BUILDING STANDARDS

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TABLE OF CONTENTS

		REMARKS	PAGES
	Executive Summary and Intent		3-15
DIVISION 1	General Requirements		16-23
DIVISION 2	Existing Conditions		24
DIVISION 3	Concrete		25-26
DIVISION 4	Masonry		27
DIVISION 5	Metals		28
DIVISION 6	Wood, Plastics, and Composites		29
DIVISION 7	Thermal and Moisture Protection		30-33
DIVISION 8	Openings		34
DIVISION 9	Finishes		35-41
DIVISION 10	Specialties		42-44
DIVISION 11	Equipment		45-46
DIVISION 12	Furnishings		47
DIVISION 13	Special Construction		48-49
DIVISION 14	Conveying Equipment		50-52
DIVISION 21	Fire Suppression		53-57
DIVISION 22	Plumbing		58-64
DIVISION 23	Heating, Ventilating, and Air Conditioning (HVAC)		65-80
DIVISION 25	Integrated Automation		81-187
DIVISION 26	Electrical		188-200
DIVISION 27	Communications		201-210
DIVISION 28	Electronic Safety and Security		211-213
DIVISION 31	Earth Work		214
DIVISION 32	Exterior Improvements		215
DIVISION 33	Utilities		216

APPENDIX "A" CONSTRUCTION SERVICES GUIDE
Division of State Fire Marshall-Bureau of Fire Prevention
(http://facilities.fiu.edu/Documents/Forms_Standards/APPENDIX-A%20Construction%20Services%20Guide.pdf)

APPENDIX "B" Design Guidelines for Sound Control
Included by reference: AMERICAN NATIONAL STANDARD ACOUSTICAL PERFORMANCE CRITERIA, DESIGN REQUIREMENTS, AND GUIDELINES FOR SCHOOLS ANSI S 12.30-2010/ Part 1.

APPENDIX "C" FIU Media Standards
(http://facilities.fiu.edu/Documents/Forms_Standards/Classroom%20AV%20standards.pdf)
(http://facilities.fiu.edu/Documents/Forms_Standards/Conference%20AV%20Standards.pdf)

APPENDIX "D" Landscaping and Irrigation Manual
(http://facilities.fiu.edu/Documents/Forms_Standards/APPENDIX-D%20Landscape%20and%20Irrigation%20Manual%20-%20November%202018.pdf)

APPENDIX "E" FIU Standards Details
(http://facilities.fiu.edu/Documents/Forms_Standards/APPENDIX-E.pdf)

APPENDIX "F" Hardware Standards
(http://facilities.fiu.edu/Documents/Forms_Standards/FIU_Hardware_Standard.pdf)

APPENDIX "G" BIM Standards
(http://facilities.fiu.edu/Documents/Forms_Standards/FIU_BIM_Standard_120814.pdf)

DIVISION ES – EXECUTIVE SUMMARY AND INTENT

0.1 PURPOSE The Florida International University Building Standards are furnished as a guide for Design Professionals providing services to the Owner (herein referred as Florida International University, FIU or the University). As of 2007, an initiative has been undertaken to update & revise to current Disaster Resistant University practices and to incorporate sustainability initiatives. This document is under review and subject to revision by staff. It is intended to assist Design Professional in fulfilling both its respective contractual and professional responsibilities. These Building Standards are incorporated by reference into the Owner-Architect Agreement, and are organized in the traditional CSI (Construction Specifications Institute) divisions of the Work as well as addressing sequence of services, from schematic design through the warranty period of a project. The University is in no way attempting to place undue restraints on Design Professionals; rather it seeks to permit design latitude necessary to develop the program. However, deviation from these standards will be permitted only with written justification and approval by the Associate Vice President for Facilities Management.

0.2 INTENT

The facilities which support the University's academic mission are critical in both function and their relation to the environment. The challenge is to impart a cohesive image of the "feel" of a university. Design and construction of new facilities at FIU is an exciting, dynamic, and challenging undertaking addressing the needs of multiple stakeholders and users with varied and at times conflicting concerns. Such considerations include, but are not limited to:

A. **Cost** – project must be in compliance with the Owner's stipulated budget.

B. **Scope** – compliance with and delivery of project meeting if not exceeding the agreed-to scope of work in full support of the academic program for which it is intended.

C. **Time** – time is of essence. The Design Professional shall provide for the timely completion of all submittals and/or work product which its Agreement for Services calls for.

D. **Constructability** – design shall be consistent with local current construction market capabilities. The Design Professional shall provide a design based on a 50 year facility life cycle based on durability of materials, sustainable design parameters, ease and economy of maintainability & efficiency of systems components.

E. **Disaster Resistant University (DRU)** – the design shall strive to reduce or mitigate potential vulnerabilities. Even though building codes addresses specific considerations for projects in the HVHZ High Velocity Hurricane Zone (See current edition of Florida Building Code) the Design Professional is instructed to look beyond and submit suggestions for the Owner's approval which would reduce the university's exposure to hazards (e.g. hurricanes).

F. **Operational Efficiency** - energy efficiency, air quality, weather- tightness, and other sustainable considerations. FIU ranks as one of the most efficient users of electricity amongst other state agencies in the State of Florida. Specific requirements as to interphase with the University's Building Management System, lighting controls, equipment efficiencies may be found in the technical sections of these Standards. As resources of potable water become more limited and energy costs escalate, the challenge to the Design Professional is to envision passive ways to mitigate these challenges.

G. **Safety and security** – the design should address safety and security of the university students, faculty, and staff.

H. **Aesthetics** - working within a sprawling urban context, siting, footprint, density and compatibility issues are critical in addressing existing adjacent facilities. The resulting design shall strive to enhance the diverse fabric of a "University context" seeking common vocabulary of references contributing to a vision of a physical environment identifiable as a university.

I. **Accessibility and paths of circulation / traffic** - awareness of and compliance with applicable codes and standards must address not just ultimate built conditions, but must be cognizant of the impact of construction activities. Segregation of vehicular traffic, bicycle traffic, service, trash disposal and public pedestrian paths must be anticipated by the Design Professional.

K. **Evolving technology and its impact on facilities** – design professional must provide a design which allows for evolving technology and the capacity for necessary future changes.

The design team will produce concepts and systems that address these and other factors in a timely and flexible design solution.

0.3 DEFINITIONS

A. **Owner**- refers to Florida International University, FIU, or the University as may be referenced interchangeably in this document.

B. **FIU Project Manager** - the primary point of contact for Design Professionals and Builders is the FIU Facilities Construction Project Manager (FIU PM). This position serves as the Owner's agent and customer liaison with end-users, providing leadership and guidance on all aspects of the project. All project-related communications, meetings, and actions shall be routed through the FIU PM, inclusive of submission of invoices and project progress payments, potential changes or variances, impacts to the budget or schedule, and dealings with other agencies, both internal and external to FIU.

C. **Building Code Administrator** - any construction, remodeling, or renovation of facilities within university property is subject to the most current edition of the Florida Building Code. All construction building permits are issued by FIU. Permits are issued by one of two methods; by affidavit or by the traditional process of plans review and inspections using in house staff or consultants. Any licensed Contractor performing work shall obtain all permits from the Code

Administrator (BCA).

D. **Design Professional -** refers to the team of professionals who collectively produce design and construction documents, studies, surveys or other instruments of professional services wherein they serve as the Architect or Engineer for their respective professional licenses in conventional Design/Bid/Build, Construction Management, or Design/Build delivery methods. For purposes of this document the term Design Professional is used interchangeably with Architect and/or Engineer of Record unless otherwise specified.

E. **Builder** - refers interchangeably to a General Contractor, Construction Manager, as well as Design/Build Lead unless otherwise specified.

0.4 ROLE OF OWNER

FIU may provide programmatic guidance, funding information, design review assistance, construction permitting, and general oversight, coordination, and management of the project. The Facilities Planning Department – www.facilities.fiu.edu – is specifically charged with managing the Capital Budget Request Process, Design Professional Selection and contract negotiations, carrying a project through schematic design. Facilities Construction and the designated FIU Project Manager manage all major capital construction as well as Minor Projects which may consist of remodeling / renovation projects from inception through warranty.

The Design Professional shall comply at all times with the provisions contained in the FIU Building Standards, the State University System Professional Services Guide and the Cost Containment Guidelines of the State University System. In the event the Design Professional determines that the best interests of the University would be served by deviating from the guidelines, it shall deliver to the FIU PM a written statement requesting a waiver of the guidelines and substantiating rationale. The Owner may grant or withhold waiver of the guidelines in its discretion. No waiver made by the Owner shall be effective unless in writing, and the waiver of a particular guideline shall not be deemed a waiver of such guideline in a subsequent project unless otherwise provided in the waiver. In the event of an irreconcilable difference between the guidelines and the written agreement between the University and the consultant, the Design Professional shall, in writing, request the Owner to clarify such conflict.

Technical review of the Design Professional's submittal(s) by FIU staff does not constitute a waiver of requirements contained within the referenced guidelines. The Design Professional shall submit to the Project Manager a completed listing all deviations proposed by the Contract Documents together with a rationale.

Said review does not constitute an exhaustive, detailed analysis of all conditions described in the Contract Documents. Reviews shall serve to highlight specific concerns of Facilities staff as well as other University staff and is thereby limited in its scope. The Design Professional(s) shall respond in writing explaining actions taken in response to each area of inquiry or comment. Responses shall be submitted via hard copy as well as an electronic media format to the Project Manager.

0.5 ENTITIES HAVING JURISDICTION

Other entities that do or may play critical roles in FIU's design and construction projects, and with whom the Design Professionals must interact in coordination with the FIU PM, include:

A. **State Fire Marshal (SFM)** - authority having jurisdiction on matters related to fire and life safety, compliance with Florida Fire Code, plan review, and inspections at 50% and 100% construction completion. All State Fire Marshal inspections shall be arranged and coordinated with the BCA. Requests shall be forwarded by e-mail to the Code Compliance Coordinator's attention. No Building Permits are issued by the BCA until the SFM has released the Permit Set. The SFM must further issue its approval prior to issuance of Final Certificate of Occupancy by the BCA.

B. **Miami-Dade Water and Sewer (MDWASD)** - jurisdictional authority for sewer and water allocation.
Consistent with concurrency requirements of Florida Statutes §163.3180, the Design Professional shall request on behalf of the Owner an allocation letter from MDWASD. In order to minimize delays in issuing permits for facilities requiring new or expanded water/sewer services, the Design Professional shall submit the request as soon as practicable, during the Schematic Design phase of a Project. Design Professional and Consultants shall coordinate all contacts, requests for allocations, information requests with the agency directly.

C. **South Florida Water Management District** - jurisdictional authority over wells.

D. **Florida Department of Environmental Protection** – jurisdiction over all state mandated environmental regulations.

E. **Miami-Dade County Health Department** - jurisdiction over all food preparation and service areas.

F. **US Army Corp of Engineers** - jurisdiction over any coastal construction at the Biscayne Bay Campus.

G. **AHCA Agency for Health Care Administration** – Office of Plans and Construction responsible for reviewing plans and supervising construction of all hospitals, nursing homes and licensed ambulatory care centers.

H. **City of North Miami** - jurisdictional authority for sewer and water allocation for the Biscayne Bay Campus. Design Professional and Consultant shall coordinate all contacts, requests for allocations, information requests with municipal government directly.

I. **Facilities Management Building Code Administrator** - building code enforcement and building construction permitting authority; liaison with SFM; provides regular construction inspection upon request and grants Construction Permits and Certificates of Occupancy;

J. **Environmental Health & Safety (EH&S)** - provides miscellaneous services such as Hot Work Permits on existing occupancies, indoor Environmental Quality, and consultation on occupational safety, hazardous materials, industrial hygiene, and radiation control.

K. **Facilities Management Maintenance and Operations** - management and maintenance entity for all grounds and facilities - provides programmatic guidance for necessary extensions or upgrades to utilities infrastructures; provides design review input, and coordination of utility outages.

L. **FIU Police Department** - may provide design review input on matters related to security and Emergency Operations.

M. **FIU Division of Information Technology (DoIT)** - provides design review input on information technology, and telecommunications standards.

N. **FIU Space Committee** - provide programmatic phase review and approval of campus projects as they relate to compliance with the adopted Campus Master Plan, academic programs, and space allocations within university facilities.

Projects requiring Space Committee approval and requiring a building permit for construction as determined by the Building Official, must be approved by Space Committee before a permit will be issued.

Detailed information about these guidelines and departments and their relationship to design and construction can be found on the FMD website at: http://facilities.fiu.edu/Documents/Planning/REQUEST_FOR_SPACE_ASSIGNMENT_FINAL_04-23-2015.pdf

0.6 PROCESSES GOVERNING DESIGN AND CONSTRUCTION

This procedure outlines the University's processes governing the design and construction of facilities.

0.7 CONSTRUCTION PROJECT PLANNING

A facilities project plan involves three interrelated elements:

1	S	Scope (program)
2	B	Budget
3	T	Time

The goal of project management is balancing these three elements to provide a facility on time, within budget while meeting the user's needs.

A realistic assessment of a project's feasibility recognizes that an owner can control only two of these elements at any given time. If the budget and time allocated for constructing a project to the desired level of quality are a constant, then the size of the project must be recognized as a variable. A fixed budget adhering to the university's standards of quality results in project that must be reduced in terms of its size to remain within the budget. Failure to design within

university standards compromises the ability to properly maintain facilities within funding Maintenance & Operations formulas.

The project team includes:

1. **The User** (Client) -the primary user is the client on the project.

2. **The Design Professional** (Consulting Architects and/or Engineer).

3. **FIU Facilities Construction Project Manager** (PM)

4. **The Construction Manager or General Contractor** - throughout the text, the term Contractor is used for both the construction manager and the general contractor.

5. Other entities as deemed by the FIU Project Manager.

The User is responsible for clearly stating the requirements of the project through academic plans, campus master plans and program specifications. During the project development, the user provides input related to the scope, size and quality of the facility, as well as the desired completion date of the project. The end user, as the client, is identified as the dean, department chairperson, or designee. One individual must be empowered to speak on behalf of the program users as their representative.

The Consulting Architect is the team of architects and engineers selected by the University responsible for developing a facilities solution as articulated by the Construction Drawings and Specifications (the Project Construction Documents) that meets the user's scope requirements.

FMD's Facilities Construction will manage the project in an effort to achieve the user's desired goals regarding scope of work, budget and time frame. The FIU PM acts as the project team leader as the end user's representative on behalf of the University. This position serves as the liaison and sole point of contact between user, Design Professional(s) and Contractor. As team leader, the PM may assist the user in clarifying and defining the project requirements.

The Construction Manager or General Contractor team member is the entity responsible for construction of the facility.

The general tasks required for facilities development include, but are not limited to:

1. Facilities (Comprehensive) Master Plan, including the Capital Improvement Program (CIP) and other funding source requests as mandated by Rule
2. Budgeting
3. Programming
4. Schematic design
5. Design Development
6. Construction Documents
7. Bidding
8. Construction

9. Move-in
10. Warranty period
11.

08. MASTER PLAN

FACILITIES COMPREHENSIVE MASTER PLAN, INCLUDING THE CAPITAL IMPROVEMENT PROGRAM (CIP), EDUCATIONAL PLANT SURVEY AND OTHER FUNDING SOURCE REQUESTS

The University's facilities needs are identified through an Educational Plant Survey and comprehensive Campus Master Plan, conducted every five years and managed by FMD's Facilities Planning Department. The planning process begins with an inventory of all University sites, facilities and rooms. Each space is identified as to one of the following 9 space categories: Classroom, Teaching Lab, Research Lab, Office, Auditorium/Exhibition, Instructional Media, Study (includes Student Academic Support), Gym and Campus Support. For each space, the inventory lists the net assignable square feet, condition (as satisfactory, requiring renovation/remodeling, or unsatisfactory), and the program or function accommodated within the space.

Using five-year capital outlay full-time-equivalent (CO-FTE) student enrollment projections and space category formulas, total square foot projections are developed for each campus. Survey recommendations are developed by subtracting the University's existing inventoried spaces from the total needs. The survey makes recommendations for site acquisitions, development and improvement, remodeling, renovation, and new construction for sites and facilities owned by the University. Recommendations also include provisions for correction of defective building components and safety deficiencies, and modifications required for compliance with the safety requirements and standards established by University practices, applicable laws, and building code requirements. Some types of projects, such as student housing, athletic and recreational facilities, and Public-Private-Partnerships are not based on the Educational Plant Survey. Instead, they may be based on special market studies, student input, and private funding opportunities.

The Campus Master Plan identifies facilities needs by project category and suggests the budget amount and sources of funds requested for each project. The Master Plan summarizes the physical needs of the proposed academic plan and coordinates with local municipal and county governments to address concurrency requirements and public services in accordance with State Statutes. The Master Plan may include strategies for locating the program components in facilities at the site and a facilities phasing plan. All projects in the Master Plan must be survey-approved to receive State Public Education Capital Outlay (PECO) funding. Projects must meet certain requirements to be eligible for operations and maintenance funding from the State.

Revision to the academic plan or project requirements after the Master Plan has been approved may require an amendment or even a new master plan. Examples are a new program or a comprehensive change in land use that trip thresholds in allowable changes in density or intensity of use.

Approvals:
Director Facilities Planning, Associate Vice-President Facilities Management, Senior Vice-President and Chief Financial Officer, Provost, University President, Board of Trustees.

0.9 BUDGETING

A budget is prepared based on meetings with the user to define the requirements for a project described in the Facilities Comprehensive Master Plan. The factors affecting budget in this phase are institutional resources and commitments. The project budget is composed of the following anticipated costs:

1. Land acquisition costs, surveys, environmental tests, and legal expenses;
2. Infrastructure to support the program requirements including site work and utilities, parking, fixtures, etc.;
3. Construction Costs;
4. Costs attributed to design professional fees, miscellaneous testing services
5. Telecommunications costs attributed to purchase and installation of telephone equipment and computer data outlets.
6. Furniture and equipment to support the program requirements.
7. Project contingency funds.
8. Any other indirect cost.

Project funds may be requested in the Comprehensive Master Plan from a number of sources:

1) State sources
a) Public Education Capital Outlay funds (PECO)
b) Capital Improvement Trust funds (CITF)
c) Critical deferred maintenance funds
d) Auxiliary Revenue Bonds
e) Joint-use funds (facilities to be shared with other State educational institutions);
f) Facilities Enhancement Challenge Grant funds (including 50 percent from private donations)
g) Student Health Fee Auxiliary Funds

2) Other sources
a) Federal, State and local funds (including grants)
b) Insurance funds (to repair/replace damaged facilities)
c) Private/matching funds Courtelis Matching Funds Program (this program is currently inactive)

§1013.79 F.S. The process begins with a statement of need for a facility for consideration in the master planning process for assessment and appropriate approvals. The statement of need should include University Advancement's assessment and support of the fund-raising effort. Facilities Planning translate the proposed need statement into a "Short Term Project.

Explanation and Budget Estimate," (CIP-3). The project and correlating matching funds request must be approved by the University's BOT to be included in the Capital Improvement Plan and legislative budget request. Private funds must be

raised for half of the project budget and deposited into university accounts by the end of the calendar year. A report of projects for which funding has been raised is sent to the BOG in January for inclusion in the Spring legislative budget session. When State funding becomes available in August, the project can start and a contract can be awarded to the design professional team.
Approvals:
Dean, University Foundation, Vice-President of Information Technology and Chief Information Officer, Senior Vice-President and Chief Financial Officer, Provost, University President, University Board of Trustees.

0.10 DEFINITION OF PROJECT SCOPE & PROJECT PROGRAM REQUIREMENTS

Prerequisites for development of Project Program Requirements: Academic plan, included in Educational Plant Survey, Facilities Comprehensive Master Plan, and fund source(s)

The user prepares Project Requirement Specs, which are reviewed and approved by Project Program Committee. Facilities Construction may assist by initiating and/or facilitating planning meetings. Consultants may be retained to assist the user. Funding for the consultant(s) utilized must be arranged by the user or from the project funds. The user assigns a contact person with authority to make decisions related to the project's development. Facilities Construction assigns a Project Manager (PM) responsible for the overall management and coordination of the project. At the end of this step, the work may be assigned to a Continuing Contract Architect or Engineer, if the projected construction budget is less than $4,000,000 (Four Million Dollars) in construction value.

Overall size of the facility described by the Project Program Requirements must be within the estimated budget and Educational Plant Survey recommendation. If adjustments to project budgets are necessary, additional fund sources must be identified.

Program Definition / Budget Validation

- The initial phase of a project is crucial. The end user defines the project scope. The definition must be unambiguous as to desired objectives, scope of the work, and the project budget.
- The Project Team must reconcile facility needs and goals within the allotted budget at all project phases.
- Clearly defined budgets inclusive of hard and soft costs are mandatory. Inclusive of: construction, design fees, survey(s), inspection(s), construction testing & permitting, miscellaneous fees, FF&E, and contingencies, and Construction Service Reimbursement (CSR).
- If budget is insufficient to support educational program requirements, it must be recognized and addressed.
- When estimates do not match program, project teams must reach to establish achievable goals and project specifications.
- The ultimate goal is to strive for the achievement of maximum programmatic return without sacrificing quality.

Approvals:

Chair of Program Committee, Director Facilities Planning, Associate Vice-President Facilities Management, Senior Vice-President and Chief Financial Officer, Provost, University President.

0.11 ARCHITECTURAL PROGRAMMING

Items required for architectural programming:
Project Program Requirements, budget, and fund source(s)
Architectural programming services may be contracted to the selected consulting architect to provide Project Program Requirements. Facilities Construction may arrange for the consulting architect to meet with the user to define the project requirements in facility terms and present concepts, which will meet the requirements. The architectural program contains a narrative statement that includes tabulations of the rooms, area required, and estimated cost. Said services are considered an additional service to the agreement.

Overall size of the project described by the architectural program must be within the budget. The addition of program requirements requires a revision of the Project Requirement Specifications, an amendment and identification of fund source(s) to the project budget, and potential Master Plan amendments, if required, before proceeding.

Approvals:
Chair of Program Committee, Director Facilities Planning, Associate Vice-President Facilities Management, Vice-President of Information Technology and Chief Information Officer, Senior Vice-President and Chief Financial Officer, Provost, University President.

0.12 SCHEMATIC DESIGN

Prerequisites for schematic design:
Project Program Requirements, budget, and fund source(s)

Schematic Design consist of two phases: Conceptual Design and Advanced Schematic Design. The consulting architect presents options on the basic shape and organization of the facility as required by the Professional Services Guide, the Cost Containment Guidelines and the University's Building Standards. Locations of departments and major functions are determined. Forms and appearance of the project are established and approved. The footprint of the building is described, and the height of the building is determined. The exterior character of the building is generally determined. Overall size of the project described by the schematic design must be within the budget. The schematic design must contain all the primary elements of the Project Program Requirements. Deletions or additions to program requirements must have written approval of the user. Revisions to the Project Program Requirements prompted by changes in program requirements must be approved before proceeding.

If any of these changes increase the project budget, or require Educational Plant Survey amendments, fund sources must be identified and the changes must be approved. Changes beyond the schematic design phase will cause the University to incur additional costs beyond those outlined. Pre- construction services may be

required of the construction manager.

Estimated cost of the schematic design must be within the budget. The Senior Vice-President and Chief Financial Officer must approve estimated costs that exceed the budget. Approval by University President required as to the design's concept and intent.
Approvals:
User, Facilities Construction Project Manager, Director Facilities Construction, Associate Vice President Facilities Management, Senior Vice-President and Chief Financial Officer, Provost, University President.

0.13 DESIGN DEVELOPMENT

Prerequisite for design development: Schematic design

The final scope (size and quality) of the project, and relationships, including the location of rooms with room numbers, furniture and equipment in the rooms, are established. At the start of design development room numbers are assigned, reviewed and approved by FIU. Room numbers must follow FIU room numbering guidelines. FMD staff reviews and approves the project for maintenance and operations standards. Changes in the elements approved in the schematic design (i.e., locations of departments and major functions, footprint, height, exterior character) will result in a delay of the project and additional costs. Estimated cost of the facility described in design development must be within the budget.

Approvals:
User, Facilities Construction Project Manager, Director Facilities Construction.

0.14 CONTRACT DOCUMENTS

Prerequisite for development of contract documents: Design development

The consulting architect prepares contract documents describing the project for the bidding and construction phases. The user's role at this stage is to confirm and clarify the project requirements established during schematics and design development. Estimated cost of the project must be within the budget. Changes in the elements approved in the design development (scope, relationships, forms, appearance, room location and furniture layout) will result in a delay to the project and additional costs. Projects that exceed the budget may proceed only if approved by the Senior Vice-President and Chief Financial Officer.

Approvals:
Facilities Construction Project Manager, Director Facilities Construction, Associate Vice President Facilities Management.

0.15 BIDDING

Prerequisites for bidding or acceptance of a guaranteed maximum price:

Approved Contract documents and construction permits by State Fire Marshall and other jurisdictions having authority and the University Building Official.

Bids that are over budget may delay the project as additional approvals to proceed and/or negotiations are completed. If redesign is required to bring the project within budget, additional time and funding will be required.

Approvals: Purchasing (for Bid Projects only), Senior Vice President and Chief Financial Officer for Finance and Administration, University President (for Construction Management Projects in the form of a Contract Amendment accepting GMP Proposal).

0.16 CONSTRUCTION

Prerequisite: Bidding, Building Permit(s), Notice of Commencement

To ensure proper contract management, no individual is authorized to meet or discuss the construction progress or changes with the contractor or the architect without the Facilities Project Manager. Design-based change orders may result in additional fees from the consulting architect to document the changes. The Facilities Project Manager may arrange meetings with the user, consulting architect and contractor to discuss progress of the work. Except for construction-related personnel, no individuals should enter a construction site without prior approval by the contractor.

The construction schedule is the responsibility of the contractor. Change orders, including design-based change orders, may cause delays. The University should avoid any action that may result in an extension of time.

As the project nears completion, systems of the project (HVAC, data network, etc.) are started and tested to make sure they meet the requirements of the contract documents. Work to be performed by the University is completed toward the end of this phase, such as installing furniture. The facility is inspected by the authorities having jurisdiction to ensure compliance with applicable building codes. The contract documents outline the requirements for substantial completion. This is generally the point at which only administrative contract requirements remain and final inspection by the State Fire Marshall and Certificates of Occupancy or Completion are issued by the University Building Official. The contractor's warranty period begins on the date of substantial completion.

Approvals:
Facilities Project Manager, State Fire Marshal, University Building Official and the Architect/Engineer of Record.

0.17 MOVE-IN

Prerequisite: Executed Certificate of Occupancy or Use

Construction work is substantially complete and all life/safety issues are satisfied. The user moves in and begins using the facility. FIU's Academic Space Management performs a walk through to confirm all room layouts, room numbers and room use codes for the FIU space file data base. The Facilities Project Manager may organize and facilitate a post-occupancy evaluation of the facility with users, the architect of record and other appropriate staff.

0.18 WARRANTY PERIODS

Prerequisite: Substantial Completion

The standard construction warranty period is one year from the date of substantial completion. Some elements of the work may have a longer warranty. Facilities Management will respond to all requests by the user, for service and will forward warranty requests to the Contractor with copies to the Facilities Project Manager. The contractor will be notified to correct all issues that are contract-related. Non-contract-related issues may be new work and require new funding. The Facilities Project Manager, Facilities Management, and the user will participate in a warranty walkthrough within eleven months after substantial completion. Facilities Construction may send out surveys to the users of the project as part of a post-occupancy evaluation.

DIVISION 1 – GENERAL REQUIREMENTS

1.01 SPACE REQUIREMENTS

A. Classrooms

Classroom Building Standards can be found on the FIU Space Management website: http://asm.fiu.edu/classroom_design.html

B. Offices

Offices shall be designed according to the latest edition of the Florida Department of Education State Requirements for Educational Facilities.

Offices should be arranged in such a way that the rooms can be assigned and used with flexibility according to present and future needs.

Office space should be planned and partitioned on a modular basis coordinating ceiling systems with fenestration, lighting, heating, ventilating, and air conditioning supply and controls and other utilities to permit quick and economical remodeling. In particular, office areas should be designed to allow the addition or removal of partitions with minimum loss of services to any of the adjacent areas.

Assignments of offices to specific departments, or units, shall always be subject to change as functional requirements dictate. The physical planning must facilitate this need.

The offices will be used primarily for studying, preparing lectures, preparing and correcting examinations and papers, and conferring with students. Generally, the conferences will be with individual students, infrequently two or three students. Acoustical privacy is essential.

Faculty offices should be arranged in departmental clusters and should be segregated from the classroom areas, but must be conveniently accessible to students for conferences. The offices should be well lighted (adequate artificial lighting and a large outside window).

The Dean's Administrative Suite and each faculty office shall be provided with electrical conduit for media and data in addition to standard electrical duplex outlets.

Partitioning between offices adjacent to the corridor should be sound retardant with closure above ceiling to structural slab above.

Refer to Appendix "B" for sound level design guidelines in offices.

C. Laboratories

The basic design concept of the laboratories is that they facilitate total involvement of students and faculty for learning and research.

Noise attenuation and visual communication are primary environmental and technical design considerations in all laboratories. Refer to Appendix "B" for sound control design guidelines.

Additional considerations include:

1. Research Labs of a building should be remotely located from the building principle entrance(s) and egress areas.

2. In Instructional Labs, provide fluorescent or LED ceiling lighting, evenly distributed, with dimmer control to accommodate AV requirements.

3. All laboratory electrical systems shall be tested for function and operation before use.

D. Audio-Visual Media: See Appendix "C"

E. Acoustic Design

Special attention should be given to resolving sound transmission problems at all offices and instructional spaces (classrooms and laboratories), i.e. sound created by the mechanical system and sound attenuation and transmission at partitioning including doors and spaces above suspended ceilings. Particular attention must be given to sound reverberation qualities within lecture and classroom spaces. (Refer to Appendix "B" for sound control guidelines).

F. Computer Spaces

Provide for rigid humidity and temperature control. Refer to detailed space requirements of specific building programs.

G. Roof Access

Access must be provided to all roof areas. The doors shall be on the Roof Master Key only. Egress from the roof must be possible at all times without the use of keys. Design preference on roof access shall be via a stair case extended to the roof. Alternate means may be provided via an inclined ship ladder and access hatch through a secured room not accessible to the general public.

H. Security

Keying and access control shall accommodate all building functional needs for user convenience as well as building security, and shall comply with current FIU Hardware Standards (Refer to Appendix “F” - Hardware Standards). All rooms are to be lockable. Generally, restrictive building circulation elements, such as corridor security gates, in addition to door keying systems, shall be determined in an early stage of project development.

Door hardware should be of high quality. The key system shall be integrated with the present campus keying system.

The A/E should coordinate floor plan room numbering with University-wide standards at the beginning of the Design Development Phase (Refer to Division 10 Specialties).

I. **Telephones (by FIU)**

Refer to Division 27 Telecommunications Wiring Standards and Design Construction Procedures.

J. Restrooms

All restrooms shall follow FIU Standards for plumbing fixtures and accessories.

1.02 BUILDING REQUIREMENTS

A. Codes and Standards

1. The design professional of record shall ascertain and ensure the project's conformance to the latest edition of applicable building codes and standards. In case of conflict, consult the University Building Code Administrator (BCA). Written approvals shall be obtained when required from the State of Florida Fire Marshal, Miami-Dade County Water and Sewer Department, other agencies as necessary as well as utility companies such as Florida Power and Light Company.

   a. Florida Building Code (Including Related Specialty Codes; Energy Conservation, Plumbing, Mechanical, Fuel Gas, Accessibility and Test Protocols for HVHZ's (High Velocity Hurricane Zone), latest edition.

   b. Other Codes and Agencies having jurisdiction:

      (1) Florida Fire Prevention Code, latest edition

      (2) NFPA Codes & Standards, including but not limited to;

      NFPA 101 (Life Safety Code), latest edition

      (3) Agency for Health Care Administration (AHCA) – refer to http://ahca.myflorida.com/MCHQ/Plans/Hospitals and other Licensed Facilities - Chapter 59A-3.080 FAC

      (4) Safety Code for Elevators, dumbwaiters, escalators and moving walks A17.1- / CSA B44-07 (ASME)

      (5) State Fire Marshal

      (6) Florida Department of Transportation

      (7) South Florida Water Management District

      (8) SMACNA

      (9) Army Corps of Engineers

      (10) ASCE 7-10 Minimum Design Loads for Buildings and Other Structures

(11) Florida Department of Environmental Protection – NPDES (Rule 62-621.300(6), Florida Administrative Code (FAC)

(12) ASHRAE 15-2004 and 62.1-2004

c. Highlighted applicable Florida Statutes:

(1) Local Enforcement Agency. Florida Statutes, § 553.71.

(2) Authority of University Building Code Administrator to enforce the Florida Building Code and the Florida Fire Prevention Code. Florida Statutes, § 1013.371(2).

(3) State Fire Marshall Inspection of state buildings & premises; tests of fire safety equipment; building plans subject to review and approval. Florida Statutes, § 633.085.

(4) University campus master plans and campus development agreements s.1013.30.

(5) Threshold Buildings. Florida Statutes, § 553.71

(6) Compliance with Local Ordinances. As a public university, all public educational and ancillary plants constructed by the FIU Board of Trustees are exempt from county, municipal, or other local amendments to the Florida Building Code, local amendments to the Florida Fire Prevention Code, or local ordinances, road closures or other impact fees or service availability fees. Florida Statutes, § 1013.371(1)(a).

2. The design of the facilities shall meet all requirements of the State of Florida Energy Life Cycle Evaluation criteria as approved by the University.

3. It is the express intent of this program to acknowledge this building as a continuum relating the existing and future developments on this campus, as outlined in the University Campus Master Plan, through the selection of design, materials, and systems utilized. Comprehensive systematizing of the campus complex provides energy and construction cost efficiencies, maintenance and repair savings by reducing replacement parts inventories and simplifying service needs, aesthetic cohesiveness, and overall life cycle cost savings based on existing plant experience.

4. Design of projects and infrastructure must be closely coordinated with plans of the existing structures, systems development, campus utilities development, and University Campus Master Plan for building development. The Civil Engineer of Record, as outlined in the FIU Campus Master Plan, Chapter 9 General Infrastructure Element, shall submit a signed and sealed statement with respect to the project's drainage system; that the impact of the new system to the existing drainage system has been evaluated, or that the project's drainage system has been designed with sufficient stormwater management improvements to handle all the runoff generated by the project on a stand-alone basis. All proposed drainage system plans have been reviewed & approved by the following;

- FDOT (when project is adjacent to an FDOT right-of-way),
- SFWMD

and furthermore, that the project's drainage system has been designed in accordance with

the following;

Miami-Dade County Public Works & Waste Management Department-Public Works Manual Section D4 Water Control, Code of Metropolitan Miami- Dade County, Florida, Chapter 11c, Development Within Flood Hazard District SFWMD-Permit Information Manual Volume IV Guidelines, FDOT-Drainage Requirements (when applicable)
The Civil Engineer of Record, shall at the end of the project, but prior to the issuance of a Certificate of Occupancy, submit a signed and sealed statement indicating the structure, as constructed, meets or exceeds the flood plain criteria defined in the FEMA document 44CRF-Part 60.

5. It is the policy of Florida International University to provide accessibility for the physically disabled in compliance with the provisions found in the Florida Building Code – Accessibility, latest edition.

B. ARCHITECTURAL PARAMETERS

It is the intent of all programs to define building standards and specifications which will ensure environmental sensitivity, construction materials quality, construction system efficiency, adherence to building codes and standards and awareness of University requirements to ensure functionality, ease of maintenance, energy efficiency and cohesiveness to the campus.

Design of any building must include review and updating of the Building Standards for either Campus. Review of this document will be coordinated with the University's Facilities Management staff. This document sets forth standards for construction materials, interior and exterior finish, paving surfaces, common building elements, accent materials, utilities, environmental and building systems landscaping and other design guidelines appropriate for this campus. Design of any project must be closely coordinated with plans of the existing structures, campus master plan and campus utility and development base maps.

In the development of conceptual design, careful consideration must be given to the following items:

1. Building Design should take advantage of prevailing breezes and the sub-tropical climate. Special consideration must be made for tropical rain and natural ventilation should be developed wherever practical and desirable based on initial costs, operating costs, energy conservation and the degree of environmental control required in various functional areas. Building design should eliminate need for excessive mechanical controls through the use of such design parameters as building orientation, sun control, breezeways, large overhangs, insulated exterior materials, etc.

2. Where applicable, weather protected floor level walkway connections are to be provided, with consideration given to future expansion. All Connections must be coordinated with design of adjacent buildings.

3. Careful consideration must be given to alternative means of accommodating level changes. The nature of the functions housed in all facilities requires that most of them be directly and conveniently accessible. Design should attempt to maximize vertical accessibility to all areas in buildings. Concepts to be explored include ramped walkways, exterior multi-level design and terracing. Where stairs are used, they must be prominent, inviting and readily accessible. It is not recommended to allow terraces over habitable spaces.

4. The A/E's attention to monitoring overall project costs, as well as costs of specific design

elements, shall be reviewed with the Facilities Management Department. COST CONTAINMENT IS UNDERSTOOD TO BE A MAJOR DEVELOPMENTAL WITH LONG TERM MAINTENANCE THE PRIME OBJECTIVE.

5. Interior finishes should be responsive to the traffic levels to which they will be subjected with recognition of the permanence of the institution and a desire for low maintenance. Hard or resilient floor surfaces shall be specified for high volume, public traffic areas. Specific room areas should be carpeted with strong, tight weave fibers, easy cleaning and/or repair. Wall surfaces in public traffic areas should anticipate wear and abuse due to student traffic volumes, use tough-wear paints.
6. Furnishings and equipment, interior finishes and color selections shall be coordinated with University Facilities Management personnel in design stages of project development prior to implementation.

7. Large glass areas that may cause sun and weather problems peculiar to South Florida should be avoided, but daylight illumination should be present on all floors for psychological reasons. Use of windows to permit views of the campus is encouraged. Building design should accommodate the use of windows on the North sides while limit the use on South and West sides. Windows should incorporate high quality glazing or film in order to reduce the amount of heat infiltration, but not of lighting, into the building. All windows must meet the South Florida Building Code Hurricane protection requirements without the use of shutters. Large-missile impact criteria is required for the full height of the building.

8. Public amenities (vending machines, water fountains, etc.) should be located in lcoves, so as to provide privacy and not interfere with traffic flow in corridors.

9. Consideration s h o u l d be given to providing an appropriate time capsule in the cornerstone of any new Building.

10. Vending areas shall be provided within the building at ground floor level. Provide space for recycling containers. All services (electrical, plumbing, floor drains, etc.) are to be included. Exterior vending areas shall be designed accordingly.

11. Provide copy rooms with electric service to accommodate copy machines located in administrative and faculty office areas of the building. Provide space for recycling containers.

12. There should be at least two (2) custodial workrooms for each 18,000 square feet or less of floor space. Each new construction and renovated facility must include two (2) custodial storage closet space of 160 square feet and a workroom on each floor of at least 80 net square feet. The custodial workroom must be located next to the restroom facilities and must be 10'minimum dimension and have a 36" minimum out-swinging double-doors with louvered vent covers. The custodial storage rooms must be located on the first level floor and must be 10'minimum dimension and have a 36" minimum out-swinging double-doors with louvered vent covers. All custodial workrooms and storage space must include: A floor mounted mop sink; one (1) additional plumbing floor drain; in addition to the faucets (hose bibbs) for the mop sink, a separate cold water faucet (hose bibb) is required for the sole use of a chemical dilution control system; mop racks over the sink; shelves (18" to 24" deep) for storing paper goods in case lots; industrial multi-outlet 6' power strip with 15A Max. Amps, and should have at least two (2) dedicated outlet (20 watt) for the purpose of charging floorcare equipment. All space within the building should be reachable from one of these workrooms without negotiating any stairways. For large floor areas, or separating wings or pods, provide closets as required to limit travel to 300 feet to a closet. In addition, provide space for extra furnishing, special setups, etc. Custodial closets should not include telephone panels, electrical panels, alarm system panels, pipe chases,

water heater, and roof access.

13. There should be a dumpster enclosure that can accommodate up to two (2) 6 cubic yard front loading dumpster at all new edifices. The enclosure must be in a location where waste collection vendor: can service it in a straight-line approach, does not have to back up vehicle more than 70 feet, and does not have to back up around corners and into traffic. The dumpster enclosure must allow at least 22 feet of overheard clearance and is clear of overhead obstructions for a minimum distance of 30 feet in front (i.e. electrical power lines, eaves, stairways, trees, etc.). The dumpster enclosure must be placed on 25 feet wide x 20 feet and 6 inches long concrete pad. The concrete pad must be able to withstand 10,000 pounds single wheel loads. The enclosure must be at least 25 feet wide x 10 feet long x 8 feet tall and have an 8 inches thick wall. The walls must be constructed with concrete blocks. The concrete blocks must be filled solid with grout and steel reinforcing bars in accordance with local building codes. The enclosure must have a minimum of 24 inches (2 – 3 feet) walk around area on the entire container. The enclosure must have ten (10) concrete pipe bollards. The concrete bollard must be 6 inches in diameter, set in concrete 3 feet below finished grade, extend 4 feet above finished grade, and painted OSHA regulation yellow. Six (6) of the concrete pipe bollards must be located 2 – 3 feet away from the back wall inside the enclosure to prevent the dumpster from hitting the enclosures walls. The other four (4) bollards are at the 90 degrees out swinging gates. Lastly, the enclosure must be closed by chain link gates with slats or steel frame gate with wood fencing. The gates must not be attached to the enclosure walls; they must be attached to separate galvanized poles on each side of the enclosure. Size of the poles depending on the span of the gates. Gates must have a locking attachment when open (stop and latches). Drawings are available upon request. Any deviations from the above should receive prior authorization from Facilities Operations.

14. There should be one storage room at least 200 net square feet per building dedicated for extra building material.

15. The A/E shall include in the project design, provided by FIU and installation by Contractor of an informational graphics, and/or signage system in accordance with University standards.

16. Roofing construction details shall be designed in accordance with the National Roofing Contractors Association Construction Details (latest edition) publication. Slope roofs minimum 1/4" per foot for positive directional drainage. New building requires parapets or flat roofs, minimum 42” in height.

17. All flat roof drainage calculations shall be revised and approved by the FIU Building Code Administrator.

18. Provide roof traffic pads, min. 48” in width in a contrasting color where equipment maintenance occurs.

19. At the construction completion inspection, provide the following to the University:

    a. Complete set of reproducible "As-Built" drawings both in BIM and (AutoCAD) format, or specified in the contract documents.
    b. Two electronic and two hard copies of operating manuals on all types of equipment used in the building.
    c. Provide all Warranties and list of Contractors, Subcontractors, and their suppliers of materials and equipment.
    d. One electronic and one hardcopy of all approved submittals and shop drawings.

1.03 Minority Contractors

1. In order to document the level of Minority Contractors participation in bidding University projects, the Builder will be responsible to provide reports on a monthly basis as to the level of minority consulting firms retained by the project architect Obtain reporting format from the office of Facilities Construction.

1.04 Project Completion

1. Prior to substantial completion, the Project Architect will send a letter to the contractor requesting the following closeout documents:

   A. Record drawings

   B. Record specifications and addenda

   C. Operating manual and maintenance data

   D. Warranties

   E. Bonds

   F. Evidence of payment and release of liens.

   G. Requirements of Section 01 78 36 of specifications list of companies providing warranties and/or bonds, contact person, address and phone number/FAX number.

   H. Equipment training session with University staff Electrical, Mechanical, Plumbing and Landscaping (attendance sign off).

DIVISION 2 – EXISTING CONDITIONS

2.01 Site Investigations

To determine surface and subsurface conditions at a site.

Visual inspection: Obtain data on surface soils, surface water, slopes, existing structures on the site, former structures, and adjacent construction. Also determine whether underground utilities may cross the site.

In-place soil tests and load tests should be performed at the discretion of the Architect/Engineer.

Soil tests and load shall be performed. Types, locations, and quantities as per A/E recommendation.

2.02 Subsurface Soil Investigation

Piles: Shall be designed and installed on the basis of a foundation investigation and report including boring, test pits or other subsurface exploration sufficient to determine the position and adequacy of the bearing soils. The investigation and report shall include at a minimum the following:

1. Recommended pile types and installed capacities
2. Driving criteria
3. Installation and field inspection procedures
4. Pile load test requirements
5. Durability of pile materials
6. Designation of bearing stratum or strata

2.03 First Floor Finish Elevation

A. DRU INITIATIVE. The first floor elevation of all new construction shall meet a minimum of +10.00 feet (NGVD).

DIVISION 3 - CONCRETE

3.01 General

A. TESTING - The University will pay for all concrete tests except those that failed which will be paid by the contractor.

B. All exposed architectural concrete will receive two coats of clear sealer or approved equal.

C. Slabs and walks

1. All sidewalks and slabs-on-grade will have adequate construction joints and complete edge joints.

2. Do not feather edge concrete over adjacent floor and walks.

3. Slope walks, plazas, courtyards, etc. to have positive drainage (1/8" per ft. min.)

D. Structural Design of Slabs: Consideration shall be given in the design of floor and roof slabs to provide exposed construction which can be used as finished ceilings whenever practicable. Such construction, however, shall be planned only if requirements for limits in heat losses and for noise control can be met.

E. Tops of footings for exterior foundations are recommended to be at least 3'0" below finish grade to provide sufficient depth of soil for plants.

F. Moisture barrier: Provide minimum 15 mil moisture barrier cover.

G. Design professional shall provide project specific technical specifications.

H. Refer to FIU Standard Details (Appendix E).

3.02 Cast-In-Place Concrete

A. On-Site Supervision: The A/E or an approved, selected representative shall observe the placing of all concrete and shall report non-compliance with specifications and drawings to the FIU Project Manager.

B. Test Reports: A copy of all concrete test reports shall be furnished to the FIU Project Manager.

C. Hardener Treatment: All finished floors which will be left exposed shall receive hardener treatment applied when concrete is still curing.

D. Protection for Nosing on concrete steps shall be provided by rounded cast nosing with non-slip surface.

E. Non-Slip Surfacing: Ramps, treads, and platforms of stairs shall have non-slip aggregate surfacing when not covered with finish flooring materials.

3.03 Architectural Concrete

A Sample Panel 4 by 8 feet in size shall be erected at the site when cast-in-place or precast architectural concrete is to be used. Panel shall be protected from construction operations but shall be left exposed to the elements. Panel shall be left in place until all architectural concrete has been approved by Facilities Management.

DIVISION 4 – MASONRY

4.01 General Requirements

A. All exterior masonry units will be insulated per project requirements.

B. All exterior masonry units will be sealed.

4.02 General Provisions

A. Split Coursing: Only full coursing will be permitted at the head of any type of opening.

B. Overhung Masonry: Construction where the masonry units are suspended using mechanical devices, or where the units extend beyond lower courses and mechanical support devices are required, are not to be used. Buildings being renovated/restored, which have such overhung structured, shall be examined for safety and a report of condition provided.

4.03 Concrete Masonry Units

A. Cinder Block: The use of cinder block is prohibited.

B. Concrete Block: Types and uses as specified by project specifications.

DIVISION 5 - METALS

5.01 General Requirements

A. Electrolysis: The joining of any dissimilar metals is prohibited.

B. Materials: Special attention should be given to the selection of metals exposed to the elements, especially on the Biscayne Bay Campus.

C. Hot Dip Galvanize after Fabrication: All steel exposed to the weather shall be hot-dip galvanized or stainless steel.

DIVISION 6 – WOODS, PLASTICS, AND COMPOSITES

6.01 Rough Carpentry

Protection Against Decay: Wood used in conjunction with roofing installations and wood, which is installed in contact with concrete or masonry, shall be pressure treated with an approved preservative and fire retardant to meet AWPA Standards. Other installations shall receive prime coats suitable for finishes specified as soon as installations are completed.

6.02 Finish Carpentry

A. Materials and Fabrication: Use solid or plywood only. Use of particle board and MDF is prohibited.

B. Cabinet Work: Material and fabrication shall conform to Architectural Woodwork Institute specifications for Premium quality work.

DIVISION 7 - THERMAL & MOISTURE PROTECTION

7.01 Thermal Design

A. Roofs - Minimum required by latest FBC-EC edition

B. Exterior walls - Minimum required by latest FBC-EC edition

7.02 Design

A. Walks

1. In areas where wind driven rains might occur, careful consideration should be given to the sloping of slabs and details at thresholds.

2. Non-skid surfaces must be provided in all major circulation zones.

3. All walks, balconies, landings and floors exposed to the elements shall be sloped for drainage.

B. Waterproofing

1. All roofs will have a minimum of 20-year Warranty with no dollar limit.

2. No roofs will be flat. Roof shall be sloped per the latest FBC, at 1/4” per foot minimum.

C. Roofing Systems

1. All roof installations must be permitted.

2. The selection of roofing materials shall be limited to those manufacturers with a 15-year history of satisfactory manufacture and installation of at least 250,000 squares of their roofing system and providing not less than a 20-year unlimited warranty/guarantee for labor and materials.

3. The use of roofing materials containing asbestos is prohibited in the installation of new or the repair of existing roofing systems.

4. All new and replacement roofing projects shall have plans and specifications developed by a registered architect.

5. All penetrations of the roof membrane shall be detailed by the architect and installed according to the recommended procedures provided in the latest NRCA manual.

6. Utility supply lines (electrical, water, gas, etc.) to roof mounted equipment shall be installed within the supporting curb of that equipment.

7. Roof-mounted equipment will not be acceptable if other reasonable locations can be found. Roof-mounted heating, ventilating, and air conditioning systems are not recommended. Projects for re-roofing buildings which currently have roof-mounted should include removing and relocating such equipment when feasible. All roof-mounted equipment

shall be provided with roof surface walkway access to allow ease of maintenance and minimize roof surface damage.

8. Roof-mounted antenna, lab equipment, or scientific devices shall be located in areas specifically designed for that purpose. Roof loads, walking surfaces, anchoring devices, mounting pads, or utility needs shall be designed and provided using approved NRCA details to the extent available. All roof mounted equipment must be permitted.

9. Pitch pockets will not be permitted, including those filled with urethane, butyl rubber, or similar pourable caulking, and bituminous material.

10. Field mixed, sprayed on roof insulations, and roof coatings are not acceptable roof systems for new roofs.

11. A minimum slope of 1/4" per foot shall be required on all areas of the roof system before final acceptance of that roof system by the University.

12. The roofing system includes all ply's of the roofing membrane, flashing, roof curbs, roof expansion and control joints, insulation, roof walkway systems, roof cants, and drainage scuppers. Roof ballast material is not permitted.

13. All base flashing shall extend a minimum of 10" up the vertical surface of curbs, walls, or roof penetrations.

14. Access door thresholds to the roof or roof hatches shall be 12" above the finished roof surface. An acceptable walking surface shall be installed immediately outside the access door threshold on the roof system.

15. All roofing contractors working on University facilities shall have a current license and be approved by the manufacturer for the system being installed or repaired.

16. The application of new roof materials over an existing roof will not be permitted until a moisture test of that roof has been completed and all wet areas detected by that scan have been removed. After a new roof is installed, roof scans and cuts of built-up roofs are to be made to record the conditions of the new roof and compliance with specifications.

17. Lightweight concrete roofing system shall be vented.

18. Roof vents through the membrane will be acceptable provided they are insulated, spun aluminum roof vents having a one-way valve design. Roof vents constructed of PVC are not acceptable.

19. All lightweight insulating concrete systems must meet the latest Florida Building Code.

20. Buildings shall use stainless steel metal flashing, a minimum gauge of 26.

21. A representative of the Roof Material Manufacturer must be present during the roof installation.

22. Recess all interior drains to insure rapid runoff from the roof surface. Ensure that all flashing plies can be contained inside the recess area to prevent a damming buildup of bituminous or stripping materials on the roof surface.

23. Expansion or control joint covers should be elevated above the roof surface along the same guidelines as elevations for membrane flashing. Expansion joint curbs should be 8 in. minimum above roof level to raise membrane base flashing well above the roof water level. The use of expansion or control joints flush with the roof surface runs the risk that ponded water will leak into the building through any damaged spot in the closure.

24. Perimeter wood nailers should be anchored to the structural deck to isolate the roof/deck system from adjacent structural components. When wood nailers are attached to perimeter walls, differential structural movement may cause damage to the roofing system at the critical wall/deck juncture.

25. Two-piece, through wall flashing should be installed at all masonry walls. Through wall metal reduces the possibility of water entering the roofing system or building interior through vertical wall cavities. By including the counter flashing receiver with the through wall metal, continuity of the "watershed" is assured, and counter flashing metal may be easily removed and reused at the time repairs are necessary to base flashing or at the time of re-roofing. Weep holes should be provided on top of the through wall metal to allow escape of any water entering the wall above the metal.

26. Continuous metal cleats should be used to secure the face side of metal coping, gravel stop and/or fascia metal. The cleat allows for lateral expansion/contraction of the exposed fascia metal while insuring positive securement against wind uplift. Cleats should be of heavier gauge metal than the coping, gravel stop/fascia of perimeter curb metal.

27. Extend metal cap or counter flashing a minimum 3 in. down over the tops of membrane base flashing to insure positive water shedding.

28. Specify watertight mechanical joints for coping and expansion joint cover sections. Sections should be maximum 60" long to control expansion. Keep corner "legs" to a maximum 18" long.

29. Roofs shall be finished or coated with light colors per the latest FBC Energy code.

30. Parapet roofs shall be incorporated into the design and construction of all new buildings whenever possible. Exceptions to this standard must be approved in advance by the FIU Facilities Management Department.

31. Roof Drainage Design-For FIU facilities with roof having parapets, with either of the following: roofs with primary and secondary/overflow internal roof drains, roofs with primary internal roof drains and secondary/overflow scuppers, or roofs with primary scuppers and secondary/overflow scuppers, whether new construction or reroofing projects. The roof drainage design shall comply with applicable sections of the FBC, 2014. As such, both the primary and secondary/overflow roof drains shall be designed to meet a maximum total of 5” of water accumulation in any given roof area (30 psf uniform live load). A sample roof drainage calculation can also be found on the FIU FMD website.

D. Re-roofing Projects

1. Coordinate timing to correspond with the dry season.

2. Coordinate project schedule with ongoing campus activities, i.e. exams, special events,

etc.

3. Coordinate re-roofing traffic with respect to other projects. Student and faculty pedestrian and vehicular traffic.

4. Protect the items inside of the building to be re-roofed (visqueen covers if necessary).

5. If removing insulation provide emergency scupper holes at low point under existing overflow scuppers.

E. Elevator Pits

1. All elevator pits below grade shall be waterproofed.

F. Concrete Panel Sealants

1. All concrete panel sealants shall have a 5-year warranty for labor and materials.

DIVISION 8 - OPENINGS

8.01 Material Doors & Frames

A. Doors - Use solid core wood or hollow metal. The use of exterior wood doors is not acceptable.

B. Frames will all be hollow metal 14-gauge minimum. All metal frames in block walls shall be filled solid with grout.

C. Label Doors - Provide where required by code.

8.02 Approved Manufacturers

A. All Hardware as set forth in FIU Finish Hardware Specification.

8.03 Storefront, Curtainwalls & Window Frames

A. All exterior storefront and window systems must meet the latest edition of Florida Building Code. All window assemblies, regardless of height, shall be designed to meet large missile impact criteria.

B. Cylinders: Must be compatible with the master key for the building.

C. The color of the frames shall be coordinated with the Facilities Management Department. The finish of the aluminum must be salt spray resistant, at Biscayne Bay Campus.

D. Aluminum Windows: Window glass is to be replaceable from inside of building and windows shall have locks on a master keying system.

8.04 Hardware

A. During the preliminary design phase of the work the Architect/Engineer shall meet with FIU's Facilities Management, Facilities Operations, Key Control and user groups to determine the keying arrangement.

B. Handicapped requirements: Use ADA Requirements

1. No vertical rise greater than 1/2" for thresholds.
2. Use lever type knobs for handicap access.
3. No Floor Mounted Door Hold Opens.
4. Floor Closer with Integral Smoke Detectors: Smoke detection systems must be made a part of the documents for fire protection work.

8.05 General Requirements

A. Specify that hardware supplier furnish, to the door manufacturer, templates or the actual items of hardware for which cutouts are required.

B. Flush exterior doors are not recommended. All exterior doors must be protected from the elements by providing eyebrows, canopies, or by recessing.

DIVISION 9 - FINISHES

9.01 Miscellaneous Requirements

A. General

1. Color charts and material samples shall be submitted on a board to the Facilities Management Department for its approval prior to the completion of working drawings. This same color board will be revised during construction if any items are changed by substitution.

2. All finishes must have a Class "B" flame spread rating or better.

3. All finishes shall be easily cleaned and maintainable.

4. The contractor shall supply the University up to 3% of selected manufactured finish materials at the end of the project to be determined by FIU Facilities Management. (Acoustical Tile, Floor Tile, Vinyl Base, Ceramic Tile, Carpet, Wall covering, etc.)

B. Prohibited Construction Practices and Materials

1. ACOUSTIC TILE: The use of acoustic tile or panels at 8 feet or less above floor is prohibited unless approved by Facilities Management.

2. REMODELING: In buildings requiring remodeling, patched materials and surfaces must be made to look as much like new as is economically feasible. It is the intent to avoid a patched appearance.

C. TRANSITIONS: In areas where partitions must be removed to create new areas, careful planning is required to insure that finishes of the newly created surfaces are homogeneous. If new materials butt against existing materials in any one plane, existing and new materials must be finished to match each other, not only in color but also in patterns and surface texture. If such a match is impossible to achieve and the budget is such that existing materials cannot be replaced, the Consultant shall show, by detailed drawings, and specify that existing materials be blended with the new in such a manner that the transitions from one material to the other cannot be readily observed, OR that the different materials be arranged in a pleasing design at the juncture of the materials.

D. SURFACE PREPARATION: Existing surfaces with several old coats of paint or varnish, to which paint, vinyl covering or other thin finishes will be applied, must have old finished stripped off, down to the substrate. Deteriorated areas of substrate must be removed and replaced with suitable filler; voids and gouged areas must be patched. A skim coat of veneer plaster shall be applied to previously plastered areas and troweled to a true, smooth surface. Wood surfaces shall be spackled and sanded smooth.

E. DESIGN INTENT: Public Restrooms – all ceilings within a public restroom facility shall be drywall or suspended grid with moisture resistant tile. All partitions on the perimeter and/or separating adjoining different sex restrooms shall be extended to the underside of the structural deck above with all abutting drywall surfaces caulked and sealed.

9.02 Ceiling Suspension Systems

A. CEILINGS: All areas shall have free access to all ceiling spaces; therefore, lay-in ceilings are preferred wherever possible. Lay-in ceilings offer the University flexibility in meeting future needs.

B. Access panels should be provided for accessibility.

9.03 Acoustical Treatment

A. ACOUSTIC MATERIALS: Mineral fiber lay-in type acoustic ceilings shall be specified. Panels shall be a minimum of 5/8 inch thick and maximum panel size shall be 2 ft. x 2 ft. THE USE OF NON-STANDARD SIZES IS PROHIBITED because of difficulties and costs of obtaining replacement panels.

B. COORDINATION WITH WORK OF OTHER TRADES: Ceiling panels may be laid only after ALL work, including telephone wiring, has been completed above the ceiling.

C. SUSPENSION SYSTEMS: Ceiling suspension systems shall be supported directly from the building structure and shall be supported at all four corners of fluorescent light fixtures. Installations require coordination with electrical layouts.

9.04 Tile

A. CERAMIC TILE: The use of the word "mosaics" is prohibited on drawings or in the specifications because of the connotation of this word implying pictorial work. If ceramic mosaics are actually used, specify by giving tile sizes.

B. CERAMIC TILE: To be specified for all restrooms and placed from floor to ceiling. Submit colors, samples for University approval to Facilities Management.

C. WALL AND BASES: Glazed ceramic tile with matching cove base is preferred.

D. FLOOR TILE: Unglazed ceramic and/or porcelain tile is required.

9.05 Resilient Flooring

A. RESILIENT TILE FLOORING:

1. High performance luxury vinyl plank or tile Class ASTM F1700: Class III Printed Film Vinyl Plank, Type B. 20, commercial grade, minimum 20 mil wear-layer for general areas. Glue-down installation
2. Vinyl composition tile, minimum 1/8 inch thick. Approval of Facilities Management is required prior to specifying thicknesses less than 1/8 inch. Glue-down installation.

B. OTHER RESILIENT FLOORING MATERIALS: In some instances, the Consultant may feel that the use of rubber tile, vinyl tile, sheet vinyl, or materials other than vinyl composition tile may be advantageous. Approval of Facilities Management is required prior to specifying such materials.

C. MANUFACTURER: Bentley, Shaw, Interface, Millken, Patcraft, Mohawk or approved equal.

D. SUBMITTALS:

1. Product Specification
2. Specification for Adhesive
3. Floor Layouts
4. Samples
5. Schedule
6. Qualifications for Installer

E. CLOSEOUT SUBMITTALS:

1. Maintenance Instructions
2. Warranty

F. QUALITY ASSURANCE:

1. Environmental: FloorScore® Certified or similar.
2. Installer Qualifications: Installer who has been trained in the installation of resilient sheet flooring.
3. Mockups: Install 100 sf of product at designated location for architect review and approval.

G. MATERIAL STORAGE AND HANDLING:

1. Store tiles on a flat surface and squarely on top of one another.
2. Store away from vents and direct sunlight.
3. When palletizing, first place a 5/8” or thicker plywood on the pallet. Stack 2 rows high side by side with no airspace between. Then quarter turn for 2 rows side by side. Do not exceed 12 boxes high. If you are stacking pallets, use a 1” thick plywood in between pallets.
4. Store in protected dry conditions between 65 and 85 degrees.

H. SITE CONDITIONS:

1. The permanent HVAC system must be on for 7 days prior to, during and after installation between 65 and 85 degrees Fahrenheit or 18 to 29 degrees Celsius.
2. Material and adhesive must be acclimated to the installation area for a minimum of 48 hours prior to installation.

I. TESTING REQUIREMENTS:

1. Static Load Limit ASTM F970:
   i. Housing 250 psi (assumes sound underlayment installed)
   ii. Public Areas (MIN) 1000 psi
2. Radiant Flux ASTM E648: Class I
3. Smoke Density ASTM E662: <450

J. INSTALLATION MATERIALS:

1. Underlayment: Use in areas such as housing where acoustics are a concern.
2. Adhesives:
   i. Glue for general space
   ii. Glue or click for housing applications
3. Primer Leveling and Patching Compounds: Use gypsum-based patching and/or leveling compounds which contain Portland or high alumina cement and meet or exceed the

compressive strength of 3,000 psi. For high moisture areas, use moisture-tolerant patch with moisture-tolerant adhesives.
4. Tack Abatement Coating if needed.
5. Barrier Coat Floor Encapsulation if needed.
6. Cove Base: 1/8 inch thick with cove toe, rounded top edge and 4-inch minimum height.

K. EXAMINATION

1. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content, pH, smoothness and level.
2. Proceed with installation after any unsatisfactory conditions have been corrected.

L. INSTALLATION: Follow the installation instructions provided by the manufacturer.

M. MAINTENANCE: Follow the maintenance instructions provided by the manufacturer.

9.06 Carpeting

A. CARPET SPECIFICATIONS: Carpet tile is preferred. Broad-loom carpet must be approved by Facilities Management.

1. Fiber: Nylon 6 or 6,6 (for entry walk-off materials, use PET or nylon).
2. Dye Method: Solution dyed, yarn dyed, piece dyed or printed for generalAreas. 100% solution dyed preferred, and if exposed to direct sunlight and aggressive cleaning (eg. bleach based) or for areas such as student housing.
3. Construction: Tufted.
4. Texture: Textured Loop.
5. Backing: Fiberglass reinforced thermoplastic composite.
6. Protective Treatment: Indicate.
7. Size: Indicate.
8. Average Density: (MIN) 5000 oz./yd3.
9. Tufted Weight: (MIN) 16 oz./yd2.
10. TARR 3.0 for general areas 3 .5 for heavy traffic areas.

B. MANUFACTURER: Bentley, Shaw, Interface, Millken, Patcraft,, Mohawk or Approved Equal.

C. SUBMITTALS:

1. Product Specification
2. Specification for Adhesive
3. Shop Drawings
4. Samples
5. Schedule
6. Qualifications for Installer
7. Submittals for carpet to be given consideration must consist of a quality sample, manufacturer's identification trade name and catalog number for carpet and manufacturers signed certificate stating that carpet supplied complies with the specifications required.

Samples (including required documents) must be submitted to FIU for approval seven (7) days prior to bid date. No submittals will be considered after this date.

D. QUALITY ASSURANCE:

1. Environmental:
   i. Green Label Plus Certified (low VOCs)
   ii. Cradle to Cradle Certified (preferred) or NSF 140 Certified
   iii. Health Product Declaration
   iv. Declare Label, red list compliant
   v. PVC-free preferred
   vi. Recycled content minimum of 40%
2. Installer Qualifications: Installer who has been trained in the installation of carpet tile.
3. Manufacturer Qualifications:
   i. 10 years of experience
   ii. Reclamation Program: Will recycle carpet tile
4. Mockups at designated location for Architect and Facilities review and approval.

E. MATERIAL STORAGE AND HANDLING

1. Store rolls on a flat surface, away from vents and direct sunlight.
2. Store in protected dry conditions between 65 and 85 degrees.

F. SITE CONDITIONS – The following conditions must be maintained for 24 hours prior to, during and permanently after installation:

1. HVAC System must be operational.
2. The installation site, carpet and adhesive must be between 50°F and 95°F.
3. The installation site's ambient relative humidity must not fall below 40%.
4. Conduct relative humidity or Anhydrous Calcium Chloride testing. Results must be within the proper range for carpet tile releasable adhesives.

G. TESTING REQUIREMENTS

1. Pill Test CPSC FF 1 70: Pass.
2. Radiant Panel ASTM E648: Class I.
3. NBS Smoke ASTM E662 NF: ≤450.
4. Static AATCC 134: <3.5 Kv.
5. Dimensional Stability AACHEN ≤ 0.1% change.

H. INSTALLATION MATERIALS

1. Install according to the manufacturer's instructions. Use manufacturer's recommended
2. adhesives.
3. Carpet tile releasable adhesive suited to the floor's moisture level.
4. Leveling and Patching Compounds if needed. Follow manufacturer's instructions. Must meet or exceed the required moisture level and pH requirements. Use gypsum-based patching and/or leveling compounds which contain Portland or high alumina cement and meet or exceed the compressive strength of 3,000 psi.
5. Transition Strips.

6. Cove base Accessories:
   i. Angle Profile.
   ii. Detail Profile
   iii. Quarter Round Profile.

I. EXAMINATION

1. Moisture testing is required on all substrates prior to carpet installation. Carpet may be subject to testing by an independent testing laboratory to verify that specification requirements have been met.
2. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content, pH, smoothness and level.
3. If dusting or powdering exists, seal the floor with a latex primer.

J. LAYOUT AND INSTALLATION

1. Install according to the manufacturer's instructions.

K. MAINTENANCE

1. Maintain according to the manufacturer's instructions.

L. SPECIAL AREAS

1. HEAVY TRAFFIC AREAS: Specific carpets able to withstand heavy-traffic.
2. VENDING AREAS: Avoid carpet under vending machines and for a distance of at least 4-feet in front of machines.
3. CAFETERIA SERVING LINES: Carpet is not allowed in or near serving line area.
4. PREVIOUSLY UNCARPETED AREAS shall not be carpeted without review and approval for carpet by Facilities Management.
5. Exterior entryways shall not be carpeted and shall have walk-off mats or graters.

9.07 Special Coatings

A. ELASTOMERIC COATINGS: If coatings specified can be applied with equipment ordinarily used by painters, these coatings may be specified in the section entitled, PAINTING.

B. FIRE RESISTANT COATINGS: The following provisions must included in the specifications:

1. Qualifications of Applicator: Materials shall be applied by applicators franchised and approved by manufacturers of materials.
2. General Contractor shall furnish the manufacturer's certification that materials delivered to the project meet requirements specified. Certification shall be countersigned by the General Contractor, who shall assume the responsibility of complying with the manufacturer's specifications.
3. Materials and application equipment shall be of type approved by the manufacturer.

C. EPOXY FLOOR COATINGS: All mechanical rooms, custodial closets, and trash rooms shall have epoxy floor coatings. Curbs shall be epoxy coated and coating shall extend up walls at least 6 inches.

9.08 Painting

A. INTERIOR WOODWORK: Natural finish-stain, 2 coats sanding sealer, 2 coats semi-gloss varnish. If polyurethane varnish is used, delete sanding sealer. Painted finish-primer and 2 coats semi-gloss alkyd enamel.

B. METAL DOORS AND FRAMES: Shop coat, touch up and two coats semi-gloss enamel.

C. NEW GYPSUM WALLBOARD OR PLASTER: Spackle as required, primer and 2 coats egg-shell enamel or 2 coats egg-shell latex.

D. EXISTING PREVIOUSLY PAINTED GYPSUM WALLBOARD OR PLASTER: Match existing finish. Primer and 1 coat semi-gloss enamel or semi-gloss latex. If surface is in poor condition or crazed or cracked, repair as required and use link or similar agent. If surface is poor, remove finish to substrate, repair and finish the same as new gypsum wallboard or plaster. For classrooms, offices, and corridors, use egg-shell latex. For mechanical rooms, custodial rooms, and industrial areas, use gloss or semi-gloss latex.

E. INTERIOR CONCRETE OR CONCRETE BLOCK (Unpainted): 1 coat self-sealing heavy filler-type primer and 2 coats semi-gloss alkyd enamel or 2 coats semi-gloss latex. For laboratories requiring chemical resistance, replace the alkyd or latex paint with epoxy two-component finish. For corridors or abuse areas, use semi-gloss latex or enamel paint.

F. All paint shall be low VOC.

9.09 ITEMS TO BE NOTED IN SPECIFICATIONS:

A. TOP AND BOTTOM EDGES OF WOOD DOORS shall be sealed after fitting and finished with at least two coats of varnish or paint.

B. TOPS AND BOTTOMS OF METAL DOORS shall be painted with the same materials and number of coats as used on the door faces.

C. DRY FILM THICKNESS shall be specified for all coats of paint on metals.

D. ACCENT COLORS: If it is anticipated 5% or more of the scheduled finishes will be in accent colors, attention should be called to this fact. Estimated percentage of accent colors should be given as an aid to bidders in preparation of bids.

E. COLOR CODING FOR PIPING: Include finish painting of insulated and un-insulated piping in the contract documents and include color banding of finished piping in the appropriate contract documents.

DIVISION 10 - SPECIALTIES

10.01 Signs

A. Room Numbering System - The Architect/Engineer shall provide the Facilities Management Department with architectural floor plans in electronic format, as specified by the Project Manager, at the end of Design Development phase and prior to commencement of working drawings. The Facilities Management Department will return the electronic files to the Architect/Engineer indicating the room numbers that must be used on the construction documents.

B. Building Directories, Interior Way-Finding, and Room Signs - Allowances shall be made within the contract for Building Directories. The Architect shall contact the Facilities Management Department for allowance data and University approved specifications for these Directories and Signs. The University will design and fabricate all room and directional signs. The Contractor shall install all signs. The project budget will reimburse the University's Facilities Management Department.

C. Exterior Building Signs and Monument Signs - The project budget shall pay for all additions or alterations to both vehicular and directional signs and kiosks. The Contractor shall install all signs. The project budget will reimburse the University's Facilities Management Department.

10.02 Glassboards

A. Guarantee: Furnish a written guarantee to the University signed by an officer of the manufacturer of the glassboard.

B. Materials and construction: Glassboards shall have the following:

1. Glassboard shall not exceed 4x8 ft. in size.

2. Backing shall be aluminum.

3. Include marker trough.

C. Mounting: Provide appropriate backing.

10.03 Toilet Partitions

A. 1" Solid Phenolic is preferred. Gapless design is required. Hooks to be installed on stationary partition. Floor mounted partition preferred.

B. Anchors and Fasteners: Anchors shall be screw anchors, toggle bolts, hollow wall anchors, or other approved type to suit construction on which compartments are hung: Wood, lead, and plaster plugs are prohibited. Fasteners shall be vandal-proof type screws. Provide wood blocking behind all toilet partition anchoring points.

C. Door Latches and Pulls: When it is necessary to provide out-swinging doors, specify slide latches and door pulls.

D. All fasteners and accessories shall be stainless steel.

10.04 Pedestrian Control Devices

A. Planning Requirements: If the Program of Requirements calls for pedestrian control but does not detail the requirements for pedestrian control, the Project Manager will consult the user and FIU Police and will indicate the kind of control devices required.

B. Coordination with Building Security System: Pedestrian control devices will usually be used in conjunction with electronic security systems. Installations will require close coordination with electrical installations.

C. Planning for Accessible use: Control devices shall be planned to provide ample room for the passage of wheelchairs and crutches.

10.05 Fire Extinguisher and Cabinets

A. Fire Extinguisher Cabinets: Cabinets shall be stainless steel or aluminum, flange, recessed or semi-recessed (similar to fire hose cabinets), break-glass type with full flat glass in the door. The full fire rating and acoustical rating of the structure walls must be maintained.

B. General: All portable fire extinguisher and non-valved cabinets shall be furnished and installed by the General Contractor. All portable fire extinguisher and components shall conform to latest applicable codes.

C. Approvals: The selection and locations of fire extinguisher are subject to the review and approval of the State Fire Marshal and the FIU Building Department.

10.06 Toilet and Shower Accessories

A. Toilet and all shower accessories to be approved by Facilities Management.
B. Toilet Tissue Holder: Georgia Pacific 56509, Sofpull Twin High-Capacity Centerpull Bathroom Tissue Dispenser.
C. Towel Dispensers: Bobrick B-39747, B-3974, B-3979, Surface Mounted or Recessed Convertible Automatic Universal Roll Paper Towel Dispenser and Waste Receptacle.
D. Hand Dryer: Xlerator Hand Dryer 40502
E. Soap Dispensers: Purell ES8 Soap Dispenser (Minimum two per bathroom).
F. Garment Hooks: Bobrick B-672 or B-6727, Classics Series Surface-Mounted Double Robe Hook. Each toilet stall shall have a garment hook. The hooks shall be mounted on the partition; hooks in stalls for the handicapped shall be on the partition, reachable from the water closet and approximately 40” above the floor. Hook can incorporate door bumper (and purse hook in stalls for women).
G. Door Bumper: Bobrick B-687, Surface-Mounted Door Bumper.
H. Toilet Seat: Olsonite No. 10 high impact solid plastic open frontseat less cover for elongated bowl. Stainless steel hinge post standards. White only.
I. I. Seat Cover Dispenser: Bobrick B-221 ClassicSeries Surface-Mounted Seat-Cover Dispenser B-221.
J. Sanitary napkin Disposal: Bobrick B-270, Surface-Mounted Sanitary Napkin Disposal.
K. Baby Changing Station: Koala Kare KB310-SSRE, Changing Station.
L. Shower Accessories: Bobrick B-4380 or B4390, Recessed Heavy Duty Soap Dish. Bobrick B-6047X48, B-6047X60, B-6047X72 Extra Heavy Duty Shower Curtain Rod. Bobrick B-5181 or B-5191 Reversible Folding Shower Seat.

M. Mirrors: Bobrick B-165 Series Mirror with Stainless Steel Channel Frame.

DIVISION 11 - EQUIPMENT

11.01 General Provisions

A. EQUIPMENT CATEGORIES: Equipment, as applied in Capital Improvements Projects, falls into one of two categories.

1. Contract Equipment. (Fixed Equipment) is acquired through one or more of the construction contracts and is funded within the project construction budget.

2. Non-Contract Equipment. (Movable Equipment) is acquired by the Using Agency utilizing a fund allocation within the total project funds, but independent of the project construction budget.

3. Typically movable equipment funding allocations are provided for new building construction projects, but not for remodeling/renovation projects.

B. GENERAL CONTRACT ITEMS: Unless otherwise directed by the Project Manager, include the following fixed equipment in the General Contract Work.

1. Library Equipment

2. Food Service Equipment

3. Unit Kitchens and Cabinets

4. Projection Screens

5. Grandstands & Bleachers

6. Laboratory. This will include fume hoods and laboratory-controlled temperature rooms, sometimes called environmental rooms or growth chambers.

7. Laundry Room Equipment: Washing Machines and Dryers.

C. SEPARATE EQUIPMENT CONTRACT PRE-BID SUBMITTALS: When separate equipment contracts are required by the Program or the Facilities Management Department, include the following requirements in the specifications regarding bidder qualifications prior to opening of bids:

1. Minimum of five years' experience in the manufacture of similar or duplicate equipment.

2. Minimum of five years completed installations of equal size which can be inspected prior to award.

3. Adequate financial resources and personnel to manufacture, deliver, install and guarantee the equipment.

D. EQUIPMENT CONTRACTOR OR SUPPLIER SUBMITTALS:

1. Price Breakdown. A breakdown for each piece of equipment, keyed to contract drawings or shop drawings, must be stipulated to accommodate auditing and inventory needs.

2. Rough-in Drawings must be required in time to enable checking by the contractor and coordination with all concerned prime contractors.

E. COORDINATION: In specifications, clearly define which contractors have responsibilities relative to equipment receiving, unloading, inventory, and installing (including accessory items such as plumbing, heating, cooling, electric hook-ups, etc.).

F. FITTINGS AND FIXTURES: Utility fittings and fixtures specified for laboratory equipment shall be of quality at least equal to that specified for the Plumbing, HVAC, and Electrical contracts. The consultant shall certify in writing to the University Architect that (1) specification quality is equal, and (2) that installation conforms to specified quality.

G. Automatic Shut-off Valves. Specify that these must have a ten-year written warranty.

H. VENDING EQUIPMENT: If vending equipment is required, it will be provided under a separate contract with a franchisee; however, the A/E shall plan spaces, plumbing, HVAC, electric and recycling containers to accommodate the desired vending equipment. Check the Program of Requirements and consult the University Architect. Be certain to provide for hook-ups.

I. LABORATORY EQUIPMENT: The Consultant must plan spaces, plumbing, HVAC and electric to accommodate all laboratory equipment. Be sure to provide for hook-ups and coordination of installation sequences.

DIVISION 12 - FURNISHINGS

12.01 Multiple Seating

A. PORTABLE FURNITURE: Chairs will be furnished by the University. The Consultant shall plan adequate storage space. Include space for chair trucks if required.

B. AUDITORIUM SEATS:

1. SPECIFICATION REQUIREMENTS: Specify seats by only ONE manufacturer for the Base Bid and by two other acceptable manufacturers as approved alternates. NOTE: THE UNIVERSITY MUST APPROVE ALL SEATING MANUFACTURERS PRIOR TO THEM BEING SPECIFIED.

2. TABLET ARMS: ALL seats shall be equipped with articulating tablet arms if required. Ten to twelve percent of these shall be left-hand; it is suggested that these seats be placed to avoid interference of right and left hand tablet arms.

10.02 Window Treatment

A. BLINDS, SHADES AND DRAPES: Necessary blocking, grounds, tracks, and other devices for installing vertical blinds and/or draperies shall be included in the contract documents even though these blinds and draperies might be furnished by the University.

12.03 Art Work

A. Protection of existing artwork shall be coordinated with the University Museum.

B. Areas considered for new artwork shall be coordinated with the University Museum.

12.04 Graphics

A. UNIVERSITY INVOLVEMENT IN DESIGN: FIU External Relations has the responsibility of reviewing appropriate signage and graphics for the University.

B. DESIGN BY THE CONSULTANT: Identification signs, which are a part of the General Contract, shall meet University standards.

C. The room signage system is fabricated by Facilities Operations and installed by the contractor.

D. SUGGESTIONS BY THE CONSULTANT on design of graphics will be given due consideration; however, suggested designs must not appear on the contract drawings.

E. PAINTING AND COLOR SCHEDULES: To be approved by Facilities Management. Wall surfaces, to which graphics designed by the University will be applied, must be included in the schedule of surfaces to receive finishes, specified in the Section entitled, PAINTING. Colors of such finishes may be selected by Facilities Management in order to provide suitable backgrounds for planned graphics.

H. MEMORIAL PLAQUES: Coordinate with Facilities Management.

DIVISION 13 - SPECIAL CONSTRUCTION

13.01 Pre-Engineered Structures

ENGINEERING DATA REQUIRED: An analysis of framing and structural components is required. Data shall bear the seal and signature of a professional architect or engineer registered in Florida attesting that the structures meet requirements of the specifications and comply with requirements of the Florida Building Code. Copies of this data shall be submitted to the FIU Building Code Administrator.

13.02 SOUND & VIBRATION CONTROL

Requirements to be determined on a per project basis as part of the design of the project.

13.03 RADIATION PROTECTION

A. MATERIAL STANDARDS AND INSTRUMENTATION: Materials and equipment shall conform to applicable recommendations of the National Council on Radiation Protection and Measurements Reports No. 102, 49, 145 and 148, and shall be furnished and installed in accordance with the Code of Federal Regulations (CFR), Title 21 (subchapter J-Radiological Health) and 10 CFR Part 20 - Standards for Protection Against Radiation, Department of Health, Education, and Welfare (FDA Division), Bureau of Radiation Control (Florida Department of Health, Environmental Health Division). Installation shall be in strict adherence with manufacturer's requirements and approved shop drawings.

NCRP Report No.	Title
102	Medical X-ray and Gamma Ray Protection for Energies up to 10 Me V-Equipment Design and Use.
49	Medical X-ray and Gamma Ray Protection for Energies up to 10 Me V-Structural Shielding Design and Evaluation.
145	Dental X-Ray Protection
148	Radiation Protection in Veterinary Medicine.

B. TESTING: After the radioactive equipment has been installed and placed in operating condition, a radiation protection survey shall be performed by a qualified expert recommended by NCRP. It is the responsibility of the FIU Office of Radiation Safety and the authorized user to ensure all equipment maintenance, testing, and surveys are conducted as required.

C. LISTING REQUIRED: The University Office of Radiation Safety has the responsibility of registering all sources of radiation generated by an electronic product, subject to Radiation Control for Health and Safety Act of 1968. A listing of all such devices, specified in the contract documents, shall be submitted by the Consultant to the EH&S Radiation Safety Officer (with a copy to Facilities Management) with those documents. Devices include, but are not necessarily limited to:

lasers and masers
radar
microwave generators
electron microscopes
infrasonic, sonic, and ultrasonic generators
X-ray generators and accelerators
electron welders

diatheraphy units
infrared and ultra-violet sources
TV sets (of the protection type only)

13.04 Swimming Pools- TBD

DIVISION 14 - CONVEYING EQUIPMENT

14.01 Elevators

A. Elevators - Passenger

1. Each multi-story building shall have at least two passenger elevators. The design professional shall provide a vertical transportation analysis to determine the appropriate size and number of cabs required to meet the anticipated use and population served.

2. Elevators shall meet all Florida Building code requirements, inclusive of accessibility requirements.

3. The minimum dimensions for elevators shall be 7 ft. wide by 5 ft. 4 in. deep by 8 ft. high. Minimum capacity shall be 3,500 lb.

4. Elevator shall be paired for each location.

5. Elevator shall be MRL (Machine Room-less).

B. Service Elevators

1. Each multi-story building shall have at least one service elevator, which may also serve as a passenger elevator.

2. Provide pad hooks and one set of protective pads.

3. Service elevator cab height shall provide a minimum 9’-0” clearance and removable within the cab and minimum 4,500 lb. capacity.

4. Entrance doors shall be 8’-0” high

C. Dumbwaiters

Not allowed.

D. Wheelchair Lifts

Not allowed unless approved by Facilities Management.

E. Escalators

Not allowed.

F. Use of Existing Elevators

If permission is granted to use existing elevators, the contractor should be alerted that elevators will be inspected before and after construction to appraise any damage caused by this use. The General Contractor shall be required to arrange and pay for maintenance during the use period and to restore interiors of cabs to original condition before acceptance of the project.

In new construction projects, if the Contractor uses permanent elevators during construction, the Contractor shall turn over the elevators in an "as-new" condition to be determined by the elevator manufacturer. The Owner shall not assume any responsibility for any wear and tear caused by the Contractor during construction.

Warranty period for elevator begins at Owner's beneficial occupancy. An extended warranty might be required.

G. General Requirements

1. Contract: Elevators shall be included in the general contract. No separate contract.

2. Provisions for Servicing: The elevator manufacturer shall be pre-approved by Facilities Management.

3. Monthly maintenance and callback service shall be provided for one year from project's date of substantial completion. Include the following provisions in the specifications:

   A. Maintenance by Manufacturer: Furnish total maintenance servicing for a period of one year beginning on the date of University acceptance of elevator. Service shall include monthly regular examinations of the equipment per university's current elevator maintenance contract, during regular work hours, by competent and trained employees of the manufacturer, and shall include necessary adjustments, greasing, oiling, cleaning, supplies, and parts to keep equipment in proper operation, except such parts made necessary by misuse, accidents, or negligence not caused by the manufacturer. Frequency of maintenance service will be established at least monthly, by the University's current elevator maintenance contract.

   B. Instructions for Maintenance Personnel: Provide one hard copy and one electronic copy of complete wiring diagrams, repair parts catalogs, instruction manuals, and lubrication charts. Furnish required verbal and written instructions to designated University personnel. Give notice of inspections so that University personnel may be present.

4. Elevator exposed to the elements shall have NEMA 3 controls and wiring.

H. Minimum Construction Standards

1. Verify prior to bidding that all code requirements have been met and that the plans have been reviewed and approved by the Chief Elevator Inspector.

2. DRU Initiative: Provide sump pump pit at all elevator pits. Where emergency power generation is provided, connect power supply to emergency circuit.

3. Provide equipment room A/C ventilation for cooling of elevator machinery and control spaces. All pressure relief vents shall be further protected with vertical louvers designed for maximum water penetration resistance. Provide operable shutters to close off pressure relief vent to protect elevator electronics in cab during hurricane weather conditions. Temperature inside elevator machinery/control room shall meet the requirements of equipment manufacturer.

4. Only equipment required for elevator operation is permitted in elevator equipment spaces. No extraneous piping, ductwork, conduits, etc. will be permitted in elevator equipment spaces.

5. Provide proper separation between equipment room and hoist way.

6. Provide two vapor proof lights and switch in each hoist way pit. Also provide one weatherproof receptacle, sump pump and drainage system. Where emergency power is provided, sump pump shall be connected to the generator. All elevator pit foundations and walls shall be waterproofed.

7. Finishes

   a. Doors and Jambs –stainless steel satin (non-directional) finish
   b. Cab panels – stainless steel textured (non-directional) finish. No polished mirrored finish permitted
   c. Floor finish – studded rubber tiles recommended
   d. Vandal-resistant control devices and indicators

8. Contractor shall coordinate installation of emergency phone with University IT Department.

DIVISION 21 - FIRE SUPPRESSION

21.01 GENERAL REQUIREMENTS

A. Refer to FIU BIM Standards for additional details and requirements.

B. All mechanical spaces shall be drawn at ¼" scale.

C. Drawings shall show all necessary sections and details so that the Contractor will not have to make assumptions in order to visualize the scope or physical layout of his work.

21.02 SPACE REQUIREMENTS

A. In laying out any fire protection system, ample space shall be allowed for servicing of equipment and to allow future expansions.

B. Space requirements for all fire protection equipment, including ventilation, air conditioning, power and plumbing systems shall be coordinated with the preparation of preliminary architectural studies to ensure ample space is provided and properly allocated for the fire protection systems.

C. Serviceability:

1. Clearances suggested by manufacturers for equipment maintenance, removal, and replacement shall be indicated on drawings and accommodated by the layout. Larger and heavier components that may require future removal or replacement shall be identified on the drawings and a clear path identified to the building exterior.
2. Door sizes, lifting supports, and other pertinent information shall be identified on drawings. All components (cleanouts, shut-off valves, floor drains, pumps, etc.) shall have at minimum 24 inches of radial room around them to allow for maintenance access.
3. All components with electrical connections shall have at minimum clearances as indicated in NFPA 70.
4. All equipment access shall be provided within the equipment room.
5. Design and install all equipment accessible with consideration with celling height.

21.03 COMMISSIONING

A. Verify fire protection commissioning requirements with FIU Project Manager.

21.04 CONSTRUCTION QUALITY CONTROL

A. All piping to be used on FIU must be cleaned and end-capped prior to delivery. Piping delivered to site that is not clean or end-capped will be refuse
B. Piping must be protected in storage and during installation. All pipes must have end caps.
C. Piping must be flushed and cleaned prior to final tie-in/connection or equipment startup.

21.05 SUBMITTALS

A. Maintenance Manuals - Contractor shall deliver to the Architect/Engineer, one (1) bound copy of manufacturer's operating instructions and maintenance recommendations and one electronic copy (original, non-scanned pdf's) for all equipment and machinery installed under the contract.

All fire protection equipment shall be cross referenced by equipment designation, fire zones and actual room locations. A complete listing of all equipment and location shall be provided in an electronic spreadsheet format (Microsoft Excel). This is to be done before completion of the project.

B. Coordinate additional product submittals requirements with FIU Project Manager.

C. Provide lubrication and recommended periodic maintenance schedule (i.e., filter replacement etc.) for each piece of equipment, on solid mounting boards.

D. Provide electronic and hard copies of valve schedules showing location and identification of all valves. Verify with FIU Project Manager for required number of hard copies. Hard copies shall be laminated on solid mounting boards.

E. Provide wiring control diagrams (both power and control voltage) laminated under plastic for each piece of equipment, on solid mounting boards.

F. Provide LEED Systems Manual.

G. Fire protection systems shall be separately bound.

21.06 TRAINING

A. Training Sessions – Contractor shall provide a full demonstration of all operating systems. Contractor shall videotape the training and demonstration sessions. Three (3) copies in digital format shall be submitted to the Owner prior to Final Payment. The Contractor shall submit an outline of all components to be covered during the training sessions for the Owner's approval prior to scheduling actual training sessions.

B. Training shall be conducted by applicable sub-contractor and/or authorized factory representative.

C. At minimum, training shall include normal operations, required maintenance operations affecting warrantee and cleaning operations.

21.07 CODES AND REGULATIONS

A. Latest editions with current revisions and amendments of the following codes and standards are considered minimum requirements for materials, workmanship, and safety where not covered elsewhere in these specifications.

1. Florida State Board of Health
2. Florida Building Code
3. Underwriters Laboratories (UL) - Equipment bearing a "UL" seal of approval
4. NFPA 1 Fire Code
5. NFPA 2 Hydrogen Technologies Code

6. NFPA 13 Standard for Installation of Sprinkler Systems
7. NFPA 14 Installation of Standpipe and Hose Systems
8. NFPA 20 Installation of Stationary Pumps for Fire Protection
9. NFPA 30 Flammable and Combustion Liquids Code
10. NFPA 45 Fire Protection for Laboratories Using Chemicals
11. NFPA 72 National Fire Alarm Code
12. NFPA 101 Safety to Life from Fire in Buildings
13. NIH National Institutes of Health
14. AAALAC Association for Assessment and Accreditation of Laboratory Animal Care

B. Requirements described in the FIU Master Plan.

21.08 MEASUREMENT AND VERIFICATION

A. Measurement and verification (M&V) not required for Division 21 unless noted otherwise.

21.09 VIBRATION AND NOISE

A. Vibration and noise considerations not required for Division 21 unless noted otherwise.

21.10 FIRE PROTECTION

A. Fire Protection System: Refer to the Appendix A for directions in the preparation of drawings to meet requirements of the State Fire Marshal and for procedures for obtaining inspections and approvals by the Fire Marshal.

B. Fire Alarm Control Panel: Location shall be in a public area readily accessible to emergency personnel.

C. Reference to NFPA Pamphlets: Whenever specifying materials and installations by National Fire Protection Association use only the current edition and include the date of each referenced publication in the specifications.

D. Testing of complete fire protection system: Include in the specifications the requirement that the contractor shall pretest under full emergency mode all components inclusive of emergency generator, transfer switch, sequence of operations, fire pump, emergency lighting, strobes, smoke detectors, etc., prior to State Fire Marshal inspection. Specifications shall address and detail appropriate piping and appurtenances required to perform the test and demonstrations as stipulated by NFPA.

21.11 FIRE PROTECTION PIPING

A. Centrifugal Type Pumps shall be provided*;* **turbine vane pumps are prohibited**.

B. Installation shall comply with NFPA 20, Standard for the Installation of Centrifugal Fire Pumps.

C. Controller: All factory pre-wired and enclosed in a NEMA IV wall mounted enclosure. Design features may include excess pressure controller containing magnetic starter, disconnect switch, dual pressure switch, three position selector switch, and an alarm bell to sound when the pressure drops below the second control point of the dual pressure switch.

D. Bearings: Wherever practical, equipment shall be furnished with sealed ball or roller bearings. Specify that the contractor shall not lubricate sealed bearings.

E. Relief Valve and Drain: The fire pump shall have a pressure relief valve integral with the casing. Provide drain line piped to mechanical room floor drain.

F. Fire Pump Test Connection: The test connection cluster valves, shall be located on the building exterior adjacent to the fire department siamese connection for the purpose of performing proper testing of the fire pump for initial acceptance and annual testing. Include piped drainage.

G. Jockey Pump: Fire pump installation shall include a jockey pump of ample capacity in addition to the fire pump. Test valve drain line shall be piped to mechanical room floor drain.

H. Inspector Test Valve: All Inspector Test Valves shall be provided with sight glass to monitor flow. Provide drain line piped from inspector test valves to exterior of building.

21.12 FIRE PROTECTION VALVES

A. Gate Valves: Use UL approved OS&Y, 175 lb., except hose cabinet valves.

B. 2-1/2” and smaller, bronze or iron body, trim and stem, solid wedge, rising stem, union bonnet, threaded ends.

C. 3” and larger, iron body, bronze trimmed, OS&Y flange ends.

21.13 SPRINKLER SYSTEMS

A. Sprinkler systems shall be automatic systems designed, installed, and tested according to NFPA Pamphlet 13, Standards for the installation of sprinkler systems.

21.14 STANDPIPE AND FIRE HOSE SYSTEMS

A. Design, Installation, and Testing: Comply with NFPA Pamphlet 14, Standards of Installation of Standpipe and Hose Systems. Wherever standpipes are installed, siamese pumper connections shall be provided as required.

B. Standpipes: In buildings where standpipes are installed, the first-aid hose for occupant use shall be in stairwell.

C. Fire Hydrants: Locations of fire hydrants shall be checked with the University Architect and approved by The State Fire Marshal. One hydrant shall be located near the exterior siamese pumper connection in accordance with NFPA Pamphlet 24.

D. Installation shall be in accordance with NFPA Pamphlet 24, Outside Protection, and The State Fire Marshal.

21.15 FIRE HOSE VALVE CABINETS

A. Fire Hose Valve Cabinets shall be stainless steel, flange, flush mounted type (similar to extinguisher cabinets) large enough to accommodate a fire extinguisher and valve.

B. Fire Extinguisher Cabinets: Specify these in Division 10 as part of the General Contract.

C. Each extinguisher and fire valve cabinet shall have a locking break-glass type door with full flat glass in the door. The full fire rating and acoustical rating of the walls shall be maintained where recessed.

21.16 IDENTIFICATION

A. Equipment Identification

1. All equipment served by fire protection systems shall be identified by number and/or legend where shown on drawings.
2. Identification shall be with engraved plastic name plates using 1” letters on equipment having cabinets and with appropriate size brass tags where cabinets do not exist.
3. Nameplate: Identify model number, size, capacity, electrical characteristics, serial number, along with other items scheduled for equipment on drawings.
4. Indicate motor horsepower, voltage, phase, cycles, RPM, full load amps, locked motor amps, frame size, manufacturer’s name and model number, Service Factor, Power Factor, efficiency and other pertinent information.
5. Locate motor nameplates for easy reading. Relocate or provide new nameplates on motors if original nameplates are not located for easy reading.
6. Provide ceiling grid label for valves or other equipment above ceiling. Coordinate labeling requirements with FIU Project Manager.

B. Exposed fire protection piping shall be painted, unless otherwise noted. Confirm with FIU project manager. Color to be comply with NFPA 13 and confirmed by FIU Project Manager.

C. Valve Identification

1. All valves shall be identified in accordance with NFPA 13 (or approved equal) engraved aluminum or PVC valve tags.
2. Furnish typewritten charts with identification and location of all valves. Provide electronic copy in O&M Manuals. The chart shall give the number, location, and purpose of each valve.
3. Furnish typewritten charts with identification and location of all access panels serving equipment and valves. Provide electronic copy in O&M Manuals.

DIVISION 22 - PLUMBING

22.01 GENERAL REQUIREMENTS

A. Refer to FIU BIM Standards for additional details and requirements

B. All mechanical spaces shall be drawn at ¼" scale.

C. Plans for plumbing systems shall be drawn to show exact dimensions and locations of all equipment, valves, control panels work, wiring, etc., so as to give the contractor a complete picture of the work required. Particular attention shall be given to space requirements so that the various phases and trades will not conflict.

D. Drawings shall show all necessary sections and details so that the Contractor will not have to make assumptions in order to visualize the scope or physical layout of his work. Sections shall be made of all risers, pipe chases, vertical take-offs, and equipment rooms, as well as other areas necessary for clarity.

E. At least one (1) single-fixture family restroom shall be included for every bank of restrooms planned.

22.02 SPACE REQUIREMENTS

A. In laying out any plumbing system, ample space shall be allowed for servicing of equipment and to allow future expansions.

B. Space requirements for all plumbing equipment, including ventilation, air conditioning, power and plumbing systems shall be coordinated with the preparation of preliminary architectural studies to ensure ample space is provided and properly allocated for the plumbing systems and risers.

C. Serviceability:
1. Clearances suggested by manufacturers for equipment maintenance, removal, and replacement shall be indicated on drawings and accommodated by the layout. Larger and heavier components that may require future removal or replacement shall be identified on the drawings and a clear path identified to the building exterior.
2. Door sizes, lifting supports, and other pertinent information shall be identified on drawings. All components (cleanouts, shut-off valves, floor drains, pumps, etc.) shall have at minimum 24 inches of radial room around them to allow for maintenance access.
3. All components with electrical connections shall have at minimum clearances as indicated in NFPA 70.
4. All equipment access shall be provided within the equipment room.
5. Design and install all equipment accessible with consideration with celling height.

22.03 COMMISSIONING

A. Verify plumbing commissioning requirements with FIU Project Manager.

B. Provide enhanced commissioning services as defined by LEED, to ensure systems designed and operate per Owners requirements. Ensure coordination with Division 1.

C. Fundamental Commissioning will only be allowed if previously approved by FIU Project

Manager. At minimum, all systems shall be commissioned per Florida Building Code – Energy Conservation, Section C408.

22.04 CONSTRUCTION QUALITY CONTROL

A. All piping to be used on FIU must be cleaned and end-capped prior to delivery. Piping delivered to site that is not clean or end-capped will be refused.

B. Piping must be protected in storage and during installation. All pipes must have end caps.

C. Piping must be flushed and cleaned prior to final tie-in/connection or equipment startup.

22.05 SUBMITTALS

A. Maintenance Manuals - Contractor shall deliver to the Architect/Engineer, four (4) bound copies of manufacturer's operating instructions and maintenance recommendations one electronic copy (original, non-scanned pdf's) on all equipment and machinery installed under the contract. A complete listing of all equipment and location shall be provided in an electronic spreadsheet format (Microsoft Excel). This is to be done before completion of the project.

B. Coordinate additional product submits requirements with FIU Project Manager.

C. Provide lubrication and recommended periodic maintenance schedule (i.e., filter replacement etc.) for each piece of equipment, on solid mounting boards.

D. Provide electronic copy of valve schedules showing location and identification of all valves. Verify with FIU Project Manager for required number of hard copies. Hard copies shall be laminated on solid mounting boards.

E. Provide wiring control diagrams (both power and control voltage) laminated under plastic for each piece of equipment, on solid mounting boards.

F. Provide LEED Systems Manual.

22.06 TRAINING

A. Training Sessions – Contractor shall provide a full demonstration of all operating systems. Contractor shall videotape the training and demonstration sessions. Three (3) copies in digital format shall be submitted to the Owner prior to Final Payment. The Contractor shall submit an outline of all components to be covered during the training sessions for the Owner's approval prior to scheduling actual training sessions.

B. Training shall be conducted by applicable sub-contractor and/or authorized factory representative.

C. At minimum, training shall include normal operations, required maintenance operations affecting warrantee and cleaning operations.

22.07 CODES AND REGULATIONS

A. Latest editions with current revisions and amendments of the following codes and standards are considered minimum requirements for materials, workmanship, and safety where not covered elsewhere in these specifications.
   1. Florida State Board of Health
   2. Florida Building Code

3. Underwriters Laboratories (UL) - Equipment bearing a “UL” seal of approval
4. Sanitary Code of Florida
5. AGA American Gas Association
6. ANSI American National Standards Institute
7. ASSE American Society of Sanitary Engineering
8. AWS American Welding Society
9. AWWA American Water Works Association
10. ASME American Society of Mechanical Engineers
11. ASTM American Society for Testing and Materials
12. NSF National Sanitation Foundation
13. PDI Plumbing and Drainage Institute
14. WQA Water Quality Association
15. Public Law 91-596 Occupational Safety and Health Act
16. NFPA 54 Gas Appliances and Gas Piping
17. ANSI B31.1, 0-1967 (with Agenda) Power Piping
18. ANSI B31.2 - Fuel Gas Piping
19. NIH National Institutes of Health
20. AAALAC Association for Assessment and Accreditation of Laboratory Animal Care

B. Requirements described in the FIU Master Plan.

22.08 MEASUREMENT AND VERIFICATION

A. Coordinate with other consultants to provide an M&V system via the building controls system to monitor energy and water by end use as defined by LEED.

B. At minimum the following utilities shall be metered:
   1. Domestic Cold Water

22.09 VIBRATION AND NOISE

A. Special consideration shall be given to sound isolation and noise control of all plumbing equipment.

22.10 PLUMBING

A. The Facilities Management Utilities Department will supply information on existing water and sewer utilities.

B. Water mains inside FIU property lines require a permit. Plans and specifications must be submitted to Miami Dade Water and Sewer Authority for review and approval as required by M.D.W.&S. The Design Professional of Record is responsible for the complete and timely submittal of all requisite documents for permit.

C. Any connections made to utilities outside of University property will require permits.

D. The north campus will require permits from the city of North Miami.

E. Sanitary sewers and force mains inside FIU property lines do not require a permit from M.D.W.& S. but a DERM Sanitary Sewage Allocation/Sewage Transmission Capacity Certificate is required. Engineer to verify if applicable.

F. Do not provide hot water for public toilets, classrooms, laboratories or other areas unless specially programmed or requested.

22.11 PIPING

A. Copper is to be used for domestic water systems.

B. Underground piping 2-1/2" and below shall be coat type Kcopper pipe with bitumastic paint.

C. Underground pipe above 3" in size shall be Ductile Iron, cement lined.

D. If dissimilar metals must be combined in the systems, then a proper dielectric coupling must be provided where they join.

E. Propress option is acceptable for plumbing system. Verify with FIU Project Manager for allowed systems.

22.12 VALVES

A. Provide shut-off valves on mains for each building, for each riser in each building, for each floor level, and for each group of fixtures (e.g. separate valves for each men's/women's restrooms). Valves shall be accessible but not visible. Identify shut-off valve locations on finish ceiling surfaces. Valves outside the building shall be provided with concrete valve boxes and covers. Shut-Off valves in restrooms shall be wall mounted.

B. Gas shut-off - Each laboratory that is equipped with liquid propane, natural gas or other piped gas under pressure, shall have a cut-off valve to control all outlets in the laboratory. The Cut-off valve shall be concealed in an accessible location in the ceiling or similar area, which would be out of the normal traffic flow in the building. The location of the cut-off valve shall be identified.

C. Triple Duty Valves: Triple duty (check, balancing, shut-off) valves are not acceptable for plumbing applications. Use separate check valves and shut off valves.

D. The use of thermostatic mixing valve in Hot Water System is not recommended.

E. Provide isolation valves in the supply and return piping at the beginning of each branch piping takeoff in vertical all mechanical piping (such as HW, HHW, DHW, DCW, and Gas, etc.).

F. Location of riser isolation valves will be directly after the riser takeoff from the main piping within the building and readily accessible for operating. Provide isolation valves at building entrance.

G. Provide ceiling grid label for valves above ceiling. Coordinate labeling requirements with FIU Project Manager.

22.13 PLUMBING EQUIPMENT

A. Floor Drains - One or more floor drains shall be provided for each restroom, custodial room, emergency showers in labs, and mechanical equipment rooms in event of fixture overflow. Resealing Prime connections (electric trap primer) are required on all floor drains. Provide

adequate slope to floor drains.

B. All mechanical rooms shall be provided with continuous six inch (6") containment curbs at the entire equipment inclusive of all floor penetrations and doors.

C. Hose Bibs - Provide chrome plated hose bibs with removable handles. Install hose bibs 18" above the finish floor in each restroom, air handling room, and every 100 linear feet along the building exterior perimeter. Exterior mounted hose bib cabinets shall be keyed and recessed.

D. DRU Initiative: Provide floor drain at all Safety showers and Eye Wash locations. Include flow switch with alarm.

E. Hot water recirculating pumps use wet rotor single - stage, direct drive pump. All lines from water heaters to point of use shall be insulated with pipe insulation.

F. Hot water Gas Heaters shall use liquid propane and/or natural gas. Units shall be high efficiency commercial type hot water heater with instant recovery with insulated storage tanks and a recirculating pump system. Use Instant-On water heaters only when gas service is not available.

22.14 PLUMBING FIXTURES AND TRIM

A. Define all fixtures, flow rates, and or systems. Ensure LEED compliance if applicable.

B. Sloan Optima Electronic Royal Flushometers or Zurn Aquasense Battery Flush valves, low water consumption only.

C. Restrooms faucets Solis by Sloan and kitchen sink faucets Delta.

D. American Standard water saver fixtures (less than 1.5 GPM flow), wall hung only.

E. Eljer custodial floor service sink acid resisting enameled cast iron.

F. Elkay barrier-free drinking fountains.

G. Josam 17100 series floor mounted single carriers with concealed arms.

H. Haws emergency equipment model 8347.

I. Zurn access doors.

J. Olsonite open front less cover No.10 white only.

K. Water Closets 1 . 5 Gal/Flush, MAP Score, wall mounted.

L. Urinals .5 Gal Flush Rate /Flush Valve (diaphragm}

N. Electric Water Coolers – With Bottle Filler.

22.15 INSULATION

A. General Provisions for Fire and Smoke Hazard ratings: All insulation shall have a system fire and smoke hazard rating as tested by procedure ASTM-E-84, NFPA 255, and U.I. 723 not exceeding: Flame Spread 25 and Smoke Developed 50. The system rating shall be based on insulation, jacket, adhesives, coatings, fittings, and cements. Any treatment of jackets or facings to impede flame and/or smoke shall be permanent. **The use of asbestos containing material is prohibited**.

B. Insulation shall be continuous throughout the entire system. Maintain insulation and vapor barrier through all penetrations.

C. Piping Insulation

1. Required Installation: The following piping shall be insulated:
   (1) Domestic hot water lines
   (2) Condensate lines
   (3) Rainwater leaders above ceilings, under roof deck
2. Insulation for water heaters shall meet or exceed ASHRAE standard 90A-1980 for energy conservation.
3. Piping with an operating temperature under 400°F shall be insulated with molded pipe covering composed of fiberglass wool, resin-bonded and factory applied jacket. Compression strength at 25% deformation shall be 500 lbs. per sq. ft.
4. Fittings, flanges, unions, and valves shall be insulated. Insulation covers shall be either prefabricated or fabricated of pipe insulation. Insulation efficiency shall not be less than that of the adjoining piping. Specify that insulation vapor barrier be installed continuous and unbroken.
5. Hangers, supports, anchors, secured directly to cold surfaces, must be adequately insulated and vapor sealed to prevent condensation.
6. Rigid insulation inserts of proper length shall be installed between pipe and insulation protection shield to prevent sagging of pipe covering at hanger points. Compressive strength of insulation inserts shall be not less than 350 psf at 10% deformation. Specify that inserts be installed as pipe is erected.
7. Insulated piping lines running outdoors shall have corrugated or plain 0.016 in. aluminum jacket complete with integral longitudinal Pittsburgh seam and butt joint strips to lock out the weather. In addition to the vapor barrier, this jacket is required on cold lines.

D. Equipment Insulation

1. All pieces of equipment with surface temperature of 130°F or with surface temperatures causing condensation shall be insulated. Type and thickness of insulation shall be as specified for piping.

22.16 METERING

A. Provide metering for building utilities as indicated on Division 25.

22.17 CONTROLS AND INSTRUMENTATION

A. Refer to Division 25 for details.

22.18 MINIMUM REQUIREMENTS FOR BIO-SAFETY LEVEL II RESEARCH LABORATORY, WET LABS, ANIMAL ROOMS, AND OTHER SPECIAL FACILITIES

A. An eyewash station should be easily accessible.

B. Modifications to the space should be such that the performance of the fume hood is not adversely affected.

22.19 IDENTIFICATION

A. Equipment Identification

1. All equipment except plumbing fixtures served by piping systems shall be identified by number and/or legend where shown on drawings.
2. Identification shall be with engraved plastic name plates using 1" letters on equipment having cabinets and with appropriate size brass tags where cabinets do not exist.
3. Nameplate: Identify model number, size, capacity, electrical characteristics, serial number, along with other items scheduled for equipment on drawings.
4. Indicate motor horsepower, voltage, phase, cycles, RPM, full load amps, locked motor amps, frame size, manufacturer's name and model number, Service Factor, Power Factor, efficiency and other pertinent information.
5. Locate motor nameplates for easy reading. Relocate or provide new nameplates on motors if original nameplates are not located for easy reading.
6. Provide ceiling grid label for valves or other equipment above ceiling. Coordinate labeling requirements with FIU Project Manager.

B. Piping Identification

1. Identify all piping "1" in diameter or larger exposed or concealed in accessible pipe spaces and ceilings shall be provided with color bands, legend, and flow arrows and pipe sizes in accordance with ANSI A13.1 latest edition.
2. Identification markings shall be laminated plastic appropriately color coded with a clearly printed legend to identify the pipe contents.
3. Piping ¾" and smaller shall be provided with 1-1/2" diameter brass identification tags indicating the product in ¼" depressed black filled letters.
4. Identification shall be not less than once every 25 ft, not less than once in each room, horizontal and vertical changes, at each branch, adjacent to each access door or panel, at each valve and where exposed piping passes through walls and floors.
5. Include flow direction arrows and pipe sizes at each pipe identification location. Labels shall be applied at each horizontal and vertical change in direction and behind each access door.

C. Valve Identification

1. All valves in each system shall be identified by system and number with Seton Style 2070 (or approved equal) engraved aluminum or PVC valve tags.
2. Markings shall be installed at each valve, at each branch or riser take-off, at each equipment connection, where pipes pass to underground, and on all horizontal piping at 25-foot intervals.
3. Furnish typewritten charts with identification and location of all valves. Provide electronic copy in O&M Manuals. The chart shall give the number, location, and purpose of each valve.
4. Furnish typewritten charts with identification and location of all access panels serving equipment and valves. Provide electronic copy in O&M Manuals.

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

23.01 GENERAL REQUIREMENT

A. Refer to FIU BIM Standards for additional details and requirements.

B. All mechanical spaces shall be drawn at ¼" scale.

C. DRU INITIATIVE: Hurricane Design Criteria. In the event of an impending tropical storm or hurricane, all facilities shall be switched into a "lock-down" mode. The intent is to cease operations on all mechanical equipment including ventilation make up air and exhaust systems (restroom fans, food service hoods, fume hood exhaust fans, etc.) for a "no-flow" condition. All fume hood sashes will be closed and facilities will become unoccupied. Louvers will be internally closed to minimize the transfer of water penetration into mechanical rooms. To maintain refrigerated and frozen specimens in research or laboratory occupancies, refrigerators and freezers will remain operational under emergency power along with an electric-DX standby air conditioning unit to maintain environmental conditions.

D. Plans for HVAC systems shall be drawn to show exact dimensions and locations of all air handling equipment, duct work, control work, wiring, etc., so as to give the contractor a complete picture of the work required. Particular attention shall be given to space requirements so that the various phases and trades will not conflict. The design engineer shall graphically indicate the profile of an AHU coil removed from the unit to show required clearances for servicing the unit in the future. In no case will one line schematic drawings of duct work be acceptable. All mechanical spaces shall be drawn at ¼" scale.

E. Drawings shall show all necessary sections and details so that the Contractor will not have to make assumptions in order to visualize the scope or physical layout of his work. Sections shall be made of all risers, pipe chases, vertical take-offs and equipment rooms, as well as other areas necessary for clarity.

23.02 SPACE REQUIREMENTS

A. In laying out any ventilating system, ample space shall be allowed for servicing of equipment and to allow future expansions.

B. Space requirements for all mechanical rooms housing ventilation, air conditioning, power and plumbing systems shall be coordinated with the preparation of preliminary architectural studies to be ensure ample space is provided and properly located for the mechanical systems and duct shafts.

C. Serviceability:

1. Clearances suggested by manufacturers for equipment maintenance, removal, and replacement shall be indicated on drawings and accommodated by the layout. Larger and heavier components that may require future removal or replacement shall be identified on the drawings and a clear path identified to the building exterior.
2. Door sizes, lifting supports, and other pertinent information shall be identified on drawings. All components (cleanouts, shut-off valves, floor drains, pumps, etc.) shall have at minimum 24 inches of radial room around them to allow for maintenance access.
3. All components with electrical connections shall have at minimum clearances as indicated

in NFPA 70.
4. All equipment access shall be provided within the equipment room.
5. Design and install all equipment accessible with consideration with celling height.

D. Special consideration shall be given to sound isolation and noise control of all mechanical equipment

23.03 COMMISSIONING:

A. Verify HVAC commissioning requirements with FIU Project Manager.

B. Provide enhanced commissioning services as defined by LEED, to ensure systems designed and operate per Owners requirements. Ensure coordination with Division 1.

C. Fundamental Commissioning will only be allowed if previously approved by FIU Project Manager. At minimum, all systems shall be commissioned per Florida Building Code – Energy Conservation, Section C408.

23.04 CONSTRUCTION QUALITY CONTROL

A. All piping and ductwork to be used on FIU must be cleaned and end-capped prior to delivery. Ductwork or piping delivered to site that is not clean or end-capped will be refused.

B. Ductwork and piping must be protected in storage and during installation. All pipes must have end caps and all ductwork openings must be tightly covered with clean plastic.

C. Piping must be flushed and ductwork cleaned prior to final tie-in/connection or equipment startup. After the flush is completed, chilled water piping/equipment must be then treated by FIU's water chemical vendor. Coordinate treatment requirements with FIU Project Manager.

D. Air intakes, diffuser or grille for outside air, return air and exhaust must be covered with filter media during construction. Filter media must be cleaned or changed frequently during construction. Replace all permanent filters prior to occupancy.

E. During construction, materials shall not be stored inside equipment. Air handling units cannot be utilized as storage.

23.05 SUBMITTALS

A. Maintenance Manuals - Contractor shall deliver to the Architect/Engineer, one(1) bound copies of manufacturer's operating instructions and maintenance recommendations and one electronic copy (original, non-scanned pdf's) for all equipment and machinery installed under the contract. All equipment shall be cross referenced by equipment designation, fire zones and actual room locations. A complete listing of all equipment and location shall be provided in an electronic spreadsheet format (Microsoft Excel). This is to be done before completion of the project.

B. Coordinate additional product submittals requirements with FIU Project Manager.

C. Provide lubrication and recommended periodic maintenance schedule (i.e., filter replacement etc.) for each piece of equipment, on solid mounting boards.

D. Provide electronic and hard copies of valve schedules showing location and identification of all valves. Verify with FIU Project Manager for required number of hard copies. Hard copies shall be laminated on solid mounting boards.

E. Provide wiring control diagrams (both power and control voltage) laminated under plastic for each piece of equipment, on solid mounting boards.

F. LEED Enhanced commissioning projects require a Systems Manual. System manual components include, but are not limited to:

1. Basis of Design
2. Single line diagrams
3. Record documents
4. Approved submittals
5. As-built Drawings
6. Final Sequences
7. Final Set-points
8. Re-commissioning schedule
9. O&M Manual
10. PM schedule
11. Training Material

23.06 TRAINING

A. Training Sessions – Contractor shall provide a full demonstration of all operating systems. Contractor shall videotape the training and demonstration sessions. Three (3) copies in digital format shall be submitted to the Owner prior to Final Payment. The Contractor shall submit an outline of all components to be covered during the training sessions for the Owner's approval prior to scheduling actual training sessions.

B. Training shall be conducted by applicable sub-contractor and/or authorized factory representative.

C. At minimum, training shall include normal operations, required maintenance operations affecting warrantee and cleaning operations.

23.07 CODES AND REGULATIONS

A. Latest editions with current revisions and amendments of the following codes and standards are considered minimum requirements for materials, workmanship, and safety where not covered elsewhere in these specifications.

1. Florida State Board of HealthFlorida Building Code
2. Underwriters Laboratories (UL) - Equipment bearing a "UL" seal of approval
3. NFPA 1 Fire Code
4. NFPA 2 Hydrogen Technologies Code
5. NFPA 45 Fire Protection for Laboratories Using Chemicals
6. NFPA 54 Gas Appliances and Gas Piping
7. NFPA 70 National Electric Code
8. NFPA 90A Air Conditioning and Ventilating
9. NFPA 91 Blower and Exhaust Systems

10. NFPA 101 Safety to Life from Fire in Buildings
11. UL 555 - Fire Dampers
12. Public Law 91-596 Occupational Safety and Health Act
13. Sanitary Code of Florida
14. ASHRAE Guide - Equipment, System and Applications
15. SMACNA - Low Velocity Duct Construction Standards
16. SMACNA - High Velocity Duct Construction Standards
17. ANSI B9.1-1971 Safety Code for Mechanical Refrigeration
18. ANSI B31.1, 0-1967 (with Agenda) Power Piping
19. ANSI B31.2 - Fuel Gas Piping
20. UL - Equipment bearing a "UL" seal of approval
21. NIH National Institutes of Health
22. AAALAC Association for Assessment and Accreditation of Laboratory Animal Care

B. Requirements described in the FIU Master Plan.

C. Unless otherwise specified in this section of the Building Standards, or otherwise directed by the Owner, the latest edition of Duct Manual and Sheet Metal Construction for Ventilating and Air Conditioning Systems published by the Sheet Metal and Air Conditioning Contractors National Association, Inc (SMACNA) herein after called the "Duct Manual" shall be used as a guide for construction of duct systems for air distribution.

23.08 MEASUREMENT AND VERIFICATION

A. Coordinate with other consultants to provide an M&V system via the building controls system to monitor energy and water by end use as defined by LEED.

B. At minimum the following utilities shall be metered:

1. Chilled Water
2. Heating Hot Water

C. Segregate HVAC loads for and totalize on monthly basis. Coordinate with LEED M&V requirements and FIU Project Manager.

23.09 VIBRATION AND NOISE

A. Special consideration shall be given to sound isolation and noise control of all HVAC equipment.

B. Maximum Noise Criteria

1. Classrooms & Private Offices: NC-30.
2. Conference Rooms: NC-30
3. Open Office: NC-40.
4. Laboratory with fume hoods: NC-50
5. Laboratory without fume hoods: NC-45
6. Halls, Corridors, Lobbies: NC-40.
7. Specialty Spaces: To be determined on project-by-project basis.

C. Vibration Criteria

1. Coordinate requirements with FIU Project Manager. Specialty Spaces may require specific parameters or requirements. Parameters to be determined on project-by- project basis.

23.10 AIR CONDITIONING

A. All new or remodeled buildings or buildings over 5,000 square feet gross area will be cooled by a chilled water system. New or remodeled buildings and/or additions under 5,000 square feet will be cooled as indicated in the building program. Interface to separate the building loop from the central distribution loop will be as instructed by the Facilities development Utilities Planning Engineer.

B. Direct Expansion (DX) system for main cooling it is not desired. Usage of DX system for main cooling shall be approved by FIU Project Manager.

C. IT closets shall have dedicated Fan Coil Unit on emergency power.

23.11 PUMPS

A. Provided each building with at minimum two, zone chilled water pumps, connected in parallel. Pumps shall be sized to provide redundancy of the total flow at the total building system pressure. Total building system pressure for zone shall include all pressure from the supply valve at the transport loop through the building back to the return valve at the transport loop. Consider pressure at the valves connecting to the transport loop as 0 psig.

B. Pumps up to 250 gpm shall be suction, base mounted, with mechanical seals, bronze trimmed. Pumps over 250 gpm shall be split case, double suction, with mechanical seals, bronze trim.

C. All end suction pumps to be selected at a minimum 75% efficiency. Split-case, double suction pumps to be selected at a minimum of 80% efficiency. All pumps to be selected to be non-overload at any point on their curve. Impeller diameter shall not exceed 90% of the maximum catalog published impeller diameter for each pump.

D. Pumps shall be provided with variable speed drives mounted in the wall near the pumps. Changes in flow through building due to load variation to be sensed across main supply and return pipes downstream of pump discharge. Pumps will be controlled in response to this variation by reducing speed, and/or shutting off one pump. The characteristics of each specific system to be approved by University Development Engineer.

E. At 50% construction document submittal phase, submit a pump report and composite curve showing hydraulic curve and the curve representing the sum of the operating pumps. This data to be superimposed on the manufacturer's published pump curve for the proposed pump. Indicate points of system operation at full flow, reduced flow due to speed changes and shutting off pump. Indicate required NPSH at each point. Individual pump curve and report and composite curves shall be as generated by H20 optimizer, Paco Select or equivalent computer program output by Goulds or Weinman pumps.

F. Provide a differential pressure sensor at building entrance. Location to be approved by FIU prior to installation.

23.12 AIR HANDLING UNITS

A. Coil control valves shall be two position, two way, normally open valves. Each building shall be provided with at least one 3-way valve or a bypass valve to allow a trickle flow through the building. Buildings required to maintain round the clock temperature or humidity in designated areas shall try to group all such loads in a single air handler.

B. Air handler units to have sealed bearings, motor & fan. Bearings shall be insulated.

C. Air handling units shall not be located above any suspended ceiling. Locate all air handling units in mechanical rooms.

D. Provide mechanical equipment room for all equipment.

E. Locate all air conditioning equipment external to classroom areas so they may be serviced without interrupting classes.

F. Filters - Filter types will be pleated filters or permanent self-charging electrostatic filters with 55% or higher efficiency rating. Construction filters must also have 55% or better efficiency rating. For design conditions requiring different media than these, consult with University project engineer.

G. All air handling units shall be Draw thru type unless noted or approved otherwise by the FIU Project Manager.

H. Provide units with large access sections for proper maintenance. Access sections shall be minimum 24” wide or bigger if required for equipment removal.

I. UV Radiation Lights at each coil: The use of UV lights in air handling unit shall be review and approved by FIU Project Manager prior to its implementation. Safety interlock power switches to automatically disengage power to UV lamps shall be installed on all air handler panels or doors accessing the UV lights-section when the panel or door is opened; install identifying labels at the safety interlock switches. Lamp ballast be mounted on the outside of the AHU, inside of an approved enclosure for ease of access for replacement. UV lights shall be provided with all necessary controls to allow the University staff/maintenance to program them ON/OFF automatically based on building schedule.

J. Maximum allowable face velocities:

1. Cooling and Heating Coils: 450 fpm
2. Pre-filters and Final Filters: 450 fpm
3. Energy Recovery Wheels: 700 fpm

K. Limit sizing of coils to 8 rows and 12 fins/inch (FPI). Multiple coil banks will be required if 8 rows cannot be archived with one coil.

L. Cooling coils shall be sized for 45°F entering water temperature.

M. Size 100% outside air cooling coils for 20 F delta T and recirculating air handling unit coils for 16 F delta T.

N. Heating coils shall be sized for 120°F entering water temperature

O. Size air handling unit preheat and reheat coils for a minimum 30 delta T.

P. Coils shall be specified in accordance with ARI 410-64.

Q. Drain Pan: stainless steel, double wall, insulated drain pans that are sloped for positive drainage. Provide a trap from the drain pan of each cooling coil designed for the static pressure of the air handling unit.

R. Consider the use of fan arrays with variable frequency drives (VFDs). Utilized standard fan motor sizes for all fan motors on the array. All motors in the array shall be the same sizes and shall be maximum 15 hp.

S. For fans rated five (5) HP. or greater, maximum fan wheel speed shall be 1800 RPM, unless otherwise directed by the FIU Project Manager.

T. Equipment Pad: Mount air handling units on concrete pads at least 4 inches above finished floor. Provide equipment support railing as necessary to allow proper trapping for the cooling coil condensate line.

U. Air handling units shall be constructed with thermal breaks between all sections of the units.

V. Rooftop units shall be in an enclosure.

W. Provide adequate lighting and power inside the air handling units. Units shall be provided with convenient outlets and LED lights. Air handling unit lights shall have switches in the exterior of the unit to turn ON/OFF.

X. Condensate drain piping shall be ASTM B88, Type M, hard temper copper tubing.

Y. Provide rust inhibiting coating for protection for 100% OA coils. Protect coils with coating similar to Heresite P-413C baked phenolic with plasticizer. Total dry film thickness of coating shall be approximately –1 to 2 mils. Coating shall withstand dry heat up to 400°F, and show no sign of attack after 3000 hrs of salt spray test to ASTM Specification B117.

Z. Provide two-way modulating valves on return line at all air handling units. Chilled water valves shall fail open. Heating valves shall fail closed.

23.13 FAN COIL UNITS

A. Cooling coils shall be sized for 45°F entering water temperature.

B. Size cooling coils for 8-10 F delta T.

C. Size heating coils shall be sized for 120°F entering water temperature

D. Size preheat and reheat coils for a minimum 30 delta T.

E. Provide fan coil units with auxiliary drain pans. Install cut-off switch for auxiliary drain pan. Drain pans shall be constructed per SMACNA but with minimum gauge 20ga and properly supported to withstand the weight of their capacities.

F. Fan coil units and auxiliary drain pans shall be supported properly. Provide vibration isolation and flexible duct connections for fan coil unit

G. Provide a trap from the drain pan designed for the static pressure.

H. Coils shall be specified in accordance with ARI 410-64.

I. Condensate drain piping shall be ASTM B88, Type M, hard.

23.14 FANS

A. Provide cast iron sheaves, belt drive, belt guard, motor sheave with adjustable pitch diameter, for plus or minus 10 percent variation from rated speed.

B. After test and balance, remove adjustable sheave and replace with fixed sheave of proper diameter.

C. Direct drive plenum fans are allowed for fan arrays.

D. All fans located in the exterior (supply, return and/or exhaust fans) shall be constructed of stainless steel or aluminum or fiberglass.

E. Properly tie-down all exterior fans to meet wind zone requirements.

F. Provide 100% redundancy for fan systems serving Laboratories. Confirm requirements with FIU Project Manager.

23.15 MOTOR AND STARTER

A. Select with 1.15 service factor but not to exceed name plate current at normal operation load.

B. Provide reduced voltage starters for all motors above 60 HP at 480 volt and 30 HP at 208 volt.

C. All major mechanical equipment (such as air handling units, exhaust fans, pumps, etc.) shall be provided with variable speed drives to allow soft-start.

D. All motors greater than 1/2 H.P. shall be 480V. Motor with horsepower less than 1/2 HP motors shall be 120V. Air handler units, supply fans, exhaust fans, etc.

E. All variable frequency drives shall be mounted near equipment on a wall.

F. Provide variable frequency drives with bypass.

G. Evaluate variable frequency drives and harmonics. Engineer to determine appropriate filters for variable frequency drive.

23.16 DUCTWORK

A. Specify galvanized sheet metal designed and constructed in accordance with the latest edition of Sheet Metal and Air Conditioning Contractor's National Association, Inc. manual (SMACNA) low or high velocity as applicable.

B. Special Exhaust Systems such as exhaust from laboratory hoods shall be made of acid resistant materials and construction. Special Exhaust System ductwork shall be 316 stainless steel, 304 stainless steel, fiberglass or internally coated galvanized steel. Where stainless steel material is used, connections shall all be welded air and watertight. Where fiberglass material is used, connections shall comply with duct manufacturer's recommendations. Where internally coated galvanized steel is used, connections shall comply with the duct manufacturer's recommendations. In all cases, connections at manufacturer's equipment, connections shall comply with equipment manufacturer's recommendations.

C. Wall penetrations shall be sealed in accordance with Underwriters Laboratories details and/or Specification to properly maintain wall rating.

D. Use Underwriters Laboratories label fire dampers at all penetrations of fire rated walls, floors, ceilings and in accordance with NFPA 90A. All fire dampers shall be dynamic type.

E. Provide smoke dampers in all ductworks that pierces smoke partitions. These dampers will be in addition to those specified for air units. Dampers shall be actuated by a smoke detector mounted within occupied space. Provide sequence for testing per project requirements. Provide remote monitoring and fail to safe condition.

F. Provide insulated access door in ductwork for all devices requiring routine maintenance and/or inspection such as fire damper, fire/smoke dampers, turning vanes, duct smoke detectors, airflow meters, etc.

G. Turning vanes shall not be allowed in any return and/or exhaust system.

H. Flexible ducts are only allowed for final connections to diffuser and grilles. Flexible ducts are not allowed to pass thru walls.

I. Duct seams and joints shall be sealed to meet SMACNA Class A.

J. Outside Air Dampers:

1. Provide dampers on all outside air intakes. Provide automation as needed. These dampers shall open automatically when unit is on and close automatically when the unit is off. Dampers to be constructed of stainless steel or aluminum only.
2. Outside air dampers shall be monitored and alarm in the event of a failure.

23.17 TERMINAL UNITS

A. Terminal units shall be located outside of offices where feasible. In no case shall terminal units be located above furniture.

B. Provide 120 volts / 1PH power to each terminal unit, unless fan-powered. Each terminal unit shall have a primary voltage to 24 volts secondary transformer in the control cabinet.

C. Air terminal units shall be provided with option to easily remove the flow ring.

D. Provide access doors at inlet and outlets for reheat coils to allow proper cleaning and maintenance. Size access doors to properly inspect and clean reheat coils.

23.18 THERMOSTATS AND ZONING

A. No more than three offices shall be combined on a single thermostat (zone).

B. Offices with different exposures or loads shall not be combined on the same thermostat.

C. Classrooms, conference rooms, laboratories, and places of assembly shall each have a dedicated thermostat.

D. Thermostats in public spaces shall be tamper proof.

E. Proposed thermostat locations with FIU Project Manager prior to the submission of 100% Construction Documents.

F. Equipment shall be zoned such as operation, function, schedule is similar (where practical). This will allow entire systems shutdown or setback for operating economies.

23.19 AIR DISTRIBUTION PRODUCTS

A. Use criteria as outlined in ASHRAE Guide and Data Book, latest edition. Chapter entitled “Space Air Distribution”.

B. All supply air grilles, registers and ceiling outlets to be aluminum.

C. All sidewall supply grilles and registers shall be 4-way adjustable deflection type.

D. Provide multi-blade volume control dampers which are adjustable by removable key from the front of each outlet.

E. Provide plaster frames for each register.

F. Ceiling diffuses to be adjustable type with volume damper, equalizing deflector and volume damper.

G. For areas with hard ceiling provide access doors to all dampers and devices above ceiling. Provide Young regulator (or approved equal) where access door is not feasible

H. All air distribution devices shall have opposed blade damper.

23.20 CHILLED AND HOT WATER PIPING.

A. Use standard weight black steel, ASTM-A-53 grade B seamless steel with welded fittings for pipe 3” diameter and larger.

B. For pipe 2-1/2” diameter and smaller, use threaded ends 150 psi class malleable iron fittings.

C. For pipe sizes 3” diameter and smaller use solid wedge gate valves.

D. Strainers - Provide wye type with valved blowdown lines piped to floor drains. For strainers 2-1/2" and larger, provide flange bonnets for basket removal.

E. Provide strainers at each air handling unit cooling coil.

F. Air Eliminators - Provide at the high points of all chilled and hot water lines drain lines.

G. Full port ball valves, with stainless steel ball and trim. Provide serviceable inline ball valves.

H. Gauges and Ports

1. Provide pressure gauges with 4-1/2" minimum dial with 1.0 psi graduations on each chilled water supply and return line at building entrance.
2. Provide gauge cocks and thermometer wells on supply and return piping on all air handling units.
3. Gauges shall also be installed at strainer entering pumps, pump suction, pump discharge. Gauges shall be bourdon tube types with an accuracy of 1/2% of scale range.
4. Provide balancing valves with pressure taps.
5. Provide pete's plug on supply and return of coils.

I. Provide venturi flow measuring device in return lines from each handling unit, and in main return line to building pumps.

1. Venturi stations shall be complete with permanent rust-proof metal identification tag showing designed flow rates, meter readings or differential pressure outputs at designed flow rates.
2. Provide each venturi with valve taps.

J. Isolation Valves

1. Provide isolation valves in the supply and return piping at the beginning of each branch piping takeoff in vertical all mechanical piping (such as HW, HHW, DHW, DCW, and Gas, etc.).
2. Location of riser isolation valves will be directly after the riser takeoff from the main piping within the building and readily accessible for operating. Provide isolation valves at building entrance.
3. Provide ceiling grid label for valves above ceiling. Coordinate labeling requirements with FIU Project Manager.

23.21 VALVES

A. Provide shut-off valves on mains for each building, for each riser in each building and for each floor level. Valves shall be accessible but not visible. Identify shut-off valve locations on finish ceiling surfaces. Valves outside the building shall be provided with concrete valve boxes and covers. Shut-Off valves in restrooms shall be wall mounted.

B. Triple Duty Valves: Triple duty (check, balancing, shut-off) valves are not acceptable for mechanical systems such as chilled water, heating hot water and condenser water applications. Use separate check valves and shut off valves.

C. Provide isolation valves in the supply and return piping at the beginning of each branch piping

takeoff in vertical all mechanical piping (such as HW, HHW, DHW, DCW, and Gas, etc.).

D. Location of riser isolation valves will be directly after the riser takeoff from the main piping within the building and readily accessible for operating. Provide isolation valves at building entrance.

E. Provide ceiling grid label for valves above ceiling. Coordinate labeling requirements with FIU Project Manager.

F. Provide ball valves on supply and return piping with balancing cock on return line to all air handling units. Provide ball valves and tee handle up to 3".

23.22 INSULATION

A. General Provisions for Fire and Smoke Hazard ratings: All insulation shall have a system fire and smoke hazard rating as tested by procedure ASTM-E-84, NFPA 255, and U.I. 723 not exceeding: Flame Spread 25 and Smoke Developed 50. The system rating shall be based on insulation, jacket, adhesives, coatings, fittings, and cements. Any treatment of jackets or facings to impede flame and/or smoke shall be permanent. The use of asbestos containing material is prohibited.

B. Insulation shall be continuous throughout the entire system. Maintain insulation and vapor barrier through all penetrations.

C. Piping Insulation

a. Required Installation: The following piping shall be insulated:

a. Steam lines
b. Condensate lines c. Chilled water lines
d. Refrigerant lines
e. Heating hot water
f. Process cooling water

b. Insulation for water heaters shall meet or exceed ASHRAE standard 90A-1980 for energy conservation.
c. Piping with an operating temperature under 400°F shall be insulated with molded pipe covering composed of fiberglass wool, resin-bonded and factory applied jacket. Compression strength at 25% deformation shall be 500 lbs. per sq. ft.
d. Fittings, flanges, unions, and valves shall be insulated. Insulation covers shall be either prefabricated or fabricated of pipe insulation. Insulation efficiency shall not be less than that of the adjoining piping. Specify that insulation vapor barrier be installed continuous and unbroken.
e. Hangers, supports, anchors, secured directly to cold surfaces, must be adequately insulated and vapor sealed to prevent condensation.
f. Rigid insulation inserts of proper length shall be installed between pipe and insulation protection shield to prevent sagging of pipe covering at hanger points. Compressive strength of insulation inserts shall be not less than 350 psf at 10% deformation. Specify that inserts be installed as pipe is erected.
g. Insulated piping lines running outdoors shall have corrugated or plain 0.016 in. aluminum jacket complete with integral longitudinal Pittsburgh seam and butt joint strips to lock out the

weather. In addition to the vapor barrier, this jacket is required on cold lines.

h. Insulate chilled water piping 6 inches and smaller with 2" thickness of foamglass with approved protective covering where exposed. Provide coating or fabric to maintain a continuous vapor barrier.

i. Insulate chilled water piping 6" and larger with 2-1/2" thickness of foamglass with approved protective covering where exposed. Provide coating or fabric to maintain a continuous vapor barrier.

j. Prior to installation of foamglass provide coating to prevent corrosion (CUI).

k. Insulate hot water heating pipe with 1-1/2" thickness of tubeglass with factory applied jackets

l. Insulate hot water heating pipe with 1-1/2" thickness of tubeglass with factory applied jackets.

m. Insulate underground steel chilled and hot water heating piping with 2-1/2" foamglass covered with factory applied felt or glassed fabric and mastic coatings to render water tight vapor barrier.

n. For chilled water piping 2" or less Armaflex insulation will be allowed. Provide coating or fabric to maintain a continuous vapor barrier.

D. Duct Insulation

1. Thickness of supply air duct and plenum insulation shall be selected to prevent condensation on the surface of insulation when the ambient relative humidity is 90% at the maximum difference between the ambient air temperature and the supply air temperature. Minimum thickness of supply-air or return-air duct insulation shall be 2 in. nominal, and 2 in. nominal on outside air duct or plenum. Insulation shall be continuous through all openings but shall be interrupted at fire dampers. Insulation shall meet or exceed ASHRAE Standard 90A-1980 for energy conservation.

a. Exposed rectangular air conditioning supply ducts and return ducts in non-air-conditioned space shall be insulated with rigid fiberglass insulation board having a density not less than 3 lb./cu. ft. and with factory applied fire retardant glass cloth or vinyl jacket with vapor barrier.

b. Concealed air conditioning supply air ducts in ceiling space above an air-conditioned room shall be insulated with fiberglass duct wrap insulation of ¾ lb./cu. ft. density with factory applied vapor barrier and fire-retardant jacket. When insulation is necessary on return air ducts, ducts shall be insulated in the same manner.

c. All exposed round air conditioning supply air and return air ducts shall be insulated the same as specified for concealed ducts except that glass cloth jacket shall be field applied over the factory applied vapor barrier.

d. Outside air intake ducts and air plenums shall be insulated the same as specified for exposed rectangular air conditioning supply air ducts.

23.23 METERING

A. Provide metering for building utilities as indicated on Division 25.

B. Coordinate meter(s) installation requirements with ductwork and piping drawings.

23.24 CONTROLS AND INSTRUMENTATION

A. Refer to Division 25 for details.

23.25 TESTING AND BALANCE

A. The contractor is required to test and balance the HVAC system. The University will retain a company to verify that the system has been properly tested and balanced.

23.26 MINIMUM REQUIREMENTS FOR BIO-SAFETY LEVEL II RESEARCH LABORATORY, WET LABS, ANIMAL ROOMS, AND OTHER SPECIAL FACILITIES

A. Recirculation of building ventilation air from rooms or other facilities containing potential airborne contaminants shall not be permitted.

B. All hoods must be equipped with a monitoring device.

C. The minimum occupied air changes per hour shall be 6 ACH. The minimum unoccupied air change rate shall be 4 ACH. Confirm air changes with FIU Project Manager.

D. Prevention of Exhaust Air Recirculation:

1. The location of fresh air intakes shall be chosen to avoid drawing in hazardous chemicals or products of combustion either from the building itself, loading docks, or from other structures and devices.
2. Exhaust stack height and exhaust air exit velocities shall be selected to ensure that exhaust air is safely discharged vertically beyond the building's atmospheric boundary layer.

E. Methods of providing emergency ventilation shall be considered, such emergency airflow switches, standby local exhaust systems, etc., to protect occupants against major chemical spills or similar hazards.

F. To maintain safe conditions in the lab in the event of fan system failure or maintenance shutdown, redundant supply and exhaust fan systems shall be equipped with fume hoods, air handling units and/or other critical exhaust systems. The fans shall be scheduled for equal run times to facilitate reduced maintenance.

G. Laboratory modules in which hazardous chemicals are being used shall be maintained at an air pressure that is negative to the corridors or adjacent non laboratory areas. The laboratory must be maintained under negative pressure of at least – 0.76 mm of water. An exception to this requirement is where operations, such as those requiring clean rooms, animal rooms, etc, preclude a negative pressure relative to surrounding areas; in this case, special precautions shall be taken to prevent air leaks to the surrounding space. Pressure requirements shall be review and approved bay FIU Project Manager.

H. In labs where pressurization failure would create hazardous conditions, differential pressure alarms shall be considered.

I. Care shall be exercised in the selection and placement of air supply diffusion devices to avoid air currents that would adversely affect the performance of laboratory hoods, exhaust systems, and fire detection or extinguishing systems.

J. Modifications to the space should be such that the performance of the fume hood is not adversely affected.

K. Engineer shall coordinate special requirements with FIU Project Manager.

23.27 FUME HOODS SYSTEM

A. Early in the design process, the Design Consultant responsible for the fume hood exhaust system shall obtain a list of the chemicals used and stored in the lab. This list shall be used to analyze fume hood exhaust for flammability, toxicity, corrosiveness, and explosion hazard. In selecting and analyzing fume hazard control techniques, the Mechanical Design Consultant shall work closely with the FIU Project Engineer and University Environmental Health and Safety personnel.

B. All fume hoods shall be equipped with a local audible and visual alarm system that is activated by a differential pressure type switch when the hood exhaust flow deviates from specified safe ranges.

C. Fume hoods shall be located away from doors, operable windows, and major traffic corridors to avoid cross drafts at the hood face.

D. Fume hoods shall not be located next to doorways that are primary means of egress.

E. Provide a differential pressure sensor for fume hood system. Location and type shall be approved by FIU Project Manager prior to installation.

23.28 IDENTIFICATION

A. Equipment Identification

1. All equipment systems shall be identified by number and/or legend where shown on drawings. Identification shall be with engraved plastic name plates using 1” letters on equipment having cabinets and with appropriate size brass tags where cabinets do not exist.
2. DRU INITIATIVE: All rooftop equipment (fans, exhaust fans, etc.) shall bear Identification markings which shall be laminated plastic screwed or rivited to the structural mounting frame with a clearly printed designation consistent with identifications found in the mechanical plans and electrical panel schedules (for example EF 07).
3. Nameplate: Identify model number, size, capacity, electrical characteristics, serial number, along with other items scheduled for equipment on drawings.
4. Indicate motor horsepower, voltage, phase, cycles, RPM, full load amps, locked motor amps, frame size, manufacturer’s name and model number, Service Factor, Power Factor, efficiency and other pertinent information.
5. Locate motor nameplates for easy reading. Relocate or provide new nameplates on motors if original nameplates are not located for easy reading.
6. Provide ceiling grid label for valves, VAV, or other equipment above ceiling. Coordinate labeling requirements with FIU Project Manager.
7. Provide labels for all thermostats. Label shall indicate associated equipment (i.e. air terminal number, fan coil unit number, air valve number, etc.). Locate label behind thermostat cover if possible.

B. Piping Identification

1. Identify all HVAC piping (chilled water, process chilled water, hot water, high pressure steam, low pressure steam, steam condensate, condensate, etc.) 1" in diameter or larger exposed or concealed in accessible pipe spaces and ceilings shall be provided with color bands, legend, and flow arrows and pipe sizes in accordance with ANSI A13.1 latest edition.
2. Identification shall be not less than once every 25 ft, not less than once in each room, at each branch (including run-outs to terminal devices), adjacent to each access door or panel, at each valve and where exposed piping passes through walls and floors.
3. Include flow direction arrows and pipe sizes at each pipe identification location. Labels shall be applied at each horizontal and vertical change in direction and behind each access door.
4. Identification markings shall be laminated plastic appropriately color coded with a clearly printed legend to identify the pipe contents.
    a. Piping ¾" and smaller shall be provided with 1-1/2" diameter brass identification tags indicating the product in ¼" depressed black filled letters.

C. Valve Identification

1. All valves in each system shall be identified by system and number with Seton Style 2070 (or approved equal) engraved aluminum or PVC valve tags.
2. Markings shall be installed at each valve, at each branch or riser take-off, at each equipment connection, where pipes pass to underground, and on all horizontal piping at 25 foot intervals.
3. Furnish typewritten charts with identification and location of all valves. Provide electronic copy in O&M Manuals. The chart shall give the number, location and purpose of each valve.
4. Furnish typewritten charts with identification and location of all access panels serving equipment and valves. Provide electronic copy in O&M Manuals.

SECTION 25 0000

DIVISION 25 – INTEGRATED AUTOMATION

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes the general requirements for the Integrated Automation systems.

B. Related Sections:

1. All sections within Division 25.

C. Where architectural features govern location of work, refer to architectural drawings and coordinate with other trades.

1.2 REFERENCES

A. This section includes any rules and regulations of Federal, State, local authorities, and utility companies in force at the time of execution of contract.

B. Agencies or publications referenced herein refer to the following:

1. ADA Americans with Disabilities Act
2. ANSI American National Standards Institute
3. ASHRAE American Society for Heating, Refrigeration, Air-Conditioning Engineers
4. ASTM American Society for Testing and Materials
5. BICSI Building Industry Consulting Services International
6. EIA Electronic Industries Association
7. FCC Federal Communications Commission
8. ICEA Insulated Cable Engineers Association
9. IEEE Institute of Electrical & Electronics Engineers
10. ISO International Organization for Standards
11. NEC National Electrical Code (2002)
12. NECA National Electrical Contractors Association
13. NEMA National Electrical Manufacturers Association
14. NETA National Electrical Testing Association
15. NIST National Institute of Standards & Technology
16. OSHA Occupational Safety and Health Administration
17. TIA Telecommunications Industries Association
18. UL Underwriters Laboratories, Inc

1.3 DEFINITIONS

A. AHU - Air Handling Unit

B. ATC - Automatic Temperature Control

C. ATU - Air terminal Unit

D. AWG - American Wire Gauge (standard wire size measurement)

E. BAS - Building Automation System

F. Device - Intelligent controller or other automated monitoring piece of equipment

G. CD - Compact Disc used for data storage

H. Commissioning - Process to ensure installation and functionality is per design

I. Enterprise - Top level of integrated systems for overall logistical monitoring and business Planning

J. EMS - Enterprise Management System

K. FCU – Fan Coil Unit

L. IBS - Integrated Building Systems

M. I/O - Hardware inputs and outputs

N. Instrument - Device used to sense inputs or control outputs or both

O. Integration - Connection of disparate systems to a common platform using communication protocols.

P. IP Address – Internet Protocol node address

Q. IT - Information Technologies

R. O&M - Operation & Maintenance Manuals

S. Object - Hardware or Software component such as a device or point

T. Point - Single hardware input/output or software data objects such as setpoints and attributes.

U. Pointlist - List of inputs, outputs and parameters for specific systems

V. RFI - Request for Interpretation

W. Stand-Alone - The ability to function upon loss of communication

1.4 SYSTEM DESCRIPTION

A. The integrated automation system includes integration, control and monitoring of the various systems throughout the facility including:

1. Procurement and installation of integrated automated systems.
2. Integration of systems with the Enterprise Management System.
3. Integration of data from various systems to allow for seamless monitoring and control of the various systems.

B. The functionality of the integrated automation system must include:

1. The ability to communicate with systems shown, utilizing protocols specified.
2. Stand-alone functionality of critical HVAC and Fire sequences.

C. Lead the coordination effort to integrate with the various networked equipment, systems, specialty vendors and the Enterprise.

D. Lead the coordination effort of implementation meetings and activities.

E. Integrated Automation includes but is not limited to labor and materials for terminations, pathways, installations, certifications, testing, system verification, project commissioning, network equipment, integration equipment, instrumentation and controls and integrated automated systems.

F. Provide additional, supplementary or miscellaneous items, products and labor incidental to or necessary for a complete and operable system including but not limited to:

1. Uninterruptable Power Supplies (UPS)
2. Surge suppression devices
3. Transformers and power supplies
4. Programming modifications

G. Request IP addresses and other IT requirements from Owner to accommodate project schedule.

1.5 SUBMITTALS

A. All submittals shall be original and searchable electronic pdf format.

B. Submit complete schedule/outline of product submittals prior to submittal submission. Submit each section independent and separate from other sections. For each product submission:

1. Specification Section and Product number.
2. Include only products within referenced specification section submission.

C. Product Data: For each product submission, include the following:

1. Table of contents for each submission.
2. Submit each section independent and separate from other sections. Include only products within referenced specification section submission.
3. Product data sheets for all required components and accessories.
4. Submit manufactures checklist & calibration documentation for calibrated instrumentation.
5. Identify actual product model number used for each drawing.
6. Identify any proposed modifications to system design. (Specifications or Drawings)
7. Organize product data based on specification Section, Part, and Article.
8. A paragraph-by-paragraph specification compliance report indicating compliance for each numbered paragraph. The following format shall be used in completing the compliance report:
    a. Comply—without exception.

b. Qualify—meet the functional intent. For each paragraph, the contractor shall identify all differences in specific functions stated in the given paragraph and provide a description of what is excluded or how the qualifying system will meet the function specified.

c. Does not comply—cannot meet specified function.

d. Does not apply – not used or not required.

D. Integration Plan

1. Network architecture and communications concepts/diagrams. Network architecture includes but is not limited to:

    a. Nodes
    b. Switches and Routers
    c. Integrated systems and/or sub-systems
    d. Dedicated I/O locations

2. Coordination of vendor protocol and pointlist submission. Include an integration matrix detailing systems and protocols to be used.
3. Workflow processes to integrate systems
4. Include communication hardware, software, and protocols to implement full systems integration.
5. Identify proposed enhancements or deviations from project documents. Include specific drawings or specifications impacted.
6. Provide coordination efforts to accommodate complete integration of systems including:

    a. Vendor protocol requirements
    b. Vendor pointlist

7. Submit communication risers for controllers and all integrated systems.
8. Submit maintenance schedules for all controller, valves, dampers, and instrumentation.

E. Start-up Plan

1. Coordination of equipment controlled and monitored
2. Workflow process to start equipment
3. Equipment start-up requirements
4. Checklist
5. Intended sequence of work items
6. Start dates of individual work items
7. Duration of individual work items
8. Planned delivery dates for major material and equipment, and expected lead times
9. Milestones indicating possible restraints on work by other trades or situations

F. Owner Instruction and Training Plan

1. Organized list of specific equipment or systems that require training
2. Separate agenda for each training session including but be not limited to:

    a. Construction Document review of systems
    b. Installation and as-built conditions

c. Theory of operation
d. Demonstration of operation
e. Operation and Maintenance Document
f. Servicing and Maintenance Schedules
g. Interlocks and Safeties

3. Manufactures recommended classroom training and schedule

G. Record Documents:

1. Include field condition updates
2. Document material, make and model numbers where appropriate
3. Update details, schedules, risers, etc.
4. I/O point as-builts
5. Sequence details, modifications, or updates
6. Control loops including final set-points and parameters
7. Mark and detail on coordination drawings, exact locations of equipment installed
8. Panel details for each unique panel

H. Operation Manuals:

1. At minimum, submit one electronic copy and one hard copy
2. Do not include previously submitted product data
3. Include a table of contents
4. Tab manual based on specification chapters or sections
5. Network architecture and communications concepts/diagrams
6. Uploading and downloading software to the field hardware
7. Finely detailed descriptions of all software programs
8. Complete set of software engineering manuals
9. Complete system design and engineering manual same as used by manufactures personnel
10. Application Programming
11. CD of any configuration tools used in project
12. Operator instructions or User Manual
13. Calibration and/or verification sheets for all instrumentation including but not limited to:

a. Liquid Flow Meters
b. Air Flow Meters
c. CO2 Sensors
d. Temperature Sensors
e. Humidity Sensors

I. Project Maintenance Manuals:

1. Include a table of contents
2. 1 copy on CD
3. Organize by manual by specification section number
4. Index sheet listing contents in alphabetical order
5. Include the following:

a. Installation instructions

b. Manufacturer's operating and maintenance instructions (not product submittals)
c. Factory and field-test records, including calibration and factory setup
d. Printout of application control programs (typical)
e. Snapshot printout of each system installed
f. Signed checklist of each system
g. Factory training schedule and course description catalog
h. Archived backup of software, drawings, and record documents
i. Installation contractor and service representative information
j. Licensing and warranty information

J. Submit a User Workstation Planning Session Plan for each subject.

1. Graphics Generation
2. Point naming
3. Alarm management

1.6 QUALITY ASSURANCE

A. All systems, equipment, components, accessories, and installation hardware must be new, free from defects, and currently in production.

B. All work shall be compliant with applicable national and local codes.

C. Demonstrate project compliance to Engineers satisfaction including construction and integration.

D. Provide the same manufacturer components of a given type product throughout project.

E. Support future compatibility for no less than 7 years with the ability to upgrade existing field panels and extend new field panels on an installed network.

F. Digital equipment furnished under this contract shall have been tested and made to comply with limits of Class A computing device pursuant to Subpart J of Part 15 of FCC Rules.

G. Maintain NEC workspace clearances.

1. Install and operationally check systems utilizing factory-trained competent technicians skilled in the setting and adjustment of equipment used in this project.

H. Test, adjust, and calibrate all end instruments.

I. Follow project communication protocol for all correspondence. Any changes, decisions, etc. must be properly documented. The Engineer will not issue verbal directions. Verbal interpretations, clarifications, conversations, etc. are non-binding without proper documentation.

J. Request for Interpretation (RFI) shall include:

1. Referenced drawing and/or Specification Section number.
2. Single request per RFI
3. Single proposed solution per RFI
4. Attached sketch of solution (if applicable)

5. Attached specification verbiage (if applicable)
6. Incomplete RFI's will be returned without response.
7. Contact person.

K. RFI answers are for clarification only and do not authorize additional work or change orders.

L. Install devices in appropriate enclosure and in an accessible location.

M. Install systems and devices in a neat, workmanlike manner and in accordance with manufacturer's recommendations.

N. Continually monitor the field installation for code compliance and quality workmanship.

O. Remove and re-install any systems or devices where installation is deemed of poor quality by Owner or Engineer.

P. Provide software and firmware updates prior to and within 2 months of substantial completion.

Q. Lead the coordination effort to ensure integration of various systems prior to installation.

R. Comply with all health and safety regulations

S. Include automatic restart logic for loss of power, safeties, fire alarm shutdown, etc.

T. Provide components not specifically indicated or specified, but necessary to make system function within the intent of contract documents.

U. All electrical products to be listed and labeled by UL and comply with NEMA Standards.

V. As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the BAS business for at least the last five (5) years and have successfully completed total projects of at least 5 times, the value of this contract, in each of the preceding five years.

W. Provide a competent and experienced Project Manager

X. Engineering services shall be performed by factory-trained engineers.

Y. System shall be installed by factory trained mechanical and electrical installers either in direct employ of this Contractor or by subcontractors who are under direct supervision of this Contractor.

Z. Use only manufacturer trained technicians who are skilled, experienced, trained, and familiar with the specific equipment, software and configurations to be provided under this section.

AA. Coordinate with the Owner to ensure that the BAS will perform in the Owner's IT environment without disruption to any of the other activities taking place on that LAN or WAN

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products according to manufacturer's recommendations.

B. Store products in original manufacturers packaging.

C. Do not store products more than 3 months prior to schedule installation.

D. Coordinate deliveries of material with construction schedule and appropriate trades.

1.8 SCHEDULING

A. Included in this project are connections to equipment provided by others. Coordinate deliveries, final locations, factory mounting, and various connections required.

B. Coordinate activities with contract project schedule.

1. Ensure integration activities are incorporated into project schedule.
2. Communicate requirements to prevent potential damage from paint, dust, water, weather, etc. Monitor and take measure to assure protection for all equipment.

C. Coordinate all IT requirements with owner and contract project schedule.

1.9 WARRANTY

A. Submit warranty documentation upon completion of project or phase and acceptance by Engineer and Owner.

1. Warranty start date shall be the date of substantial completion.
2. Warranty period shall be 1 year on parts and labor and include 3 years of software upgrades.

B. Repair or replace systems or parts found defective at no cost to Owner including but not limited to:

1. Operator workstation software, project-specific software, graphic software, database software, and firmware updates that resolve known software deficiencies as identified by the contractor shall be provided at no charge during the warranty period.
2. All corrective software modifications made during the warranty period shall be updated on all user documentation and on user and manufacturer archived software disks.
3. Include parts, labor, and necessary travel during warranty.

C. Scheduled preventive maintenance (p.m.) visit twice a year to audit system performance.

1. Each p.m. visit shall include exercising each control loop and control sequence for performance.
2. A log of each loop tested, and each control sequence verified shall be reviewed with the Owner.

D. Provide vendor specific warranty information.

E. Provide services incidental to proper performance.

1.10 SYSTEM STARTUP

A. Start equipment according to manufactures recommendation.

B. Document system start up time and date.

C. Document person(s) performing startup.

D. Provide completed vendor specific start up documentation.

1.11 OWNER'S INSTRUCTIONS

A. Provide a factory-trained instructor to give full instructions to designated personnel in the operation, maintenance, and programming of each piece of equipment or system. Instructors shall be thoroughly familiar with all aspects of the subject matter.

B. The training shall be specifically oriented to the system and interfacing equipment installed.

C. Include classroom instruction and field demonstration.

D. Classroom instruction should include at a minimum:

1. Detailed review of and as-built documentation and conditions
2. In depth discussion of theory or sequence of operations
3. Review organization and usability of O&M documentation
4. Maintenance procedures and schedules

E. Field instruction should include at a minimum

1. Normal maintenance procedures
2. Demonstration of operation
3. Demonstration of safeties and interlocks

1.12 COMMISSIONING

A. Participate in the commissioning process.

B. Refer to section 25 0800 for additional requirements for Division 25 work.

PART 2 - PRODUCTS

2.1 NOT USED.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Prior to start of any work, check, verify, and coordinate work with drawings and specifications

prepared for other trades. Include modifications, relocations, or adjustments necessary to complete work or to avoid interference with other trades.

B. Promptly request clarification and instruction or report any conflicts, inadequate conditions or missing information in the Project Documents. Report unacceptable conditions immediately.

C. Inspect site to verify that equipment can be installed as shown.

D. Examine drawings and specifications for work of others.

E. Perform necessary changes in specified work caused by failure or neglect to report discrepancies.

3.2 INSTALLATION

A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

B. Provide sufficient slack, flexible connections and isolation to allow for equipment vibration.

C. Verify elevations and measurements prior to installation of materials.

D. Beginning installation means contractor accepts existing conditions

E. Conceal wiring in conduit in mechanical spaces, above hard ceilings, and other spaces where exposed wiring could be damaged.

F. Provide temporary service, routing of service, or other temporary requirements to minimize downtime of service.

G. Equipment and wiring shall be selected and installed for conditions in which it will be required to perform. (i.e., general purpose, weatherproof, rain-tight, explosion proof, dust tight, or any other special type as required.)

H. Arrange for necessary openings in building to allow for admittance of all apparatus.

I. Install equipment with ample space allowed for removal, repair or changes to equipment. Provide ready accessibility to equipment and wiring without moving other equipment, which is to be installed or which is already in place.

J. Coordinate all systems in order to minimize access door requirements.

L. Coordinate final locations, sizes and rough-in dimensions for access doors.

M. Verify door swings for proper clearance before installing.

N. Perform of the work in a safe and competent manner and use of industry accepted installation procedures required for the work.

3.3 FIELD QUALITY CONTROL

A. Testing:

1. Conduct a complete performance test for all systems to assure compliance with the contract documents.

    a. Any components on systems found defective or not performing satisfactorily shall be readjusted and retested after necessary corrective measures are performed.
    b. Corrective measures may include modification or addition of equipment and devices, control strategies and/or software program.

2. When testing is to be witnessed by Engineer or Inspector. Schedule Engineer at least 10 days prior to testing date.
3. Conduct and lead the coordination effort to integrate systems. Verify communication capabilities of each integrated vendor prior to installation of each system. Provide documented integration capabilities.
4. Certify in writing, successful equipment and system test results. Include in certifications the following:

    a. Identification of system tested.
    b. Date.
    c. Test criteria.
    d. Print name, title and company of person signing test certification documents.
    e. Alternative solutions implemented to successfully complete test.

B. Coordinate with the Owner and execute a User Workstation Planning Sessions including 1–2-day sessions (for each subject) to finalize details for the following:

1. Integration of systems
2. Graphics Generation
3. Point naming
4. Alarm management
5. Energy management
6. Automated work order generation
7. Recommended Operation & Maintenance procedures.

C. Repair, reprogram or replace any equipment or work that fails test.

3.4 CLEANING

A. Upon completion of each phase, system, panel, etc, clean all system panels, enclosures and field device enclosures.

B. Clean debris from equipment, control panels, security panels, and fire panel enclosures, junction boxes and pull boxes and arrange wire neatly with surplus length cut off prior to installation of covers.

C. Thoroughly clean equipment of stains, paint spots, dirt and dust. Remove temporary labels not used for instruction or operation.

3.5 DEMONSTRATION

A. Demonstrate operation of systems with Owner or Engineer.

B. Coordinate with commissioning activities. Refer to section 25 0800.

3.6 PROTECTION

A. Protect installation against and be liable for damage to work and to material caused by Contractor's work or employees.

B. Maintain protection for work and equipment until inspected, tested, and accepted.

C. Protect material not immediately installed.

D. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

E. Material sensitive to temperature, dust, humidity, or other elements and found unprotected shall be replaced.

F. Material with showing signs of exposure shall be replaced.

END OF SECTION

SECTION 25 0513

CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Integrated Automation conductors and cable for signal transmission, communications, power, and other miscellaneous cables for complete integration of systems specified.

B. Related Sections:

1. 25 0528 Pathways

1.2 REFERENCES

A. NEC 725 Class 1, Class 2, and Class 3 Remote Control, Signaling And Power-Limited Circuits

B. NEC 800 Communication Circuits

1.3 DEFINITIONS

A.	AWG	American Wire Gauge
B.	EMI	Electromagnetic Interference
C.	kVA	One thousand Voltamps
D.	Noise	Unwanted electrical or electromagnetic energy
E.	Signal Wire	Wire used to transmit an electrical signal such as voltage, amps, or resistance.
F.	PVC	Poly vinyl Chloride

1.4 SYSTEM DESCRIPTION

A. Final connectors to control device.

B. Communication cables for integrated systems.

C. Signal cables for Integrated Automated systems.

D. Power cables for Integrated Automated systems.

E. Final terminations of conductors and cables not specifically shown, but required for systems operation.

1.5 SUBMITTALS

A. Submit installation plan including:

1. Recommended modifications to design documents.
2. Documentation for vendor specific limitations or modifications.
3. Sequence of installation.
4. Coordination requirements.

1.6 QUALITY ASSURANCE

A. All work shall meet the requirements of the National Electrical Code.

B. All wiring shall be done in accordance with all local and national codes and authorities having jurisdiction.

C. Ground and Bond according to manufacturer's recommendations. Refer to section 26 0526 for grounding and bonding requirements.

D. Review test and documentation structured communication cables for acceptance.

E. Splicing communication and instrumentation cables is prohibited.

F. Kinked cable is prohibited and must be replaced.

G. Conform to requirements of National Electrical Code Articles 725 and 800, as well as local electrical codes, where required by the various systems.

H. Ensure cable is free of tension at both ends. In cases where cable must bear stress, provide appropriate grips to spread stress over longer length of cable.

I. Adhere to the following minimum distances to reduce effects of EMI:

1. Five (5) inches from power lines of 2kVA
2. Eighteen (18) inches from high voltage lighting (including fluorescent)
3. Thirty-nine (39) inches from power lines of 5kVA or greater
4. Thirty-nine (39) inches from transformers and motors

J. Maintain separation of signal wire and wire carrying more than 100 VAC.

K. Separate cable from other building systems.

L. Install cables parallel and perpendicular to building walls. Coordinate space requirements with other trades.

M. Conceal wiring in conduit in mechanical spaces, above ceilings, and other spaces where exposed wiring could be damaged. Refer to Section 25 0528 for pathway requirements.

N. Where conduit is not required:

1. Space J-hook cable supports every 4 ft or in accordance with cable manufacturer's specifications, whichever distance is shorter. Use of tie-raps, structure, ductwork, wire, etc. for support is prohibited.
2. Cable shall be free of tension at both ends. In cases where cable must bear stress, provide appropriate grips to spread stress over longer length of cable.

O. Refer to Section 25 0553 for label requirements

1.7 DELIVERAY, STORAGE AND HANDLING

A. Store all produces according to manufacture's recommendations.

B. Protect stored cable from vandalism and weather.

C. Store cable and equipment no more than 6 weeks prior to installation.

D. Maintain a minimum storage temperature of 50 Deg F.

1.8 OWNER'S INSTRUCTION

A. Provide 4 hours training on structured cable system.

B. Include:

1. Location of devices
2. Terminations
3. Troubleshooting
4. Identification

PART 2 - PRODUCTS

2.1 FLOOR LEVEL COMMUNICATIONS CABLE

A. Cabling Requirements:

1. Min Size: 23 AWG
2. Min number of Conductors 2 –4 (vendor specific)
3. Jacket UL listed Teflon
4. Jacket color: Violet

2.2 INSTRUMENTATION SIGNAL CABLE

A. Cabling Requirements:

1. Min Size: 18 AWG stranded (except vendor specific instrument)
2. Min number of Conductors 2 –4 (application specific)
3. Jacket PVC
4. Jacket Color Grey
5. Shield per manufacturer recommendations

2.3 POWER WIRE (50 VOLTS OR LESS)

A. Cabling Requirements:

1. Min Size: 18 AWG stranded
2. Number of Conductors 2
3. Jacket PVC
4. Jacket Color Grey

2.4 POWER WIRE (GREATER THAN 50 VOLTS)

A. Refer to section 26 0519.

PART 3 – EXECUTION

3.1 FLOOR LEVEL COMMUNICATIONS CABLE

A. Install cable in approved pathways only.

B. Provide appropriate shielding to eliminate equipment noise from VFD's and other equipment.

C. Provide additional shielding and grounding per applicable manufacturer's recommendations and/or job site conditions.

D. Label cable according to Section 25 0553.

3.2 INSTRUMENTATION SIGNAL CABLE

A. Provide signal cables for instrumentation.

B. Install cable in approved pathways.

C. Provide appropriate shielding to eliminate equipment noise from VFD's and other equipment.

D. Provide isolated instrument grounding system as per manufacturer's recommendations.

E. Terminate instrument cables at terminal blocks or terminal strips in cabinets.

F. Label cable according to Section 25 0553.

3.3 POWER WIRE (50 VOLTS OR LESS)

A. Unless otherwise specified or noted, provide final power connections including conduit, wire, and/or control panel disconnect switches to all control devices from appropriate electrical j-box.

B. Provide power cables for instrumentation and devices.

C. Install cable in approved pathways.

3.4 POWER WIRE (GREATER THAN 50 VOLTS)

A. Provide final power cables and connections for instrumentation and devices.

B. Install cable in approved pathways.

3.5 FIELD QUALITY CONTROL (TESTING)

A. Verify cable shield or coupled bonding conductor for end-to-end continuity.

END OF SECTION

SECTION 25 0528

PATHWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes complete pathway system and requirements for Integrated Automation including but not limited to:

1. Conduit and fittings
2. Outlet boxes
3. Pull and junction boxes
4. Sleeves

B. Related Sections:

1. 07 8413 Penetration Firestopping
2. 25 0513 Conductors and Cables
3. 26 0529 Hangers and Supports for Electrical Systems
4. 26 0533 Raceway and Boxes for Electrical Systems
5. 27 0533 Communications

1.2 DEFINITIONS

A. Pathways - Support and protection system for conductors and cabling.

B. Sleeves - Protection for wall and other penetrations.

1.3 SYSTEM DESCRIPTION

A. All integrated automation systems must be in approved pathways.

B. Approved pathways include:

1. Conduit as specified in section 26 0533.
2. Cable tray as specified in section 27 0533

C. Includes conduit pathway for the Integrated Automation System where not in cable tray.

D. Includes a complete independent conduit pathway system for the Smoke Control System and any components of the Smoke Control System.

E. Where specifically allowed or specified, pathway system includes hangers, bridle rings, j-hooks and other supports for cabling not required to be in conduit.

1.4 SUBMITTALS

A. Refer to section 26 0529 and 26 0533.

1.5 QUALITY ASSURANCE

A. Install pathways parallel and perpendicular to building structure. Coordinate space requirements with other trades. Avoid horizontal runs through walls.

B. Provide appropriate protection at all penetrations.

C. For fire-rated construction, seal penetrations to maintain fire rating of construction penetrated. Refer to requirements in Section 07 8413.

D. In addition to other pathway requirements, low voltage cable must be in an enclosed pathway system for exposed areas, inaccessible spaces (including walls), electrical and mechanical spaces, etc.

E. Do not install pathways on floor structure or in any way that may obstruct access to equipment, spaces walkways, etc.

F. Support pathways appropriately to avoid movement, vibration, etc.

G. Instrumentation boxes are not to be used for pathway junctions.

H. Refer to section 26 0533 for additional requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to section 26 0529 and 26 0533.

PART 2 – PRODUCTS

2.1 Refer to Section 26 0529 and 26 0533 for pathway product requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify routing and termination locations of pathways prior to rough-in.

B. Coordinate equipment, floor, wall and roof penetrations with appropriate trades.

1. Provide penetrations for pathways.
2. Provide appropriate sleeves for penetrations.
3. Provide fire-stopping as described in section 07 8413.

C. Provide pathways for all work within this division.

1. Provide non-continuous pathway systems from wall sensor conduit stub to associated controller.
2. Provide continuous enclosed conduit pathway systems in mechanical spaces, electrical spaces, exposed areas and in any areas not specifically allowed to be non-continuous pathways
3. Provide continuous enclosed conduit pathway systems for Smoke Control System

D. Size conduit and boxes by circular mil size of cable in conduit or box.

E. Minimum conduit size is 3/4" unless otherwise noted.

F. Maximum length of flexible conduit is 3 feet.

G. Refer to section 26 0553 for additional requirements.

3.2 PROTECTION

A. Conduit and raceway penetrations through walls, floors, and ceilings require fire stopping. Refer to Section 07 8413.

B. Provide sleeves for penetrations. Coordinate sleeve selection and application with section 26 0533.

C. Furnish information as to size and location of built-in openings required.

D. Do not cut, remove, or pierce general or mechanical insulation, fire rated walls, ceilings, or steelwork without prior permission and instruction.

E. Provide conduit to protect pneumatic tubing outside of panels.

F. Provide appropriate protection for all work within this division.

G. Refer to section 26 0553 for additional requirements.

END OF SECTION

SECTION 25 0553

IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section defines labeling requirements for control panels, instrumentation, including, control valves, control room instruments, panel instruments, wire, cable, and tubing

B. Related Sections

1. All sections in Division 25.

1.2 REFERENCES

A. TIA/EIA-606-A - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

1.3 SUBMITTALS

A. Sample valve, damper and other instrument tags.

B. Sample wire, cable and tubing tags.

C. Sample panel tags.

D. Sample tagging abbreviations (if used).

E. Installation methods for each type and condition.

1.4 QUALITY ASSURANCE

A. Tag each valve, damper and instruments according to contract documents.

B. Where major devices are above ceiling, provide identification on ceiling grid to assist in locating device.

C. Tags shall be machine generated and easily readable.

D. Tags shall be appropriate for the environment installed.

E. Do not mark on instruments with permanent markers, i.e.: felt pens or paint sticks.

F. Install tags for easy readability.

G. All identification in a single infrastructure must have the same format where possible.

H. Comply with TIA/EIA- 606A and Owner identification standards.

PART 2 – PRODUCTS

2.1 INSTRUMENT IDENTIFICATION

A. Construction:

1. 1/16" thick laminated phenolic plastic, white with black core.
2. Nominal size of 1" high by 1 to 4” wide.
3. Stamped in 1/4" high block characters.

B. Self-adhesive is acceptable where conditions will allow for permanent mounting.

2.2 CONTROL PANELS IDENTIFICATION

A. Construction:

1. 1/16" thick laminated phenolic plastic, white with black core.
2. Nominal size of 2" by 4".
3. Stamped 1" high block letters.

B. Self-adhesive is acceptable where conditions will allow for permanent mounting.

2.3 VALVE AND DAMPER IDENTIFICATION

A. Construction:

1. 1/16" thick laminated phenolic plastic, white with black core or minimum 0.032" thick, polished brass or 316 stainless steel.
2. Nominal size of 2" by 4".
3. Stamped 1" high block letters.

B. Hanging type only, self-adhesive is not acceptable for permanent mounting.

2.4 WIRE, CABLE AND TUBE IDENTIFICATION

A. Heat Shrink Tubing:

1. Manufacturer: Rhino or Brady Bradysleeve.
2. Labels shall be heat shrink tubing type. Heat shrink labels shall be used on wire, cable, and tubing except for vendor specific cables which may not be cut.

B. Self Laminating Wrap-On Labels:

1. Manufacturer: Rhino or Brady WML series.
2. Self Laminating Wrap-On Type Labels shall be sel-flaminating wrap-on type. Self-laminating, wrap- on labels shall be used only on wire, cable, which may not be cut, and on tubing.

C. Self adhesive is acceptable where conditions will allow for permanent mounting

2.5 JUNCTION BOX IDENTIFICATION

A. Blue paint and black stencil lettering.

PART 3 – EXECUTION

3.1 INSTRUMENT IDENTIFICATION

A. Label each instrument with hardware tag and software name.

1. Instrument hardware tagging shall be according to symbols and tag numbers used on control diagrams.
2. Instrument software name shall be according to database generated point name. Coordinate with section 25 1223.

B. Size label to accommodate instrument tag number and description.

C. Affix label to permanent to instrument or housing (if direct instrument mounting is unreasonable).

D. Fastening Methods for indoor applications:

1. Self adhesive or double-side adhesive tape.
2. Epoxy Cement as required

E. Fastening Methods for weather exposed or other conditions where self adhesive is impractical:

1. Field tags: Use Round head, No. 0 x 3/16", Type U, metallic drive screw, (0.075 diameter, blunt), size 51 (0.067") drill, stainless st eel or chromium plated. Cadmium plated screws are not allowed. Similar screw may be substituted.
2. Panel face: Use Phillips panhead, No. 2-56 x 5/16", Ty pe T, self-tapping sheet metal screw (0.086 diameter., blunt, notched), size 48 (0.076") drill, stainless steel or chromium plated. Cadmium plated screws are not allowed. Similar screw may besubstituted.

F. Provide control panel interior mounted instrument tags. Engraved legend shall be instrument tag number

3.2 CONTROL PANEL IDENTIFICATION

A. Provide control panel face mounted instrument tags as required. Engraved legend form ad follows:

PROCESS EQUIPMENT IDENTIFICATION
DEVICE FUNCTION INSTRUMENT TAG NUMBER

1. Instrument tag number shall be per owner's standard.
2. Coordinate label tags and format prior to purchasing or installation.

B. Provide phenolic tag for each controller.

3.3 VALVE AND DAMPER IDENTIFICATION

A. Provide valve and damper tags for controlled equipment.

B. Valve and damper tags number shall be per contract documents and owner's standard.

C. Coordinate label tags and format prior to purchasing or installation.

3.4 WIRE, CABLE AND TUBE IDENTIFICATION

A. Provide cable sheaths labeling on both ends approximately 6 inches from the termination in case the cable becomes separated from its termination.

B. Provide a complete documented cable record for Integrated Automation systems.

C. Label Coverage area cables at each end:

1. Label terminating end with distribution location identification serving terminal device.
2. Label distribution end with terminal device destination.

D. Label instrumentation cable and tubing at each end:

1. Label terminating end with panel device tag.
2. Label distribution end with instrument device tag.

END OF SECTION

SECTION 25 1219
INTEGRATION PROTOCOLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes Network protocol for all Integrated Automated Systems.

B. Related Sections:

1. 25 1223 Client-Server Information Database Integration.
2. 25 1313 Control and Monitoring Supervisory Control.
3. 25 5600 Monitoring and Control of Electrical Equipment.

1.2 REFERENCES

A. ANSI/ASHRAE Standard 135-2004 Data Communication Protocol for Building Automation and Control Systems.

B. WS-1 – Web Services Interoperability Organization Basic Profile

1.3 DEFINITIONS

A. BACnet	Building Automation and Control Network open communication protocol.
B. BTL	BACnet Testing Laboratory.
C. ModBus	Serial communication protocol developed by Modicon
D. IP	Internet Protocol
E. PICS	Protocol Implementation Conformance Statement
F. Protocol	An agreed-upon format for transmitting data between two devices.
G. XML	xtensible Mark Up Language
H. Web Services	The Integration of web applications using XML standards.

1.4 SYSTEM DESCRIPTION

A. Integrated Automated System protocol at the Enterprise level shall be BACnet/IP, MODBUS TCP, or XML/Web Services.

B. Integrated Automation System at the floor level shall utilize the BACnet protocol.

C. Integration to 3rd party equipment may utilize LonWorks or ModBus in addition to above

protocols if BACnet is not available. Provide gateways as necessary to communicate to Automation System. Refer to section 25 1200 for additional gateway requirements. Coordinate polling rate and other requirements to minimize operation of integrated equipment.

D. Proprietary protocols are not allowed.

1.5 SUBMITTALS

A. Protocol Plan:

1. Proposed communication protocols integration
2. Include latest version of protocol profiles used

    a. A BACnet Protocol Implementation Conformance Statement (PICS) for each type of controller and operator interface included in the submittal.
    b. Modbus profiles for electrical equipment.
    c. Industry compliance

1.6 QUALITY ASSURANCE

A. BACnet products shall be BTL compliant.

B. Coordinate other system requirements with owner.

1.7 WARRANTY

A. Include protocol fixes and version upgrades during warranty period.

1.8 SYSTEM STARTUP

A. Document system start up.

PART 2 – PRODUCTS

2.1 ENTERPRISE COMMUNICAITON

A. BACnet/IP

1. Support BACnet read data request from the system network.

B. Modbus/IP

2.2 FLOOR LEVEL COMMUNICATION

A. The following protocols shall be used

1. BACnet/MSTP
2. Modbus TCP

PART 3 – EXECUTION

3.1 ENTERPRISE COMMUNICATION PROTOCOL

A. Coordinate all integration activities with owner for connection to the existing automation server. Provide all information to the campus server system integrator.

B. Enable all points for integration to existing automation server.

C. Utilize published functional profiles wherever possible

3.2 FLOOR LEVEL COMMUNICATION

A. Utilize dedicated structured cable system for communication to floor level devices.

B. Provide communication protocol necessary to communicate to floor level devices.

END OF SECTION

SECTION 25 1223
CLIENT-SERVER INFORMATION /DATABASE INTEGRATION

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes

1. The database generation and integration of the Integrated Automated Systems to the Enterprise Building Management System.

B. Related Sections:

1. 25 1219 Integration Protocols

1.2 DEFINITIONS

A. Archive	Data storage
B. Command Priorities	The order in which commands are allowed to be executed.
C. Escalation	Alarm advancement after delay to the next level of notification.
D. Event	Alarm, transaction, or sequence.
E. Mapping	The act of integrating data points from different systems back to the Enterprise.
F. Normalize	Create consistency among dissimilar data for a specific use.
G. Real-time	Up to the minute.
H. Trend	Record data for specified time intervals.

1.3 SYSTEM DESCRIPTION

A. The integration of the various systems throughout the facility using protocols specified in section 25 1219.

B. Remote read/write capabilities of Integrated Automated Sy stems using open and industry standard protocols. Refer to section 25 1219 for command priorities.

C. Scope includes but not limited to:

1. Data collection.
2. Database generation.
3. Graphics generation.
4. Scheduling generation.
5. Trending and storage of all points.

6. Alarm generation and management.
7. Web Page Development.
8. Reports generation.
9. Coordination of integration activities.

D. Provide supplementary or miscellaneous items, products and labor incidental to, or necessary for complete integration of systems to the Enterprise Building Management System.

E. Lead the coordination effort with vendors for integration activities.

1.4 SUBMITTALS

A. Include the following:

1. All required hardware components and accessories.
2. Sample proposed Graphics systems including:

   a. Air Handling system
   b. Air terminal box
   c. Floor plan
   d. Hydronic System
   e. Energy Wheel

3. Sample proposed Graphics status pages including:

   a. Area status pages
   b. Group status pages
   c. Overview pages

4. Object and point naming conventions.
5. SOAP messaging methods.
6. External Web Services Interfaces including:

   a. Include configuration requirements
   b. Operational requirements
   c. Hardware requirements

B. Record Documents:

1. One copy of each type of report generated.
2. Copy of all schedules.
3. Copy of all Graphics.
4. Calculations used for control and monitoring.

C. Operation Manuals

1. System Overview.
2. Networking and communications concepts.
3. Web Services publishing.
4. Integration documentation.
5. Web browser applications for a networked PC/PDA.

6. Browser User Interface screen functions and their definitions.
7. Creating, modifying, or deleting equipment and report schedules.
8. Uploading and downloading software to the field hardware.
9. Creating historical trends, collecting trend data and generating trend graphs.
10. Enabling and assigning alarms, priorities, suppression and messages to desired users.
11. Report generation and 'third party software".
12. Procedures for backing up software and data files.
13. Project specific alarm priorities, limits and messages.
14. Finely detailed descriptions of all software programs.
15. Complete system design and engineering manual. (Same as used by manufactures personnel).
16. Refer to 25 0000 for additional requirements.

1.5 QUALITY ASSURANCE

A. Scope and products included in this section shall be compatible and consistent with existing Enterpris Building Management System.

B. Limit temperature readings to 1 decimal unless otherwise noted.

1.6 WARRANTY

A. Refer to 25 0000.

1.7 OWNER'S INSTRUCTIONS

A. Provide 32 hours of off-site training by factory trained instructor for 4 people. Include travel and hotel accommodations.

B. Provide an additional 24 hours of on-site training by factory trained instructor of owner specific subject, after 6 months of occupation and prior to end of warranty.

C. Coordinate and schedule training with Owner.

D. At minimum, include the following:

1. Web services data management, functions and toolkit
2. Design requirements.
3. Using O&M documents.
4. Basic and advanced operator functions.
5. Graphic generation and modifications
6. Report features and generations
7. Exporting data to third party software.
8. Drawings and Specification review

E. Identify all project equipment locations

F. Refer to 25 0000 for additional requirements.

PART 2 – PRODUCTS

2.1 NOT USED.

PART 3 - EXECUTION

3.1 DATA COLLECTION:

A. Provide mapping of points from various automated systems. Provide the ability to read and Display any value of any used property of any object from any networked device including properties available and supported optional properties, as well as proprietary extensions.

B. Trending

1. Trend all points at 15-minute intervals.
2. Normalize and archive data.
3. Store data for minimum of 2 years

C. Timestamp all data.

D. Normalize data points shown in contract documents for ease of database management, graphic displays, readability, and simple identification.

E. Provide real-time dynamic screen updates for all points.

F. Provide real time rates for all utilities.

3.2 DATABASE GENERATION:

A. Develop relational database of data objects, time stamps, events, alarms, and transactions.

B. Provide the ability to modify loop Object setpoinst , alarm limits, tuning parameters, routing, scheduling etc. initiated through operator interaction with graphics displays.

C. Archive all data points, graphics, reports, alarms, trends, events, and transactions.

1. Store data for 2 years
2. Make data available for industry standard 3rd party applications and application implementation.

D. Develop databases including:

1. Applications
2. Configuration
3. Trending or historical Data
4. Event storage

E. Include construction document Tag for Hardware objects.

F. Link database graphic objects with associated product specification data sheet.

G. Coordinate point naming standards with owner, prior to any database generation. First eleven

(11) digits include:

1. First number is the campus designation. It is one(1) digit in length. (1 = MMC (Main Campus), 2=BBC (Biscayne Bay Campus).
2. Second number is the building number. It is three (3) digits in length.
3. Third Number is the floor. It is Two (2) digits in length.
4. Fourth Number is the room number. It is Five (5) digits in length.

3.3 GRAPHICS GENERATION

A. Prior to generation/submission of graphics, coordinate with Owner/Engineer to ensure consistency with existing format. Utilize Graphic Library to generate color graphics including but not limited to:

1. Legend:

   a. Color codes
   b. Definitions
   c. Symbols

2. Common Points (for every system)

   a. Time/Date
   b. Outside Air Temperature/Humidity

3. Integrated systems

   a. Communication Risers

4. Site and Floor plans including integrated systems:

   a. Automated Temperature Controls system
   b. Fire Alarm system
   c. Security system
   d. Lighting system
   e. Plumbing systems
   f. Column numbers
   g. Room numbers and names

5. Dashboards including (coordinate symbols with Owner):

   a. Picture of facility
   b. Facility weather
   c. Facility Pressurization
   d. Facility cost per hour
   e. Facility alarms
   f. Facility utility usage
   g. Security Alerts
   h. Links to various major systems such as: Floor Air Systems, Water Systems, Energy, Reports etc.

6. Provide system graphics such as:

a. AHU, FCU, and ATU equipment
b. Utilities
c. Security
d. Plumbing
e. Power Monitoring

B. Include other points such as:

1. Calculated points
2. Alarms and Limits
3. Shared points
4. Integrated points
5. Setpoints

C. Site Plan

1. Utilities
2. Lighting
3. Allow penetration to floor plans graphics

D. Floor Plans:

1. Coordinate with as-built drawings to include

a. Room name and numbers
b. Column numbers

2. Identify

a. HVAC zones by AHU
b. HVAC rooms served by singe space sensor.
c. Fire Zones

3. Allow penetration to associated system graphic
4. Thermographics
5. Color Scheme

E. Risers:

1. Systems service and status
2. Hardware service and status

F. Summaries:

1. Alarms
2. Overrides
3. Transactions
4. Events

G. Links

1. Link to previous screen (top left corner)
2. Link to associated master system from sub-system

3.4 ARCHIVES

A. Provide automatic trending for all points.

B. Initiate trending for all points.

1. Trend points every 5 minutes or change of state
2. Normalize trend data for common reporting and archiving.

C. Provide initial trend graphs and reports per owner request.

D. Integrate information to existing Maintenance Management System.

3.5 ALARM MANAGEMENT

A. Provide alarms including:

1. Any point reaching a high or low limit.
2. Anytime feedback does not equal command.
3. Points overridden.

B. Provide alarms for points as shown in point list. Coordinate with Owner and include the following:

1. Point Name and Description.
2. Alarm differentials (automatically adjust with setpoints).
3. Units.
4. Coordinate settings (limits or state) with Owner.
5. Instrument tag.
6. Priority.
7. Message.

C. Coordinate and implement alarm notifications and routing with the Owner. Include:

1. Paging/PDA.
2. Email.
3. Text Messaging.
4. Group and network notifications.
5. Alarm acknowledgement.
6. Existing Maintenance Management System.

D. Provide hardware or interface required to implement alarm notification and routing.

E. Provide alarms suppression, to minimize nuisance alarms resulting from higher level alarms.

1. Hot water and chilled water alarms master to AHU temperatures.
2. AHU alarms master to associated ATU and room temperatures.
3. Fire alarms master to associated HVAC equipment.

F. Provide state-based alarming to prevent alarms during specific equipment states.

1. Interlock equipment status and/or modes to lock out associated alarms during shutdowns.
2. Enterpris Building Management System.

G. Provide and implement alarm escalation for alarms.

H. Filter and rout alarms based on user log in.

I. Allow alarms to be sorted and displayed chronologically, priority, filtering, etc.

J. Provide alarms for conditions such as offline and poor communication performance.

K. Archive all data in standard database platform Microsoft Data Engineer Microsoft SQL. Including but:

1. I/O points.
2. Software points such as

    a. Alarm limits
    b. Setpoints
    c. Parameters

3. Schedules.
4. Alarm messages.

3.6 CALCULATIONS

A. Coordinate with GRU and provide calculations for dynamic points including:

1. Real Time chilled water consumption (KTons)
2. Real Time cost per KTons of cooling
3. Real Time steam consumption (lbs/hour)
4. Real Time Electric consumption
5. Real Time Domestic Water consumption
6. Real Time total building energy cost ($/sq. ft.)
7. Real Time outside and return air enthalpy

B. Provide calculations for tantalization points including:

1. Runtime Hours on major equipment
2. Monthly Energy Cost
3. Yearly Energy Cost

END OF SECTION

SECTION 25 1300

CONTROL AND MONITORING NETWORK

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes a complete microprocessor controlled BACnet compatible control and monitoring MS/TP network for the various systems connected to the BAS communication network such as but no limited to:

1. Air Handlers
2. Air Terminals
3. Fan Coil Units
4. Pumps
5. Heat Exchangers
6. Variable Frequency Drives
7. Computer Room Air Conditioners
8. Chillers
9. Lighting
10. Fire Alarm

B. The Control and Monitoring Network shall integrate to the following systems:

1. Variable Frequency Drives
2. Lighting
3. Electrical Power
4. Fire Alarm
5. Security
6. Other BAS
7. Emergency Power

C. Related Sections

1. 23 0514 Variable Frequency Motor Controllers.
2. 23 8123 Computer Room Air Conditioners.
3. 25 1223 Client-Server Information Database Integration.
4. 25 1400 Local Control Units.
5. 25 1416 Application Specific Controllers.

1.2 REFERENCES

A. UL 864/UUKL Smoke Control Listing (Ninth Edition)

B. UL 873 Temperature-Indicating and -Regulating Equipment

C. UL 916 Energy Management Systems

1.3 DEFINITIONS

A. FLN Floor Level Network.

B. MS/TP Master Slave Token Ring-Passing

1.4 SYSTEM DESCRIPTION

A. The Control and Monitoring Network shall utilize an open architecture capable of all of the following:

1. Utilizing standard Ethernet communications and operating at a minimum speed of 10/100 Mb/sec.
2. Connecting via BACnet/IP at the Tier 1 level in accordance with ANSI/ASHRAE Standard 135- 2004.
3. The BAS network shall support both copper and optical fiber communication media at the Tier 1 level.

B. Include isolation modules, repeaters, etc. to comply with UL 864/UUKL for the smoke control devices.

1.5 SUBMITTALS

A. Submit device BAS device schedule. Include:

1. Device name and physical address
2. Device I/O points
3. Associated Building Level Controller
4. Device location
5. Associated system
6. Location served
7. Make and model number of controller
8. Shop Drawings:

a) Control drawings
b) Wiring details
c) Installation details
d) Bill of materials
e) Sequence of Operations
f) Panel layout for major control panels

B. Submit riser and protocol requirements for all devices on the FLN.

C. Submit grounding and shielding requirements.

D. Submit termination requirements.

E. Submit distance limitations if any.

F. Submit UL 864 UUKL compliance documentation.

1.6 QUALITY ASSURANCE

A. The control contractor shall have a manufacturer owned office within a 50-mile distance of the project site and offer complete maintenance and support services on a 24-hour, 365 day/year basis. The office shall be staffed by factory trained and certified technicians and an engineering staff. The office shall have direct access to inventory of spare parts and all necessary test equipment required to install, commission, and service the BAS provided.

B. Programming, start-up, and service must be performed by factory trained,employee of Manufacturer.

C. Installation of system must be performed or supervised by qualified employee of Manufacturer.

D. Documented history of compatibility by design for a minimum of 2 years.

E. Future compatibility shall be supported for no less than 10 years Compatibility shall be defined as the ability to upgrade existing field panels and extend new field panels on a previously installed network.

F. Conform to UL 864 UUKL for the smoke control system and computer interface.

G. Conform to UL 916.

1.7 SYSTEM STARTUP

A. Document system start up and provide upon request.

B. Coordinate start up procedures and requirements with other trades.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Honeywell

B. Johnson Controls, Inc.

C. Siemens

D. Trane

E. Delta

F. ALC (Automatic Logic)

G. Qualified equivalent. To be judged a “qualifi ed equivalent” the vendor shall obtain a Systems

Integration Certification Form that the proposed system meets all specifications and standards contained in the Division 25 standard and that the proposed system integrates with the existing campus Building Automation System (BAS) head-end (Metasys) for all existing campus Building Automation System (BAS) head-end (Metasys) for all under continuing services contract to FIU.

2.2 NETWORK ARCHITECTURE

A. Complete communication architecture for BAS devices as well as other integrated vendor devices.

B. Complete device programming capabilities via Operator Workstation.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Provide system to monitor and/or control of BAS devices.

B. Connect to 3rd party equipment per network diagram.

C. Provide and coordinate all points for inclusion in database generation per section 25 1223.

D. Mount laminated and framed system specific control drawings near controlled equipment.

3.2 NETWORK ARCHITECTURE

A. Coordinate all network communication and low voltage power requirements with appropriate contractor including the installation of cabling, and overall communication system architecture, signal quality, attenuation, power level or special needs of the control system.

B. Coordinate communications systems design and requirements (segmenting, broadcasting, multicasting, etc.) with the owner's Information Technology Services.

END OF SECTION

SECTION 25 1313

CONTROL AND MONITORING SUPERVISORY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. System includes:

1. Building (or network) level control units for Integrated Automation systems
2. Incidental labor and material required, for a complete and operable system.

B. System Configuration & Definition

1. Changes made at the server shall be automatically recorded and downloaded to the appropriate Controller. Changes made at the Controllers shall be automatically uploadedto the workstation, ensuring system continuity.
2. System configuration, programming, editing, graphics generation shall be performed on-line. If programming and system back up must be done with the PC workstation off-line, the Controls contractor shall provide at least 2 operator workstations.

C. Related Sections:

1. 25 1219 Integration Protocols.

1.2 REFERENCES

A. UL 916 Energy Management Equipment, per category PAZX for Energy Management Equipment.

B. UL 864 Control units for Fire-Protective Signaling Systems, per category UUKL for Smoke Control System Equipment.

C. ANSI/ASHRAE Standard 135-1995 BACnet protocol.

1.3 SYSTEM DESCRIPTION

A. Acceptable Manufacturers

1. Honeywell
2. Johnson Controls, Inc.
3. Siemens
4. Trane
5. Delta
6. ALC (Automatic Logic)
7. Qualified equivalent. To be judged a “qualified equivalent” the vendor shall obtain a Systems Integration Certification Form that the proposed system meets all specifications and standards contained in the Division 25 standard and that the proposed system

integrates with the existing campus Building Automation System (BAS) head-end (Metasys) for all agreed upon points. The certification must be signed by one of the MEP firms under continuing services contract to FIU

B. Microprocessor based, field programmable controllers to:

1. Integrate systems specified.
2. Accept commands from existing enterprise server the following:

   a. Commands
   b. Overrides
   c. Schedules
   d. Interlocks
   e. Adjustments

3. Perform stand-alone facility wide control strategies and sequences.

C. Additional programming or hardware shall not be a llowed at the Building Level controller to support various system integrations using a BACnet compliant interface.

1.4 SUBMITTALS

PRODUCT DATA SHEET 1 - Identify specific parts and accessories proposed for project. Order submittals based on the specification section and include the following:

A. BAS network architecture diagrams including all Tier 1 nodes, Tier 2interconnections, and 3rd party integration. Include repeater locations.

B. Provide floor plans locating all control units, workstations, servers, LAN interface devices, gateways, etc. Include all Tier 1 and Tier 2 communication wiring routing, power wiring, power originating sources, and low voltage power wiring. Indicate network number, deviceID, address, device instance, MAC address, drawing reference number, and controller type for each control unit. Indicate media, protocol, baud rate, and type of each LAN. All optical isolators, repeaters, end-of- line resistors, junctions, ground locations etc. shall be located on the floor plans. As-built wire routing conditions shall be maintained accurately throughout the construction period and the drawing shall be updated to accurately reflect accurate, actual installed conditions.

C. Schematic flow diagram of system showing all equipment and control devices. Diagram shall include designation of all inline devices, wells, taps and other devices furnished under this Section but installed by other trades.

D. Identification of immersion wells, pressure taps, associated shut-off valves, flow switches, level switches, flow meters, air flow stations and ot her such items furnished under this section but installed by other trades.

E. Setting or adjustable range of control for each control device.

F. Written description of detailed sequence of operations. Include all initial set-point values, time delay values, references to specific device names. The sequences shall be detailed and

include all vendor specific pre-engineered logic. They should not be a duplication of the Engineer's sequences.

G. Points schedule for each real point in the BAS, including Tag, Point Type, System Name and Display Units. Device Type, Address, Cable Destination, Module Type, Terminal ID, Panel, Slot Number, Reference Drawing, and Cable Number. Cable destination, terminal ID, slot number, etc… may also be identified in panel detail drawings.

H. Samples of each typical system Graphic Display screen and associated menu penetrations to show hierarchy and functional interrelationships for systems specified. Sample floor plan graphic showing all proposed components and colors.

I. Detailed Bill of Material list for each system, identifying quantity, part number, description, and optional features selected.

J. Relevant resumes and documentation for proposed project team members.

1.5 Control Dampers

A. Schedule including a separate line for each damper and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Frame Type, Blade Type, Bearing Type, Seals, Duct Size, Damper Size, Mounting, Actuator Type, Actuator model number, Actuator torque rating and quantity of actuators required to ensure total closure of damper(s).

B. Leakage and flow characteristics data for all control dampers. Leakage ratings to be based on AMCA Standard 500 and dampers to bear AMCA leakage certification seal.

1.6 Control valve schedules including a separate line for each valve and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Actual Valve CV, Calculated CV, Design Pressure drop, Actual Pressure drop, Actuator Type and model number.

1.7 Room Schedule including a separate line for each terminal unit indicating terminal identification, minimum/maximum cfm, box area, thermostat/sensor location, Htg/Clg Set points and bias setting. The schedule shall include typical calibration factors to be filled in byTAB contractor during startup and verification.

1.8 Air Flow Measuring System Schedule including a separate line for each flow device and column for device type, model number, size, location.

1.9 Cabling indicate all required electrical wiring. Information including wire jacket colors for low voltage signal wiring, low voltage power wiring and communication cable. Indicate wire gauge for each type of cable.

1.10 Electrical wiring diagrams: Shall include both ladder logic type diagram for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly

differentiate between portions of wiring which is existing, factory-installed and portions to be field-installed.

1.11 FCC compliance.

A. Refer to section 25 0000.

1.12 QUALITY ASSURANCE

A. The control contractor shall have a manufacturer owned office within a 50-mile distance of the project site and offer complete maintenance and support services on a 24-hour, 365 day/year basis. The office shall be staffed by factory trained and certified technicians and an engineering staff. The office shall have direct access to inventory of spare parts and all necessary test equipment required to install, commission, and service the BAS provided.

B. Comply with ISO 9000 (Model for Quality Assurance in Production, Installation, and Servicing).

C. Documented history of compatibility by design for a minimum of 2 years. Future compatibility shall be supported for no less than 7 years.

D. Comply with the ANSI/ASHRAE Standard 135-1995 BACnet protocol in one open, interoperable system.

E. Provide UPS for controller where required to accomplish sequences, failure scenarios, and/or power loss.

F. Refer to section 25 0000 for additional requirements.

1.13 WARRANTY

A. Upon completion of final test of installation and acceptance by Engineer and Owner, provide any service incidental to proper performance for a period of two years.

B. Include:

1. Software revisions or updates during the warranty period.
2. Two-year warranty for parts replacement.
3. Registration and warranty documents and warranty rights to the Owner.
4. Extended warranties, if necessary, to meet the warranty requirement.
5. Software and firmware updates which resolve known deficiencies.

C. Refer to section 25 0000 for additional requirements.

1.14 OWNER'S INSTRUCTIONS

A. Provide 8 hours training on Local Control Units.

PART 2 – PRODUCTS

2.1 SUPERVISORY CONTROLLERS

A. The Supervisory Controller connects to high speed Local Area Network (LAN), serves as communications hub for other DDC on slower speed LANs, and has sufficient processor capabilities and RAM to implement all types of custom software applications.

B. Include uninterrupted real time clocks capable of time of day, week, and year information to the system as needed to perform software functions.

1. Clocks in multiple DDC's shall be synchronized to automatically match designated enterprise server.
2. Accuracy shall be within 1 second per day.
3. The general purpose DDC Controllers shall have the ability to perform all of the following energy management routines:

a. Time-of-day scheduling
b. Calendar-based scheduling
c. Holiday scheduling
d. Temporary schedule overrides
e. Start-Stop Time Optimization
f. Automatic Daylight Savings Time Switch-over
g. Night setback control
h. Enthalpy switch-over (economizer)
i. Peak demand limiting
j. Temperature-compensated duty cycling

C. Maintain volatile memory and real time clocks for a period of at least 72 hours during power failure.

1. Batteries shall be maintenance free and have minimum life of 2 years.
2. Upon power restoration, the following occurs automatically:

a. Orderly startup of controlled equipment (user defined)
b. Continuation of control algorithms
c. Database revision
d. Logging of power interruption and restoration times
e. Battery recharging

3. Provide local visual indication and system annunciation of low battery power for each battery.

D. The general purpose DDC Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

E. Support firmware upgrades without the need to replace hardware.

F. Communication Speed: Controllers shall communicate at a minimum of 100 – 200 MBps using Ethernet implemented over EIA-802.3 using a CAT.5 cable at the Data Link Layer.

G. Include a communications port to connect display device for operator access to information and operating system functions.

PART 3 – EXECUTION

3.1 SUPERVISORY CONTROLLERS

A. Provide Supervisory Controllers as needed to accommodate network architecture and cable design. Floor level network will be by floor only (not floor to floor).

B. Provide communication cards, repeaters, connectors, jumpers, terminals, and other hardware for complete system.

C. Provide all software for a complete system.

D. Coordinate final controller locations prior to installation.

END OF SECTION

Systems Integration Certification Form

Project:_____

EquivalentSystem:_____

Providing Contractor/Firm:_____

The Building Automation System (BAS) proposed for the listed project meets all specifications and standards contained in the FIU Division 25 standard and integrates with the existing BAS head-end (Metasys) for all agreed upon points.

Certified by:

_____
Signature Date

_____
Printed Name, Title

_____
MEP Firm

SECTION 25 1400

LOCAL CONTROL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. System includes Digital Controllers for automation systems.

B. Related Sections:

1. 23 3600 Air Terminal Units
2. 25 1400 Local Control Units
3. 25 1423 Field Equipment Panels

1.2 REFERENCES

A. UL 864/UUKL Smoke Control Listing

B. UL 916 Energy Management Equipment, per category PAZX for Energy Management Equipment.

C. ANSI/ASHRAE Standard 135-1995 BACnet protocol.

1.3 DEFINITIONS

A.	AI	Analog Input
B.	AO	Analog Output
C.	DI	Digital Input
D.	DO	Digital Output
E.	Dry Contact	Contact closure without an electrical output (switch)
F.	I/O	Inputs and Outputs.
G.	Ma	Milliamps
H.	MS/TP	Master/Slave Token Passing protocol used on the EIA-485 network.
I.	NC	Normally Closed
J.	NO	Normally Open
K.	Ohm	Unit of electrical resistance
L.	PID	Proportional Integral Derivative
M.	Setpoint	The goal of any control loop
N.	Stand-Alone	To operate or control without the need for higher level communications
O.	TAB	Test Adjust and Balance

P. Terminal Equipment HVAC equipment used for localized or zone control.

Q. VDC Voltage Direct Current

1.4 SYSTEM DESCRIPTION

A. Microprocessor based, field programmable controllers, include controllers dedicated to monitor and control of specific equipment such as:

1. Air Handling Units
2. Air Terminal Units
3. Laboratory Controllers
4. Fan Coil Units
5. Unit Ventilators
6. Lighting Panels
7. Pumps
8. Fans
9. Remote Dampers
10. Other miscellaneous equipment

B. Stand-alone controllers, performing specified control sequence independently of other controllers on the structured MS/TP network.

C. Capable of performing control and monitor functions including:

1. Stand-alone system control. (Normal control of each independent systems operation shall continue without the need for a communication network).
2. Perform specific control sequences in contract documents. Revise sequences, timers, delays, intervals, as required to meet design intent and field conditions, for a fully operations system.
3. Accepting voltages, current, thermisters or resistive inputs.
4. Accepting discrete inputs from isolated, dry-type contacts (no grounds or no voltage) of either normally open (NO) or normally closed (NC) configuration.
5. Convert controller information into output signals to actuators and field control devices.
6. Accepting voltages 0-5 VDC or 0-10 VDC, current (0-20ma or 4-20 mA), thermisters or resistive input (0-1000 ohm).
7. Maintain setpoints, flow limits, and occupancy schedules, etc. indefinitely in each controller's non- volatile memory.
8. Unless otherwise specified, control to within 5% of set point.
9. Control by VFD is not allowed.

1.5 QUALITY ASSURANCE

A. Comply with the ANSI/ASHRAE Standard 135-1995

B. Comply with UL 916.

C. Comply with category UUKL of UL 864 for controlling smoke and fire/smoke dampers.

D. Limit quantity of controllers to 85% of capacity of network or segment. Include any additional Hardware required.

E. Mount controllers for easy accessibility within enclosure and outside of airsteam.

F. Limit quantity of controllers to maximum of 8 per HCP.

G. At time of final observation, demonstrate the sequence of operation for each system to Owner.

H. Provide services to assist Testing, Adjust and Balancing of systems.

I. Provide weather protection cover or weatherproof control devices where required for control devices located outdoors. All control devices located outdoors shall be rated for the anticipated environment. Include provisions for supplemental ventilation when control devices must be located within these outdoor control panels. Refer to section 25 1423 enclosure requirements.

J. In the event of a loss of communication, all lower controller and components shall revert to occupied mode.

1. Power failures shall cause the control module to go into an orderly shutdown with no loss of program memory.

   a. Upon resumption of power, the Control module shall automatically restart and report the time and date of the power failure and restoration.
   b. The restart program shall automatically restart affected field equipment without human intervention.

2. Hard-wired safeties including, but not limited to fire alarm, high/low static, high/low temperature, etc, that cause unit shutdowns, shall allow automatic restart upon manual reset of tripped device. (no additional reset at workstation required)

K. Include spare I/O's for each major piece of equipment (non-terminal) controlled per the following:

1. 2 spare AI's
2. 2 spare AO's
3. 2 spare DI's
4. 2 spare AO's

L. Provide Uninterruptable Power Supply for controllers as needed to accomplish sequences and recover from power loss...

1.6 WARRANTY

A. Include:

1. Software revisions or updates during the warranty period.
2. Two year warranty for parts replacement.
3. Registration and warranty documents and warranty rights to the Owner.
4. Extended warranties, if necessary, to meet the warranty requirement.
5. Software and firmware updates which resolve known deficiencies.

1.7 OWNER'S INSTRUCTIONS

A. Refer to Section 25 0800 for requirements.

B. Provide 8 hours training on Local Control Units.

C. Provide 4 hours training for TAB contractor prior to start of Test, Adjust and Balance.

PART 2 – PRODUCTS

2.1 FIELD EQUIPMENT CONTROLLERS

A. Must include the following:

1. Communicate on the local BAS structured cable system.
2. Programs and parameters stored in nonvolatile memory.
3. Access to parameters and program via laptop computer, hand held device or network.

B. Applications include but are not limited to the following:

1. Air Handling Units
2. Large Unit Ventilators
3. Large Fan Systems
4. Other system specific control.

C. Be expandable and act as one control unit.

D. Include access to the controller's inputs, outputs and parameters by via standard IBM Compatible computer plugged in to the controller or room temperature sensor.

2.2 AIR TERMINAL CONTROLLERS

A. Must include the following:

1. Programs and parameters stored in nonvolatile memory.
2. Access to parameters and program via laptop computer, hand held device or network.
3. Integral actuator for air volume control (if available).
4. Prevent overlapping of heating and cooling setpoints.
5. Maintain airflow calibration without disrupting airflow.
6. Include Analog Output for reheat control where applicable.

B. Applications include:

1. Air terminal boxes.
2. Terminal Reheat Coils.
3. Other zone specific control.

C. Performance Requirements:

1.	Min. Actuator Torque	35 in-lb
2.	Min. Operating Temperatures	40 to 120 Deg F
3.	Min. Operating Humidity	10 to 90% RH
4.	Maintain Airflow	+/- 5%
5.	Maintain zone temperature	+/- .5 Deg F.

2.3 UNITARY EQUIPMENT CONTROLLERS

A. Must include the following:

1. Communicate on the local BAS structured cable system.
2. Programs and parameters stored in nonvolatile memory.
3. Access to parameters and program via laptop computer, hand held device or network.

B. Applications include:

1. Fan Coil Units.
2. Unit Conditioners.
3. Heat Pumps.
4. Simple Unit Ventilators.
5. Small Fans.
6. Floor Static Control stations.
7. Other unit specific control.

C. Performance Requirements:

1.	Min. Operating Temperatures	40 to 120 Deg F
2.	Min. Operating Humidity	10 to 90% RH
3.	Maintain Airflow	+/- 5%
4.	Maintain zone temperature	+/- .5 Deg FAD POWER SUPPLIES (transformers)

PART 3 – EXECUTION

3.1 FIELD EQUIPMENT CONTROLLERS

A. Provide controllers to accomplish monitoring and control of systems

B. Provide additional miscellaneous equipment necessary for complete system control.

C. Provide factory mounting in appropriate enclosures per Section 25 1423.

D. To ensure stand-alone capability, provide a controller for each equipment (or group) such as Air Handling Unit, Heating Hot Water, Chilled Water, Exhaust Systems, and VFDs etc.

3.2 AIR TERMINAL CONTROLLERS

A. Provide Air Terminal Controllers to accomplish sequences for zone specific air terminal equipment including:

1. Supply Air Terminals
2. Return Air Terminals
3. Exhaust Air Terminals
4. Reheat Coils

B. Provide additional I/O modules as needed to accomplish control sequences and meet point-list requirements.

C. Provide coordination such as shipping, scheduling, and technical support for Air Terminal factory mounting and proper operation.

D. To ensure stand-alone capability, provide a controller for each terminal or fan coil unit.

E. Terminal Actuation fails in place unless otherwise noted.

F. Coordinate power requirements with Section 23 3600.

3.3 UNITARY EQUIPMENT CONTROLLERS

A. Provide Unitary Equipment Controllers to accomplish sequences for zone specific air terminal equipment.

B. Provide additional I/O modules as needed to accomplish control sequences and meet point-list requirements.

C. Provide factory mounting in appropriate enclosures per Section 25 1423.

D. To ensure stand-alone capability, provide a controller as needed for miscellaneous equipment.

END OF SECTION

SECTION 25 1416

APPLICATION SPECIFIC CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. System includes Application Specific Controllers for automation systems.

B. Related Sections:

1. 23 3600 Air Terminal Units
2. 25 1423 Field Equipment Panels

1.2 REFERENCES

A. UL 916 Energy Management Equipment, per category PAZX for Energy Management Equipment.

B. ANSI/ASHRAE Standard 135-1995 BACnet protocol.

1.3 DEFINITIONS

A. AI Analog Input

B. AO Analog Output

C. DI Digital Input

D. DO Digital Output

E. MS/TP Master Slave Token Ring-Passing

F. Refer to section 25 1400 for additional definitions

1.4 SYSTEM DESCRIPTION

A. Microprocessor based, application specific field programmable controllers, include controllers dedicated to monitor and control of specific equipment such as:

1. Air Handling Units
2. Air Terminal Units
3. Laboratory Controllers
4. Fan Coil Units
5. Unit Ventilators
6. Lighting Panels
7. Heat Pumps
8. Other packaged equipment

B. Stand-alone controller, performing its specified control sequence independently of other

controllers on the structured BACnet MS/TP network.

C. Capable of performing control and monitor functions including:

1. Stand-alone PID control.
2. Perform specific, stand-alone control sequences in contract documents.
3. Accepting voltages, current, thermisters or resistive inputs.
4. Accepting discrete inputs from isolated, dry-type contacts (no grounds or no voltage) of either normally open (NO) or normally closed (NC) configuration.
5. Have isolated, dry-type contacts (no grounds or no voltage) of either normally open (NO) or
6. Convert controller information into output signals to actuators and field control devices.
7. Accepting voltages 0-5 VDC or 0-10 VDC, current (0-20ma or 4-20 mA), thermisters or resistive input (0-1000 ohm).
8. Maintain setpoints, flow limits, and occupancy schedules, etc. indefinitely in each controller's non- volatile memory.
9. Unless otherwise specified, control to within 5% of setpoint.

1.5 SUBMITTALS

A. Submit room schedules for all zone control devices.

B. Refer to section 25 0000.

1.6 QUALITY ASSURANCE

A. Comply with the ANSI/ASHRAE Standard 135-1995

B. Comply with UL 916.

C. Limit quantity of controllers to 85% of capacity of network or segment. Include any additional hardware required.

D. At time of final observation, demonstrate the sequence of operation for each system to Owner.

E. Provide services to assist Testing, Adjust and Balancing of systems.

1.7 WARRANTY

A. Include:

1. Registration and warranty documents and warranty rights to the Owner.
2. Extended warranties, if necessary, to meet the warranty requirement.
3. Software and firmware updates which resolve known deficiencies.

B. Refer to section 25 0000 for additional requirements.

1.8 OWNER'S INSTRUCTIONS

A. Provide 8 hours training on Application Specific Controllers.

B. Provide 4 hours training for TAB contractor prior to start of Test, Adjust and Balance.

PART 2 – PRODUCTS

2.1 EQUIPMENT CONTROLLERS

A. Must include the following:

1. Communicate on the local BAS structured cable system.
2. Programs and parameters stored in nonvolatile memory.
3. Access to parameters and program via laptop computer, hand held device or network.

B. Applications include but are not limited to the following:

1. Air Handling Units
2. Large Unit Ventilators
3. Large Fan Systems
4. Other system specific control.

C. Programs and parameters stored in nonvolatile memory.

D. Be expandable and act as one control unit.

E. Include access to the controller's inputs, outputs and parameters by via standard IBM compatible computer plugged in to the controller or room temperature sensor.

2.2 AIR TERMINAL CONTROLLERS

A. Must include the following:

1. Programs and parameters stored in nonvolatile memory.
2. Access to parameters and program via laptop computer, hand held device or network.
3. Integral actuator (for air volume control only).

B. Applications include:

1. Air terminal boxes.
2. Terminal Reheat Coils.
3. Other zone-specific control.

C. Performance Requirements:

1.	Min. Actuator Torque	35 in-lb
2.	Min. Operating Temperatures	40 to 120 Deg F
3.	Min. Operating Humidity	10 to 90% RH
4.	Maintain Airflow	+/- 5%
5.	Maintain zone temperature	+/- .5 Deg F.

2.3 UNITARY EQUIPMENT CONTROLLERS

A. Must include the following:

1. Communicate on the local BAS structured cable system.
2. Programs and parameters stored in nonvolatile memory.
3. Access to parameters and program via laptop computer, hand held device or network.

B. Applications include:

1. Fan Coil Units.
2. Unit Conditioners.
3. Heat Pumps.
4. Simple Unit Ventilators.
5. Small Fans.
6. Floor Static Control stations.
7. Other unit specific control.

C. Performance Requirements:

1. Min. Operating Temperatures 40 to 120 Deg F
2. Min. Operating Humidity 10 to 90% RH
3. Maintain Airflow +/- 5%
4. Maintain zone temperature +/- .5 Deg FAD POWER SUPPLIES (transformers)

D. Power supply

1. Include power supplies.
2. Power supplies shall be internal to controller enclosure or in an enclosure adjacent to the controller.

PART 3 – EXECUTION

3.1 EQUIPMENT CONTROLLERS

A. Provide controllers to accomplish monitoring and control of systems

B. Provide additional miscellaneous equipment necessary for complete system control.

C. Provide factory mounting in appropriate enclosures per Section 25 1423.

3.2 AIR TERMINAL CONTROLLERS

A. Provide Air Terminal Controllers to accomplish sequences for zone specific air terminal equipment.

B. Provide additional I/O modules as needed to accomplish control sequences and meet point-list requirements.

C. Provide coordination such as shipping, scheduling, and technical support for Air Terminal factory mounting and proper operation.

D. Coordinate power requirements with Section 23 3600.

3.3 UNITARY EQUIPMENT CONTROLLERS

A. Provide Unitary Equipment Controllers to accomplish sequences for zone specific air terminal equipment.

B. Provide additional I/O modules as needed to accomplish control sequences and meet point-list requirements.

C. Provide factory mounting in appropriate enclosures per Section 25 1423.

END OF SECTION

SECTION 25 1423

FIELD EQUIPMENT PANELS

PART 1 – GENERAL

1.1 SUMMARY

A. Control panel requirements for Integrated Automation Systems

B. Related Sections

1. 25 0553 - Identification
2. 25 1400 - Local Control Units
3. 25 3526 - Pneumatic Piping Tubing

1.2 REFERENCES

A. ANSI 61 Drinking Water System Components - Health Effects

B. NEMA 1 General Purpose - for use in dry indoor locations.

C. NEMA 4 Watertight - for use in locations where subjected to direct water spray and outdoors.

1.3 DEFINITIONS

A. Rung – Logical decision resembling the rung of a ladder within a ladder logic diagram.

B. Wiring Duct –Pathway for wire management inside of panels.

C. Wiring Trough – Wiring enclosure used to manage wiring outside of panels.

D. Refer to section 25 0000 for additional definitions.

1.4 SYSTEM DESCRIPTION

A. Field equipment panels include, but not limited to control panels for:

1. Air Handler systems
2. Chiller systems
3. Boiler systems
4. Exhaust Fan systems
5. Pumping Systems
6. Miscellaneous systems
7. Monitoring systems

B. Enclosures for all controllers and instruments except those furnished by equipment manufacturers for factory mounted controls.

1.5 SUBMITTALS

A. Submit control panel fabrication drawings including: back-panel layout, panel face arrangement, panel name, and panel tag number (if applicable) prior to fabrication or device installation.

1. Drawings shall show operator interface configuration on panel face and device locations on back-panel. Also include panel tagging schedule or identification detailing nameplate text and size.
2. Include panel power schematic showing power sources and protection device capacity.
3. List manufacturer supplied devices in bill of material table.

B. Submit schematic and wiring interconnection drawings in ladder format. Include rung numbers. Number relays with rung number.

1. Each relay function shall be fully described to right of relay right rung. Each relay contact location shall be referenced at coil location.
2. Each contact shall have associated coil reference and shortened description of coil function. Each contact shall have relay pin-out identifiers.
3. Wire colors and designators shall be identified.
4. Terminal blocks shall be uniquely identified. Field and panel wiring shall be differentiated By solid line for panel and dashed line for field.
5. Each connection to field device or other remote panel shall be identified.

C. Submit Calibration sheets for instruments and devices connected to panel.

1.6 QUALITY ASSURANCE

A. Enclosures shall be free of scratches, dents, overspray, oil, etc. at substantial completion. Thoroughly clean interior and exterior of all panels.

B. Include instrument/equipment tag numbers, when available, on submittal documents whenever specific component appears.

C. Install panels according to manufacturer's instructions.

D. Space wire-ways and terminal strips 3" apart.

E. Locate terminal strips either horizontally in upper half of back panel or vertically. Do not locate terminal strips below 2'-0" or above 6'-6" above finished floor.

F. Separate 24 VDC and 120 VAC terminal strips, wire, cable, and devices by 6" minimum space.

G. Provide terminal strips for total controller I/O count plus 20% spare capacity with analog and discrete spare capacity calculated separately.

H. Size raceway to maximum fill of 40% per NEC.

I. Space controllers according to manufacturer's requirements with 3" minimum between controllers and other devices on back panel and 6" between controller front and door mounted

devices. Ensure adequate space is allowed for device heat dissipation.

J. Control enclosure interior temperature to 80°F maximum.

K. Do not place controller or control devices on enclosure sides.

L. Provide 25% minimum spare capacity of panel s pace, spare controller chassis space, wiring duct space, and terminal blocks to allow for future expansion by adding I/O cards and associated cabling.

M. Locate panels adjacent to equipment served with minimum of 3 ft clearance in front of door. Provide sufficient clearances to allow full door swing and full access to internal components. Remote mount panels are acceptable where accessibility will be significantly improved.

N. Mount top of panels between 5 and 6 ft above floor so that gauges and indicators are at eye level.

O. Route and terminate wiring parallel and at right angles within panels.

P. Terminate power within 4 inches of panel entrance.

Q. Refer to section 25 0000 for additional requirements.

PART 2 – PRODUCTS

2.1 ENCLOSURES

A. Manufacturer: Hoffman, Hammond Manufacturing or approved equal.

B. Construction:

1. Minimum14 gauge steel.
2. Hinged door
3. Include inner panel
4. ANSI 61 external powder paint finish.
5. Cylinder locks and master 4 master keys for all panels less than 8 foot above finished floor.
6. Include print pockets on enclosure doors.
7. Miscellaneous steel components, e.g. standoffs, shall be 12 gauge minimum rolled steel.

C. Floor Mounted Panels:

1. Minimum size for panel fastening anchors shall be 9/16".
2. Unless otherwise specified, install floor mounted control panel(s) on four 4" concrete equipment pad(s) with grout as required.
3. Install two (2) anchors for each four (4) feet of equipment length or minimum of four (4) anchors. Decrease anchor spacing for heavy panels as required. Bolt equipment to pad using cap screws and washers.

D. Wall Mounted Panels:

1. Minimum size for wall fastening anchors shall be 3/8".
2. Provide one anchor for every 4'-0" of outside perimeter for wall mounted panels; minimum

anchors for wall mounted panels shall be 4. Decrease anchor spacing for heavy panels as required.

3. Provide clear space for dressing out wiring, cables and tubing entering panel. Provide 4"2 unrestricted clear space for each inch of conduit size or each square inch of wiring duct size, with 4" x 4" being minimum area, in alignment with entering conduit or wiring duct, for bringing wiring into panel and routing to other locations

2.2 WIRING DUCT:

A. Manufacturers: Panduit, Tyton, or approved alternate.

B. Construction:

1. Slotted plastic or vinyl (PVC)
2. Grey or white
3. Snap-on covers.

2.3 WIRING TROUGH

A. Manufacturer: Hoffman, Hammond Manufacturing or approved equal.

B. Construction:

1. Minimum14 gauge steel.
2. Unpainted galvanized finish.
3. Flat cover

2.4 AC POWER SUPPLIES

A. Transformers for use with digital controllers, actuators, etc.

1. Input Power: 120 VAC to 480 VAC
2. Output Power: 24 VAC
3. Minimum capacity 40 VA
4. Resettable Circuit Breaker
5. External Plug

2.5 UNINTERRUPTABLE POWER SUPPLY

A. UPS for use with digital controllers.

1. Input Power: 120 VAC
2. Output Power: 120V VAC
3. Minimum capacity 550 VA
4. Resettable Circuit Breaker
5. Battery Failure Notification
6. Audible Alarm

PART 3 – EXECUTION

3.1 ENCLOSURES

A. Enclosures for all controllers and instruments except those furnished by equipment manufacturers for factory mounted controls.

B. Provide NEMA type 1 enclosures for dry indoor locations.

C. Provide NEMA type 4 control panel enclosures in outdoor locations or indoor locations (including maintenance spaces) where water damage is possible.

D. Label enclosures with respective unique ID numbers in accordance with section 25 0553.

E. Mount local control panels at convenient locations adjacent to and independent of equipment served. Install control panels in locations as shown on drawings and with proper clearance.

F. Mount cooling devices, receptacles and incandescent lights (if applicable) on enclosure sides.

G. Mount top of panels between 5 and 6 ft above floor. Mount panels at consistent height.

H. Provide control panels where more than one control device requires field mounting.

I. Instrument mounting:

1. Ensure connections can be easily made and ample room exists for servicing each item. Every component in and on enclosures shall be able to be removed individually without affecting other components and without the need to move other components.
2. Install devices prior to terminating wire or tubing.
3. Rigidly attach instruments with properly sized stainless steel screws or bolts so they may be removed.
4. Do not install instruments on panel sides, except for cooling devices, receptacles, and lighting, devices.
5. Provide gaskets for instruments penetrating panel exterior and seal in accordance with NEMA standards. Entire enclosure shall meet NEMA standard after installation of required devices.

J. Knockouts:

1. Distortion of panels is not permitted as a result of machining cutouts or mounting instruments and devices.
2. Cutouts shall be smooth and without irregularity from desired shape.
3. Flame cutting or arc-cutting is not permitted.
4. Align knockouts, sub-panels, and drilling for mounting to keep devices grouped and in vertical and horizontal alignment.
5. Provide rubber grommets in cutouts for wiring or tubing to prevent chaffing or scarring of insulation or jacketing of wiring or tubing.

K. Mounting fasteners:

1. Minimum size for panel fastening anchors shall be 9/16" for floor anchors and 3/8" bolt for wall anchors. Increase anchor sizes as required for heavy panels.

L. Floor Mounted Panels:

1. Unless otherwise specified, install floor mounted control panel(s) on four 4" concrete equipment pad(s) with grout as required.
2. Install two (2) anchors for each four (4) feet of equipment length or minimum of four (4) anchors. Decrease anchor spacing for heavy panels as required. Bolt equipment to pad using cap screws and washers.
3. Do necessary grouting after equipment is installed and leveled. Grouting material shall be Owner approved cement grout; mixed and placed in accordance with manufacturer's recommendations. Remove leveling shims and wedges after grout has hardened. Re-grout Shim and wedge areas after shims or wedges are removed.

M. Wall Mounted Panels:

1. Provide one anchor for every 4-'0" of outside perimeter for wall mounted panels; minimum anchors for wall mounted panels shall be 4. Decrease anchor spacing for heavy panels as required.
2. Provide clear space for dressing out wiring, cables and tubing entering panel. Provide 4" 2 unrestricted clear space for each inch of conduit size or each square inch of wiring duct size, with 4" x 4" being minimum area, in alignment with entering conduit or wiring duct, for bringing wiring into panel and routing to other locations. This space shall be sufficiently accessible to enable pulling wiring, cables, or tubing into panel for termination with initially installed equipment in place.

N. Wiring:

1. Provide flexible sleeves for protection of each wire bundle that passes across door hinge. Allow sufficient slack in wiring bundles so that door can fully open. Provide separate bundles for analog and discrete wiring crossing door hinges separated by > 6".
2. Install wire and cabling so that any item may be removed without interrupting circuit power or other terminations.
3. Use solder less spade-type compression lugs for wiring terminations except for pressure plate type terminations.
4. Identify power circuit.
5. Install wiring along vertical or horizontal runs to present neat appearance. Angled runs are not allowed.
6. Provide copper grounding lugs for electrical grounding of metal panels. Size lugs for system requirements but shall be less than #8.
7. Neatly land and terminate stranded conductors in terminal blocks. Do not remove strands of stranded wire out to make wiring fit terminal.
8. Fuses or circuit breakers shall be readily accessible and easily identified. Properly label each fuse or circuit breaker. Install circuit breakers and fuses in clear space as required by NEC.
9. Connect controller network cabling in accordance with manufacturer's connection practices and as shown on drawings.

O. Terminal Blocks:

1. Land cables on terminal blocks prior to controller terminations.
2. Assure ease of accessibility of terminal blocks.
3. Connect no more than 2 conductors under each terminal screw.

4. For terminal blocks located between 3" deep or deeper wiring duct, install terminal blocks on raise channel to facilitate ease of connection to terminal block.
5. Label terminal blocks.
6. Group terminal blocks in sequential manner following I/O type and device tag name.
7. Grouping or placement shall not compromise NEC wiring classification.

P. Power:

1. Terminate power wiring within 6 inches of enclosure entrance.
2. Include fused terminal strip with blown fused indicator.
3. Identify power source panel and breaker.

3.2 WIRING DUCT

A. Install wiring duct along vertical or horizontal runs to present neat appearance.

B. Permanently fasten wire duct into sub-panels using 10/32 screws.

C. Support lower sidewall on horizontal runs of plastic wiring duct with bracing to avoid sagging.

D. Install wiring between devices and terminal blocks in wiring duct except for dressing out to make terminations.

E. Wiring duct fill shall not exceed 40% of wiring duct volume.

F. Provide labels on wiring duct designating AC and DC wiring.

3.3 WIRING TROUGH

A. Provide wiring trough above or parallel to field control panels.

B. Route wiring through wire trough to minimize wire tension and allow re-routing of wire when necessary.

C. Wiring:

1. Neatly arrange, bundle with nylon tie-wraps, and support with adhesive backed tie-wrap supports wiring which must be outside wiring duct. Provide flexible sleeves for protection of each wire bundle that passes across door hinge. Allow sufficient slack in wiring bundles so that door can full open. Provide separate bundles for analog and discrete wiring crossing door hinges separated by > 6".
2. Install wire and cabling so that any item may be removed without interrupting circuit power or other terminations.
3. Use solderless spade-type compression lugs for wiring terminations except for pressure plate type terminations.
4. Identify power circuit.
5. Install wiring along vertical or horizontal runs to present neat appearance. Angled runs are not allowed.
6. Provide copper grounding lugs for electrical grounding of metal panels. Size lugs for system requirements but shall be less than #8.
7. Neatly land and terminate stranded conductors in terminal blocks. Do not remove strands of

stranded wire out to make wiring fit terminal.

8. Fuses or circuit breakers shall be readily accessible and easily identified. Properly label each fuse or circuit breaker. Install circuit breakers and fuses in clear space as required by NEC.
9. Connect controller network cabling in accordance with manufacturer's connection practices and a shown on drawings.
10. Connect 120 VAC or low voltage power, as required, to each I/O module and to processor rack power supply.
11. Connect I/O to terminal blocks including controller I/O spares and spare I/O cards.

D. Terminal Blocks:

1. Land cables on terminal blocks prior to controller terminations.
2. Assure ease of accessibility of terminal blocks.
3. Connect no more than 2 conductors under each terminal screw.
4. For terminal blocks located between 3" deep or deeper wiring duct, install terminal blocks on raise channel to facilitate ease of connection to terminal block.
5. Label terminal blocks.
6. Group terminal blocks in sequential manner following I/O type and device tag name.
7. Grouping or placement shall not compromise NEC wiring classification. Give special attention to Intrinsically Safe wiring.

E. Power:

1. Terminate power wiring within 6 inches of enclosure entrance.

F. GENERAL PNEUMATIC PIPING/TUBING

1. Do not splice tubing within panel. Use bulkhead bars for circuit extensions.
2. Mount tubing so that tubing run(s) do not interfere with removal of components.
3. Terminate interior pneumatic components to bulkhead bars. Terminate incoming tubing to these bulkheads.
4. Install tubing along vertical or horizontal runs to present neat appearance. Angled runs are not allowed.
5. Label pneumatic tubing.

3.4 AC POWER SUPPLIES

A. Provide power supply in control panel for major equipment (non terminal).

3.5 UNINTERRUPTABLE POWER SUPPLY

A. Provide UPS in control panel for major equipment (non terminal).

END OF SECTION

SECTION 25 1500
SOFTWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes software requirements for the following:

1. Operator Workstation
2. Network or Building level controllers
3. Application Specific or Terminal level controllers
4. Communication analyzer

B. Related Work

1. 25 1119 Network Operating Workstation
2. 25 1300 Control and Monitoring Network
3. 25 1400 Local Control Units

1.2 REFERENCES

A. UL 864/UUKL Smoke Control Listing

B. UL 916 Energy Management Equipment, per category PAZX for Energy Management Equipment.

1.3 DEFINITIONS

A. Access Process or effort to communicate to system.

B. AutoCAD Computer Aided Design software

C. Communication Analyzer Software tool used to troubleshoot communication problems.

D. Firmware Hardware imbedded with software.

E. Hardware Physical components of a system.

F. License Permit rights and restrictions for legal use and access of software and applications.

G. Patch Software upgrade typically to correct know problems

H. Software Program

I. Stand Alone Control without the need for communications

1.4 SYSTEM DESCRIPTION

A. Provide all required system software to support existing server/client architecture, designed around the open standards of web services.

B. Software

1. Software shall be compatible and integrate with Enterprise Management System.
2. Includes project specific programming such that any of the following may be performed simultaneously on-line, and in any combination, via the browser interface:

C. Licenses

1. Complete set of product licenses for systems and third party software used in system development, including documentation for all applications, databases, browsers, communications software etc.
2. Owner shall be the named license holder of all software.

D. Alarms

1. Coordinate with Owner all alarm message requirements and guidelines.

E. Security Access

1. Access control via user defined passwords for system operation.
2. Minimum of 3 access levels.
3. Campus Access Security: Communications between any campus Web browser and the BAS server shall be encrypted using 128-bit encryption technology within Secure Socket Layers 2 (SSL 2).
4. Allow authorized users complete access to the system via a web browser. The client web browser Graphical User Interface (GUI) shall support the latest version of Microsoft, Netscape or Mozilla browsers and Windows operating systems.
5. User security access from any web browser PC/PDA to the BAS controllers or server shall require both a Login Name and password.

F. Communication Analyzer for network troubleshooting.

1.5 SUBMITTALS

A. Software Manual including:

1. System overview.
2. Describe operating procedures.
3. Software command descriptions.
4. Password management.
5. Control program functions.

B. Data sheet for each software program used.

C. Documented proof of compatibility with EMS.

D. Provide all product licenses including:

1. System software
2. Documentation for all third party software

1.6 QUALITY ASSURANCE

A. Provide most current revision of software.

B. Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by this Contractor shall be provided at no additional charge during the 2 year warranty period.

1.7 OWNER'S INSTRUCTIONS

A. Provide 32 hours of off-site training by factory trained instructor for 4 people. Include travel and hotel accommodations.

B. Provide an additional 24 hours of on-site training by factory trained instructor of owner specific subject, after 6 months of occupation and prior to end of warranty.

C. Coordinate and schedule training with Owner.

PART 2 – PRODUCTS

2.1 OPERATOR WORKSTATION

A. Operating System shall be Microsoft Windows

B. Web Browsers

1. Manufactures: Microsoft Explorer, Mozilla or Netscape

C. Office Software

1. Adobe Acrobat Professional
2. Microsoft Office

D. Anti-Virus

1. Manufactures: Norton, McAfee or approved equal.

E. Platform (Vendor specific)

1. Provide access and control to Integrated Automation System
2. Allow standard web-browsers for access to Integrated Automation Systems.
3. Include real time control of system interactions
4. Provide database information requests/transfers by system hardware or by operators
5. Include uninterrupted real time clocks capable of time of day, week, and year information to the system as needed to perform software functions.
6. Allow for Daylight Savings Time.

7. Synchronize with BAS network
8. Contain a HELP function key.
9. Database management.

    a. Point values
    b. Controlled variables
    c. Set points
    d. Tuning parameters
    e. New hardware and software points
    f. Online modifications
    g. Error detection, correction, re-transmission of database values, arithmetic or logical faults.

10. Alarm management.

    a. Perform enhanced alarm analysis
    b. Buffering alarms in order of importance
    c. Filtering to minimize operator interruptions
    d. Messages
    e. Routing
    f. Parameter modification

11. Trending management.

    a. Creating
    b. Modifying
    c. Deleting

12. Field controller loop tuning.

13. Enable and Disable control loops.

14. Integration Capabilities multiple building functions including:

    a. Equipment supervision and control
    b. Alarm management
    c. Energy management
    d. Access control
    e. Information management
    f. Historical data collection and archiving

15. Simulation software

    a. Ability to view the logic execution in a step approach.
    b. Ability to view the logic in real time for easy diagnosis of the logic execution.
    c. Imbedded comment section
    d. Boolean Logic
    e. Ability to view the logic in a monitor mode.
    f. Modular custom and standard applications

2.2 COLOR GRAPHICS PACKAGE

A. Compatible with manufactures software platform.

B. Compatible with Engineer's AutoCAD software.

C. Include:

1. Animation
2. Text description
3. Calculated and shared points
4. Integrated points
5. Associated points, including dynamic input values, output values, set points, gains, time schedules, etc.
6. System schematic or picture
7. Alarm fields
8. Database fields

D. Minimum Performance:

1. Display all points within 10 seconds.
2. Refresh all points every 15 seconds.
3. Colors change with conditions such as alarms, temperatures, etc.

2.3 BUILDING LEVEL CONTROLLERS

A. Appropriate functionality to accomplish monitoring and control of system.

B. Provide security by allowing assignment of a minimum of 50 passwords for access and control priorities to each controller point individually.

C. Capable of monitoring the status of all overrides and inform the operator that automatic control has been inhibited.

D. Alarm or point change reports shall include the point's English language description and the time and date of occurrence.

E. Contain self-diagnostics that monitor panel operation.

F. Store trend and history data until uploaded to hard disk storage archival volume as required ensuring no data is lost.

G. Perform the following energy management routines:

1. Automatic Daylight Savings Time Switch-over
2. Night setback control
3. Enthalpy switch-over (economizer)
4. Peak demand limiting
5. Temperature-compensated duty cycling
6. Runtime accumulation
7. Allow for comment lines for sequence of operation explanation

2.4 APPLICATION SPECIFIC AND MULTI-EQUIPMENT APPLICATION CONTROLLER

A. Stand alone control capability.

B. Allow access to the controller's application parameters via standard Microsoft compatible laptop computer plugged in to the room temperature sensor.
C. Includes a provision for limiting the number of times each piece of equipment maybe cycled within any one-hour period.
D. Include time delays between successive start commands to heavy electrical loads (user selectable).
E. Returns equipment to normal operation upon power restoration.
F. Perform the following algorithms:

1. Two-position control
2. Proportional, integral, plus derivative control
3. Automatic tuning of control loops
4. Floating control

PART 3 – EXECUTION

3.1 OPERATION WORKSTATION

A. Provide latest software compatible with automation system.

B. Provide available upgrades, patches, etc. up to substantial completion date.

C. Coordinate system requirements with owner.

3.2 COLOR GRAPHICS

A. Provide color graphics

1. Provide graphical representation of every system monitored or controlled.
2. Utilize current systems library of graphics for consistency.
3. Provide consistent use of colors, units, descriptions, symbols, etc. Color scheme includes but is not limited to the following:
4. Provide a color legend for object points

    1) White or No Color – Normal
    2) Orange – Override
    3) Yellow – Trouble/Warning
    4) Grey – Offline
    5) Red – Alarm
    6) Blue – Below Set Point
    7) Violet –Above Set Point

B. Piping:

    1) Blue – CHWS

2) Purple – CHWR
3) Light Green – CWS
4) Dark Green – CWR
5) Red – HWS
6) Dark Red – HWR
7) Dark Orange – Condensate
8) Light Yellow – Steam
9) Neon Green – Gas
10) Grey – None/Other

5. Coordinate with Owner prior to installation of graphics.

A. Include the following:

1. Graphic symbols consistent with most current version of BAS.

2. Major equipment such as, but not limited to:

a. AHU, FCU, and ATU equipment
b. VFD's and other intelligent equipment.
c. Plumbing systems
d. Utilities
e. Misc. connected systems

3. Integrated systems such as:

a. Security
b. Fire Alarm
c. Plumbing
d. Electrical

4. Site Plan

a. Utilities
b. Lighting
c. Weather conditions
d. Allow penetration to floor plans graphics

5. Floor Plans:

a. Coordinate with as-built drawings to include

1) Room name and numbers
2) Column numbers
3) Keyplan (for floor plans with multiple screens)
4) Thermographics

b. Identify

1) HVAC zones by AHU
2) HVAC rooms served by singe space sensor.

3) Fire Zones

c. Allow penetration to associated system graphic

6. Additional floor plan requirements including:

a. Automated Temperature Controls system
b. Fire Alarm system
c. Simultaneous display of smoke control system per UUKL.
d. Lighting system
e. Color coded temperature and/or pressure zones.
f. Color coded alarms.
g. Provide small key plan for partial floor plans.

7. Provide dynamic Risers:

a. Electrical- metering
b. Chilled Water – valves, temperatures, flow, pumps, etc.
c. Air Distribution- AHU, Exhaust, dampers, temperatures, flow, etc
d. Steam – Exchangers, flow, temperatures, pressures,
e. Heating Hot Water flow, temperatures, pressures,
f. BAS Communications – status

8. Summaries:

a. Alarms
b. Overrides
c. Transactions
d. Terminal Equipment
e. AHU's (if more than 3)

B. Provide organized hierarchy:

1. Provide penetration from main page down to instrument level using mouse point and click feature.
2. Provide penetration from instrument level back up to main page level using mouse point and click feature.
3. Provide links from sub-systems to main systems such as:

a. Air terminal shall have a link to associated AHU, lighting, etc.
b. AHU shall have a link to cooling, heating, exhaust, energy recovery, etc.
c. Labs shall have a link to supply and exhaust systems.
d. Rooms shall have a link to floor plan.

4. Provide links to

a. Equipment schedules
b. Sequences of operations

C. Simulation software

1. Provide programming for the system and adhere to the sequences of operation provided.
2. Imbed into the control program sufficient comment statements to clearly describe each section of the program.
3. Document all programming in the form of a logic flowchart.
4. Provide actions for all possible situations.
5. Programming shall be modular and structured.

3.3 BUILDING LEVEL CONTROLLERS

A. Provide software as utilized for complete operating system.

1. Include building level controller software for engineering and application modifications.
2. Include software data/configuration files for each separate controller, programming code and documentation.

B. Provide a software data/configuration files for each separate controller.

3.4 APPLICATION SPECIFIC AND MULTI-EQUIPMENT APPLICATION CONTROLLER

A. Provide software as utilized for complete operating system.

1. Include software for engineering and application modifications.
2. Include software data/configuration files for each separate controller, programming code and documentation.

B. Provide a software data/configuration files for each separate controller.

END OF SECTION

SECTION 25 3313
UTILITY METERING

PART 1 – GENERAL

1.1 SUMMARY

A. Systems include metering and integration of electric metering for the facility:

B. Related Sections:

1. 25 0000 Integration Automation.
2. 5 1219 Integration Protocols

1.2 REFERENCES

A. Refer to section 25 1219 for protocol compliance.

1.3 SYSTEM DESCRIPTION

A. Installation of electrical metering and accessories.

B. Low voltage wiring and pathways for metering.

C. Integration of metering to the Building Automation System.

D. Coordinate installation of metering electronics, including but not limited to:

1. Power requirements
2. Meter and panel locations

E. Provide access to points via shared hardwired or integration.

1.4 QUALITY ASSURANCE

A. Refer to section 25 0000 for additional requirements.

PART 2 - PRODUCTS

2.1 ENERGY METER

A. Electric Meters

1.	Manufacturers:	Energy Monitoring Products & Systems.
2.	Model:	Class 3400 Smart Meter
3.	Protocol:	Modbus RTU, TCP/IP
4.	Enclosure:	NEMA 4x

PART 3 – EXECUTION

3.1 ENERGY METER

A. Install metering panels and electronics.

B. Install wiring and pathways.

C. Provide access to points via shared hardwired or integration.

END OF SECTION

SECTION 25 3513

ACTUATORS AND OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes control valve actuators, damper actuators, and positioners for systems as shown in Contract Documents and where provide by equipment manufacturer.

B. Related Sections

1. 25 0523 Conductors and Cables
2. 25 0528 Pathways
3. 25 3519 Control Valves
4. 25 3523 Control Dampers
5. 25 3526 Compressed Air Supply

1.2 REFERENCES

A. ISO 9001

B. UL 873 Temperature-Indicating and -Regulating Equipment

1.3 DEFINITIONS

A. Sub-circuit - Branch supply and return piping to terminal device, including valve, coil, control valve, and balancing valve.

1.4 SYSTEM DESCRIPTION

A. Actuators and operators for control valves, control dampers, smoke dampers, fire/smoke dampers, etc.

1.5 SUBMITTALS

A. Include Product data sheets shall include construction materials and assembly methods, maximum design parameters (temperature, pressure, velocity, etc.), and performance data for full range of actuator stroke.

B. Include actuator torque capacities locations.

1.6 QUALITY ASSURANCE

A. Manufacturer shall be ISO9001 certified.

B. UL listed under standard 873 for Temperature-Indicating and Regulating Equipment.

C. Obtain adequate system information necessary for sizing.

D. Mount actuators outside air-stream.

E. Provide manual override option for all actuators.

F. Refer to section 25 0513 for power connections and other cable requirements.

G. Refer to section 25 0528 for pathway requirements.

PART 2 – PRODUCTS

2.1 ANALOG ELECTRONIC ACTUATORS

A. Manufacturers: Belimo, Delta, Johnson Controls, Siemens Building Technologies …….

B. Modulating actuator input signals shall be 0-20ma, 4-20ma, 0-5VDC, 1-5VDC, 2-10VDC, or 0-10VDC. Floating or pulsing signals are not allowed.

C. Provide spring return feature for fail open or closed positions as required by control sequence. Terminal units such as air terminals and fan coils actuators fail in place, unless otherwise noted.

D. Provide actuator with a conduit fitting.

E. Non-spring return actuators and spring return actuators with more than 60lbs torque shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered.

F. Spring return not required for terminal equipment.

2.2 DISCRETE TWO-POSITION ELECTRIC ACTUATORS

A. Manufacturers: Belimo, Honeywell, Johnson Controls, Siemens Building Technologies or Invensys Building Systems.

B. Provide spring return feature for fail open or closed positions as required by control sequence.

C. Provide actuator with a conduit fitting.

D. Non-spring return actuators and spring return actuators with more than 60lbs torque shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered.

PART 3 – EXECUTION

3.1 ELECTRIC/ELECTRONIC ACTUATORS

A. Provide actuator for each automatic damper or valve with sufficient capacity to operate damper or vale under all conditions.

B. Select actuators to provide tight shut-off against maximum system temperatures and pressure encountered.

C. Each actuator shall be full-modulating or two-position type as required or specified, and shall be provided with spring-return for fail open or fail closed position for fire, freeze, occupant safety, equipment protection, heating or cooling protection on power interruption as indicated and/or as required.

D. Fail smoke dampers and steam valves serving pressure rated heat exchangers or converters closed unless otherwise shown.

E. Valve and damper operating speeds shall be selected or adjusted so that actuators will remain in step with controllers without hunting, regardless of load variations. Actuators acting in sequence with other actuators shall have adjustment of control sequence as required by operating characteristics of system.

F. Provide proper linkage and brackets for mounting and attaching actuators to devices. Design mounting and/or support to provide no more than 5% hysteresis in either direction (actual movement of valve stem or damper shaft versus ideal movement) due to deflection of actuator mounting.

G. Coordinate the factory installation of control valve actuators and operators.

H. Mount actuators and operators outside the airstreams.

END OF SECTION

SECTION 25 3515
SWITCHES AND RELAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Systems include switches and relays for the control of Heating, Ventilation, and Air Conditioning systems.

B. Related Sections:

1. 25 0553 Identification

1.2 REFERENCES

A. UL 20 – General Use Snap Switches.

1.3 SYSTEM DESCRIPTION

A. Include all components not specifically indicated or specified, but necessary to make the system function within the intent of the specification and in accordance with control sequences located on contract documents.

B. Unless otherwise specified, functionality of interolcks and safeties shall be operational in hand, auto, or bypass (for VFD's)

1.4 QUALITY ASSURANCE

A. Electrical devices, switches, and relays shall be UL listed and of type meeting current and voltage characteristics of project.

B. Ratings of normally open and normally closed contacts shall be adequate for applied load (minimum 5 amps at 240 Volts) unless otherwise specified.

C. Accuracy of devices shall be ± 1% of scale with adjustable offset unless otherwise specified.

D. Mount adjustable or resettable instruments for easy access without the need for a ladder, flashlight, etc.

PART 2 – PRODUCTS

2.1 LOW LIMIT TEMPERATURE SWITCHES

A. Electric 2-position type with temperature sensing element and manual reset.

B. Capable of opening circuit if any one-foot length of sensing element is subject to temperature below setting.

C. Include auxiliary contact for alarm condition reporting to the control system.

D. Sensing element shall not be less than one lineal foot per square foot of coil surface areas.

E. Include auxiliary contact for alarm condition reporting to the control system.

2.2 DRY PRESSURE SWITCHES

A. Manufacturers: Cleveland, Allen Bradley, Ashcroft, Dwyer, Honeywell, Johnson Controls/Penn, Siemens Building Technologies, Invensys, SOR, or United Electric. Or approved equal.

B. Field adjustable set point, differential pressure type.

C. Manual Reset. (for safety switches only).

D. Minimum Requirements:

1. Set Point Range 2 times normal operating pressure
2. Switch differential .06”min to 0.8”max
3. Contact Type 2 SPST-NC
4. Ratings:

    a. 15 amps @ 125, 250 or 277 VAC
    b. .5VA @ 24 VAC
    c. ¼ HP @ 125 VAC
    d. ½ HP @ 250 VAC

E. UL approved for application.

F. Include auxiliary contact for alarm condition reporting to the control system.

2.3 CONTROL RELAYS

A. Manufacturers: IDEC, Potter Brumfield, Square D, or Allen Bradley.

1. Equal to IDEC type RH2B-U, miniature 8 blade pilot relay with DPDT silver cadmium oxide contacts rated at 10A, 30 VDC, or 120 VAC. Coil shall match control circuit characteristics.
2. Rectangular base socket mount with blade type plug-in terminals and polycarbonate dust cover.
3. Provide DIN rail mountable (Snap type) mounting sockets equal to IDEC SH2B-05.

B. Enclosed Relay (Relay-in-a-Box):

1. Manufacturers: Veris Industries, Kele & Associates, Functional devices, Inc. or approved equal.
2. 1 or 2 SPDT relays in NEMA 1 or better enclosure. Coil shall be selected for control circuit characteristics.
3. Contacts rated at 10A, 28 VDC or 120 VAC. Conduit nipple is 1/2" NPT. Maximum coil current burden 50 milliamps.
4. LED status indication.
5. Include Hand-Off-Auto (HOA) switch.

2.4 CURRENT SWITCHES

A. Manufacturers: Hawkeye, Veris Industries, N-K Technologies, Absolute Process Instruments, Kele & Associates, R-K Electronics or approved equal.

B. Induction type sensors clamped over single- phase conductor of AC electrical power and shall be solid state sensors with adjustable threshold, visual indication and normally open contacts. Each current switch shall be selected for proper operating range of current.

2.5 POSITION SWITCHES (END SWITCHES)

A. Manufacturers: Allen Bradley, Johnson Controls/Penn, Honeywell, Ruskin, Greystone Energy Systems, NAMCO, Kele & Associates, Omron or Westlock.

B. SPDT contacts rated for application.

C. Provide damper brackets and connecting rods for connecting position switch actuation levers to damper blades or jackshafts

2.6 LEVEL SWITCHES:

A. Manufacturers: Drexelbrook, Magnetrol, Endress and Hauser or Dwyer.

B. Radio Frequency (RF) type continuous level probe with multiple adjustable set points and SPDT snap action contacts to meet intended use. Probe shall have probe shielding to reject buildup of sticky or viscous material. Probe length shall match vessel dimensions to measure within 6" of bottom.

C. Provide probe brace every 4 ft if probe length exceeds 6 ft, and not installed in stilling well.

1. Supply Voltage: 120 VAC/60 Hz
2. Fail Safe: Low Level output on instrument failure
3. Ambient Temperature Limits: -40 to 160°F
4. Minimum Enclosure Rating: NEMA 4
5. Transmitter Mounting: Remote
6. Performance:

   a. Accuracy: ± 2% nominal
   b. Linearity: ± 1% nominal
   c. Repeatability: ± 1% nominal
   d. Response Time: 20 milliseconds
   e. Ambient Temperature Effect: 2% per 100°F max.
   f. Voltage Variation Effect: ± 0.2% maximum per 10 V change

PART 3 – EXECUTION

3.1 LOW LIMIT TEMPERATURE SWITCHES

A. Provide low limit temperature switches where indicated on drawings or as required to accomplish sequences.

B. Unless otherwise indicated, install sensing element on upstream face of cooling coil where cooling coil is provided, or at downstream side of heating coils where no cooling coil is provided.

C. Size element or add additional elements to cover no less than one lineal foot per square foot of coil surface areas.

D. Unless otherwise indicated, adjust temperature switch setpoint to 38°F.

E. Distribute sensing element across entire area of medium being sensed.

F. Install controls at accessible location with suitable mounting brackets and element duct collars where required.

3.2 DRY PRESSURE SWITCHES

A. Provide pressure switches where indicated on drawings or as required to accomplish sequences.

B. Select switches for accuracy, ranges (20 to 80% of operating range) and dead-band to match process conditions, electrical requirements and to implement intended functions.

C. Unless otherwise indicated, adjust high static pressure switch to 4”w.c.

3.3 CONTROL RELAYS

A. Provide control relays where indicated on drawings or as required to accomplish sequences.

B. Provide DIN mounted relays in control panels.

C. Provide RIB type relays for field control devices such as starters, VFD’s, etc.

1. Mount relay on controlled equipment for easy accessibility.
2. Mount relay on controlled equipment for easy visual accessibility.

3.4 CURRENT SWITCH

A. Provide current switches where indicated on drawings or as required to accomplish sequences.

B. Locate in starter or VFD or in an appropriate adjacent enclosure.

3.5 POSITION SWITCHES (END SWITCHES)

A. Provide end switches where indicated on drawings or as required to accomplish sequences.

B. Install

3.6 LEVEL SWITCHES:

A. Provide level switches where indicated on drawings or as required to accomplish sequences.

END OF SECTION

SECTION 25 3516
SENSORS AND TRANSMITTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Instrumentation for the following Sensors and Transmitters for HVAC

B. Products Supplied But Not Installed Under This Section

1. Sensor wells

C. Related Sections:

1. 23 0513 Common Motor Requirements for HVAC Equipment
2. 23 2120 Piping Specialties
3. 23 2123 Pumps

1.2 REFERENCES

A. DIN-IEC -751 Standard for platinum sensors

B. UL 773A – Non-Industrial Photoelectric Switches for Lighting Controls.

C. NEMA WD7 – Occupancy Motion Sensors.

D. Refer to section 25 0000 for additional references.

1.3 SYSTEM DESCRIPTION

A. Provide supplementary or miscellaneous items, products and labor incidental to or necessary for a complete and operable installation.

B. Wiring shall be done in accordance with all local and national codes.

C. Coordinate installation of instrumentation, including but not limited to:

1. Power requirements
2. Panel locations
3. Commissioning
4. Test and Balance
5. Equipment start-up
6. User access

1.4 SUBMITTALS

A. Refer to section 25 0000.

1.5 QUALITY ASSURANCE

A. Coordinate timely delivery of materials.

B. Coordinate installation activities of inline devices such as immersion wells, pressure tapping's, any associated shut-off valves, flow switches, level switches, flow meters, air flow stations, and other such items.

C. Install control devices in appropriate enclosure and in an accessible location.

D. Provide junction box or enclosure to protect wiring and allow conduit connection for all sensors.

E. Mount duct instrumentation on side of horizontal ducts. Do not mount on bottom of duct.

F. Refer to section 25 0000 for additional requirements.

1.6 WARRANTY

A. Refer to section 25 0000.

PART 2 - PRODUCTS

2.1 AVERAGING TEMPERATURE SENSORS

A. Platinum RTD type, with the following minimum performance

1. Accuracy: ± 1.0% at 32°F (Class B)
2. Operating Range: -50 to 170°F
   0 to 99% RH
3. Conformance: DIN-IEC 751

2.2 SINGLE POINT TEMPERATURE SENSORS

A. Platinum RTD type, with the following minimum performance

1. Accuracy: ± 0.1% at 32°F (Class B)
2. Operating Range: -50 to 170°F
0 to 99% RH
3. Conformance: DIN-IEC 751

B. Thermistors type, with the following minimum performance

1. 5 yr. guarantee that device will maintain its accuracy within tolerance of ±0.36°F between 32°F and 150°F, and 0.5°F between -20°F and 212°F.
2. Accuracy: ± 0.1% at 32°F (Class B)
3. Operating Range: -50 to 170°F 0 to 99% RH

2.3 SINGLE POINT AIR TERMINAL TEMPERATURE SENSORS

A. Thermister or RTD type, with the following minimum performance

1. Minimum Accuracy: ± 1.0 Deg F at 70°F (Class B)
2. Operating Range: -50 to 170°F 0 to 99% RH

2.4 SPACE TEMPERATURE SENSORS

A. Warmer/Cooler adjustable, with programmable minimum/maximum setpoints. (Non-adjustable in corridors, restrooms and other public spaces)

B. Compatible with the intended service (VAV, VAV Reheat, Dual-duct, unoccupied setback, etc.), and associated controlled devices (DDC air terminal controller, damper, valve, etc.).

C. Incorporate a portable operator communication bus and terminal plug-in port, under the cover.

D. RTD type, with the following minimum performance:

1. Accuracy: ± 0.1% at 32°F (Class B)
2. Temperature Operating Range: -50 to 500°F
3. Humidity Operating Range: 0 to 99% RH

E. Thermistors will be acceptable in lieu of RTD provided that device will maintain its accuracy within tolerance of ± 0.36°F between 32°F and 150°F, and 0.5°F between -20°F and 212°F.

2.5 SPACE HUMIDITY SENSORS/TRANSMITTERS

A. Manufactures: Viasala, General Easter, or Automation Components.

1. Vendor specific humidity sensors can be substituted for specified manufactures.

B. Space humidity sensors shall be wall mount type to match room thermostats and/or temperature sensors.

C. Sensing element shall be resistive bulk polymer, or thin film capacitive type.
Sensor/transmitter shall have the following minimum performance:

1. Accuracy: ± 2% RH at 25°C over range of 20-95% RH including hysteresis, linearity and repeatability
2. Temperature Effect: Less than 0.06% per °F at baseline of 68°F
3. Sensitivity: 0.1% RH
4. Repeatability: 0.5% RH
5. Hysteresis: Less than 1%
6. Long Term Stability: Less than 1% RH drift per year.
7. Adjustment: ± 20% RH zero, non-interactive± 10% RH span, non-interactive.
8. Operating Range: 0-99% RH, non-condensing, sensor 0-95% RH, non-condensing, electronics
9. Output: 4-20mA or 0-10VDC 0-100% linear, proportional.
10. Power: 12-36 VDC or 24VAC

2.6 SENSOR WELLS

A. Compatible with sensor and application.
B. Include thermal compound.

2.7 DUCT MOUNTED HUMIDITY SENSORS/TRANSMITTERS

A. Probe type, temperature compensated, resistive bulk polymer or thin film capacitive type.

B. Sensor/transmitter shall have the following minimum performance.

1. Accuracy: ± 2% RH at 25°C over 20-95% RH including hysteresis, linearity and repeatability
2. Temperature Effect: Less than 0.06% per °F at baseline of 68°F.
3. Sensitivity: 0.1% RH
4. Repeatability: 0.5% RH
5. Hysteresis: Less than 1%
6. Long Term Stability: Less than 1% drift per year
7. Adjustment: ± 20% RH zero, non-interactive ± 10% RH span, non-interactive
8. Operating Range: 0-99% RH, non-condensing, sensor 0-95% RH, non-condensing, electronics
9. Output: 4-20 mA or 0-10VDC 0-100% linear, proportional
10. Power: 12-36 VDC or 24VAC

2.8 WATER DIFFERENTIAL PRESSURE TRANSMITTERS

A. Manufacturers: Veris, Mamack.

B. Pressure sensor and integral transmitter.

C. Include 3-valve manifold for servicing.

D. Performance:

1. Zero: Continuously adjustable within 1% of span.
2. Span Zero-based calibration span
3. Output Linear 4-20 mA or 0-10VDC
4. Accuracy: ± 1% of span, including effects of linearity, hysteresis, repeatability.
5. Stability: ± 0.25% for 12 months.

PART 3 – EXECUTION

3.1 AVERAGING TEMPERATURE SENSORS

A. Provide flexible averaging element for air ducts where prone to temperature stratification or where ducts are larger than 9 square feet.

B. Provide rigid averaging probe for air ducts smaller than 9 square feet.

C. Provide multiple averaging type sensors as required for sufficient duct or coil coverage. At minimum provide appropriate size and number of sensors as necessary to provide 1 linear foot of sensing for every 1 sq. ft of coil.

3.2 SINGLE POINT TEMPERATURE SENSORS

A. Provide single point duct mounted probes where ducts are too small for averaging elements.

3.3 SINGLE POINT AIR TERMINAL TEMPERATURE SENSORS

A. Provide single point duct mounted sensors at air terminal coils.

3.4 SPACE TEMPERATURE SENSORS

A. Provide space thermostats/sensors where indicated, as required to perform specified control sequences, and as directed to meet job site conditions.

B. Coordinate mounting height prior to installation. Unless otherwise noted, mounst ensors at 48” above finished floor.

C. Recess mounting box unless otherwise indicated, or required by the building construction materials.

D. Unless otherwise noted provide at minimum, 1/2" conduit from room sensors to corresponding controller.

E. Mounted space thermostats/sensors, located on exterior walls, on thermally insulated sub-base.

F. Relocate space thermostats/sensors if required due to draft, interferences with cabinets, chalkboards, etc., or improper sensing.

G. Label, inside cover, with tag number of equipment serving the area.

3.5 SPACE HUMIDITY SENSORS/TRANSMITTERS

A. Provide space thermostats/sensors where indi cated, as required to perform specified control sequences, and as directed to meet job site conditions.

B. Mount sensors at 48” above finished floor.

C. Recess mounting box unless otherwise indicated, or required by the building construction materials.

3.6 SENSOR WELLS

A. Furnish wells for installation.

B. Coordinate with Section 23 2120 for location placement.

1. Wells mounted in pipe 3" and larger may be installed in horizontal or vertical lines provided that element is always in the flow, (for condensate and other gravity return lines, install in bottom of pipe).
2. Wells mounted in pipe 2-1/2" and smaller shall be installed at elbow tee fittings with well pointed upstream. Minimum of 2" pipe size for elbow tee installation.

3.7 DUCT MOUNTED HUMIDITY SENSORS/TRANSMITTERS

A. Provide duct humidity sensors and transmitters where indicated, and as required to perform specified control sequences, and as directed to meet job site conditions.

3.8 WATER DIFFERENTIAL PRESSURE TRANSMITTERS

A. Provide Water differential pressure transmitters where required.

END OF SECTION

SECTION 25 3517
AIR AND GAS MEASUREMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Systems include air flow measurement, static pressure measurement, and differential pressure measurement.

B. Related Sections:

1. 23 3300 Air Duct Accessories
2. 23 7323 Custom Indoor Central-Station Air Handling Units
3. 25 1219 Integration Protocols

C. Products Supplied But Not Installed Under This Section:

1. Duct mounted Air Flow measuring stations
2. Inlet fan mounted Air Flow measuring stations.

1.2 SYSTEM DESCRIPTION

A. Provide supplementary or miscellaneous items, products and labor incidental to or necessary for a complete and operable installation.

B. Wiring shall be done in accordance with all local and national codes. Communication via protocols as described in section 25 1219 are acceptable.

C. Coordinate installation of instrumentation, including but not limited to:

1. Power requirements
2. Panel locations
3. Communication requirements (if applicable).
4. Commissioning
5. Test and Balance
6. Equipment start-up
7. User access

1.3 SUBMITTALS

A. Include recommended probe quantities to meet specified accuracies for air flow devices.
B. Identify locations where measurement accuracy may be negatively affected and demonstrate solution to maintain specified accuracy.
C. Meter Schedule including:

1. Manufacturer
2. Size
3. Location
4. Range

1.4 QUALITY ASSURANCE

A. Coordinate timely delivery of materials.

B. Coordinate installation activities of inline devices such as immersion wells, pressure tapping's, any associated shut-off valves, flow switches, level switches, flow meters, air flow stations, and other such items.

C. Install control devices in appropriate enclosure and in an accessible location.

D. Provide access doors where removal of instrument is not possible or practical for maintenance.

PART 2 - PRODUCTS

2.1 DUCT MOUNTED AIR FLOW MEASURING STATION

A. Manufacturers: Ebtron (gold series).

1. Transmitter and/or systems, which require periodic calibration to maintain accuracy specified, shall not be acceptable.
2. Provide display of air flow.
3. Minimum Requirements:

a. Accuracy:	± 2.0% of Reading
b. Span:	Less than twice maximum flow
c. Temperature Range	-20 Deg F to 160 Deg F.
d. Humidity Range	0-99% RH (non-condensing)
e. Power	24 VAC
f. Output Signal:	4-20 mA or 0-10VDC

B. Velocity measured by each sensor shall be linearized, summed, averaged, and an output signal proportional to air-flow rate (cfm) or velocity (fpm) by transmitter electronics.

2.2 DIFFERENTIAL PRESSURE TRANSMITTERS

A. Manufacturers: GE Modus, Setra, Veris, Ashcroft XLDP or approved equal.

B. Sensors shall convert velocity pressure differential or static duct pressure relative to sensor location into electronic signal.

C. Unit shall be capable of transmitting linear signal proportional to differential (total minus static or static minus ambient) pressure input signals with the following minimum performance and application criteria:

1.	Span:	Less than twice maximum reading.
2.	Accuracy:	± 1.0% of span or ± 1.0% of full scale
3.	Dead Band:	Less than 0.5% of output
4.	Hysteresis:	Within 0.5% of span or within 0.5% of full scale
5.	Linearity:	Within 1.0% of span or within 0.5% of full scale
6.	Repeatability:	Within 0.5% of output

7.	Response:	Less than 1 second for full span input
8.	Output Signal	4-20 mA or 0-10VDC

2.3 CO2 SENSORS

A. Manufacturers: Veris,

B. Units shall have following minimum characteristics:

1.	Range	0-2000ppm
2.	Power Supply	20-30 VDC/VAC
3.	Output	0-10VDC or 4-20ma
4.	Operating Temperature	40 – 100 Deg F
5.	Operating Humidity	0 to 85% RH non-condensing
6.	Accuracy	5.0% or 30ppm

PART 3 – EXECUTION

3.1 DUCT MOUNTED AIR FLOW MEASURING STATION

A. Furnish and coordinate the installation of Air Flow Measuring Stations according to contract documents, control sequences or to achieve LEED credit.

B. Include manufacturer's recommended number of probes for the proper traverse of the air duct and required mounting hardware.

C. Provide transmitter as part of air flow sensor, and shall include integral diagnostics within-line zeroing and sensor operation verification.

D. Provide all cabling required for connection to probe assemblies and transmitter electronics.

3.2 DIFFERENTIAL PRESSURE TRANSMITTERS

A. Provide Differential Pressure Transmitters according to contract documents or to accomplish sequences.

B. Locate static pressure transmitters and transducers in control panel where controlled from.
C. Select instrument for intended usage range, maximum pressure/temperature.

D. For indicating type instruments, locate indicating element with 6 ft of floor with readout easily visible from floor level.

3.3 CO2 SENSORS

A. Provide CO2 sensors according to contract documents, control sequences or to achieve LEED credit.

END OF SECTION

SECTION 25 3518
LIQUID PRESSURE AND FLOW MEASUREMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Systems include instrumentation for the following water systems pressure and flow measurement for Integration and Automation.

B. Products furnished but not installed under this section:

1. Chilled Water Meter/BTU Meter
2. Pressure Transmitters
3. Domestic water flow meter
4. Heating hot water flow meter.
5. Reverse Osmosis

C. Related Sections:

1. 22 6700 Reverse-Osmosis Water System
2. 23 2120 Piping Specialties
3. 25 3313 Utility Metering

1.2 REFERENCES

A.

1.3 SUBMITTALS

A.

1.4 QUALITY ASSURANCE

A. Coordinate timely delivery of materials.

B. Coordinate installation activities of inline devices such as immersion wells, pressure tapping's, any associated shut-off valves, flow switches, level switches, flow meters, air flow stations, and other such items.

1.5 WARRANTY

A.

PART 2 - PRODUCTS

2.1 DIFFERENTIAL PRESSURE TRANSMITTERS

A. Manufacturers: Foxboro, Rosemount, or Yokogawa.

B. Pressure sensor and integral transmitter.

C. Enclosures to be NEMA 4 or NEMA 4X.

D. Include 3-valve manifold for servicing.

E. Performance:

1.	Zero:	Continuously adjustable within 1% of span.
2.	Span	Zero-based calibration span
3.	Output	Linear 4-20 mA or 0-10VDC
4.	Accuracy:	± 0.075% of span, including effects of linearity, hysteresis, repeatability.
5.	Stability:	± 0.1% of upper limit for 60 months.
6.	Power Supply Effect:	Less than 0.01% of output span per volt.
7.	Static Pressure Effect:	Zero Error: ± 0.1% of upper range limit per 1000 psi
8.	Span Error:	± 0.2% of reading per 1000 psi
9.	Temperature Effect:	± (0.025% upper range limit plus 0.125% span) per 50°F.

F. Provide remote sensing element(s) whenever operating temperature exceeds transmitter maximum temperature.

2.2 PRESSURE TRANSMITTERS

A. Manufacturers: Foxboro, Rosemount, or Yokogawa.

B. Pressure sensor and integral transmitter.

C. Enclosures to be NEMA 4 or NEMA 4X.

D. Performance:

1.	Zero:	Continuously adjustable within 1% of span.
2.	Span	Zero-based calibration span
3.	Output	Linear 4-20 mA or 0-10VDC
4.	Accuracy:	± 0.075% of span, including effects of linearity, hysteresis, repeatability.
5.	Stability:	± 0.1% of upper limit for 60 months.
6.	Power Supply Effect:	Less than 0.01% of output span per volt.
7.	Static Pressure Effect:	Zero Error: ± 0.1% of upper range limit per 1000 psi
8.	Span Error:	± 0.2% of reading per 1000 psi
9.	Temperature Effect:	± (0.025% upper range limit plus 0.125% span) per 50°F.

E. Provide remote sensing element(s) whenever operating temperature exceeds transmitter maximum temperature.

2.3 WATER FLOW METER

A. Insertion Type

B. Magnetic Insertion Flow meter/Transmitter

1. Manufacturers: Onicon

2. Electromagnetic induction type with hot tap design.
3. Transmitter shall be fully field configurable microprocessor based unit.

a.	Flow Range :	.1ft/s to 20 ft/s
b.	Operating Temperature:	-20-150°F (Ambient)
c.	Operating Pressure	up to 400psi
d.	Power Requirements:	20-28 VDC or VAC
e.	Output:	4 - 20 mA DC current or 0-10 VDC.
f.	Turndown Ratio	200:1

C. BTU Meter

1. Manufacture: Onicon System 10
2. NIST traceable calibration with Certification

a. Temperatures	± 0.15 Deg F from 32-200 Deg F.

3. MODBUS TCP communication protocol.

PART 3 - EXECUTION

3.1 DIFFERENTIAL PRESSURE TRANSMITTERS

A. Provide differential pressure transmitters as shown in construction documents or as required to implement sequences.

B. Coordinate installation and location with Section 23 2120.

3.2 PRESSURE TRANSMITTERS

A. Provide pressure transmitters as shown in construction documents or as required to implement sequences.

B. Coordinate installation and location with Section 23 2120.

3.3 WATER FLOW METER

A. Furnish Flow Meter for Hot Water Systems.

1. Span flow meter for twice design flow.
2. Provide wiring, pathways, terminations, etc.

B. Install metering instrumentation.

1. Coordinate with meter installer.
2. Coordinate final location with other trades.

C. Coordinate installation of flow meter with Section 23 2120.

END OF SECTION

SECTION 25 3519
CONTROL VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Control valves for systems as shown in Contract Documents, except where provide by equipment manufacturer.

B. Products Supplied but Not Installed Under This Section:

1. Control Valves

C. Related Sections:

1. 23 2120 Piping Specialties
2. 25 3513 Actuators and Operators
3. 25 0553 Identification

1.2 DEFINITIONS

A. Sub-circuit - Branch supply and return piping to terminal device, including valve, coil, control valve, and balancing valve.

1.3 SYSTEM DESCRIPTION

A. Pressure independent control valves for the HVAC systems.

1.4 SUBMITTALS

A. Valve Schedule:

1. Indicate size, location and model of each control valve.
2. Indicate unique tag numbers for each device, equipment item or system served, d
3. Include sizes, shut-off head required, actuator air pressure or force required to meet shut-off head torque requirements for rotary valves, actual flow requirements based on equipment shop drawings, and calculation of actual pressure drops.

B. Include construction materials and assembly methods, maximum design parameters (temperature, pressure, velocity, etc.), and performance data for full range of actuator stroke.

C. Include charts, graphics or similar items used in making selections

1.5 QUALITY ASSURANCE

A. Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

B. Obtain adequate system information necessary for valve sizing.

C. Water Valves:

1. Pressure independent control valves shall be factory calibrated and tested.
2. Provide ability to manually override valve position.

D. Coordinate pneumatic actuated pressure independent valves for factory mounting.

E. Tag control valves appropriately. Refer to 25 0553.

PART 2 - PRODUCTS

2.1 WATER CONTROL VALVES (2" OR SMALLER):

A. Manufacturers: Belimo, Bray, or Delta P.

1. Valves shall be pressure independent.
2. Control flow from 0 to 100%
3. Include pressure/temperature ports

B. Characteristics:

1.	Valve Body:	Brass
2.	Max Operating Temperature:	212°F
3.	Rated Pressure:	150 PSI
4.	Accuracy	+/- 10%

2.2 WATER CONTROL VALVES (LARGER THAN 2"):

A. Manufacturers: Belimo, Bray, or Delta P.

1. Valves shall be pressure independent.
2. Control flow from 0 to 100%.
3. Include pressure/temperature ports.

B. Characteristics:

1.	Valve Body:	Iron, Bronze, or Steel
2.	Max Operating Temperature:	212°F
3.	Rated Pressure:	150 PSI
4.	Accuracy	+/- 5%

2.3 TWO POSITION CONTROL VALVES (2" and Larger)

A. Manufacturers:

1. Meet ANSI Class 150 rating design,
2. Provide bubble-tight shut off with pressures in either direction to 275 psi suitable for 150 psi steam.

3. External disc position indication.
4. Valve neck extensions with sufficient length to allow for insulation.
5. Provide threaded lug type valves for equipment isolation, permitting removal of downstream piping without removing valve. Dead end pressure rating of lug type valves shall be 275 psi.

B. Characteristics:

1.	Valve Body:	Carbon or Cast steel, Cast Iron
2.	Valve Type	Butterfly
3.	Max Operating Temperature:	250°F (minimum)
4.	Min Rated Pressure	150 PSI
5.	Shaft	Stainless steel
6.	Disc	Stainless steel
7.	Seat	Reinforced PTFE
8.	Packing	graphite

PART 3 - EXECUTION

3.1 WATER CONTROL VALVES (2" OR SMALLER):

A. Furnish pressure independent control valves for terminal units.

B. Factory mount actuator.

C. Select valves to provide tight shut-off against maximum system temperatures and pressure encountered.

3.2 WATER CONTROL VALVES (LARGER THAN 2"):

A. Furnish pressure independent control valves for larger equipment.

B. Factory mount actuator where possible.

C. Shut-off against maximum system temperatures and pressure encountered.

D. Select valve components to withstand maximum pressure and temperature encountered in system.

3.3 TWO POSITION CONTROL VALVES (2" and Larger)

A. Furnish two position control valves for equipment isolation.

B. Factory mount actuator.

C. Select valves to provide tight shut-off against maximum system temperatures and pressure encountered.

D. Size valve to full pipe size

END OF SECTION

SECTION 25 3523
CONTROL DAMPERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes control dampers for systems shown in Contract Documents and except where provide by equipment manufacturer.

B. Products Supplied but Not Installed Under This Section:

1. Control dampers.
2. Optional factory mounted actuators.

C. Related Sections:

1. 23 3300 Air Duct Accessories
2. 25 3513 Actuators and Operators
3. 25 0553 Identification

1.2 REFERENCES

A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

B. AMCA 511 - Certified Ratings Program for Air Control Devices.

1.3 DEFINITIONS

A. AMCA – Air Movement and Controls Association

B. Duct Section- Ductwork containing flow control damper starting with inlet or branch tee and ending wit outlet or branch tee.

1.4 SYSTEM DESCRIPTION

A. High performance low leakage Class I control dampers suitable for HVAC applications.

1.5 SUBMITTALS

A. Damper Schedule:

1. Indicate size, location and model of each damper

B. Product Data shall Include:

1. Construction materials and assembly methods
2. Maximum design parameters (temperature, pressure, velocity, etc.)
3. Performance data for full range of actuator stroke and installation details.
4. Graphics or similar items used in making selections, including damper to duct area ratio and

free area ratio.
5. Sizing calculations

C. Indicate AMCA certified leakage rates for given pressure differentials.

D. Indicate pressure drop ratings based on AMCA tests and procedures.

1.6 QUALITY ASSURANCE

A. Meet certified leakage rates and pressure drop ratings in accordance with AMCA. Leakage ratings shall be based on AMCA Standard 500 and dampers shall bear AMCA Air Leakage Seals.

B. Base sizing calculations on actual characteristics of ductwork system being installed.

C. Size dampers as close as possible to duct size, but in no case is damper size to be less than duct size.

D. Size opposed blade dampers shall for minimum of 10% of duct system pressure drop.

E. Size parallel blade dampers for minimum of 30% of duct system pressure drop.

F. Calculate actual duct pressure drops for each duct section containing modulating damper using latest version of ASHRAE Handbook of Fundamentals.

G. Obtain adequate system information necessary for sizing.

H. Two position dampers to be sized as close as possible to duct size, but in no case is damper size to be less than duct area.

I. Select dampers to meet their intended service with respect to maximum approach velocities and maximum pressure differential.

J. Damper materials shall meet intended service for which they are installed (galvanized steel, aluminum, 304 or 316 stainless steel, etc. unless otherwise noted).

K. Dampers shall be tested, rated and labeled in accordance with the latest UL requirements.

L. Tag control dampers appropriately. Refer to 25 0553.

1.7 WARRANTY

A. Include two-year warranty for parts replacement.

B. Include registration and warranty documents and warranty rights to the Owner.

PART 2 - PRODUCTS

2.1 STANDARD CONTROL DAMPERS

A. Manufacturers: Ruskin, Tamco, Johnson Controls, Siemens or Honeywell.

B. Opposed or parallel blades for modulating dampers and opposed blade only for 2 position dampers.

C. Aluminum dampers in dampers exposed to outside air conditions.

D. Blade linkage hardware shall have corrosion-resistant finish.

E. Requirements:

1.	Frame	16 ga galvanized steel or 14 ga extruded aluminum hat-shaped channel.
2.	Blades	16 ga galvanized steel or 14 ga aluminum airfoil shaped.
3.	Max Blade Width	8 inches.
4.	Bearings	Molded synthetic, nylon, bronze, or ball.
5.	Max Leakage	Less than 3 cfm per square foot at 1 inch of static pressure.
6.	Temp. Range	-40 to 250 Deg F.
7.	Diff. Pressure	6.0 INWG
8.	Approach Velocity	6000 fpm

2.2 EXHAUST FAN SHUT-OFF DAMPERS:

A. Manufacturers: Swartwout 902 or Ruskin CDR92.

B. 304 stainless steel construction, flanged connection, grease lubricated ball bearings, continuous shaft with seal, suitable for maximum temperature 250°F, approach velocity 6000 fpm, and differential pressure of 13" WG.

C. Furnish dampers with neoprene blade seals.

D. Stainless steel may be changed to galvanized st eel where application allows. Change 304 to 316 if ductwork is 316 SS. If rectangular dampers are required, consider Ruskin CD80AF3 or CD80AF4 Industrial Control Dampers for Fume Exhaust Fan Shut-off Dampers.

2.3 OUTSIDE AIR DAMPERS:

A. Manufacturers: Ruskin Model CD80AF2 or American Warming and Ventilating Model VC-423.

B. Galvanized steel construction, suitable for maximum temperature 250°F, approach velocity 6000 fpm and differential pressure of 13.5" WG.

C. Air foil blade design, 16 gauge minimum and 12" maximum width.

D. Furnish with flexible jamb seals, EPDM, silicone or neoprene blade seals.

PART 3 - EXECUTION

3.1 STANDARD CONTROL DAMPERS

A. Furnish control dampers as shown on drawings or as required to perform control sequences specified, except those furnished with other equipment.

B. Coordinate delivery, storage and installation with Section 23 3300.

C. Mount blade linkage hardware to be readily accessible for maintenance.

D. Mount actuator to achieve fail safe condition as shown on drawings or as needed to accomplish

3.2 EXHAUST FAN SHUT-OFF DAMPERS

A. Furnish for exhaust fan systems as indicated.

B. Coordinate delivery, storage, and installation with Section 23 3300.

C. Mount actuator to fail damper to the closed position, unless otherwise shown.

3.3 OUTSIDE AIR DAMPERS:

A. Furnish dampers located in outside air ducts or where exposed to outside air conditions.

B. Provide cover or enclosures to protect exposed linkage and actuators from weather.

C. Coordinate delivery, storage, and installation with Section 23 3300.

D. Mount actuator to fail damper to the closed position, unless otherwise shown.

END OF SECTION

SECTION 25 3524
SMOKE DAMPERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes dampers systems as shown in Contract Documents and except where provide by equipment manufacturer.

B. Products Supplied But Not Installed Under This Section:

1. Smoke rated dampers and combination fire/smoke dampers.
2. Required factory mounted actuators.

C. Related Sections:

1. 23 3300 Air Duct Accessories
2. 25 3523 Control Dampers
3. 25 0553 Identification

1.2 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

B. NFPA 92A - Smoke-Control Systems.

C. NFPA 92B - Smoke Control Systems in Atria, Covered Malls, and Large Areas.
D. UL-864/UUKL Smoke Control Listing.

E. UL 555/555S - Standard for Safety; Leakage Rated Dampers for Use in Smoke Control Systems.

F. Refer to section 25 0552 for additional references.

1.3 DEFINITIONS

A. Reset – Device returns to normal operating position.

B. Refer to section 25 3523.

1.4 SYSTEM DESCRIPTION

A. Class 1 rated Smoke Dampers and Combination Fire Smoke Dampers for HVAC systems.

1.5 SUBMITTALS

A. Damper Schedule:

1. Indicate size, location and model of each damper

B. Include:

1. Construction materials and assembly methods
2. Maximum design parameters (temperature, pressure, velocity, etc.)
3. Performance data for full range of actuator stroke and installation details.
4. Graphics or similar items used in making selections, including damper to duct area ratio and free area ratio.
5. Sizing calculations

C. Indicate AMCA certified leakage rates for given pressure differentials.

D. Indicate pressure drop ratings based on AMCA tests and procedures.

1.6 QUALITY ASSURANCE

A. Calculations for sizing dampers shall be based on actual characteristics of ductwork system being installed. Opposed blade dampers shall be sized for minimum of 10% of duct system pressure drop.

B. Meet certified leakage rates and pressure drop ratings in accordance with AMCA. Leakage ratings shall be based on AMCA Standard 500 and dampers shall bear AMCA Air Leakage Seals.

C. Base sizing calculations on actual characteristics of ductwork system being installed.

D. Size dampers as close as possible to duct size, but in no case is damper size to be less than duct size.

E. Size opposed blade dampers shall for minimum of 10% of duct system pressure drop.

F. Size parallel blade dampers for minimum of 30% of duct system pressure drop.

G. Calculate actual duct pressure drops for each duct section containing modulating damper using latest version of ASHRAE Handbook of Fundamentals.

H. Obtain adequate system information necessary for sizing.

I. Two position dampers to be sized as close as possible to duct size, but in no case is damper size To be less than duct area.

J. Select dampers to meet their intended service with respect to maximum approach velocities and maximum pressure differential.

K. Damper materials shall meet intended service for which they are installed (galvanized steel, aluminum, 304 or 316 stainless steel, etc.).

L. Dampers shall be tested, rated and labeled in accordance with the latest UL requirements.

M. Tag smoke dampers appropriately. Refer to 25 0553.

1.7 WARRANTY

A. Include two-year warranty for parts replacement.

B. Include registration and warranty documents and warranty rights to the Owner.

PART 2 - PRODUCTS

2.1 SMOKE DAMPERS

A. Manufacturers: Air Balance, Johnson Controls, Ruskin, Greenheck, NCA Manufacturing, Cesco or Prefco.

B. Requirements:

1. Leakage rated under UL 555S (less than 4 cfm per square foot at 1”of static pressure and 8 cfm.
2. Static pressure) at temperature category 250°F
3. Maximum blade width of 8”.
4. Minimum 16 gauge galvanized steel or aluminum airfoil shaped blades.
5. Stainless Steel or bronze bearings.
6. Dampers and seals shall be suitable for maximum system temperature, pressure differential and approach velocity, but not less than temperature category 250°F, pressure differential of 4" WG, and approach velocity of 2000 fpm.

C. Actuator mounting assemblies shall be outside airstreams.

D. Include damper position switch linked directly to damper blade to provide capability of remotely indicating damper blade open position and closed position.

E. Dampers shall fully open in 15 seconds or less and fully close in not more than 15 seconds and not less than 5 seconds when activated.

F. Electric actuators shall be 120 volt non-stall type unless otherwise stated, and shall be rated for energized hold open position period of 6 months or more.

G. Allow reset from fire alarm control panel.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Ruskin, Air Balance, Prefco, Greenheck, Nailor, Cesco, equal to Ruskin FSD-60.

B. Requirements

1. Meet requirements of NFPA 90A.
2. 1-1/2 or 3 hr rated as shown on drawings,
3. Maximum blade width of 6”.
4. Minimum 14 gauge galvanized steel or aluminum airfoil shaped blades.
5. Leakage rated at no higher than leakage ClassI (4 cfm/ft2 at 1" WG and 8 cfm/ft2 at 4" WG) under UL 555/555S at temperature category 350°F, and compatible with system static

pressures.
6. Rated pressures to 4" WG and velocities to 3000 fpm.

C. Operators shall be electric, factory installed outside of air stream, linked to dampers for fail closed operation, and be UL listed and labeled for the application.

D. Include damper position switch linked directly to damper blade to provide capability of Remotely indicating damper blade open position and closed position.

E. Operators to be capable of closing damper at pressures encountered in system. Electric Operators of 6 months or more.

F. Dampers shall fully open in 15 seconds or less and fully close in not more than 15seconds and not less that 5 seconds when activated.

G. Firestat

1. Dampers shall be furnished with UL classified firestat, functioning to close dampers when duct temperatures exceed 165 □F while allowing reset capability from fire alarm sy stem or building automation system.
2. Include damper position switch linked directly to damper blade to provide capability of remotely indicating damper blade position. Firestat and position indicator switches to be capable of interfacing electrically with building fire alarm system or automation system.
3. Firestats shall be equipped with high limit temperature sensors meeting requirements of NFPA 92A by returning damper to fire protection mode when temperature reaches 350°F.

H. Furnish EP switches where pneumatic operators are used.

I. Submit UL installation details showing mounting method and duct connection method.

2.3 FACTORY MOUNTED ACTUATORS

A. Pneumatic Diaphragm with Spring Return

1. Provide spring return feature for fail closed positions.

B. Discrete Two-Position Electric:

1. Provide spring return feature for fail open or closed positions as required by control sequence.

PART 3 - EXECUTION

3.1 SMOKE DAMPERS

A. Furnish smoke dampers as shown on drawings oras required to perform control sequences specified.

B. Furnish factory mounted actuator mounted outside airstream.

C. Coordinate delivery, storage and installation.

D. Coordinate final power requirements and locations.

3.2 COMBINATION FIRE AND SMOKE DAMPERS

A. Furnish combination fire/smoke dampers as shown on drawings or as required to perform control sequences specified.

B. Furnish factory mounted actuator mounted outside airstream.

C. Coordinate delivery, storage, and installation.

D. Coordinate final power requirements and locations.

3.3 FACTORY MOUNTED ACTUATORS

A. Select actuators to provide tight shut-off against maximum system temperatures and pressure encountered.

B. Fail smoke dampers serving pressure rated heat exchangers or converters closed unless otherwise shown.

END OF SECTION

DIVISION 26 - ELECTRICAL

26.01 GENERAL REQUIRMENTS

A. Refer to FIU BIM Standards for additional details and requirements.

B. Drawings shall show all necessary sections and details so that the Contractor will not have to make assumptions in order to visualize the scope or physical layout of his work. Sections shall be made of all risers, pipe chases, vertical take-offs and equipment rooms, as well as other areas necessary for clarity.

26.02 SPACE REQUIREMENTS

A. Refer to individual systems for space requirements.

26.03 COMMISSIONING

A. Confirm electrical commissioning requirements with FIU Project Manager.

B. Provide enhanced commissioning services as defined by LEED, to ensure systems designed and operate per Owners requirements. Ensure coordination with Division 1.

C. Fundamental Commissioning will only be allowed if previously approved by FIU Project Manager. At minimum, all systems shall be commissioned per Florida Building Code – Energy Conservation, Section C408.

26.04 CONSTRUCTION QUALITY CONTROL

A. Conduit must be protected during installation. Conduit openings where potential for dirt and debris to fall into should be covered.

B. During construction, materials shall not be stored inside equipment. Switchboards, panelboards, etc. cannot be utilized as storage.

26.05 SUBMITTALS

A. Maintenance Manuals - Contractor shall deliver to the Architect/Engineer, two (2) bound copies of manufacturer's operating instructions and maintenance recommendations one electronic copy (original, fully searchable, non-scanned pdf's) on all equipment and machinery installed under the contract. A complete listing of all equipment and location shall be provided in an electronic spreadsheet format (Microsoft Excel). This is to be done before completion of the project.

B. Coordinate additional product submittal requirements with FIU Project Manager.

C. Provide electronic copy of panel schedules. Verify with FIU Project Manager for required number of hard copies. Hard copies shall be laminated on solid mounting boards.

D. Provide wiring control diagrams (both power and control voltage) laminated under plastic for each piece of equipment, on solid mounting boards.

E. Provide electronic copy of as-builts.

F. LEED Enhanced commissioning projects require a Systems Manual. System manual components include, but are not limited to:

1. Basis of Design
2. Single line diagrams
3. Record documents
4. Approved submittals
5. As-built Drawings
6. Final Sequences
7. Final Set-points
8. Re-commissioning schedule
9. O&M Manual
10. PM schedule
11. Training Material

26.06 TRAINING

A. Training Sessions – Contractor shall provide a full demonstration of all operating systems. Contractor shall videotape the training and demonstration sessions. The complete training session shall be videotaped by the Contractor. Three (3) copies in DVD format shall be submitted to the Owner prior to Final Payment. The Contractor shall submit an outline of all components to be covered during the training sessions for the Owner's approval prior to scheduling actual training sessions.

B. Training shall be conducted by applicable sub-contractor and authorized factory representative.

C. Training shall include normal operations, required maintenance operations affecting warrantee, cleaning operations.

26.07 CODE AND REGULATIONS

A. Codes and Standards (Edition currently adopted)

1. Florida Building Code - Building
2. Florida Building Code - Energy Conservation
3. Florida Fire Prevention Code
4. NFPA 70 National Electrical Code
5. NFPA 72 National Fire Alarm and Signaling Code
6. NFPA 110 Standard for Emergency and Standby Power Systems
7. NFPA 780 Installation of Lightning Protection Systems
8. ADA Standards for Accessible Design
9. ASME A17.1 Safety Code for Elevators and Escalators
10. IES Lighting Handbook
11. AALAC Guide for the Care and Use of Laboratory Animals
12. NIH Design and Policy Guidelines
13. OSHA National Recognized Testing Laboratory
14. NECA National Electrical Installation Standards
15. National Electrical Manufacturing Standards

16. Applicable regulations and requirements of FPL utility
17. UL - Equipment bearing a “UL” seal of approval

B. Requirements described in the FIU Master Plan.

26.08 MEASUREMENT AND VERIFICATION

A. Coordinate with other consultants to provide an M&V system via the building controls system to monitor energy and water by end use as defined by LEED.

B. Segregate HVAC loads for and totalize on monthly basis. Coordinate with LEED M&V requirements and FIU Project Manager.

26.09 UTILITY SERVICE

A. Primary Service - Electrical energy distributed underground throughout the Campus at primary voltage to transformer vaults located at major buildings or to pad mounted transformers locate near small buildings. Distribution system pad mounted transformers and vault equipment provided by FPL.

B. Secondary Service - Secondary distribution from transformer vaults to individual or grouped facilities at nominal 480Y/277 volts for major buildings, 208Y 120 volts for small buildings.

C. Electrical Meters - Every new building and any additions to existing buildings must be separately metered. Meters must comply with FP&L requirements.

D. Provision must be made so that utility meters may be read by University personnel. Major buildings must also have a terminal block in a weather proof enclosure receiving pulse signal from FPL meters. This signal is to be used for demand limiting control by the Energy Management System.

26.10 BACKUP POWER SYSTEM SOURCE

A. Diesel engine generator

1. Approved manufacturers

    a. Caterpillar
    b. Cummins
    c. Detroit Diesel
    d. Kohler

2. Provided when required by FIU Facilities.
3. Engine and generator shall be produced in the USA.
4. Generator shall be located as near as practicable main electrical room.
5. Generators shall be located in interior rooms, unless exterior units are authorized by FIU facilities.
6. Generators shall have a start/stop/automatic selector switch on the control panel.
7. Generator shall be sized for the anticipated load on the generator system. Provide calculations showing anticipated generator load diversity. Loads to include 15% spare capacity for future.
8. Generator alternator to utilize a permanent magnet. Select the alternator that delivers the

highest surge KVA available at the specified KVA / KW rating.
9. Provide communications with Building Automation System. Coordinate monitor/control points with FIU Facilities.
10. Ensure generator is provided with fuel gauge.
11. Located generator annunciator adjacent to fire alarm annunciator.

B. Exterior enclosure (when authorized by FIU Facilities)

1. Generator sound rating shall not exceed 85B @ 7 meters.
2. Service platforms and railings shall be provided for generators with sub-base fuel tanks.

C. Fuel tank

1. Diesel fuel tank to be double wall with leak detection and fuel gauge. Install above tank only.
2. Tank shall be sized for 24 hours of run time, class 24; provide longer run time for critical facilities.

D. Automatic transfer switch

1. Approved manufacturers

a. ASCO
b. Zenith
c. Eaton

2. Automatically transfer power within the code required time frame by system type.
3. Provide mod-bus communications for remote monitoring of switch position (normal or emergency source).

E. Dual-rated generator docking station and load bank station shall be provided.

1. Station shall be provided when on-site generation is required.
2. Station shall be located outside of building near planned location for portable generator and portable load bank.
3. Connections to be Camlock type.

F. Diesel fuel tank to be double wall with leak detection and fuel gauge. Install above tank only.

G. Conductors and equipment fed by the generator shall be sized per applicable codes.

26.11 DISTRIBUTION SYSTEM

A. Characteristics

1. Power distribution for major buildings will be 480Y/277V. Dry-type transformers will provide 208Y/120V, 3P, 4W systems where required. The wiring colors for distribution shall be industry standards for 480Y/277 it shall be L1 brown, L2 orange, L3 yellow. For 208Y/120 it shall be L1 Black, L2 Red, L3 Blue. The following loads shall be selected with 480Y/277V system operating voltages where possible

a. Interior and exterior lighting
b. Mechanical systems
c. Elevators

2. Power distribution for minor buildings will be 208Y/120V.

B. Systems shall be separated as required by code

1. Normal power distribution

a. All loads not requiring backup power

2. Emergency power distribution

a. Emergency egress lighting, exit signs and some lighting in restrooms
b. Fire detection and alarm systems
c. Fire pumps
d. Elevators required for emergency egress
e. Ventilation where essential to main life

3. Standby power distribution as required by FIU Facilities

a. Research facility refrigerators, freezers and cold rooms.
b. Space cooling for rooms housing refrigeration equipment with self-contained condenser on standby power.
c. Mechanical/electrical room lighting and receptacles
d. Sump pumps
e. Domestic water booster pumps
f. Adjacent lift stations
g. Building automation system
h. Access control system
i. Security system
j. IT equipment and distribution rooms
k. Receptacles and equipment identified needing backup power
l. Elevators as required by FIU Facilities

C. Equipment

1. Approved manufacturers

a. Square D
b. General Electric
c. Siemens
d. Cutler Hammer

2. Service entrance equipment

a. Provide power monitoring. Power monitor shall communicate with Building Automation System. Coordinate monitor/control points with FIU Facilities.
b. Locate main breaker in a separate enclosure from the distribution to eliminate the possibility of arc flash when performing work on distribution. Connect and main to distribution using feeder conduit and wire.

3. Switchboards and Switchgear

    a. Switchboards - Free standing metal enclosed assemblies of busses. Main breaker to be individually mounted and feeder breakers to be group mounted.
    b. Switchgear, where required by FIU Facilities - Free standing metal enclosed assemblies of busses, main and feeder breakers, and instrumentation. Each cubicle and compartment totally isolated from all others.
    c. Bussing to be copper.
    d. Provide the largest of either 25% breaker space or 3 breaker spaces for future feeder breakers.
    e. Provide phase failure relay protection for service main overcurrent protection.

4. Distribution and Branch Panels

    a. Bussing to be copper.
    b. Metal enclosed assemblies with common keyed hinged fronts, containing busses and bolted-on molded-case circuit breakers, with adequate interrupting capacity.
    c. Load shall be balanced between all phases.
    d. Flush panels shall be provided with (4) 1" spare conduits to above accessible ceiling.
    e. Provide 25% breaker spaces in distribution and branch panels.
    f. The wiring colors for distribution and branch panels shall be industry standards for 480Y/277 it shall be L1 brown, L2 orange, L3 yellow. For 208Y/120 it shall be L1 Black, L2 Red, L3 Blue.

5. Transformers

    a. Windings to be copper.
    b. Transformers larger than 25KVA to be 80 degree Celsius rise and class 220 degree Celsius insulation.
    c. Sound levels to meet NEMA ST 20 requirements.

6. Electrical distribution equipment to be located in dedicated electrical rooms, unless permitted below:

    a. Distribution equipment is dedicated to serve loads / equipment located within the same room.
    b. Branch panels located outside of laboratory entry doors.

7. Equipment to be rated to withstand the available fault current.

8. Circuit breakers shall be rated to interrupt the full available fault current. Series rating not allowed.

9. Distribution system circuit breakers shall be selectively coordinated down to 0.1 seconds. Final settings shall be verified and submitted with O&Ms.

D. Wiring Methods

1. Conductors

    a. Service entrance conductors and feeder conductors to be copper or aluminum.

b. Branch circuits conductors to be copper.
c. If VFD is greater than 50' from motor, conductors on load side of VFD to be rated 2000V VFD cable.
d. Shared neutrals for multi-wire branch circuits are not allowed.
e. Code required separation between cables with differing insulation voltage ratings shall be maintained.

2. Raceways

a. Conduit below grade to be direct buried polyvinyl chloride (PVC) schedule 80. Conduit below slab on grade to be direct buried polyvinyl chloride (PVC) schedule 40. Where conduits turn up and exit grade, elbow and riser below grade to be mastic or PVC coated rigid galvanized steel (RGS).
b. Conduit exterior exposed above grade to be mastic or PVC coated rigid galvanized steel (RGS).
c. Conduit interior above slab to be electrical metallic tubing (EMT).
d. Conduit to interior motors to be flexible metallic conduit (FMC).
e. Conduit to exterior motors to be liquid tight flexible metallic tubing (LFMC).
f. Metal Clad (MC) cable to be used for lighting fixture whips.
g. Metal Clad (MC) cable inside walls and above accessible ceilings (other than fixture whips) requires special permission by FIU Facilities. Homeruns and circuits between rooms to be EMT conduit. MC cable shall not daisy chain from room-to-room.
h. Minimum homerun conduit size to be ¾".

3. Boxes

a. Site handholes to be polymer concrete.
b. Floor boxes and poke-thru devices
(1) Utilize closable protective cover to enclose cable plugs while box is in-use.
(2) Cover to be die cast aluminum and protect box against water, dirt and debris.
c. TV wall boxes to consolidate power, data and audio / video in one assembly behind wall mounted TV.
d. Projector ceiling boxes to support suspended projector and provide power, data and audio / video in one assembly flush with ceiling.

3. Special Purpose

a. Provide surface metal raceways for use in lab equipment zones.

26.12 GROUNDING

A. Ground bus

1. Provide wall mounted ground bus in each main electrical service room.
2. Provide wall mounted ground bus located in branch electrical rooms to ensure that no space within a building is more than 200' from an available ground bus.
3. Connections to newly installed ground bus to be exothermic weld.
4. Connections to ground rods to be exothermic weld.

B. Provide an insulated ground wire in each conduit. Raceway shall not be a substitute for a ground wire.

26.13 IDENTIFICATION

A. Engraved plastic nameplates shall be secured with machine screws to identify equipment

1. Switchboards and switchgear main and feeder breakers
2. Distribution panels and panelboards
3. Motor controllers and motor control centers

B. Distribution panels and panelboards shall have typed circuit directories placed on the inside of panel fronts and shall reference room numbers approved by FIU Facilities.

C. All room numbers shown on working drawings shall be approved by FIU Facilities.

D. Control Conductors - Adhesive labels corresponding to approved Control Diagrams shall be affixed to all control wire terminations.

E. Lighting control device coverplates and receptacle coverplates to be engraved with panel and circuit number (ex. PNL - #).

26.14 RECEPTACLES

A. Provide GFI receptacles outdoors, in elevator pits, in each public restroom, at counters with sinks and within 5’ 0” of water source. Receptacles to be self-testing type.

B. Provide dedicated 20A 120V circuits for corridor, lobby and bathroom receptacles for floor cleaning equipment. Provide duplex outlets for every 60 feet of interior public space.

C. Provide combination USB / duplex receptacles in common gathering areas including lobbies, lounges, dining areas, study areas, classrooms and conference rooms as directed by FIU Facilities.

D. Corridor receptacle coverplates to be stainless steel or vinyl.

26.15 MOTORS

A. Characteristics

1. Less than ½ HP – Single phase
2. ½ HP and greater – Three phase
3. Motors shall be placed on the highest voltage available in the building and available by the manufacturer.
4. 3600 RPM motors shall not be used, unless approved by FIU Facilities.

B. Single-phase Motors

1. All single-phase motors, unless inherently self-protected, to be provided with manual or magnetic motor starters, dependent on system of control.

C. Three-phase Motors

1. All three-phase motors to be provided with magnetic motor starters or variable frequency drives.

D. Controls

1. Provide Hand-Off-Auto switches for manual and automatic control.
2. Where multiple motor starters are grouped together, starters to be incoproated into Motor Center Assemblies. Large motors utilizing reduced-voltage starters or variable speed control may utilize single free-standing controllers.
3. Each starter shall be equipped with three overload relays and auxiliary contacts necessary to complete any indicated control function.
4. Ensure phase loss/imbalance protection is provided for all phases of multiphase motors.
5. Motors shall be connected to re-start after loss of voltage except those which are continuously attended by an operator and those where automatic re-start will create a hazard to property or personnel. Where equipment requires a delay prior to re-start, provide suitable time-delay relay at the equipment control.
6. All combination magnetic control starters to have breakers, not fuses, and to have three overload trips, and sufficient auxiliary contacts to interlock associated equipment.
7. Motor starter, circuit breakers or disconnect switch shall be capable of being locked open during maintenance.
8. All motor starting equipment used on 460V motors and above shall have a control transformer to operate control items.

26.16 LIGHTING

A. Fixtures

1. Exterior

a. All exterior lighting to be LED, unless approved by FIU Facilities.
b. Site pole lights shall be as follows
(1) Pedestrian walkways: Hubbel/Kim BNSP2 Bounce 3000K (Dark Sky). See Appendix “E”, DWG 26-100-D004.
(2) Parking areas: Review with FIU Parking and Transportation Department.
(3) Drives / roadways: American Electric Lighting Autobahn Series ATB2. See Appendix “E”, DWG 26-100-D001.
c. Each site pole shall have an in-ground handhole. The in-ground handhole shall contain a ground rod with a #10 bonding wire to the lighting pole. Provide 10A fuses in waterproof holder to protect circuit to lighting pole. Conductors to pole light shall be spliced within handhole using insulated multi-tap lugs.
d. Site pole shall have an in-pole handhole. The in-pole handhole shall contain fuses in waterproof holder to protect circuit to lighting fixture.
e. In-ground fixtures must be approved by FIU Facilities.
f. Pole lighting shall be designed to meet wind loads required by code.
g. All lenses must be of the non-yellowing type easily cleaned and easily changed without special equipment.
h. Shielding shall be provided to control light pollution on adjacent properties.

2. Lamps & LEDs

a. Fixtures to be LED, unless approved otherwise by FIU Facilities. Compact fluorescent lamps will not be allowed.
b. Color shall be 4000-4200 degrees Kelvin
c. CRI shall be no less than 80.

d. Lamps should be standard and easily changed without special equipment.
e. Exit signs must use LEDs connected to generator emergency power. Self-luminous signs are not allowed. **Batteries are not allowed when generator power is available.**

Incandescent lighting will only be allowed in visual arts performance spaces. Lamp color and CRI as needed.

3. Stairway fixtures shall be wall mounted at landings and shall be accessible from a 6 foot ladder.
Do not install ceiling mounted fixtures over stairs. On high ceiling areas, specify fixtures which can be mechanically lowered for re-lamping. Verify with FIU Facilities availability of existing university equipment to reach ceilings beyond a 12 foot ceiling height.
4. Performance

a. Exterior

(1) Site Lighting Required. Design, construction, and installation of exterior security lighting shall be provided for:

(a) Auto, bus, and service drives and loading areas.
(b) Parking areas.
(c) Building perimeter.
(d) Covered and connector walks between buildings and between buildings and parking.

(2) Lighting spilling onto adjacent properties not owned by FIU must meet Miami-Dade County Code requirements.
(3) Area lighting levels measured at grade

ILLUMINATION STANDARDS

PARKING GARAGES			
Description	**Avg: Min**	**Max: Min**	**Min**
Ground Level Parking Area	-	10:1	2.0 fc
Upper Level Parking Area	-	10:1	1.5 fc
Roof Parking Area	-	10:1	1.0 fc

EXTERIOR AREAS/ SITE			
Description	**Avg: Min**	**Max: Min**	**Min**
Parking Lots	-	12:1	1.0 fc
Covered and connector walkways	4:1	-	1.0 fc
Sidewalks and Plazas	4:1	-	1.0 fc
Roads and Driveways	-	10:1	1.0 fc
Building entrances and exits	4:1	-	5.0 fc
Building Surrounds	-	10:1	1.0 fc
Courtyards and Terraces	4:1	-	1.0 fc
Exterior Stairs	4:1	-	10.0 fc

b. Interior

(1) Consideration for luminance ratios, light distribution, and shadows should be in each lighting design with appropriate supporting calculations.
(2) Area lighting levels measured at work surfaces

Areas	Average (fc)
Cafeterias	
Cashier	50
Food Displays	50
Kitchen Inspection, Checking, Pricing	50
Classrooms	
Drafting rooms	100
Lecture rooms, Audience area	50
Shops	100
Study Halls	50
Typing	50
Corridors and Stairways	10
First Aid rooms	
General	50
Examination room	100
Library	
Reading areas	
Reading printed matter	50
Study and note taking	50
Conference areas	50
Book repair & binding	50
Cataloging	50
Card files	50
Rare Book rooms	
Reading areas	50
Use areas	50
Audio / visual areas	
Preparation rooms	50
Viewing rooms	50
Audio listening areas	
Record inspection table	50
Microfilm areas, files	50
Lounges	
Reading books, magazines, newspapers	30
Toilet and washrooms	30
General	
Dormitories	10
Reading books, magazines	50
Study desk	50
Television, Recreation room	50
Offices	50
Research	
Laboratories	75

Mechanical, electrical & IT rooms	30
Elevator machine rooms	50

B. Controls

1. Approved manufacturers

   a. Watt stopper
   b. nLight
   c. Crestron

2. Corridor lighting shall be arranged to permit separate switching of certain fixtures for use as night lights. Night lights shall be connected to the emergency generator.
3. Digital room lighting controllers are recommended. Wired systems are required for new buildings and projects where walls will be opened up. Wireless systems are allowed for minor renovations.
4. Indoor and Outdoor lighting control shall be designed to permit remote lighting control by zones from a central control station, location of central control station to be determined by FIU Facilities.
5. Indoor and Outdoor lighting at North Campus shall be activated automatically from the Central Control console located in the Central Utilities Building.
6. Outdoor lighting at Modesto Maidique Campus shall be controlled by local digital timers or from the central control console located in the Central Utilities Building. Whenever it is appropriate photocells shall be used to control lighting.
7. Provide dual technology sensors to control lights in offices, restrooms, classrooms and lab areas. Passive infrared only sensors may be used were obstructions are not likely to be present and occupant is always in direct line of sight. Ceiling sensors should be used in classrooms and wall plate type sensors should be used in office and restrooms. Occupancy sensor motion coverage must completely cover space. All sensors should be set for a maximum of 30 minutes of on time of overall occupancy is desired. Cover lenses in sensors should be vandal proof type.
8. Photocell and astronomical timeclock shall be used to control all outdoor lighting wherever appropriate.

26.17 PROTECTION

A. Surge

1. All surge protection to be line-line, line-neutral and line-ground for all phases.
2. Locations

   a. Main service entrance overcurrent protection. Locate external to switchboard.
   b. Separately derived system main overcurrent protection. Locate external to distribution panel or panelboard.
   c. Distribution panels or panelboards serving devices and equipment mounted on the roof or areas outside the zone of protection.

B. Lightning

1. All new buildings are required to have a lightning protection system installed per NFPA 780

2. Copper conductors to be basis of design.
3. All new lightning protection systems shall achieve UL Master Label certification.

26.18 Installation and Maintenance Information.

A. Provide one electronic searchable PDF and two bound sets of manufacturer's installation, operation and maintenance instruction shall be required for the following:

1. Switchboards and Switchgear
2. Power Circuit Breakers
3. Distribution Panels and Panelboards
4. Busway
5. Dry-type Transformers
6. Motor Controls and Control Centers
7. Engine-generators
8. Day-tanks9. Batteries and Charges
9. LED drivers, Fluorescent and HID Ballasts
10. Lighting controls
11. Other Special Systems and Equipment

B. Record Drawings

1. Provide a laminated 24"x36" minimum one-line diagram for each electrical service to be permanently mounted within electrical room.
2. Provide electronic as-built set.

DIVISION 27- COMMUNICATIONS

27.01 GENERAL REQUIREMENTS

A. The FIU network utilizes a hierarchical, layered architecture that includes core, distribution/aggregation, and access layers. Each layer assumes specific functions and provides services to its adjacent layers. This layered architecture provides many advantages including modularity, scalability, adaptability, redundancy, and ease of management. The core layer provides maximum transport data rates and high reliability. The distribution/aggregation layer imposes traffic control functions such as traffic policing/shaping, routing policy, route aggregation, and network security. The access layer provides first level access into the network for end devices such as personal computers and VoIP phones.

B. All new buildings at FIU connect back to the core of network via redundant 10G fiber links. FIU connects to the Internet, Internet2 and Florida Lambda Rail via two redundant high speed 10G links. FIU has deployed 802.11 a/b/g/n wireless throughout all buildings on the campus.

C. FIU has standardized on Cisco's Unified Communications Call Manager platform to provide PBX services to the university. Services include dial-tone, voice mail, IVR, and call center among many others. FIU has an emergency alert system that will display text on IP phones and play audio on IP phones as well as to speakers and emergency call boxes throughout the university. This standardization enables the university to leverage its exiting core infrastructure and common platform for communications.

D. The purpose of this standard is to provide for the planning and installation of telecommunications facilities in new buildings and major renovations. This standard has been developed with little knowledge of the telecommunications equipment that subsequently will be installed. Therefore, the definitions included herewith are for generic telecommunications facilities that will support a multitude of rapidly changing telecommunications technologies in a multivendor and variable end user environment.

E. The purpose of this standard is to provide for the planning and installation of telecommunications facilities in new buildings and major renovations. This standard has been developed with little knowledge of the telecommunications equipment that subsequently will be installed. Therefore, the definitions included herewith are for generic telecommunications facilities that will support a multitude of rapidly changing telecommunications technologies in a multivendor and variable end user environment.

F. This standard recognizes three fundamental concepts related to telecommunications and buildings:

G. Buildings are dynamic. Renovation, remodeling and upgrading are more the rule than exception. This standard takes into account that change will occur.

H. Building telecommunications systems and media are dynamic. As time passes both telecommunications equipment and media change considerably. This standard recognizes this fact and the facilities prescribed herein are capable of supporting a vast array of telecommunications systems and media.

I. Telecommunications is more than telephones. Telecommunications is inclusive of a variety of building systems including data systems, environmental control, security, audio, television, sensing, alarms and much more.

J. Above all, this standard recognizes a fact of fundamental importance: if a building is to be properly designed, built and provisioned for telecommunications systems, it is imperative that the telecommunications design be incorporated during the architectural design phase.

K. The FIU/Division of Information Technology (DoIT) Infrastructure Department developed this document in accordance with industry specifications. It is the standard by which the University defines the physical facilities required for the provisioning of telecommunications systems for new buildings and major renovations to existing buildings. These specifications take into account the physical facilities such as the size and provisioning of telecommunications rooms, cable distance limitations, vertical and horizontal cabling considerations, number and size of conduits and numbers and types of information outlets. The general cabling requirements are not addressed, however, the "Telecommunications Wiring Specifications" which are produced after consultation with the building occupants include the detailed procedures and specifications for the wiring and installation of telecommunications systems for campus buildings. The "Telecommunications Wiring Specifications" are provided to FIU Facilities Management 90 days after completion of the project design phase.

27.02 SPACE REQUIREMENTS

A. FIU has standardized on single mode fiber for inter and intra building connectivity. Cabling to end stations is Cat 6.

B. FACULTY/ADMINISTRATIVE OFFICES must have a minimum of one (1) information outlet per designated occupant, however two (2) are recommended for furniture relocation of additional staff.

C. CLERICAL/STAFF OFFICES shall have a minimum of one (1) information outlet per designated occupant plus one (1) information outlet for every two (2) additional occupants.

D. SECRETARY/ADMINISTRATIVE ASSISTANT OFFICES shall have a minimum of one information outlet per designated occupant plus two (2) outlets per office or two (2) extra outlets per five (5) people.

E. CLASSROOM/LECTURE HALLS/Auditoriums shall have a minimum of one (1) information outlet for emergency phone, and one (1) to four (4) information outlets for data depending on occupancy size:

F.

Classroom Size (Student Occupancy)	Minimum Number of Outlets
1 50	1
51 100	2
101 200	3
201 or more	4

G. The recommended location priority relationship for the information outlets must be:

chalkboard/dry eraser board, lectern, projection booth/rear wall and remaining sides. The recommended location for emergency phone must be: next to chalkboard/dry erase board or teaching station podium.

H. GRADUATE STUDENT OFFICES shall have a minimum of one (1) information outlets per designated occupant.

I. LABORATORIES shall have a minimum of one (1) information outlet per room; actual number may be more depending on function and occupant requirements.

J. CONFERENCE ROOMS shall have a minimum of one (1) information outlet per room. Rooms with more than 500 ft2 shall have a minimum of two (2) information outlets installed.

K. STORAGE AREAS shall have a minimum of one (1) information outlet for rooms over 500 ft2 and one (1) additional outlet for each additional 2000 ft2.

L. INDOOR WIRELESS AREAS shall have a minimum of one (1) information outlet location per access point which will be located above ceiling.

M. OUTDOOR WIRELESS AREAS shall have a minimum of one (1) information outlet location per access point, to be located above ceiling on the inside of the outside wall of building.

N. OUTDOOR EMERGENCY PAGING HORNS shall have a minimum of (1) information outlet location per horn, to be located on the outside wall of building.

27.03 COMMISSIONING

A. Confirm commissioning requirements with FIU Project Manager.

27.04 CONSTRUCTION QUALITY CONTROL

A. It is the responsibility of the project architect/engineer to ensure the inclusion of the standards for building telecommunications facilities into the design and construction documents for new and major renovation projects

B. COORDINATION - Prior to the start of any telecommunications related work, the contractor shall contact the DoIT/Infrastructure Department to coordinate the installation.

1. CABLE PATHWAYS

2. INFORMATION OUTLETS

27.05 SUBMITTALS

A. Coordinate additional product submittals requirements with FIU Project Manager.

27.06 TRAINING

A. Training Sessions – Contractor shall provide a full demonstration of all operating systems. Contractor shall videotape the training and demonstration sessions. The complete training

session shall be videotaped by the Contractor. Three (3) copies in DVD format shall be submitted to the Owner prior to Final Payment. The Contractor shall submit an outline of all components to be covered during the training sessions for the Owner's approval prior to scheduling actual training sessions.

B. Training shall be conducted by applicable sub-contractor and authorized factory representative.

C. Training shall include normal operations, required maintenance operations affecting warrantee, cleaning operations.

27.07 CODES AND REGULATIONS

A. Codes and Standards (Edition currently adopted)
   1. Florida Building Code – Building
   2. Building Industry Consulting Service International (BICSI); Telecommunications Distribution Methods Manual (Latest Edition).
   3. Electronic Industries Association, Telecommunications Industry Association (EIA/TIA) Building Telecommunications Wiring Standards
   4. NFPA's National Electric Code (NEC).
   5. FIU/DoIT Infrastructure Department.

B. Requirements described in the FIU Master Plan.

27.08 INFORMATION OUTLETS

A. FLOOR MOUNTED The use of floor mounted information outlets is strongly discouraged as it does not allow for flexibility in furniture layout and inhibits future changes to the telecommunications system.

B. ELECTRICAL BOXES Locations for information/wireless outlets must be equipped with a 4 in. X 4 in. X 2.5-in. electrical box equipped with a mudring sized for the installation of a standard duplex outlet.

C. WATERPROOF BOXES- Outdoor wireless antenna locations must be equipped with a 4 in. X 4 in. X 2.5-in waterproof box with blank cover.

D. MOUNTING HEIGHT - Electrical boxes installed for information outlets must be placed at the same level as the adjacent duplex electrical receptacles or at least fifteen (15) inches above the finished floor.

E. Electrical boxes installed for information outlets located above counters equipped with a splash back must be placed at 6 in. above the top of the counter. (Measure to the center of the outlet.)

F. Electrical boxes installed for information outlets located above counters not equipped with a splash back must be placed at 12 in. above the top of the counter. (Measure to the center of the outlet.)

G. Electrical boxes installed for emergency phones in classrooms/lecture halls/auditoriums shall be mounted 48 in. above finished floor.

H. Electrical boxes installed for indoor wireless access points information outlets shall be located above drop ceiling spaces or alternate location that is determined by DoIT after site survey is completed.

I. Waterproof boxes for outdoor wireless antennas and emergency paging horns installation heights will be provided to contractor after a site survey of building is conducted by DoIT.

27.09 CONDUITS

A. Under no circumstances will flexible metallic conduit be used for any telecommunication wiring.

B. Under no circumstances will any conduits be “daisy-chained” together.

C. A 1 inch EMT conduit must be installed from each information outlet electrical box including indoor/outdoor wireless access point, and emergency paging horn location and "stubbed" up above the ceiling level to cable tray.

D. If fixed ceilings are installed cable trays cannot be used and conduit from information outlets must be "homerun" to the telecommunications room or cable tray.

E. The open ends of conduits and/or sleeves must be equipped with bushings to avoid damage to cable sheaths and must be readily accessible and not concealed within walls.

F. SLOPE - Underground conduit must be installed such that a slope exits at all points of the run to allow drainage and prevent the accumulation of water. A drain slope of no less than .125 in. per foot is desirable.

G. Telecommunications rooms contain the vertical cable riser space. Conduits and/or sleeves must be used to interconnect telecommunications rooms. The open ends of conduits and/or sleeves must be located a maximum of 3 in. from the wall and extend a minimum of 1 in. above the finished floor.

1. REQUIRED NUMBER The minimum number of conduits, and/or sleeves interconnecting the telecommunications rooms must be determined as follows:

Building Total (Square Footage)	Quantity of Conduits	Size of Conduit
Up to 50,000 ft2	3	4”
50,001 ft2 to 100,000 ft2	4	4”
100,001 ft2 to 300,001 ft2	5 8	4”
300,001 ft2 to 500,000 ft2	9 12	4”

H. PULL BOXES A pull box must be installed in sections of conduit longer than 100 ft. or containing more than two 90-degree bends or if there is a reverse bend in the run.

I. Minimum requirements for installed conduit, such as support, end protection, and continuity, are found in appropriate electrical codes.

J. The inside radius of a bend in conduit must be at least 6 times the internal diameter. When

the conduit size is greater than 2 in. the inside radius must be at least 10 times the internal diameter of the conduit.

K. PULL CORDS All conduits must have a fish tape or pull cord, rated for 200 lbs. of pull force, and installed end-to-end.

L. ELEVATOR – A ¾" conduit must be installed from each elevator equipment room to the nearest telecommunication room or cable tray.

M. EMS – A ¾" conduit must be installed from each mechanical room "homerun" back to the nearest telecommunication room or cable tray.

N. FIRE ALARM - A ¾" conduit must be installed from the fire alarm panel to the nearest telecommunication room or cable tray.

27.10 CABLE TRAYS

A. Cable trays are rigid structures for the containment of telecommunications cables.

B. GROUNDING Cable trays must be installed and grounded in accordance with the National Electric Code (NEC) and local requirements.

C. TYPE Cable trays must be of the 12-in. ladder type, equivalent to Wiremold, Part No. A060612, unless otherwise specified by the DoIT Project Manager.

E. Cable trays must be installed above false ceilings and run down hallways and corridors providing a pathway for telecommunications cable from the information outlets to the respective telecommunications closet.

E. Cable tray installation must be coordinated with all work of other trades to avoid any interference. Cable trays must be installed such that they are not obstructed by other trades equipment, i.e., air conditioning ducts, electrical conduit etc. Cable trays must be easily accessible for the installation of cables and, future changes to telecommunications systems.

F. A minimum of 3-in. clear vertical space must be available between the top of the ceiling tiles and the bottom of the cable tray. A minimum of 12 in of clear horizontal space on each side of the cable tray must be available. Also, minimum of 6 in of clearance must be available between the top of the cable tray and any other utilities.

G. Under no circumstances, shall any other utilities pass within the distances specified above.

H. To avoid electromagnetic interference, all cable pathways must provide clearances of at least:

1. 4 ft. from large motors or transformers.
2. 1 ft from conduit and cables used for electrical power distribution.
3. 5 in. from fluorescent lighting. Pathways should cross perpendicular to fluorescent lighting and electrical power cables or conduits.

27.11 TELECOMMUNICATIONS ROOMS

A. Telecommunications rooms must be dedicated to the telecommunications function and related support facilities. Telecommunications rooms must not be shared with janitorial facilities or other trades especially with electrical installations other than those required for telecommunications systems.

B. Telecommunications room refers to any room where telecommunications facilities terminate and telecommunications system equipment is housed.

C. The term building Intermediate Cross Connect (IC) is used to indicate the telecommunications room where the campus backbone facilities enter the building.

D. The term Telecommunications Rooms (TR) is used to designate the telecommunications room required for the distribution of facilities to adjoining floors and areas exceeding distance limitations.

E. NUMBER OF ROOMS. There must be a minimum of one telecommunications room per floor and centrally located in the building, unless otherwise specified by the DoIT Project Manager. Additional telecommunications rooms must be provided when:

1. The floor area to be served exceeds 10,000 ft2, or
2. The horizontal distribution distance to the workstation exceeds 295 ft.

F. SIZING OF ROOMS. Telecommunications rooms must be sized as follows:

Serving Area (net bldg. ft2)	Room Size
10,000 ft2	10 ft. X 11 ft.
8,000 ft2	10 ft. X 9 ft.
5,000 ft2 - less	10 ft. X 7 ft.

10 ft. X 7 ft. is the minimum size for telecommunications rooms.

G. Telecommunications rooms must be stacked vertically to provide for the installation of telecommunications facilities between floors. Telecommunications rooms must be interconnected as specified in section above.

H. BACKBOARDS – All four walls must be covered with rigidly fixed 3/4 in. x 4 ft. X 8 ft. **Fire Retardant Marine-Grade** plywood, preferably void free, capable of supporting attached equipment and painted with black fire-retardant paint.

I. LIGHTING Lighting must be a minimum of 50-ft. candles measured 3 ft. above the finished floor, mounted 8.5 ft. minimum above finished floor.

J. CEILINGS False ceilings are not allowed in any Telecommunication Room.

K. DOORS The door must be a minimum of 36 in. wide and 80 in. high, without doorsill, hinged to open outward and fitted with a lock.

L. KEYING Access to all telecommunication rooms will be through one uniform master key system. Facilities Management will establish the lock type to be used.

M. TREATMENT Floors, walls, and ceiling must be treated to eliminate dust. Floors must be covered with VCT tiles or concrete sealer.

N. ELECTRICAL REQUIREMENTS Two dedicated 30 A, 110 or 208 V AC electrical outlets (L5-30R/120, L6-30R/208), each on separate circuits, must be provided for equipment power, unless otherwise specified by DoIT Project Manager. In addition, a third 20A, 110 V AC circuit shall feed duplex outlets, which must be placed at 6 ft. intervals around the perimeter wall, at a height of 18 in above the floor. In addition, all dedicated outlets in IC's and TR's must be connected to the emergency power system (generator). All dedicated circuit outlets must be readily identifiable by using a different color outlet.

O. GROUNDING Each telecommunications room must have direct attachment to the closest point in the building's electrical service grounding electrode system. A Number 6 AWG solid conductor cable must be placed between the ground source and a bus bar of the type: Chatsworth Products, Inc. part number 13622-010 or equivalent.

P. A #6 THW ground cable shall be installed for each Outdoor Wireless Access Point location from the nearest Intermediate Closet (IC) or Telecommunications Room (TR).

Q. SLEEVES/CONDUIT Sleeves or conduit passing through the telecommunications room floor should be adjacent to the door with a minimum of 1 in. exposed above the finished floor. Sleeves and conduit must be no more than 3 in. away from the wall. Sleeves and conduit shall not be left open except during cable installation and must be properly fire stopped per the applicable codes.

R. FIRE PROTECTION Fire protection of the telecommunications rooms, if required, must be provided as per applicable code. All conduits and cable trays penetrating any Telecommunications Rooms must be properly sealed with the appropriate fire stopping material, as per NEC and local fire codes. If used, fire sprinklers shall not be water based. An optional gaseous system must be used.

S. AIR CONDITIONING HVAC must be provided on a 24 hours per day, 365-days per year basis. If the building system cannot assure continuous operation for large equipment applications, a stand-alone unit must be provided for the equipment room.

T. TEMPERATURE The temperature and humidity must be controlled to provide continuous operating ranges of 64 degrees F to 75 degrees F with 30% to 55% relative humidity.

U. COLLOCATION OF OTHER TRADES No water, sewer etc. pipes must be placed within or pass through the telecommunications rooms.

V. PLENUM AIR SPACE - All Telecommunications Rooms must be completely separated from Plenum air space in accordance with NEC and BICSI standards. (Please see 1.2 reference)

W. LOCATION OF ROOM - All Telecommunications rooms must be accessible at all times. The IC (building main telecommunications room) must be designed to be adjacent to an outside wall in order to facilitate the addition of entrance conduits if needed, unless specified by DoIT Project Manager.

27.12 OUTSIDE PLANT

A. All new building construction planning must provide for connection of the building to the campus communications infrastructure.

B. CONDUIT SIZE - All direct buried conduits used to connect to the University Telecommunications infrastructure must be 4" PVC, Schedule 40.

C. NUMBER REQUIRED The minimum number of conduits connecting the building IC to the campus MC must be at least four four-inch (4 - 4") conduits. Note: More entrance conduits might be needed depending on the size and utilization of the building.

D. DEPTH - The top of the conduit bank must be buried at least 30 inches below the ground surface and separated from other service structures as required for fiber optical cable under EIA/TIA specifications.

E. Separation of telecommunications conduits from other utilities shall meet the following guidelines:

1. Power or other conduit- (Minimum Separation)

    (a) 3 inches in concrete
    (b) 4 inches in masonry
    (c) 12 inches in earth

2. Pipes (gas, oil, water) - (Minimum Separation)

    (a) 6 inches when crossing pipe
    (b) 12 inches when parallel to pipe

3. Power conduit terminated on poles- (Minimum Separation)

    (a) Separate poles, if possible.
    (b) If on same pole, 180 degree separation
    (c) Preferable, but not less than 90 degrees.

4. Railroads- (Minimum Separation)

    (a) At a crossing: 5 feet below top of the rail.

5. Terminating on poles: - (Minimum Separation)

    (a) 12 feet from the nearest rail, except 7 feet at sidings.

27.13 DUCT BANK PROTECTION

A. Conduit must be encased in concrete when:

1. Minimum conduit depth of 30 inches cannot be attained.
2. Conduits pass under roads, driveways, or railroad tracks.
3. Bend points are subject to movement.

B. A detectable warning tape must be placed 18 inches above all duct banks (detectable: containing metallic tracings).

27.14 MANHOLES (MAINTENANCE HOLES)

1. DESCRIPTION - A manhole (maintenance hole) is used to pull in and splice cables in an underground, concealed manner. Manholes must be equipped with a sump, corrosion resistant pulling iron, cable racks, and manhole ladders. Concrete used for manholes must be of at least 3500 lb./in2 strength. All manholes must be properly grounded as required by BICSI. (Please refer to 1.2)

2. SIZE - Manholes must be sized at 6-ft. width X 12-ft. length X 7-ft. height, unless specified by the UTS Project Manager. All manholes must be equipped with a round ring and cover, clearly labeled "TELECOM" or "TELEPHONE".

3. WHERE REQUIRED Manholes must be placed when the conduit section length exceeds 500 ft., whenever a cable splice will be required, when bends exceed a total of 180 degrees or two bends, or the section length of conduit requires the pulling in of cable in two segments.

4. HANDHOLES are not an acceptable alternative to manholes described. Handholes can only be used in place of manholes after consultation with and receipt of written approval from the UTS/Infrastructure Department.

5. PULL POINTS - Wherever distances between manholes exceeds 200 feet or there are more than two 90-degree bends in the conduit run, a 4’ x 4’ x 4’ pull box must be placed. The number of conduits going in and out of the pull box shall not exceed six. Under no circumstances shall a pull box replace a manhole.

6. POSITIONING OF CONDUITS IN MANHOLE - Conduits entering a manhole shall do so only through the manhole walls designed for conduit penetration. Under no circumstances shall the structural integrity of the manhole be compromised.

7. Conduits being added to a manhole must be placed as deep as possible in order to accommodate future expansion of duct banks and guarantee maximum utilization of the manhole.

27.15 FOR MISC. DETAILS SEE APPENDIX “E”

DIVISION 28 - ELECTRONIC SAFETY & SECURITY

28.01 GENERAL REQUIREMENTS

A. Refer to FIU BIM Standards for additional details and requirements.

B. Fire alarm panel/system to be Non-Proprietary such as “NOTIFIER”.

C. Fire alarm systems shall be addressable, microprocessor controlled and shall include alarm initiating devices, notification appliances, control panels, auxiliary control devices, annunciators, printers, power supplies and wiring. All smoke detectors in housing facilities, including living quarters, shall be addressable.

D. All systems shall be compatible. Systems shall be power limited type and comply with latest NFPA 70 and 72.

E. Fire alarm system shall include remote annunciation at the building entrance or where deemed by the local emergency responders.

F. Ensure system is connected to emergency generator.

G. Main fire alarm panel must communicate alarm signals to the headend receiver at the University’s Police Department via the existing Campus Ethernet Network. No Analog Phone Lines shall be used. The communication panel shall use a vendor neutral universal IP network communicator card (DSC T-Link TL300) housed in a UL enclosure, specifically designed to work with fire panels from various manufacturers and is compliant with NFPA 72. Coordinate equipment specifications with Facilities Information Technology (IT).

H. Surveillance video is stored and managed at the FIU MMC Campus and remote access to cameras and archival footage is granted to FIU Police using the video management software. Facilities Information Technology (IT) group is responsible for providing this access.

I. Video surveillance is required for the following areas:

   a. Parking areas
   b. Building perimeters including all entry and egress points, emergency stairwells, and trash chute entrances
   c. Reception areas
   d. Lounges, common areas, hallways, elevator landings, pools, laundry rooms
   e. Vehicle and pedestrian entrances
   f. Emergency call stations
   g. Elevator cabs
   h. Perimeter and entrances to utility and communication rooms
   i. Coordinate camera location with Facilities IT Department

J. Camera Equipment

   a. Coordinate camera equipment with Facilities IT Department

K. Server Hardware

   a. Provided by FIU at the actual cost. Both initial and recurring costs may apply.

L. VMS Software

a. Provided by FIU at the actual cost. Both initial and recurring costs may apply.

28.02 SPACE REQUIREMENTS

A. Avoid the use of battery operated smoke detectors.

B. Restricted spaces

1. Modifications to the space should include the capability to limit or restrict access via a “smart card” and possible use of a surveillance camera specific to the lab.

28.03 COMMISSIONING

A. Confirm fire alarm commissioning requirements with FIU Project Manager.

B. Confirm security system commissioning requirements with FIU Project Manager.

28.04 CONSTRUCTION QUALITY CONTROL

A. Record Drawings

1. Provide a one-line diagram for fire alarm system service to be permanently framed and mounted.

28.05 SUBMITTALS

A. Maintenance Manuals - Contractor shall deliver to the Architect/Engineer, one (1) bound copies of manufacturer’s operating instructions and maintenance recommendations and one electronic copy (original, non-scanned pdf’s) for all equipment and machinery installed under the contract. All fire protection equipment shall be cross referenced by equipment designation, fire zones and actual room locations. A complete listing of all equipment and location shall be provided in an electronic spreadsheet format (Microsoft Excel). This is to be done before completion of the project.

B. Coordinate additional product submittals requirements with FIU Project Manager. C. Record Drawings

1. Provide a one-line diagram for fire alarm system service to be permanently framed and mounted.

D. Permanently frame and mount four (4) charts indicating the fire zones.

28.06 TRAINING

A. Training Sessions – Contractor shall provide a full demonstration of all operating systems. Contractor shall videotape the training and demonstration sessions. Three (3) copies in digital format shall be submitted to the Owner prior to Final Payment. The Contractor shall submit an outline of all components to be covered during the training sessions for the

Owner's approval prior to scheduling actual training sessions.

B. Training shall be conducted by applicable sub-contractor and/or authorized factory representative.

C. At minimum, training shall include normal operations, required maintenance operations affecting warrantee and cleaning operations.

28.07 CODES AND REGULATIONS

A. Codes and Standards (Edition currently adopted)

1. Florida Building Code - Building
2. Florida Fire Prevention Code
3. NFPA 70 National Electrical Code
4. NFPA 72 National Fire Alarm and Signaling Code
5. NFPA 110 Standard for Emergency and Standby Power Systems
6. ADA Standards for Accessible Design
7. ASME A17.1 Safety Code for Elevators and Escalators
8. AALAC Guide for the Care and Use of Laboratory Animals
9. NIH Design and Policy Guidelines
10. OSHA National Recognized Testing Laboratory
11. NECA National Electrical Installation Standards
12. National Electrical Manufacturing Standards
13. Applicable regulations and requirements of FPL utility

B. Requirements described in the FIU Master Plan.

28.08 INSTALLATION AND MAINTENANCE INFORMATION

DIVISION 31 – EARTH WORK

31.01 Earthwork

A. Site Examination

Ascertain exact locations of utilities and substructures that may be affected by the Project.

B. Subsurface data

Contractor shall maintain existing benchmarks, monuments, and other reference points on the project site.

C. Conformance Standards

1. American Society for Testing and Materials
2. D2487-69 (1975) Classification of Soils for Engineering Purposes
3. D698-78 Moisture-Density Relationship of Soils
4. D2922-81 Density of Soil and Soil-Aggregate in Place by Nuclear Methods
5. D1556-82 Standard Methods of Test for Density of Soil in Place by Sand Cone Methods
6. D1557-78 Methods of Test for Moisture-Density Relations of Soils Using a 10-lb. Hammer and 18-in. drop
7. D1557, Method D.

D. Compaction

Compaction as specified by the geotechnical report and civil and structural engineer.

E. Testing

All testing during construction shall be performed by a testing laboratory approved by the Owner, and Architect/Engineer.

The University will pay for all testing except for tests that fail. Contractor will pay for all failed tests.

All materials encountered proposed to be re-used must be tested.

31.02 Soil Treatment

All building sites shall receive termite soil as required by the Florida Building Code.

DIVISION 32 – EXTERIOR IMPROVEMENTS

32.01 Asphalt Paving and Surfacing

Use F.D.O.T. Standards.

32.02 Landscaping and Irrigation

A. The project architect shall reference the Landscape and Irrigation Manual to use as a guideline.

B. Landscaping - The Architect/Engineer must employ a registered Landscape Architect to design, coordinate, and prepare the contract documents for this project.

C. See Appendix "D" - Landscaping and Irrigation Standards.

32.03 Grading

A. Provide positive drainage away from all buildings, interior/exterior patios and walks.

B. See Appendix “D” – Landscaping and Irrigation Standards.

32.04 Berm or Mounds

The use of berm and mounds is to be limited and not recommended.

32.05 Fences and Gates

A. At Modesto Maidique Campus use hot dipped galvanized chain link fencing. See Appendix “E” FIU Standard Details.

B. At Biscayne Bay Campus use black vinyl clap hot dipped galvanized chain link fencing.

DIVISION 33 - UTILITIES

33.01 General

A. Coordination - The Architect/Engineer shall be responsible for careful coordination of the design of all infrastructure equipment including stub outs for future expansion.

B. Utility Companies - The Architect/Engineer shall arrange coordination meetings between the utility company, FIU and him/herself. These meetings should be held at the beginning of the schematic and preliminary design phase and at the end of the contract document phase.

C. FIU As-Builts-

1. Facilities Construction will provide the Architect/Engineer with the current available site-utility as-builts during the schematic phase of the project. Architect/Engineer shall verify location of all underground utilities.

D. Project As-Builts - The Contractor shall accurately record the precise size, location and depth of all underground utilities within the project limits. Information to be given to A/E a no more than 30 days after project's substantial completion.