceptance of the project, should be provided to the UNC Charlotte by the designer. All closeout documents should be provided within 60 days of project acceptance, unless required earlier by the contract. The UNC Charlotte BIM Manager will verify that all required closeout documents have been uploaded and approved prior to authorizing final payment to the Designer.

Responsibilities: The Contractor/CM is responsible for providing UNC Charlotte closeout documents. All closeout documents should be provided within 60 days of project acceptance, unless required earlier by the contract.

6.8 Level of Development (LoD)

UNC Charlotte intends to make final deliverable building information models available for integration into a Lifecycle Management solution. To meet that objective, it is important that UNC Charlotte's model is delivered following a LoD specified by the Universities BIM/VDC Manager in an approved [MDS](#).

UNC Charlotte welcomes the use of the Level of Development for BIM/VDC deliverables as defined by the 2017 Level of Development Specification by BIM/VDC Forum. As UNC Charlotte specific information will be added to the Design and Construction Models, the Record Model will consist of many LoD 350 components. This number refers to a LoD 300 for those items defined in the MDS and delivered at the Construction Document Phase. The 50 represents the more specific supplemental equipment and facilities metadata and As-Built construction changes that may have been included in the Record Model. Supplemental metadata during construction is required to be entered via the approved Field Asset Management application. The Contractor/CM shall coordinate this process with UNC Charlotte in the BXP-C.

During Construction and Coordination modeling the Contractor/CM and Sub-trades should use LoD 400 on elements requiring a high level of spatial coordination or constructability review. For questions related to LoD please review the latest [BIM/VDC Forum/AIA Level of Development Specification](#) for additional information.

6.9 Model Quality

Discussions regarding processes and best practices to ensure Quality should be reviewed at the Kickoff Orientation as a project team. At project milestones mentioned earlier in these requirements, the model and metadata will be reviewed to confirm that each model and its corresponding metadata/documents are being developed in accordance with the UNC Charlotte's intended use. The goal is to support each team member and verify that the processes are being followed throughout the timeline of the project, that there are no unresolved issues during construction and that there are no issues that may result in a significant loss of metadata upon exchange of information.

The Team shall establish and use in-house modeling quality control guidelines and exchange protocols. Good BIM/VDC practices may include but are not limited to:

- Use of element and component objects that embed the best practices of the firm.
- Maintenance of parametric linkages within the model at all times.
- Dynamic Search Sets as opposed to Static Selection Sets
- Use of UNC Charlotte defined nomenclature from the Equipment Standards Matrix.
- Use appropriate and interoperable viewing, checking, and output file formats.
- Review of a random 15% of model components, metadata and documentation for compliance.

UNC Charlotte will provide Issue Reports back to the Design and Construction Teams when variations or incorrect modeling and/or data collection procedures are not followed per these requirements.

--- END OF SECTION ---



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Lifecycle Management

7.1 Integrated Workplace Management System (IWMS)

The Computer Aided Facilities Management (CAFM) portion of the application helps UNC Charlotte improve space efficiency and evaluate the true costs associated with space usage. The reports resulting from a space management analysis will reveal how each square foot of space is being allocated which can enable a highly granular chargeback process. This can, in turn, improve reimbursement rates from third parties who require accurate and defensible space allocation and occupancy reports. With Space Management, organizations can easily satisfy these needs and better plan for current and future space needs across the organization.

The Computerized Maintenance Management System (CMMS) portion of the application allows UNC Charlotte to cost-effectively manage on demand or preventive maintenance (PM), improve internal and outsourced service provider performance, and simplifies forecasting and budgeting. Building Operations Management puts all of those capabilities—and more—easily within reach so the organization may gain more control over workload.

UNC Charlotte intends to integrate the final deliverable Record Model into a Lifecycle Management solution. In order to meet that objective, it is important that the data guidelines presented in this document be followed so it can be validated by the Owners IWMS. The integration of the Record BIM/VDC data into an IWMS is critical to UNC Charlotte's O&M procedures. Electronic data already in the model allows the FM team to start planning for building start up and tracking building operations; instead of spending time "catching-up" with data entry after taking control of the building. Any additional BIM/VDC advice or data collection opportunities that the AEC Team might be aware of or can be provided during the process are welcomed.

7.2 IWMS Construction Data Collection

Field Asset Management applications enable users to leverage Equipment and their attributes (i.e. name, type and manufacturer). Using a mobile device in the field as well as web-based applications that are dynamically updated as work and operations progress allowing the entire team to review the project at any time. Users do not need to see the BIM/VDC while entering data as part of this workflow.

Equipment related metadata should be uploaded to the Field Asset Application as made available during construction so the information can be reviewed by the AEC Team, Cx Team Members and the Owner's Facilities Maintenance team. The purpose is to create a more collaborative team approach and to collect equipment data and documentation throughout construction, not just at the end of the project. Metadata within the Field Asset Application is to be utilized to manage equipment during construction in preparation for Lifecycle Management. These documents and metadata inside the Field Asset Application can then be mapped to UNC Charlotte's IWMS for Lifecycle Management and Operations and Maintenance creating a Real-Time Data Collection Process.

Tracking of the materials and equipment are identified in the attached Exhibits, these assets have components and metadata to be tracked across all stages of the construction process. The Contractor/CM will be responsible for coordinating with the Owner and any other Consultants to ensure all custom metadata fields needed for Facilities O&M metadata are produced per these requirements. The QA/QC of models and metadata as well as the metadata mapping integrations is the responsibility UNC Charlotte's BIM/VDC Manager.

Tracking electronic information by barcoding is part of UNC Charlotte's business and usual process and the University is now extending that into the Construction and VDC process as well. Using Owner supplied barcodes the Contractor/CM is required to track materials and assets with the Field Asset Management Application throughout the installation and into building handover. By attaching barcodes to the Equipment Assets, the team will track and update the progress and metadata of these components and can directly access information about the asset. This process further prepares the database for Lifecycle Management tracking for UNC Charlotte.



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7.3 Barcoding Requirements

The proper scheduling and association during the construction project is key to a successful process of allowing the barcode to be utilized in all phases of construction as well as O&M. Two areas of importance to focus on throughout the process is the individual placement of the tag and when the association with the tag begins. Installing generic barcodes, provided by the University, by the installer during the asset's installation has the best return on investment. A member of that same Trade Partners team or someone from the CM/GC team can then come through and quickly associate the barcode to the asset record, and/or model and collect additional information required. A good validation review during this process is for the Commissioning Agent to review when checking and commissioning the equipment.

A team meeting to review a label location standard for equipment is recommended because multiple people from the Trade Partner or CM/GC may be applying these labels. Without such standards each individual will determine what they think is best, leaving the owner to figure out that logic and search for labels each time they approach a piece of equipment. One universal standard set by UNC Charlotte is to not install the barcode label on a cover plate or any other type of removable cover. During construction and O&M, removable plates get lost, relocated and switched out, leaving an asset with no label or a label from another similar piece of equipment.

On a monthly basis, at a minimum, the Contractor/CM shall include UNC Charlotte and all BIM/VDC Managers in a coordination established for the purpose of assessing and/or executing FM data reviews and/or transfers from the construction process. Data transfers shall be coordinated with the UNC Charlotte BIM/VDC Manager and other project BIM/VDC Managers (when feasible) and be based on the FM objectives as defined. The Contractor/CM will be responsible for coordinating with the UNC Charlotte BIM/VDC Manager to ensure all custom metadata fields needed for Facilities O&M data are produced in the Field Asset Management Application. It will be UNC Charlotte's responsibility to integrate systems so that metadata is transferred to UNC Charlotte's IWMS and the attached asset documentation to the Digital Management Exchange Guidelines (DMEG).

--- END OF SECTION ---

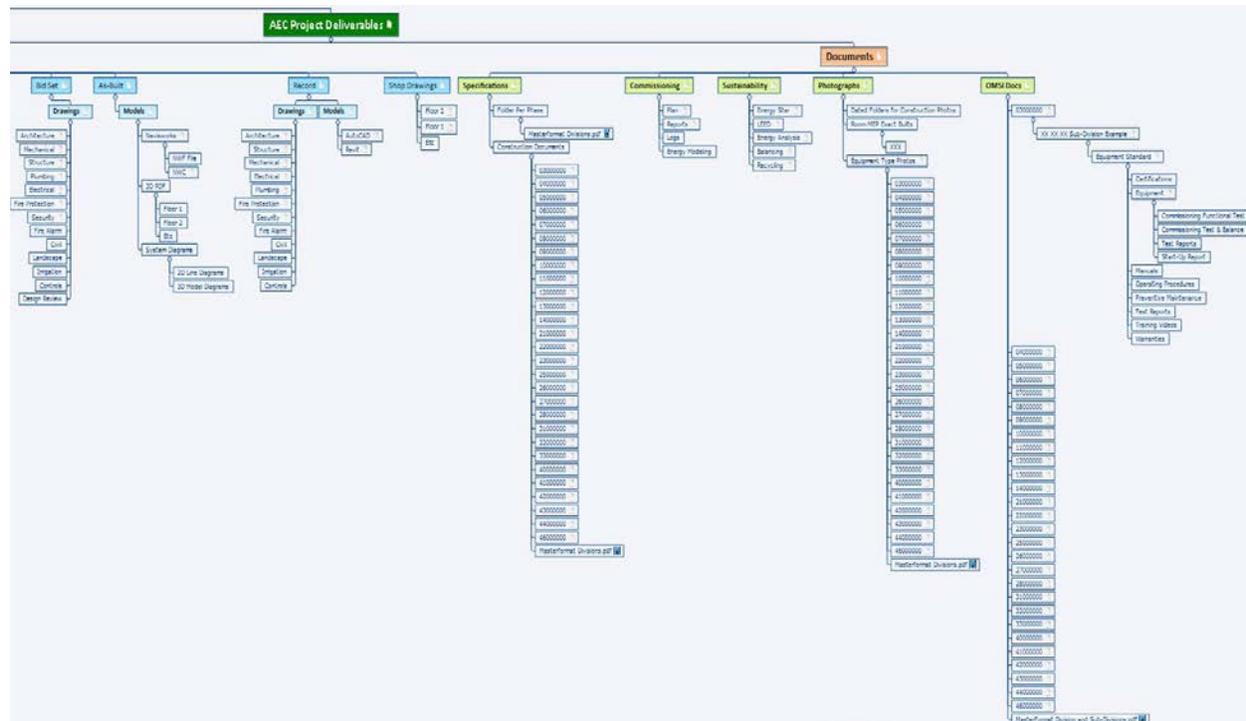


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Digital Management Exchange Guidelines (DMEG)

A Digital Management Exchange shall be established for the purpose of efficient and timely transfer of model, metadata and document files in an electronic process. Also, reference the 01 78 23 Spec Section in the Project Manual for additional information. UNC Charlotte’s Capital Projects deliverables have advanced beyond hard copy deliverables. UNC Charlotte seeks to advance the quality, timeliness and cost- effectiveness of the collection, input and maintenance of the facility information and be as paperless as possible in doing so. Further aiding this process is a deliverable standard that produces all design & construction documentation in a consistent format the Owner understands and receives on all projects. This electronic workspace is established for the purpose of efficient and timely transfer of information and a standard structure for deliverables to reside. The Contractor/CM is to obtain, file and store this data from the entire AEC Team based on UNC Charlotte’s required structure. For this process, UNC Charlotte will leverage a Cloud based platform for the design and construction team to file electronic documents per the DMEG. The contractor will have full administrative access to this cloud based project for their team and UNC Charlotte will only have read-only capabilities until building handover. If the contractor would like to leverage their own Cloud based document management tool the Contractor/CM will need to request this exception in their BXP-C. If so granted UNC Charlotte’s BIM/VDC Manager will provide the Contractor/CM with a [template folder structure](#) for the document exchange process. This folder structure has a direct relationship to the DMEG and should be exchanged with UNC Charlotte at the close of the project based on the process agreed on by the Contractor/CM and Owner outlined in the BXP-C.

2D documentation for the purposes of assembling a design or construction set shall be derived from the models. All BIM/VDC information shall be fully parametric so that all applicable information regarding fixtures and/or elements can be generated for the schedules. Also, refer to *Exhibit 8-Digital Management Exchange Guidelines*.



(Exert from the DMEG Folder Structure)

--- END OF SECTION ---



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Appendix

[Exhibit 1 - BIM Execution Plan \(BXP\)](#)

[Exhibit 2 - Space Mapping and Responsibility Matrix](#)

[Exhibit 3 - Space Assets](#)

[Exhibit 4 - Equipment Mapping and Responsibility Matrix](#)

[Exhibit 5 - Equipment Assets](#)

[Exhibit 6 - Equipment Asset Details](#)

[Exhibit 7 – Equipment Specific Asset Details](#)

[Exhibit 7 – Exhibit 7 Excel File](#)

[Exhibit 8 - Digital Management Exchange](#)

[Exhibit 9 - Revit Shared Parameters File](#)