



# AMERICAN UNIVERSITY DESIGN AND CONSTRUCTION STANDARDS

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## PREFACE

The American University Design and Construction Standards, a guide for Consultants, is provided to assist you in meeting the expectations of American University for professional design and construction services and our goals for a sustainable campus.

These guidelines do not change your professional and legal responsibility to provide to American University the highest quality design needed for the project for which you are being asked to provide services. It is our intention that this publication assists you with your work and better enables you to be responsive to the needs of American University.

The American University Design and Construction Standards have been produced for your benefit, and ours, to clarify expectations for sustainable design and construction services. Although we believe it is comprehensive in scope, we do not claim that it covers every aspect of the professional services required by you or as spelled out in the particular agreement for the professional services to be performed. We welcome your comments on these guidelines and will endeavor to interpret them fairly as they relate to your services.

Please feel free at any time to call us concerning these guidelines. We want to ensure that communication between the University and yourself is clear and that you are able to perform your duties as required.

## FOREWARD

This publication has been prepared for the guidance of Consultants providing architectural and engineering services under contract to the American University (AU) and was developed with input from key stake holders including, Facilities Management (FM), Planning and Project Management (PPM), Facilities Administration, Public Safety, Office of Sustainability, Auxiliary Services, and Housing & Dining Programs and Office of Information Technology.

This document is to be used by Consultants for all new construction and renovation projects. Exceptions to the technical standards must be submitted in writing to the University's designated project manager for approval by AU's design standards committee. Such submissions shall be sufficiently developed and both technically and financially justified in order to be considered.

A firm or individual providing consulting services to the American University will be the Designer of Record, and will incur the usual professional responsibilities and liabilities for the specific project. The Consultant should be familiar with the contract terms and content of this publication with respect to sustainable pre- construction, construction, and post-construction design responsibilities.

This document is updated as necessary to reflect any required changes to the technical standards and specifications. It is the user's responsibility to ensure that he/she is working from the most current update. The most current version is available on the Facilities Management Website (previous revisions are archived by the University for reference). Contractually, "the most current version" is the revision in effect on the Facilities Management Website when the design or consulting contract Notice to Proceed" is given.

Chapter 1 — Consultants Guide



*McKinley Building – School of Communications*

## INTRODUCTION

### CONTRACT SERVICES

Contract Services fall into two broad types:

1. Consultant Services related to the design of, construction, maintenance, alteration, or repair of facilities. This type of service produces a set of contract documents, consisting of, but not limited to drawings, specifications, cost estimates, and pre design and design support activities. (Soil borings, site topography, and construction monitoring)
2. Consultant Services related to the planning, investigation, study, and project development for existing or proposed facilities. This type of service typically produces a feasibility study or report.

### DESIGN QUALITY

At American University each design project has its own unique programmatic and contextual requirements. The Consultant shall take into consideration the location of the project and shall design with the unique surroundings fully understood. All design elements must be carefully explored with long-term goals (projected life of facility, equipment, and systems) in mind. New facilities will be designed with a minimum LEED rating of Gold. Unless noted otherwise, existing facilities will establish LEED EB ratings targeting the same as practical, based on the current condition and the extent of renovation required.

American University requires that the Consultant adhere to the latest edition of the Design Standards. Exceptions may be made on a case-by-case basis by requesting approval in writing from the Design Standards Committee (Chaired by Facilities Management's Director of Energy & Engineering). The University's Project Manager must maintain documentation for any exceptions.

There are no pre-established design styles or solutions for any project, and the Consultant is expected to explore appropriate options toward making a recommendation for a design solution.

A detailed comparison and lifecycle economic analysis between various design options should be prepared where appropriate. Their use in determining the design solution shall be coordinated with AU's project manager and key stakeholders from the Operations team.

Design concepts shall incorporate the latest available technology wherever possible including the LEED rating system.

Utilities Master Planning is essential to long term reliability, operability, flexibility and efficiency. Facilities Management has developed an Energy and Utilities Masterplan committed to district heating and cooling whenever practical. Consultants shall work with Facilities Management to become familiar with these campus plans. Energy Conservation and efficiency of Mechanical/Electrical systems and equipment is of prime importance to AU and as such designs supporting Energy Star ratings for our systems and facilities are our strategic objective. The Consultant is advised that design decisions regarding equipment/system selections will not be based solely on Energy Star or nor shall they be based solely on first cost. A Life Cycle Cost Analysis (LCCA) will be prepared in the early design stages and presented to the Project Manager and Director of Energy and Engineering for review and/ or approval. LCCA is the total cost to operate a piece of equipment, product or system over its useful life, including the cost of procurement. Additionally, very high energy use equipment such as HVAC chillers and pumping systems, require a Present Worth Analysis (PWA) over the projected life cycle. PWA considers the time value of money and all future cash flows brought back to present value.

In the project conceptual phase, the Consultant shall meet with the appropriate operations offices of the University for their input and requirements. A typical project may include, but not limited to, Planning & Project Management (P&PM), Office of Information Technology (OIT), Public Safety Office (PS), Facilities Management (FM) including Energy & Engineering (E&E) and Facilities Maintenance Operations (FMO).

## DESIGN PROCESS

The Design Team shall coordinate all proposed projects with appropriate AU's internal reviewing officers or agencies to receive approval. The Design Team shall establish and submit to the University's project manager a schedule identifying specific milestones and approval requirements and the time necessary, after the project is approved, for design and/ or construction.

The Consultant shall prepare appropriate presentation materials to convey the design concepts at each phase. Project Specific Requirements are TBD.

## AESTHETIC CONSIDERATIONS

The Consultant shall become knowledgeable with sustainable planning principles that have been established for the American University campus. This information is contained in the following documents (available as appropriate via AU's project manager):

- Campus Plan 2011
- Zoning Order approving the Campus Plan
- Related planning documents from the University where appropriate

These general design principles have evolved over the years at AU and must be followed:

- On or near the Freidheim Quadrangle, enhancement rather than dramatic departure from existing design is a necessity.
- When selecting an exterior building material, approval from AU's Project Management and Facilities Maintenance representatives must be secured prior to proceeding with development of details. Material samples are required.
- Provision for future expansion should be considered for each building project.
- The American University campus is an Arboretum and trees are cherished as is the vintage Architecture. Each project shall be designed with limited tree removal and impact on traditionally forested areas.

## AU RESPONSIBILITIES

AU's project manager may provide the following information or services:

1. Scope for Design Services
2. Project Budget and schedule
3. Drawings of existing facilities and information pertinent to building services and utilities
4. American University Design and Construction Standards
5. Hazardous materials testing and coordination for removal
6. Environmental monitoring
7. Coordination of drawings distributed for in-house reviews
8. Coordination of in-house reviews
9. Coordination of User/Occupant reviews
10. Coordination of interior Design related needs
11. Coordination of User/Occupant moves
12. Soils and Material testing
13. Coordination of University Approval & Committee reviews
14. Site survey and sub-surface investigating
15. Building information access – all design phases

16. Access to existing building systems archive (blueprints, specifications, etc.)
17. Other responsibilities as defined in the current edition of A.I.A. document B151
18. Information on Commissioning requirements and responsibilities

Document loaning terms: File searching and document retrieval shall be the responsibility of the Consultant. Only copies of documents may be removed from the document archive. All documents loaned shall be accompanied with a transmittal from the Consultant to AU's Project Manager and/or the archives representative.

## DESIGN AND CONSTRUCTION SUBMITTALS

### General

The Consultant shall develop for AU's project management and operations & maintenance unit's review and approval Schematic Design Documents, Design Development Documents and Construction

Documents (as applicable), to establish the scope, relationship, forms, size and appearance of the project in accordance with the requirements of all Agreements.

Pre-design, programming and feasibility studies are not required, unless specifically requested by AU's project management.

The Consultant shall provide design calculations for AU's project management and operations & maintenance staff to review upon request. A tabulation of gross, net, and assignable square foot building areas shall be submitted with each design phase and shall follow FICM (Facilities Inventory and Classification Manual) methodology.

The latest edition of the American University Design and Construction Standards shall be used by the Consultant throughout the design process. Use of this document does not relieve the Designer of Record of the responsibility for the final design in accordance with the Project Agreement and with professional standards of practice.

A detailed cost estimate, according to CSI format, is required with each phase of the project. Document submittals to AU's project and maintenance staff at each phase of design shall consist of multiple sets of drawings and specifications (including electronic copies).

The Consultant shall submit project schedules to AU's project manager. When projects involve interruptions of existing building operations or major utility usage, the Consultants shall be responsible for discussing the required outages and service interruptions with Facilities Management at least 30 days in advance.

The Consultant will establish a schedule for these interruptions, which may adversely impact the project cost, and/or time for completion. A brief description of the restrictions and their basis shall be required.

## SCHEMATIC DESIGN

Estimates – Estimates of Probable Costs are required for all project phases, including a projection of a Not to Exceed Budget Estimate. Estimates shall include all expected project construction cost categories. Outline Specifications –The specifications shall point out the principle features of the overall project. A schematic outline specification shall be presented using the CSI division format.

Drawings will include:



Sustainable schematic site plan- proposed location for the new building or alterations affecting the site of an existing building and its environmental impact on the site.

Architecture plans of each floor, including those below grade, all elevations, and typical building section and preliminary analysis and evaluation of LEED criteria.

Utilities and Infrastructure plans –

- Campus Utility Connections & Preliminary Building Utility Loads including water, sewer, gas, electric, steam, chilled water,
- Campus IT Connections & bandwidth including phone, data, security, EMS, fire alarm, etc.
- Building Mechanical, Electrical & Special systems and equipment – preliminary concept and equipment/system list and preliminary analysis and evaluation of LEED criteria.

## DESIGN DEVELOPMENT

General

- Written analysis of applicable codes
- LEED analysis
- ADA requirements
- Updated building load analyses
- Building Envelope description and details
- Description of energy conservation renewable energy features which are incorporated into the project
- Energy modeling & Life cycle cost analysis (LCCA) of all high energy use equipment
- Detailed Project Estimate by major building component/system
- Project Schedule
- Presentation material as required and/ or appropriate

Development of and verification with Project Team including Facilities Management of the project Owners Program Requirements Outline Specifications

The specifications in this phase shall identify all significant architectural, mechanical and electrical materials and equipment in CSI format and how it conforms to the LEED criteria being sought for the project.

Drawings

Drawings shall reflect an expansion of the schematic design phase and shall establish the final scope, form and size of the project. At the minimum, drawings shall present the following:

1. Site Plans
  - a. Site plan showing connections to all utilities with routing of new and existing services and connections
  - b. Site Improvements Plan to establish final scope and details of site improvement work and landscape concepts
2. Architecture
  - a. Floor plans, exterior elevations and sections including room numbers.
  - b. Fire Life Safety drawings showing means of Egress, Areas of Refuge, rated partitions and doors, areas of high hazard
  - c. Exterior materials palette and samples that show any changes in materials, patterns, textures and color

- d. Typical wall sections and major construction details
  - e. Built in equipment layouts to establish final project requirements
  - f. Renderings or models as required
  - g. Furniture and moveable equipment layouts as required
3. Structural
    - a. Plans of each building level to show basic structural systems
    - b. Drawings to show preliminary sizing of major structural components
    - c. Drawings to show critical clearances and height restrictions
  4. Mechanical
    - a. Floor plans of each building level with single line layout and riser diagrams of piping and ductwork; applies to HVAC, Plumbing,
    - b. Drawings & Specifications documenting Fire Protection / Life Safety systems including Fire Suppression systems and equipment, fire dampers, etc.
    - c. Preliminary equipment schedules with sizes and capacities of major system components. Equipment & Asset identification consistent with AU standard nomenclature.
    - d. Equipment layouts for HVAC and plumbing to establish space requirements and clearance.
    - e. Acoustical and vibration control
    - f. Preliminary Sequence of Operations and set points consistent with University Standards & Policies (including Section II specifications Division 25 Integrated Automation).
    - g. Preliminary BAS/EMS system architecture drawings and basis of design.
    - h. Energy conservation features/Preliminary Energy modeling
  5. Electrical
    - a. Drawings to show plans for lighting, power, communication systems
    - b. Drawings & Specifications documenting Emergency and Critical Power Systems
    - c. Drawings & Specifications documenting Fire Protection/Life Safety systems including Fire Alarm systems and equipment.
    - d. Equipment Schedules to show preliminary sizes and capacities of major equipment and electrical distribution system, equipment layout establishing space requirements and clearances. Equipment & Asset identification consistent with AU standard nomenclature.
    - e. Riser diagrams and energy modeling
  6. Landscape and site improvements
    - a. Drawings that will establish final scope and details of landscape and site improvement work
  7. Special Equipment
    - a. Drawings showing special equipment including general arrangement, elevations, schedules and details of conveying systems, kitchen equipment, materials handling systems, IT systems, A/V systems, etc.
    - b. Energy Star Appliances and ratings
  8. Design Calculations

Update of design calculations for AU's review and approval.

#### Construction Documents

1. Energy conservation analysis prepared during the Design Development phase shall be updated and submitted for FM review and approval including updated energy modeling and LCCA.
2. The Consultant shall prepare a detailed code analysis which conforms to District of Columbia Building Code. Including ADA requirements to show the final scope and cost of compliance.

3. Grounds Conservation & Recovery Plan (for any disturbance to the grounds by project construction).
4. Project Narrative including Basis of Design/Design Intent Document
5. Detailed Estimate of probable construction cost by major building component.
6. Presentation materials as required by AU's Project management.
7. Specifications – CSI Format
8. The specifications shall allow contractors to prepare bids without the need to make assumptions or judgments.
  - a. For materials and equipment, the Consultant shall reference names of three manufacturers that are deemed to be suitable for meeting the desired product quality. Specific exceptions can be found in the Design Guidelines.
  - b. Drawings – The Contract Document drawings shall provide sufficient detail (including existing systems and sustainable design components) to allow for clear understanding of the scale and scope by AU and the Contractor as necessary to bid, permit and construct the project and to minimize interference between new and existing systems. The drawings should be an accurate and detailed set of documents that fully elaborates and reinforces the design development drawings.

#### Equipment Procurement

AU may elect to pre-purchase equipment for some projects and will, in such cases, require the Consultant to assist in the preparation of equipment bid documents and bidding. AU's Project Manager will coordinate the equipment procurement and delivery schedule.

#### Construction and Project Close-Out Phases

The Consultant shall be responsible for, but not limited to, the following:

- Site visits to verify record drawings.
- Construction Progress meetings including representatives from all disciplines of the design, as scheduled.
- Review and Responding to contractor RFI's, Change Order review meetings including representatives from all disciplines of the design, as scheduled.
- Updates to energy models (including LCCA) and record documents associated with design changes, value engineering, submittal approvals, approved RFI's and Change Orders.
- Review of Submittals, Balancing Reports & Commissioning Documentation.
- Project Punch-out. Punch list items shall be organized by CSI specification Division prior to submission to the Contractor and shall include CX agent and Facilities Management's and other operating units comments.
- Verification and Submission of the project substantial completion certificate and project close-out form (reference Section III of these standards).

The Consultant, Contractor, Project Manager or a combination of these disciplines shall provide and maintain a Change Order/Proposal Log during the construction phase, providing the Project Manager and AU with a copy on a monthly basis. This log shall contain, but not be limited to, the following information:

#### Proposal Request Number

- Change Order Number
- Time Extension Request

- Description
- Reason for Proposed Changed
- Proposal Amount
- Change Order Breakdown
- Demolition
- General Construction
- HVAC
- Plumbing
- Electrical

Schedule Dates and line-item costs for the above items:

After completion of punch-list items by the Contractor, the Consultant shall submit to AU a report of field verification and status of items. This status report will be updated at regular intervals until all punch-list items are resolved to AU's satisfaction.

Review Operating and Maintenance Manuals submitted by the Contractor for completeness prior to submission to AU. These manuals shall include all pertinent information to successfully operate and maintain all equipment related to the project.

The Consultant shall provide consultation to the Contractor for the training of maintenance personnel. Consultant shall assist AU in defining correct operational parameters of new mechanical / electrical systems.

#### Documents

American University requires "RECORD" drawings on each project. The Consultant shall be responsible for the preparation of "RECORD" drawings in both hard-copy and electronic format. The Contractor shall be required to provide a marked copy of project drawings to the Consultant indicating all changes made during construction. The AUTO-CAD files and reproducible plans shall be corrected to reflect actual construction and marked "RECORD". Optional methods of construction not used should be crossed out and marked "NOT RECORD".

Furnish to AU:

- One copy of AUTO-CAD file digital media on CD-ROM completely compatible with the current AUTO-CAD version in use by FM, in the American University CAD Drawing Standard format. A copy of the current standard can be obtained from AU's Project Manager.
- One set of high quality reproductions that are in keeping with current reproduction technology plus electronic red-line drawings via USB stick.
- Complete record documents shall be submitted to AU's Operations & Maintenance staff for review as listed on the project turnover document developed in conjunction with the Project Manager and Facilities Management. Review comments shall be incorporated into the final submittal of reproducible record documents.

Note: The Consultant shall reject any Record Drawings, Documents or Turnover Submissions from the contractor which are incomplete or inaccurate.

— END OF SECTION I —

Chapter 1 Divisions 0 - 33



*Washington College of Law – Tenley Campus*

## DIVISION 0 - PROCUREMENT AND CONTRACTING REQUIREMENTS

### GENERAL

The Bidding Requirements consist of the following information:

1. Invitation to Bidders
2. Project Manual Cover/Table of Contents
3. Instructions to Bidders
4. Bid Form/Non-Collusion Affidavit and Certification
5. Special Conditions

The Contract Forms consist of the following documents:

1. AU Contract
2. AIA Document A101 – Standard Form of Agreement Between Owner and Contractor as amended by AU (Stipulated Sum)
3. The Conditions of the Contract consist of the following documents:
  - a. AIA Document A201 – General Conditions of the Contract for Construction as amended by AU
4. Bid Bond, Performance and Payment Bonds as required by the Owner.

AIA documents are to be furnished by the Procurement & Contracts Department (PCD) . Current modifications and all other contractual documents are to be obtained from American University's PCD . Reference Section I, Consultants Guidelines for additional information.

### PROCUREMENT AND CONTRACTING REQUIREMENTS`

A complete and comprehensive understanding of the requirements of American University can be found at the PCD Procurement and Procedures Policy website:<http://www.american.edu/loader.cfm?csModule=security/getfile&pageid=3830738>

### PROJECT CLOSE-OUT

Close-out is hereby defined to include general requirements near the end of the Contract Performance, in preparation for final acceptance, final payment, and ultimately occupancy by the University and similar actions evidencing completion of the work. All requirements for close-out are outlined in the contract documents. Specific requirements for individual units of work are specified in Section I.

Project close-out includes submission to the University of the American University Check-list (see attachment). The Turnover Checklist will list the items from the Contract and Specifications and include those documents, specialty items and transmittals required for owner operational use. This Checklist does not replace other Contract or AIA requirements.

### GENERAL CAD REQUIREMENTS (00 65)

All Construction and Renovation Projects must include 'AS-BUILT' AUTO-CAD drawings as part of the Project compatible with the current AutoCAD Release used by American University. AS-BUILT AUTO-CAD Drawings will be furnished to the Project Office at the Close-Out phase of the project or within thirty (30) days of closeout..

— **END OF DIVISION 0** —

## DIVISION 1

### GENERAL REQUIREMENTS

- 01 33 00 Submittal Procedures
- 01 33 29 Sustainable Design Reporting
- 01 35 00 Special Procedures
- 01 35 43 Environmental Procedures
- 01 35 43.13 Environmental Procedures for Hazardous Materials
- 01 35 43.16 Environmental Procedures for Toxic Materials
- 01 35 46 Indoor Air Quality Procedures

Indoor air quality systems will be designed and constructed in compliance with LEED requirements, including ASHRAE 62.1 2007 standards, and in compliance with DC Building Code.

### 01 35 63 SUSTAINABILITY CERTIFICATION PROJECT REQUIREMENTS

New facilities will be designed with a minimum LEED rating of Gold. Existing facilities will establish LEED EB ratings based on the current condition and the extent of renovation.

### 01 35 66 SUSTAINABILITY CERTIFICATION PROJECT PROCEDURES

#### Documentation

This section is a SAMPLE of the American University Contract & Special Conditions for information only.

#### GENERAL

This document is a minimum standard. The Consultant's Standard Form of General Requirements can be used, provided the Consultant coordinates the document with American University's Special Conditions, and AU's procurement team.

#### SPECIAL CONDITIONS/CONSTRUCTION CONTRACTS

The following section is from the American University Contract & Special Conditions document. The Consultant and the Project Office must obtain a current edition of this document from AU's Procurement Officer.

#### SCOPE OF WORK

Briefly and clearly describe the project & work to be included.

#### THE CONTRACT DOCUMENTS

Includes all drawings, terms and conditions, and specifications to be issued to all bidders: List Drawing Numbers and Title, if applicable.

## EXCLUSIONS

All the work for the project except that designated as "Owner furnished" shall be awarded under a General Construction Contract.

## PROJECT EXPEDITER AND SUPERINTENDENTS

It shall be the responsibility of the Contractor to schedule the work of all subcontractors. The Contractor is also to maintain a progress schedule for all trades for this project. The Contractor must notify the Architect of any changes in the progress schedule. All major subcontractors shall have a full-time superintendent as well.

## PRE-CONSTRUCTION CONFERENCE

Prior to starting any work on the site, the Contractor, Owner and Architect shall conduct a pre-construction conference at a location, time and date to be determined including all project managers and representatives of major subcontractors.

## PRE-EXCAVATION PROCEDURE AND CONFERENCE:

- No excavation and/or subsurface investigation will be allowed by the Contractor until pre-excitation procedures have been agreed to by the Owner
- The layout of the trenches, excavations, soil borings, etc. will be the responsibility of the Contractor. (Utility surveys and locations of same will be the responsibility of the Owner.)

## TEMPORARY SERVICES (01 50 00)

The Contractor shall provide the following temporary services for all work of the project.

## TEMPORARY TOILETS (01 52 19)

Provide on the premises, where directed by the Project Office, suitable temporary toilets and enclosure for use of all workmen on the job. OR The Contractor may utilize the designated rest room located at a place to be determined. (If the Contractor fails to maintain this facility in a condition which is satisfactory to the Owner, the privilege of the use of this facility will be revoked.)

## TEMPORARY LIGHT AND POWER (01 51 13) & (01 51 26)

Electricity for light, power and construction purposes will be provided at a point designated by the Owner on the project site.

It will be the responsibility of the Contractor to run any lines necessary from the designated point for the execution of his work. (The Contractor will be charged the same rate that the University pays for electricity. The power available is 120/208, 3P, 200 amps. OR The Contractor may utilize existing power supplies within the work area provided that such use does not interfere with any building or laboratory functions.)

The Consultant shall specify that the Contractor provide and maintain his or her own electrical construction system for all needs during construction. Temporary service to facilities shall be provided by the Owner to a metered point of connection. The Contractor shall be responsible for final connection and payment for energy used.



#### TEMPORARY WATER (01 51 36)

Temporary water services as required for construction purposes will be provided by the Owner without charge at a point designated by the Owner. (It will be the responsibility of the Contractor to run any lines necessary.)

#### TEMPORARY TELEPHONE (01 51 33)

Arrangements for telephone shall be made by the Contractor with the local telephone company. OR the University Telecom Department if it is mutually beneficial. (The Contractor will pay the installation charges and will pay local and long distance charges.)

#### TEMPORARY OFFICE AND SHEDS (01 52 13)

The Contractor shall provide, where directed on the premises, such office facilities and temporary sheds as he may require for the work. (He shall maintain same and remove from the premises when directed.)

#### TEMPORARY HEAT (01 51 23)

Temporary heat as required for construction purposes shall be provided by the Contractor. (If steam is available from the University, the Contractor will pay for the steam at the same rate charged to University departments.)

#### SERVICE CONTINUITY

Utilities and services shall not be interrupted without the Owner's approval as to time and duration. (No utilities and services serving existing facilities shall be discontinued until the new service connections are installed unless temporary connections are installed to serve the existing facilities. Owner's representative must be present at all service interruptions.) All capital construction projects shall include arrangements for sub-metering and reporting all water, gas/steam, and electric usage.

#### PROTECTION

Temporary security and protection provisions required include, but are not limited to fire protection, barricades, warning signs/lights, building enclosure/ lockup, environmental protection, and similar provisions intended to minimize property losses, personal injuries and claims for damages at project site. Plant Material (01 45 26): Protect all trees, shrubs, lawns, and all landscape work from damage by providing guards and covering. Any damaged work shall be repaired or replaced at Contractor's expense. Water Protection (01 45 16): Protect excavation, trenches, building and existing buildings and site from damage from rain water, spring water, ground water, backing up of drains or sewers, and all other water. Provide all pumps and equipment and enclosures to provide this protection.

Open fire will not be permitted within the building enclosure or on the project site. For cutting and welding, the Contractor shall obtain a permit from American University's Risk Management Office. Hot Work shall be done through an approved Hot Work Program administered by the General contractor or all work will fall under the AU Hot Work Policy

#### INTERIM LIFE SAFETY MEASURES POLICY

American University will take every precaution to provide a safe environment for its employees, visitors and construction workers in all occupied areas during alteration or new construction to buildings and/or grounds. These measures shall pertain to all construction projects, whether by outside contractors or by AU personnel.

## Standards and Measures

1. Provide and maintain unobstructed egress for exits. Instruct personnel for evacuation in emergency situations.
2. Temporary enclosures must maintain the integrity of means of egress of the facility.
3. Wherever practical existing fire detection or suppression alarm systems may not be impaired. If compromising a fire detection or suppression system is unavoidable to complete work, the contractor shall propose an equivalent temporary system for protection.
4. The contractor will provide, install, and maintain temporary fire extinguishers throughout the work until the permanent system is in operation.
5. The contractor shall establish procedures to minimize storage of combustible and flammable materials on site. (Combustible trash shall be removed from the site daily.)
6. Within two weeks of starting work on site, the contractor's site representative will schedule a meeting with AU Construction Personnel for one hour of fire and life safety training.
7. Hazard surveillance of buildings, grounds and equipment is increased with special attention being given to excavations, construction areas, construction storage, and field offices. Zone Supervisors from Facilities Management (FM) will review the areas during their site visits in addition to regular Fire and Safety inspections.
8. Temporary partitions serving as fire rated partitions or smoke partitions shall be detailed and described in the contract documents.

## WASTE DISPOSAL

Collection/Disposal of Waste Materials: The Contractor is to establish and maintain a system for his personnel and the personnel of the subcontractors to collect and store waste materials until their removal from the site. (Storage facilities should be constructed in such a manner to prevent material from being blown across the site and/or to the adjacent grounds of American University. Removal of waste material from the site is to be on a weekly basis (minimum). Burning or burying material on site is not permitted. Dumpster locations must be approved by Facilities Management). The university requires that construction waste be recycled in accordance with a LEED certified waste management plan. Weights of all collected waste salvaged, reused, recycled, composted, or otherwise diverted, as well as the weights of waste sent to landfill must be tracked and reported to the Zero Waste Coordinator.

## CONTRACTOR STAGING

No parking for Contractor's or subcontractor's employees vehicles will be allowed on paved streets, sidewalks, grassed areas, or un-designated parking areas of American University. (All material storage and staging will be within the project area as shown in the drawings and is the responsibility of the Contractor.)

## REPORTING ACCIDENTS

The Contractor is required by the University to prepare and submit reports of accidents at the site within 24 hours of the event. (A significant accident is defined to include events where bodily injury is sustained, or property loss of substance is sustained.)

## SCHEDULING OF WORK

The Contractor shall confine his operations to those parts of the building in which the construction work is located. (The Contractor shall so organize his Work as to cause no interference with the normal activities of the University.)

## DELIVERY AND STORAGE OF MATERIALS

Materials and equipment must be taken into the staging area and cannot be stored on sidewalks, service drive or loading docks.

## INSPECTION PROCEDURES

Upon receipt of Contractor's request, Architect will either proceed with inspection or advise Contractor of prerequisites not fulfilled. Following initial inspection, Architect will either prepare certificate of substantial completion, or advise Contractor of work which must be performed prior to issuance of certificate; and repeat inspection when requested and assured that work has been substantially completed. Results of completed inspection in conjunction with the Facilities Management commissioning action list will form initial "punch-list" for final acceptance.

## RECORD DOCUMENT SUBMITTALS

### GENERAL

Specific requirements for record documents are indicated in individual sections of these specifications. Other requirements are indicated in "General Conditions". General submittal requirements are indicated in "Submittals" sections.

### Record Drawings

Maintain a white-print set (blue-line or black-line) of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on cover of each set.

### Record Specifications

Maintain one copy of specifications, including addenda, change orders and similar modifications issued in printed form during construction, and mark-up variations (of substance) in actual work in comparison with text of specifications and modifications as issued.

### Record Product Data

Maintain one copy of each product data submittal, and mark-up significant variations in actual work in comparison with submitted information. Include both variations in product as delivered to site, and variations from manufacturer's instructions and recommendations for installation.

### Maintenance Manuals

Organize maintenance and operating manual information into suitable sets of manageable size, and bind into individual binders properly identified and indexed (thumb-tabbed). Include emergency instructions, spare parts listing, and copies of warranties, wiring diagrams, recommended "turn-around" cycles, inspection procedures, shop drawings, product data, and similar applicable information. Mark identification on both front and spine of each binder. Each manual shall include a Table of Contents and will be tabbed accordingly. Compile specified warranties and bonds and review to verify compliance with contract.

## DOCUMENTS

Submit to Architect for his review and transmittal to the Owner.

## CLOSEOUT PROCEDURES

Follow the closeout procedures enumerated in the AIA Contract or the Contract for construction.

## FACILITY SECURITY

The Owner's foremost priority is the security of facility occupants. Therefore, the following policies and procedures shall be conformed to at all times:

All required facility access keys and/or cards shall be issued to the Contractor's Superintendent by the Project Office. Only the Contractor's Superintendent shall be allowed to sign out keys and/or cards. (The Contractor shall be responsible for the security of the loaned keys and/or cards during the loan term and shall be responsible to reimburse the Owner for all costs to revise the key and/or card system of the facilities if the Contractor fails to return the loaned keys and/or cards. If requested the Owner shall furnish the Contractor an estimated cost for such aforementioned measures.)

All Contractors and Subcontractor personnel shall display a picture identification badge at all times while on the Campus. The picture identification badge shall display the photograph, company name and person's name.

## PARKING PERMITS

Contractors are required to adhere to AU's parking policy. Permits to be purchased from Parking and Traffic Services, Letts Hall, Lower Level, American University 4400 Massachusetts Avenue, NW, Washington, DC 20016-8068.

## UNIVERSAL ACCESS

It is American University's intent to provide universal access, to the extent that is feasible, above and beyond minimum code requirements.

The following Handicapped Access guidelines are to be considered as a 'minimum' for American University public buildings and should be incorporated in the early design phase and project budget for any Construction/Renovation project.

- See DC Building Code for ADAAG Requirements
- It is recommended that the United States **FEaI** Accessibility Standards (UFAS Manual, available from the Government Printing Office) be used as a reference during the project design phase.
- Provision of both audible and visible alarms shall be required at all locations where either type is required—per CODE.
- Great emphasis shall be placed on providing tactile warnings at entrances to areas potentially hazardous to the visually impaired.
- Provide handicapped seating as required. Wherever possible, handicapped seating shall be located at both the front and rear of the room.
- Ramps steeper than 1:12 are not permitted without written approval of Risk Management.
- At changes in floor elevation, especially subtle changes, provide a readily visible change in color and/or pattern to alert visually impaired (but not blind) individuals to the potential trip hazard.
- Provide ramps at all cross-walks leading to (or from) an accessible area or route. Locate said ramps so as to provide the most direct route possible
- Construction of Interior ramps shall conform to construction requirements for sidewalks in regard to concrete thickness, base thickness, base compaction, etc.
- All curb ramps at streets must occur at marked cross- walks and each ramp must have corresponding ramp at the other side of the street. Refer to the Appendix.

- Edge protection may include rails that are designed so as to prevent wheelchair wheels from rolling off of the ramp edge.
- It is recommended that 36" doors be used. Provide lever type door handles.
- Provide power assisted door operators on all cross-corridor doors occurring in main corridors. If in compliance with applicable code, magnetic door "hold-opens" may be used in lieu of power assisted operators.
- All handicapped accessible toilet stalls shall be 60" x 60". Note that prior approval by Risk Management must be obtained to use other stall configurations on remodeling projects only and only where absolutely required by existing conditions.
- All handicapped accessible stalls shall have slide latch door hardware.
- Handicapped accessible tubs and showers shall be equipped with a standard wall-mounted nozzle and a hand-held shower sprayer with a 60" hose. Mount hand-held sprayer at 42" above the bottom of the tub or shower basin.
- All Toilet Rooms, except "private" rooms containing a single water closet, shall be equipped with Push-Pull door hardware. Latches are neither needed nor desired on the doors of multiple fixture Toilet Rooms.
- Avoid the use of vestibules with inner and outer doors as access to handicapped equipped toilet rooms. Use vision screens, turns or other methods approved by Facilities Management.
- Grab bar fastening system shall be of a concealed type.

01 61 00 Common Product Requirements

01 74 00 Cleaning and Waste Management

01 74 19 Construction Waste Management and Disposal

For new construction, contractors must comply with MR2 Section 017419 "Construction Waste Management and Disposal – NEW CONSTRUCTION." For existing buildings, facility alteration and addition projects, contractors must comply with Section 017419 "Construction Waste Management and Disposal – Existing Buildings – Facility Alterations & Addition Projects." This segment aligns with LEED EBOM "MRc9 SWM, Facility Alterations LEED VOLUME EBOM Prototype."

01 74 19 Construction Waste Management and Disposal – NEW CONSTRUCTION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - a. Salvaging nonhazardous demolition and construction waste.
  - b. Recycling nonhazardous demolition and construction waste.
  - c. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:

- a. Section 024119 "Selective Structure Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
- b. Section 044313.13 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
- c. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

### 1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

### 1.4 PERFORMANCE REQUIREMENTS

#### A. General:

Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

#### B. Demolition Waste:

- a. Asphalt paving
- b. Concrete.
- c. Concrete reinforcing steel.
- d. Brick.
- e. Concrete masonry units.
- f. Wood studs.
- g. Wood joists.
- h. Plywood and oriented strand board.
- i. Wood paneling.
- j. Wood trim.
- k. Structural and miscellaneous steel.
- l. Rough hardware.
- m. Roofing.
- n. Insulation.
- o. Doors and frames.

- p. Door hardware.
- q. Windows.
- r. Glazing.
- s. Metal studs.
- t. Gypsum board.
- u. Acoustical tile and panels.
- v. Carpet.
- w. Carpet pad.
- x. Demountable partitions.
- y. Equipment.
- z. Cabinets.
- aa. Plumbing fixtures.
- bb. Piping.
- cc. Supports and hangers.
- dd. Valves.
- ee. Sprinklers.
- ff. Mechanical equipment.
- gg. Refrigerants.
- hh. Electrical conduit.
- ii. Copper wiring.
- jj. Lighting fixtures.
- kk. Lamps.
- ll. Ballasts.
- mm. Electrical devices.
- nn. Switchgear and panelboards.
- oo. Transformers.

C. Construction Waste:

- a. Masonry and CMU.
- b. Lumber.
- c. Wood sheet materials.
- d. Wood trim.
- e. Metals.
- f. Roofing.
- g. Insulation.
- h. Carpet and pad.
- i. Gypsum board.
- j. Piping.
- k. Electrical conduit.

D. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

- a. Paper.
- b. Cardboard.
- c. Boxes.
- d. Plastic sheet and film.
- e. Polystyrene packaging.
- f. Wood crates.

- g. Plastic pails.

#### 1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:
  - a. Material category.
  - b. Generation point of waste.
  - c. Total quantity of waste in tons.
  - d. Quantity of waste salvaged, both estimated and actual in tons.
  - e. Quantity of waste recycled, both estimated and actual in tons.
  - f. Total quantity of waste recovered (salvaged plus recycled) in tons.
  - g. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. LEED Submittal: LEED letter template for Credit MR 2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
- H. Qualification Data: For waste management coordinator.
- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

#### 1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-



Accredited Professional, certified by the USGBC, as waste management coordinator. Waste management coordinator may also serve as LEED coordinator.

- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
  - a. Review and discuss waste management plan including responsibilities of waste management coordinator.
  - b. Review requirements for documenting quantities of each type of waste and its disposition.
  - c. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  - d. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  - e. Review waste management requirements for each trade.

#### 1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis.
- B. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan, preferably weights rather than volume.
- C. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.
- D. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - a. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  - b. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - c. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - d. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - e. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - f. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

- E. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:
  - a. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
  - b. Total cost of disposal (with no waste management).
  - c. Revenue from salvaged materials.
  - d. Revenue from recycled materials.
  - e. Handling and transportation costs. Include cost of collection containers for each type of waste.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  - a. Comply with operation, termination, and removal requirements in the "Temporary Facilities and Controls" Section.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
  - a. Distribute waste management plan to everyone concerned within three days of submittal return.
  - b. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - a. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  - b. Comply with the "Temporary Facilities and Controls" Section for controlling dust and dirt, environmental protection, and noise control.
- E. Waste Management in Historic Zones or Areas: Hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches or more.

### 3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
  - a. Clean salvaged items.
  - b. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - c. Store items in a secure area until installation.
  - d. Protect items from damage during transport and storage.
  - e. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Permitted on Project site.
- C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
  - a. Clean salvaged items.
  - b. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - c. Store items in a secure area until delivery to Owner.
  - d. Transport items to Owner's storage area designated by Owner.
  - e. Protect items from damage during transport and storage.
- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- F. Plumbing Fixtures: Separate by type and size.
- G. Lighting Fixtures: Separate lamps by type and protect from breakage.
- H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

### 3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

- a. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
- b. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- c. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
- d. Store components off the ground and protect from the weather.
- e. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

### 3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.
  - a. Crush asphaltic concrete paving and screen to comply with requirements in Section 312000 "Earth Moving" for use as general fill.
- B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
  - a. Pulverize concrete to maximum 1-1/2-inch size.
  - b. Crush concrete and screen to comply with requirements in Section 312000 "Earth Moving" for use as satisfactory soil for fill or subbase.
- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
  - a. Pulverize masonry to maximum 1-inch size.
  - b. Crush masonry and screen to comply with requirements in Section 312000 "Earth Moving" for use as satisfactory soil for fill or subbase.
  - c. Crush masonry and screen to comply with requirements in Section 329300 "Plants" for use as mineral mulch.
  - d. Clean and stack undamaged, whole masonry units on wood pallets.
- E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- F. Metals: Separate metals by type.
  - a. Structural Steel: Stack members according to size, type of member, and length.
  - b. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
- I. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

- J. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- K. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- L. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
  - a. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
  - b. Carpet Tile: Remove debris, trash, and adhesive. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- N. Conduit: Reduce conduit to straight lengths and store by type and size.

### 3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - a. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - b. Polystyrene Packaging: Separate and bag materials.
  - c. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - d. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
  - a. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - b. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
  - c. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
  - a. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
  - b. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

### 3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

- a. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - b. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
  - C. Burning: Burning of waste materials is not permitted per DCMR Chapter 20 and IFC 3304.2.
  - D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
  - E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.7 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-2 for demolition waste identification.
- C. Form CWM-3 for construction waste reduction work plan.
- D. Form CWM-4 for demolition waste reduction work plan.
- E. Form CWM-7 for construction waste
- F. Form CWM-8 for demolition waste.

01 74 19 Construction Waste Management and Disposal – EXISTING BUILDINGS – FACILITY ALTERATIONS & ADDITION PROJECTS

For new construction, contractors must comply with MR2 Section 017419 “Construction Waste Management and Disposal – NEW CONSTRUCTION.” For existing buildings, facility alteration and addition projects, contractors must comply with “MRc9 SWM, Facility Alterations LEED VOLUME EBOM Prototype” in construction waste management outlined below.

**Technical Documentation**

MRc9 addresses buildings with facility alteration and addition projects during the performance period and includes projects completed by general contractors (GCs), AU Capital Renewal and Deferred Maintenance (CRDM), and/or AU Office of the University Architect (PPM).

AU documents conformance with MRc9 on a building level. Construction waste resulting from facility alterations or additions is tracked when projects meet the following definition of a “facility alteration or addition” for changes that affect usable spaces in the building:

<b>MAXIMUM QUALIFICATION FOR AN ALTERATION OR ADDITION</b> <i>Anything more shall be tracked for the LEED Design and Construction rating system.</i>	<b>MINIMUM QUALIFICATION FOR AN ALTERATION OR ADDITION</b> <i>Anything less is considered a minor repair and is not substantial enough for this credit.</i>
The project may not encompass more than 50% of the original floor area, or increase the floor area by more than 50%	Alterations must involve more than one trade specialty.
The project may not relocate more than 50% of existing occupants during construction.	Alterations must occur in at least one room, isolating it from the existing building during alteration.
	Additions must increase the floor area by at least 5%
	Mechanical, electrical, or plumbing system upgrades that involve no disruption to usable space are excluded.

For applicable projects, these requirements are written into the General Contractor contract by the AU Project Manager overseeing the alteration: divert at least 70% of facility alteration and addition waste (see table below for qualifying items), track all waste, and provide receipts verifying the weights diverted. For projects implemented by AU employees, CRDM staff strives to divert at least 70% of facility alteration and addition waste and provides a tracking log of all materials disposed of as well as receipts verifying the weights diverted. Project Managers assigned to projects will track weights and tickets verifying the construction waste recycled or reused and will submit data to the Zero Waste Coordinator for documentation and quality control.

WASTE THAT MUST BE TRACKED FOR FACILITY ALTERATIONS AND ADDITIONS	ITEMS EXCLUDED FROM FACILITY ALTERATION & ADDITION TRACKING
Structural building components such as wall studs, insulation, doors, and windows	Hazardous waste, such as materials contaminated with asbestos
Materials with attached finishes, such as panels, drywall, trim, ceiling panels, carpet, and flooring.	Mechanical, electrical, plumbing, or equipment waste
	Furniture (see MRc8)
	Landscaping debris (see SSc3)

Requirements for GCs include the following language related to waste management:

“The contractor shall submit a Construction Waste Management Plan to the University Representative for review and approval. This plan shall outline strategies for construction waste, demolition waste, disposal, and recycling.

Comply with LEED EB: O&M 2009 MRc9 Solid Waste Management – Facility Alterations and Additions by diverting at least 70% of waste (by weight) generated by facility alterations and additions from disposal to landfills and incineration facilities. This applies only to base building elements permanently or semi-permanently attached to the building itself that enter the waste stream during facility renovations, demolitions, refits, and new construction additions. Base building elements include, at minimum, building components and structures (wall studs, insulation, doors, windows), panels, attached finishings (drywall, trim, ceiling panels), carpet and other flooring materials, adhesives, sealants, paints, and coatings.

Submit a final waste report signed by the GC that includes a list of materials, total quantity of waste in volume and tonnage, and amount and method of diversion from landfill and incineration.”

### Quality Control Process

Bid documents will require GCs to state their experience with diverting, and tracking, construction waste. The ability of a GC to divert construction waste is among the criteria considered when bidding a project, including demonstrating ability to divert at least 70% of project waste. The receipts, invoices, or certificates verifying the weights diverted from landfill are sent to the Zero Waste Coordinator for documentation and tracking.

In order to verify that items have been diverted, CRDM and Facilities Management Staff retain receipts of all items disposed or diverted and enter the actual weights (or volumes) of each item.

Collection and diversion strategies will be determined for each project. For example, general contractors for small projects may be instructed to collect and dispose debris in AU construction waste receptacles. For larger projects, contractors may be instructed to utilize separate receptacles provided at the construction site. Regardless, alteration and addition solid waste diversion rates for buildings will be tracked by project building.

The Zero Waste Coordinator verifies that:

- The information is building-specific and includes facility alteration and addition waste from the specific building and associated grounds.

- The project building had a qualifying facility alteration or addition during the performance period. Buildings not undergoing facility alteration or addition projects during the project period are not eligible for MRc9.
- No furniture, fixtures, and equipment (FF+E - movable furniture, fixtures or other equipment that have no permanent connection to the structure of a building or utilities), specialty items, or mechanical, electrical, and plumbing components have been included. Furniture and electronics should be tracked in MRc8.
- A program is in place to ensure that facility alteration and addition waste is not leaving the project building or associated grounds in uncontrolled or unmonitored channels of the waste stream. Recycling Associates are trained to visually observe any construction waste that may have been disposed in compactors or open dumpers.

Ongoing verification and tracking will take place for this credit after the initial certification as part of AU's Zero Waste Plan and efforts to send zero waste to landfill or incineration.

### **Education Process**

Project Managers within the Office of the University Architect, Facilities Management, and CRDM are trained on the general contractor requirements for solid waste management of facility alteration and addition waste and follow the standardized contracting procedures. The annual training will be completed by the head of each unit.

All individuals involved in documentation and quality control are trained on the credit requirements, common errors, useful tips, and available resources. Training topics include, for example:

- Training on items to be tracked as only base building elements permanently or semi permanently attached to the building should be including and furniture, fixtures, and equipment (FF+E) are excluded from this credit. Mechanical, electrical, and plumbing components and specialty items such as elevators are excluded, as well.
- Detailed information on performance period requirements and that all facility alteration and addition projects must occur within the performance period to comply.
- Building-level tracking steps to ensure that all facility alteration and addition waste occurring within a project building and associated grounds

### **Audit Documentation**

In the case of an audit, the following will be provided for each building:

- "MRc9: Facility Alterations and Additions - Waste Management Tracking Sheet" (attached)
- Scanned copies of all receipts indicating the percentage of waste that was diverted and via what method (recycling, salvage, etc.) (sample attached)

01 78 00	Closeout Submittals
01 78 53	Sustainable Design Closeout Documentation
01 80 00	Performance Requirements
01 81 00	Facility Performance Requirements
01 81 13.13	Sustainable Design Requirements -

LEED FOR CONSTRUCTION AND RENOVATIONS

PART 1 - GENERAL



## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED Gold certification based on USGBC's "LEED 2009 for New Construction & Major Renovations."
  - a. Other LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
  - b. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
  - c. A copy of the LEED Project checklist is attached at the end of this Section for information only.
  - d. Specific requirements for LEED are included in greater detail in other Sections.

## 1.3 DEFINITIONS

- A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- B. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- C. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
- D. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
  - a. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

## 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Respond to questions and requests from Architect and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or

that depend on Contractor's procedures until the USGBC has made its determination on the project's LEED certification application. Document responses as informational submittals.

## 1.5 ACTION SUBMITTALS

- A. General: Submit additional LEED submittals required by other Specification Sections.
- B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
- C. LEED Documentation Submittals:
  - a. Credit EA 5: Product data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy-consumption performance over a period of time of not less than one year of post-construction occupancy.
  - b. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal."
  - c. Credit MR 4: Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating cost for each product having recycled content.
  - d. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - e. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
  - f. Credit EQ 3.1:
    - i. Construction indoor-air-quality management plan.
    - ii. Product data for temporary filtration media.
    - iii. Product data for filtration media used during occupancy.
    - iv. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
  - g. Credit IEQ 3.2:
    - i. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
    - ii. Product data for filtration media used during flush-out and during occupancy.
    - iii. Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
  - h. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
  - i. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
  - j. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For LEED coordinator.
- B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
  - a. Furniture.
  - b. Plumbing.
  - c. Mechanical.
  - d. Electrical.
  - e. Specialty items such as elevators and equipment.
  - f. Wood-based construction materials.
- C. LEED Action Plans: Provide preliminary submittals within seven days of date established for commencement of the Work indicating how the following requirements will be met:
  - a. Credit MR 2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
  - b. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
  - c. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
  - d. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
  - e. Credit IEQ 3.1: Construction indoor-air-quality management plan.
- D. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
  - a. Credit MR 2: Waste reduction progress reports complying with Section 017419 "Construction Waste Management and Disposal."
  - b. Credit MR 4: Recycled content.
  - c. Credit MR 5: Regional materials.
  - d. Credit MR 7: Certified wood products.

## 1.7 QUALITY ASSURANCE

- A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.

- B. Products with lifecycle assessments or environmental product declarations are preferred when available.
- C. Products from manufacturers using green power are preferred when available.

## 2.2 RECYCLED CONTENT OF MATERIALS

- A. Credit MR 4: Building materials shall have recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content for Project constitutes a minimum of 20 percent of cost of materials used for Project.
  - a. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
  - b. Do not include plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation.

## 2.3 REGIONAL MATERIALS

- A. Credit MR 5: Not less than 20 percent of building materials (by cost) shall be regional materials.

## 2.4 CERTIFIED WOOD

- A. Credit MR 7: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
  - a. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
    - i. Rough carpentry.
    - ii. Miscellaneous carpentry.
    - iii. Finish carpentry.
    - iv. Architectural woodwork.
    - v. Wood paneling.
    - vi. Wood cabinets.

## 2.5 LOW-EMITTING MATERIALS

- A. Credit IEQ 4.1: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - a. Wood Glues: 30 g/L.
  - b. Metal-to-Metal Adhesives: 30 g/L.
  - c. Adhesives for Porous Materials (Except Wood): 50 g/L.
  - d. Subfloor Adhesives: 50 g/L.
  - e. Plastic Foam Adhesives: 50 g/L.
  - f. Carpet Adhesives: 50 g/L.
  - g. Carpet Pad Adhesives: 50 g/L.
  - h. VCT and Asphalt Tile Adhesives: 50 g/L.
  - i. Cove Base Adhesives: 50 g/L.
  - j. Gypsum Board and Panel Adhesives: 50 g/L.

- k. Rubber Floor Adhesives: 60 g/L.
  - l. Ceramic Tile Adhesives: 65 g/L.
  - m. Multipurpose Construction Adhesives: 70 g/L.
  - n. Fiberglass Adhesives: 80 g/L.
  - o. Contact Adhesive: 80 g/L.
  - p. Structural Glazing Adhesives: 100 g/L.
  - q. Wood Flooring Adhesive: 100 g/L.
  - r. Structural Wood Member Adhesive: 140 g/L.
  - s. Single-Ply Roof Membrane Adhesive: 250 g/L.
  - t. Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine-covered board, metal, unsupported vinyl, rubber, or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
  - u. Top and Trim Adhesive: 250 g/L.
  - v. Plastic Cement Welding Compounds: 250 g/L.
  - w. ABS Welding Compounds: 325 g/L.
  - x. CPVC Welding Compounds: 490 g/L.
  - y. PVC Welding Compounds: 510 g/L.
  - z. Adhesive Primer for Plastic: 550 g/L.
  - aa. Sheet-Applied Rubber Lining Adhesive: 850 g/L.
  - bb. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
  - cc. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
  - dd. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
  - ee. Other Adhesives: 250 g/L.
  - ff. Architectural Sealants: 250 g/L.
  - gg. Nonmembrane Roof Sealants: 300 g/L.
  - hh. Single-Ply Roof Membrane Sealants: 450 g/L.
  - ii. Other Sealants: 420 g/L.
  - jj. Sealant Primers for Nonporous Substrates: 250 g/L.
  - kk. Sealant Primers for Porous Substrates: 775 g/L.
  - ll. Modified Bituminous Sealant Primers: 500 g/L.
  - mm. Other Sealant Primers: 750 g/L.
- B. Credit IEQ 4.2: For field applications that are inside the weatherproofing system, paints and coatings shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
- a. Flat Paints and Coatings: VOC not more than 50 g/L.
  - b. Nonflat Paints and Coatings: VOC not more than 150 g/L.
  - c. Dry-Fog Coatings: VOC not more than 400 g/L.
  - d. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
  - e. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
  - f. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
  - g. Pretreatment Wash Primers: VOC not more than 420 g/L.
  - h. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
  - i. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
  - j. Floor Coatings: VOC not more than 100 g/L.
  - k. Shellacs, Clear: VOC not more than 730 g/L.
  - l. Shellacs, Pigmented: VOC not more than 550 g/L.
  - m. Stains: VOC not more than 250 g/L.

- C. Credit IEQ 4.4: Composite wood, agrifiber products, and adhesives shall not contain urea-formaldehyde resin.

## PART 3 - EXECUTION

### 3.1 REFRIGERANT REMOVAL

- A. Prerequisite EA 3: Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in HVAC Sections.
- B. Credit EA 4: Remove clean-agent fire-extinguishing agents that contain HCFCs or halons and replace with agent that does not contain HCFCs or halons. See Section 212200 "Clean-Agent Fire-Extinguishing Systems" for additional requirements.

### 3.2 CONSTRUCTION WASTE MANAGEMENT

- A. Credit MR 2: Comply with Section 017419 "Construction Waste Management and Disposal.

### 3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

- A. Credit IEQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
  - a. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 015000 "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
  - b. Replace all air filters immediately prior to occupancy.
- B. Credit IEQ 3.2: Comply with one of the following requirements:
  - a. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.
  - b. Air-Quality Testing:
    - i. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "Green Building Design and Construction Reference Guide."
    - ii. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
      1. Formaldehyde: 27 ppb.
      2. Particulates (PM10): 50 micrograms/cu. m.
      3. Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
      4. 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.

5. Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
- iii. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from same locations as in the first test.
- c. Air-sample testing shall be conducted as follows:
    - i. All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
    - ii. Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
    - iii. Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
    - iv. Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

## **01 91 13 – GENERAL COMMISSIONING REQUIREMENTS**

### **PART 1 – GENERAL**

Commissioning is defined as a systematic process of assuring by verification and documentation that all building facility systems perform interactively in accordance with the design documentation and intent, and in accordance with the owner's operational needs, including preparation of operations personnel.

This Owner's commissioning specification is to be incorporated into design and construction specifications as part of the title section listed above, General Commissioning Requirements (01 91). The AU Facilities Management Commissioning (Cx) Team is to be included starting at the project initiation (PIP) phase through project closeout.

The incorporation of this specification into the design and construction specification must be approved by the AU Commissioning Authority no later than the fifty-percent (50%) submission (Design Phase). Items to be modified will be decided by consultation involving the AU Project Manager, the Consultant, and FM. This Commissioning Specification is intended to cover the greatest extent of commissioning performed at American University (i.e. Capital Projects); thus, Facilities Management recognizes that the commissioning requirements of this specification will depend on the size and scope of the project.

### **SUMMARY**

- A. This Section includes information on the following:

1. The commissioning plan
2. Commissioning coordination meetings and scheduling
3. Submittal reviews
4. Trend Logs
5. Test plans
6. Prefunctional checklists
7. Functional performance testing
8. Documentation of equipment and system deficiencies
9. Corrective actions and acceptance of corrected equipment systems
10. Operations and maintenance manuals review
11. Equipment and systems operations and maintenance training
12. Occupant training execution
13. Warranty information collection and hand-off
14. As-built documentation review
15. Systems manual and on-going commissioning plan
16. Warranty phase check-up and meeting

B. Scope of work

1. Commissioning requirements common to all sections
2. Systems and equipment start-up, pre-functional checks, and functional performance testing.
3. Validation of proper and thorough installation of systems and equipment
4. Documentation of procedures, tests, and installations
5. Coordination and requirements of training events
6. Preparation and logistics of *Facility Manual* content
7. Management of Record Construction Documentation
8. Sequencing

1.1 COMMISSIONING PLAN

- A. The American University Master Commissioning Plan, Revision 1.1, dated March 05, 2012—herein referred to as “MCP”—shall be incorporated into construction specifications explicitly and by reference.
- B. The MCP is intended to be a roadmap for the parties involved in the Commissioning process. It lists the systems to be commissioned, the Commissioning process activities, and the roles and responsibilities for each party involved.

1.2 COMMISSIONING TEAM

For each member of the Commissioning Team include

- i. Name
- ii. Company name
- iii. Title
- iv. Years of experience
- v. Office phone number
- vi. Cell phone number
- vii. Fax number
- viii. E-mail address.

A.Owner: American University

B.Commissioning Authority: Director of Energy and Engineering, Facilities Management

C.AU Commissioning Coordinator:



D.Architect:

E. Design Engineer:

F. Build Contractor:

G. Mechanical Contractor:

H.Electrical Contractor:

I. LEED Facilitator:

J. Commissioning Professional:

K.Commissioning Coordination Supervisor:

The Contractor shall assign a person with five (5) years of experience with the coordination of disciplines of construction.

The coordinator's responsibilities include:

- i. Communication with Owner's Commissioning Professional
- ii. Commissioning coordination meeting attendance
- iii. Planning
- iv. Scheduling
- v. Enforcement of subcontractors' specification requirements
- vi. Subcontractors' quality assurance
- vii. Documentation
- viii. Direction of subcontractors' corrective actions

L. Contractors' Representative:

Each of the subcontractors shall assign a person responsible for communications with the Contractor's Commissioning Coordination Supervisor. Responsibilities include:

- i. Communication with Commissioning Coordinator Supervision
- ii. Commissioning coordination meeting attendance
- iii. Planning
- iv. Scheduling
- v. Operations and Maintenance training manuals
- vi. Complete prefunctional checklists
- vii. Review of final functional performance test procedures
- viii. Functional performance test participation
- ix. Corrective actions

### 1.3 SYSTEMS TO BE COMMISSIONED

A. Systems to be commissioned shall be categorized and listed here as follows

- i. Mechanical systems
- ii. Life safety systems
- iii. Electrical systems
- iv. Security systems

- v. Building envelope
- vi. Specialty systems

#### 1.4 COMMISSIONING PROCESS MATRIX

The following matrix tabulates the major commissioning activities, when they occur during the project life cycle, and the commissioning team member roles and responsibilities for each activity. For additional detail, please refer to Section 1.6: Commissioning Activities Narratives.

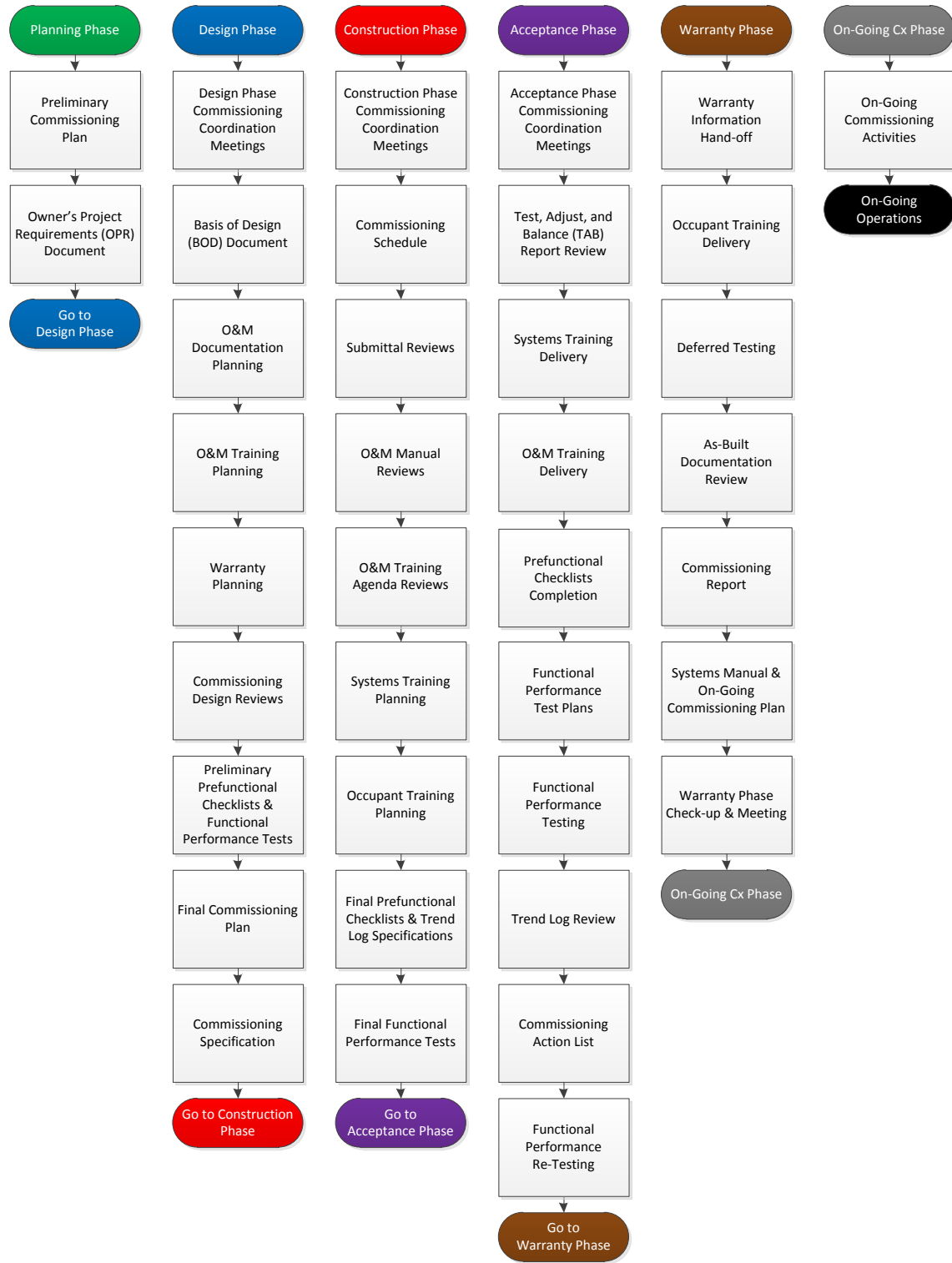
In the Commissioning Team Member columns an “R” indicates the responsible team member for each activity, and a “√” indicates a team member who needs to participate in the activity.

	PROJECT PHASES					COMMISSIONING TEAM MEMBERS						
	Planning	Design	Construction	Acceptance	Warranty	AU Project Manager	AU Construction Mgr	AU Facilities Cx Authority	Other AU Departments	Design Team	Construction Team	Cx Manager
Preliminary Commissioning Plan	√							R				
Owner’s Project Requirements (OPR) Document	√	√	√			√		R	√			√
Design Phase Commissioning Coordination Meetings		√				√	√	√		√		R
Basis of Design (BOD) Document		√				√		√	√	R		√
O&M Documentation Planning		√						R				√
O&M Training Planning		√						R				√
Warranty Planning		√				√		R				√
Commissioning Design Reviews		√				√	√	√	√	√		R
Preliminary Prefunctional Checklists & Functional Performance Tests		√						√				R
Final Commissioning Plan		√				√	√	√		√		R
Commissioning Specification		√						√		√		R
Construction Phase Commissioning Coordination Meetings			√				√	√			√	R

	PROJECT PHASES					COMMISSIONING TEAM MEMBERS						
	Planning	Design	Construction	Acceptance	Warranty	AU Project Manager	AU Construction Mgr	AU Facilities Cx Authority	Other AU Departments	Design Team	Construction Team	Cx Manager
Commissioning Schedule			✓				✓	✓			<b>R</b>	✓
Submittal Reviews			✓					✓		✓	✓	<b>R</b>
O&M Manual Reviews			✓					✓			✓	<b>R</b>
O&M Training Agenda Reviews			✓					✓			✓	<b>R</b>
Systems Training Planning		✓						✓		✓	✓	<b>R</b>
Occupant Training Planning		✓						✓	✓			<b>R</b>
Final Prefunctional Checklists & Trend Log Specifications			✓					✓			✓	<b>R</b>
Final Functional Performance Tests			✓					✓			✓	<b>R</b>
Acceptance Phase Commissioning Coordination Meetings				✓			✓	✓			✓	<b>R</b>
Test, Adjust, and Balance (TAB) Report Review				✓				✓		✓	✓	<b>R</b>
Systems Training Delivery		✓						✓		✓	✓	<b>R</b>
O&M Training Delivery				✓				✓			<b>R</b>	✓
Prefunctional Checklist Completion				✓							<b>R</b>	✓
Functional Performance Test Plans				✓				✓			✓	<b>R</b>
Functional Performance Testing				✓				✓			✓	<b>R</b>
Trend Log Review				✓				✓			✓	<b>R</b>
Commissioning Action List		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	<b>R</b>
Functional Performance Re-Testing				✓				✓			✓	<b>R</b>

	PROJECT PHASES					COMMISSIONING TEAM MEMBERS						
	Planning	Design	Construction	Acceptance	Warranty	AU Project Manager	AU Construction Mgr	AU Facilities Cx Authority	Other AU Departments	Design Team	Construction Team	Cx Manager
Warranty Information Hand-off					✓		<b>R</b>	✓			✓	✓
Occupant Training Delivery				✓			✓	✓	✓			<b>R</b>
Deferred Testing					✓			✓			✓	<b>R</b>
As Built Documentation Review					✓		✓	✓		✓	✓	<b>R</b>
Commissioning Report					✓			✓				<b>R</b>
Systems Manual & On-Going Cx Plan					✓			✓		✓	✓	<b>R</b>
Warranty Phase Check-up & Meeting					✓	✓	✓	✓	✓	✓	✓	<b>R</b>
On-Going Commissioning Activities								<b>R</b>				

# COMMISSIONING PROCESS FLOWCHART



## 1.6 COMMISSIONING ACTIVITIES NARRATIVES

### 1.6.1 PLANNING PHASE ACTIVITIES

#### **Preliminary Commissioning Plan**

The Preliminary Commissioning Plan will focus on identifying project-specific commissioning activities, commissioning team members, and roles and responsibilities for all team members as part of the commissioning process. The Preliminary Commissioning Plan will be prepared by the Facilities Management Commissioning Authority and will be incorporated into requests for proposal for Design Team and Commissioning Manager services.

Example pre-functional checklists (PFCs) and functional performance test procedures (FPTs) will be included in the Preliminary Commissioning Plan as appendices to demonstrate level of rigor required of future commissioning team members.

#### **Owner's Project Requirements (OPR) Document**

The Owner's Project Requirements (OPR) will quantitatively define the performance and operational requirements for the commissioned systems. These performance requirements will be the acceptance criteria against which the systems will be judged. They will include parameters such as temperatures, flows, pressures, moisture content, light fixture types, light levels, warranty information requirements, central system availability/tie-in capability, electrical spare capacity requirements, building automation system requirements, etc.

For LEED certification purposes, the OPR must include the following sections:

- Owner and User Requirements
- Environmental and Sustainability Goals
- Energy Efficiency Goals
- Indoor Environmental Quality Requirements
- Equipment and System Expectations
- Building Occupant and Operations and Maintenance Requirements

The Facilities Management Commissioning Authority will oversee the development of the OPR, but critical input will be needed from the Project Manager, Occupant/User Groups, and the Design.

The Commissioning Manager will maintain the OPR throughout the duration of the project, editing as necessary to reflect American University performance expectation changes.

### 1.6.2 DESIGN PHASE ACTIVITIES

#### **Design Phase Commissioning Coordination Meetings**

The Commissioning Manager will plan, facilitate and document Design Phase Commissioning Coordination Meetings. The coordination meetings are intended to help every team member understand and execute their roles and responsibilities within the commissioning process, to coordinate the details of current and upcoming commissioning activities, and to review outstanding action items.

The first meeting will be a Design Phase Commissioning Kickoff Meeting to review the specifics of the Commissioning process, identify representatives to the Commissioning Team, and establish communication and documentation protocols for implementing the Commissioning process as effectively and efficiently as possible. This meeting provides an overview so that the team understands the big picture and the benefits they will accrue by participating in the process.

Subsequent Commissioning Coordination Meetings will be held as frequently as deemed necessary

by the Commissioning Manager to remain integrated into the Design Phase process and to coordinate Commissioning deliverables into the bid documents.

The Commissioning Manager will assist with the development of the project specific Owner Program Requirements (OPR) by engaging with the Design Team and AU. The Commissioning Manager will identify for owner pre-review any variances with the existing AU Temperature Control Policy and accepted Building Master Plan sequences and strategies for exception approval by the Design Team and Facilities Management prior to developing the Basis of Design document.

### **Basis of Design (BOD) Document**

The Basis of Design (BOD) documents the Design Team's approach to achieving the requirements of the OPR. It describes the types of equipment to be used, system configurations, systems interactions, and general operating strategies. It also documents any general rules, philosophies, and assumptions made by the Design Team. This document will be created and managed by the Design Team and reviewed by the Facilities Management Commissioning Authority and the Commissioning Manager.

Throughout the life of the project, the Commissioning Manager will monitor the design Evolution and bring any deviations from the BOD to the attention to the Design Team. If changes to the system design and operational strategies are made during the project, a final BOD will be prepared by the Design Team at the end of construction.

### **Operations & Maintenance (O&M) Documentation Planning**

In the Construction Phase, the Contractor will facilitate and manage the delivery of accurate, meaningful, and timely operation and maintenance (O&M) documentation to the Facilities Management Commissioning Authority. Planning for this will take place in the Design Phase in order to incorporate project-customized requirements into the contract documents.

The Commissioning Manager will participate in the discussion and definition of requirements for O&M documentation (e.g., hardcopy & electronic copy requirements, equipment O&M criteria, planned maintenance schedules, systems manual and on-going commissioning criteria, etc.) with the Facilities Management Commissioning Authority. The Commissioning Manager will coordinate with the Design Team to confirm that project specifications reflect American University's O&M documentation requirements.

### **System Training Planning**

Whereas the O&M Training sessions will pertain to individual pieces of equipment, the Systems Training sessions will focus on how those components are uniquely put together as systems for the project. The Commissioning Manager will facilitate the development of a Systems Training program. The purpose of this training will be to present all of the commissioned systems; their design intent; schematic diagrams; sequences of operation; integration with other systems; and areas of the building served by the systems.

Although facilitated by the Commissioning Manager, Systems Training will be a collaborative effort between the Design Team, the Contractors, and the Commissioning Manager; each delivering their area of expertise for each system.

Systems training planning will require defining the type and level of training required for the systems; number of sessions; video recording expectations; training agenda; and presentation/documentation materials. The Commissioning Manager will compile Systems Training presentation materials from documents submitted by the Design Team and the Construction Team.

## **Operations & Maintenance (O&M) Training Planning**

To achieve successful operations & Maintenance (O&M) training delivery, the Facilities Management Commissioning Authority needs to start with a well-thought-out, un-hurried process for planning the training process. The Commissioning Manager will involve the Facilities Management Commissioning Authority as much as possible to define what training the Facilities Management staff needs and wants in order to understand the systems and equipment that they will have to operate. This will involve customizing training to match the level of experience and detail that AU Facilities Management will require for each system.

The Commissioning Manager will participate in the discussion and definition of requirements for O&M training (e.g., differentiating between systems and equipment training; addressing levels of training; O&M shift coordination; video recording expectations; training agenda and documentation requirements, etc.) with the Facilities Management Commissioning Authority.

The outcome of the training planning process will be an O&M Training Plan matrix to be included in the bid documents. The Commissioning Manager will coordinate with the Design Team to confirm that project specifications reflect American University's O&M training requirements. Refer to Section 7 of the MCP for a Training Plan example.

## **Occupant Training Planning**

With an understanding that some building systems require certain behaviors from building occupants and system users in order to perform as intended, the Commissioning Manager will facilitate the development of an Occupant Training program. The Occupant Training program will introduce, in appropriately technical terms for the occupants, the systems impacting the occupied spaces. The training will also present the various ways in which the occupants may be able to influence system performance (i.e., opening doors and windows, adjusting thermostats, introducing space heaters, moving furniture, overriding occupancy sensors, etc.) and establish ground rules for building occupant behavior.

## **Warranty Planning**

The warranty information requirements will be defined in the contract documents and will define how the warranty information is transitioned from the Contractor to the Facilities Management Commissioning Authority at the end of construction. The Facilities Management Commissioning Authority and the Commissioning Manager will work with the Project Manager to define the warranty information format which will include, at a minimum, master equipment lists; warranty start and end dates; manufacturer contact information; extended warranty (if any) details; planned maintenance activities required to keep equipment under warranty; etc.

The Commissioning Manager will coordinate with the Design Team to confirm that project specifications reflect American University's warranty requirements.

## **Commissioning Design Reviews**

The Facilities Management Commissioning Authority, the AU Construction Manager, AU Other Departments, and the Commissioning Manager will review the design documents at predetermined design phase milestones (e.g., DD, 50% CD, 100% CD/Permit documents). For LEED certification purposes, at least one commissioning design review at the 50% CD phase is required, along with a back check to confirm incorporation of commissioning review comments into the final construction documents.

The Commissioning Manager will review the design drawings and specifications for the following commissioning-related items:

- Compliance with the Owner's Project Requirements.
- Clarity of the design.
- Clear integration requirements between equipment and systems



- Equipment accessibility and maintainability.
- Ability to test and validate system operation.
- O&M Documentation, Training, and Warranty details

Comments will be categorized as follows:

Critical: Issues which in the Commissioning Manager's professional opinion are related to a system's ability to achieve the Owner's Project Requirements performance criteria.

Question: Requests for clarification of intent.

Suggestion: Design features which can meet the Owner's Project Requirements but for which the Commissioning Manager has a recommendation for improved efficiency, increased reliability, and/or lower life cycle cost.

Coordination: Although a commissioning review is not a coordination review, the Commissioning Manager will note coordination items noticed during the course of the commissioning review.

Along with the Commissioning Manager's comments, the Commissioning Manager will collect and consolidate comments from the Facilities Management Commissioning Authority and AU Other Departments. The Design Team will respond in writing to each of the comments provided. Refer to Section 7 of the MCP for the Document Review Template.

### **Preliminary Prefunctional Checklists & Functional Performance Tests**

The Commissioning Manager will prepare preliminary prefunctional checklists and functional performance test procedures for the systems to be commissioned based on the design documents. There shall be one prefunctional checklist and one functional performance test procedure for each commissioned system.

These preliminary documents should be included in the Final Commissioning Plan and incorporated into the bid documents to demonstrate anticipated level of rigor to the Contractor. If project-specific prefunctional checklists and functional performance test procedures cannot be developed, sample documents for similar system types will suffice.

Refer to Section 7 of the MCP for examples of both Prefunctional Checklists and Functional Performance Test Procedures. These examples are intended to communicate format and level of rigor. The actual project checklists and test procedures will be customized to match the final design requirements for each system.

### **Final Commissioning Plan**

The Commissioning Manager will prepare the Final Commissioning Plan, building on and editing the Preliminary Commissioning Plan to reflect the project at the end of the Design Phase. The systems to be commissioned section will be refined to represent the quantity and types of systems in the final construction documents. Sampling strategies pertaining to the functional performance testing will be detailed in the Final Commissioning Plan. The Final Commissioning Plan will be incorporated into the bid documents by reference.

### **Commissioning Specification**

The Commissioning Manager will prepare a Commissioning Specification to be included in the construction documents. The Commissioning Specification will detail the Contractor's responsibilities (as outlined in the Final Commissioning Plan) during the Construction, Acceptance, and Warranty Phases of the project. The Design Team will incorporate the Commissioning Specification into the Division 1 specification section.

The Commissioning Specification will include, but not be limited to commissioning-related scheduling; submittal management; prefunctional checklists; functional performance testing; O&M and systems

manuals; O&M and systems training; as-built drawings; and warranty management. Furthermore, the Commissioning Specification will include language defining incentive program(s), if applicable, established to encourage Contractor readiness for functional performance testing.

The Commissioning Manager will recommend coordination language to be included in other Design Team specification sections that will direct the Contractors' attention to the Division 1 Commissioning Specification for required commissioning activities. The Design Team will incorporate, as they deem appropriate, the coordination language into their respective specification sections.

### **Systems Training Delivery**

The Commissioning Manager will facilitate the scheduling of Systems Training with the AU Commissioning Coordinator, the Design Team, and the Construction Team. Systems Training will be executed in two (2) training events: There will be a Mechanical Systems Overview, and an Electrical & Life Safety Systems Overview.

At a minimum, the Mechanical Systems Overview must educate the Facilities Staff on the design intent of the mechanical systems, including the way(s) the building heats, cools, is fed utilities (to include plumbing systems), and connects / interacts with other equipment. The primary audience for this training is AU's Facilities Operations Staff, the Central Plant Staff, and the Energy Management Staff.

The Electrical & Life Safety Systems Overview will, at a minimum, educate the Facilities Staff on the electrical distribution systems, including the normal power, emergency power, and any dedicated uninterruptable power, and the fire suppression system. The primary audience for this training is AU's Facilities Operations Staff, the Electrical & Life Safety Staff. The secondary target audience is the Central Plant Staff and the Public Safety Staff who will respond to University matters after non-normal business hours.

The systems training will be delivered by the Mechanical Engineer and the Electrical Engineer. Each training session will be scheduled for ninety (90) minutes, allowing an hour for the overview and thirty (30) minutes for a question-and-answer period. The training events will be coordinated for the convenience of the trainees, i.e., between shifts, manageable amounts of training at a time to accommodate trainees' other responsibilities, etc. As a minimum, no training event will be offered less than two (2) times, and will be scheduled on separate days. Training sessions may be offered on the same day if at least one session is video recorded and with the approval of AU Commissioning Authority.

The Commissioning Professional will schedule and coordinate the video recording of the Systems Training sessions with assistance from the American University Commissioning Coordinator.

### **1.6.3 CONSTRUCTION PHASE ACTIVITIES**

#### **Construction Phase Commissioning Coordination Meetings**

The Commissioning Manager will plan, facilitate and document Construction Phase Commissioning Coordination Meetings. The coordination meetings are intended to help every team member understand and execute their roles and responsibilities within the commissioning process, to coordinate the details of current and upcoming commissioning activities, and to review outstanding action items.

The first meeting will be a Construction Phase Commissioning Kickoff Meeting to review the specifics of the Commissioning process, identify new representatives to the Commissioning Team, and establish communication and documentation protocols for implementing the Commissioning process as efficiently and effectively as possible. This meeting provides an overview so that the team understands the big picture and the benefits they will accrue by participating in the process.

Subsequent Commissioning Coordination Meetings will be held as frequently as deemed necessary by the Commissioning Manager to remain integrated into the Construction Phase process. Frequency will vary throughout the construction as the Commissioning process requirements vary depending on what is happening on the construction site.

### **Commissioning Scheduling**

There will not be a separate commissioning schedule. The Contractor will be required to incorporate commissioning activities into the master construction schedule. The Commissioning Manager will assist the Contractor, as needed, to understand the relationship between construction and commissioning activities. The Facilities Management Commissioning Authority will regularly review the master construction schedule in order to coordinate the availability of Facilities Management staff for critical commissioning activities.

Master construction schedule commissioning milestones will include, but not be limited to, O&M manual submissions; training agenda submissions; training delivery; prefunctional checklist completion; functional performance testing; system manual and on-going commissioning plan submissions; as-built drawing submissions; and the warranty information hand-off. Some of the activities may require multiple milestones due to some systems following a different construction schedule than others.

### **Submittal Reviews**

The Commissioning Manager will identify submittals associated with systems to be commissioned that need to be reviewed by the Commissioning Manager and Facilities Management staff. The Facilities Management Commissioning Authority, AU Other Departments, and the Commissioning Manager will review the submittals concurrent with the Design Team.

The Contractor will send copies of the selected submittals to the Facilities Management Commissioning Authority and to the Commissioning Manager simultaneous with issuing them to the Design Team for review. The Facilities Management and AU Other Departments reviewers will submit their comments to the Commissioning Manager who will consolidate all comments and forward them to the Design Team. The Design team will incorporate the commissioning comments, at their discretion, into their formal submittal review responses to the Contractor. The Design Team will provide written responses to each submittal review comment to the Commissioning Manager.

Commissioning submittal review comments will focus on the same areas as the commissioning design reviews (e.g. compliance with the OPR, clarity of the design, integration coordination, accessibility and maintainability, O&M training and documentation requirements, and the ability to test and validate system operation). Refer to Section 7 of the MCP for the Document Review Template.

The Commissioning Manager and Facilities Management Commissioning Authority will be given access to all approved submittals after processing by the Design Team.

### **Operations & Maintenance (O&M) Manual Reviews**

Early submission of the O&M manuals will help ensure they are complete and approved prior to the start of the AU Facilities Management staff training. The manuals will serve a critical part of the training program.

The Commissioning Manager will identify O&M manuals associated with systems to be commissioned that need to be reviewed by the Commissioning Manager and Facilities Management staff. The Facilities Management reviewers will submit their comments to the Commissioning Manager who will consolidate all comments and forward them to the Contractors.

### **O&M Training Agenda Reviews**

Each training session - represented by a row in the Training Plan (refer to Section of the MCP 7 for a Training Plan example) - will have a Training Agenda. The Training Agenda requires specific detailed

information about the content of its respective session. The agenda will be completed by the Contractor responsible for the training session and will be reviewed by the Facilities Management Commissioning Authority and the Commissioning Manager. The Facilities Management reviewers will submit their comments to the Commissioning Manager who will consolidate all comments and forward them to the Contractors.

During delivery of the O&M training sessions, each approved Training Agenda form will be used to document attendees of the training session and to formalize American University's acceptance of the training.

### **Final Prefunctional Checklists & Trend Log Specifications**

The Commissioning Manager will finalize Prefunctional Checklists (PFCs) customized for each system to be commissioned after reviewing approved submittals, requests for information, change orders, supplemental instructions, and other construction phase modifications and/or additions. The Commissioning Manager will issue final PFCs to the Facilities Management Commissioning Authority for review and comment. Upon incorporation of accepted Facilities Management Commissioning Authority comments, the Commissioning Manager will issue final PFCs for completion and sign-off by the Contractor during final system checkout.

The PFCs shall be used to document that key system-level installation, startup, programming, coordination, integration, and testing activities have been completed. These are not contractor quality control checklists for each piece of equipment but system-level confirmation of readiness for the system's Functional Performance Test. The General Contractor will be responsible for overseeing the completion of the checklists by the Subcontractors, because each system typically requires the participation of multiple Subcontractors to be complete and ready for testing.

Examples of Prefunctional Checklist items include, but are not limited to, pipe pressure testing; duct air leakage testing; electrical wiring; major equipment startup; variable frequency drive setup; controls point-to-point checkout; controls programming; test, adjust, and balance completion and issues resolution; successful completion of the contractor-only dry run of the Functional Performance Test, etc.

PFCs for systems controlled and /or monitored by central campus energy management system (EMS) include a requirement that building automation system graphics screen is complete, points have been properly mapped to the central EMS, and AU Facilities Management personnel have access to view system status and operation.

PFCs for systems controlled and/or monitored by the building automation system also include requirements for building automation system trend logs to be programmed prior to the start of Functional Performance Testing. These requirements will include the points to be trended, the frequency of the trends, and the points to be included together on color graphic trend logs when submitted for review.

### **Final Functional Performance Tests**

The Commissioning Manager will finalize Functional Performance Test Procedures (FPTs) for each system to be commissioned after reviewing approved submittals, requests for information, change orders, supplemental instructions, and other construction phase modifications and/or additions. The following are the minimum requirements for American University FPTs:

#### **Step-by-Step Script**

FPTs should dictate a chronological list of steps to be followed. The steps should be scripted in an efficient manner, minimizing the level of redundancy between steps as much as practical. The intent of testing is to demonstrate performance of each mode of system operation as effectively and efficiently as possible.

### **Repeatable**

Although the Commissioning Manager will develop and oversee the execution of FPTs when they are implemented at the end of construction, the test procedures are required to be designed to be referenced by future Facilities Management staff for recommissioning purposes. As such, the test procedures should be designed to stand alone and be understood by reasonably knowledgeable building operations personnel without the Commissioning Manager's involvement.

The action required for each step should not be open to interpretation in the field. For example, a step that reads, "Put the system into economizer mode," does not explain how that should be done. The Commissioning Manager should define whether that should be accomplished by overriding outdoor air inputs, overriding return air inputs, changing set points, overriding the economizer mode software point, or some other method appropriate for the system and sequence being tested. Given the differences between building automation systems and their programming, a systems' reaction is likely to vary depending on how the action is performed. To the greatest extent practical, this needs to be understood by the Commissioning Manager prior to the start of field testing.

### **Unambiguous Pass/Fail Acceptance Criteria**

For each step of the test procedure, there should be a pass/fail definition of acceptable response. This typically is a description of how each device in a system is designed to react to the scripted action imposed on the system.

In the interest of field testing efficiency, the acceptance criteria should be clearly defined in terms that everyone in the field can understand and agree on. Valves and dampers should "open" or "close;" fans and pumps shall "start" or "stop;" modulating devices shall "modulate higher" or "modulate lower." Simply stating that the system should respond "as specified," is not acceptable in an FPT procedure.

### **Customized**

Each test procedure must reflect the final design and approved shop drawings for the unique systems in each project. There should be nothing "not applicable" in a project's FPT, i.e., if a step or reaction is not applicable, it should be removed from the procedure.

### **Sampling Strategies**

The Contractor can employ a sampling strategy to functionally test a fraction of the total number of non-life safety or non-critical equipment that are identical or near identical pieces of equipment (e.g., terminal units, occupancy sensors, exhaust fans, etc.). The sampling strategy must be well-defined and approved by AU Facilities during the Design Phase and documented in the Final Commissioning Plan and the Commissioning Specification. The sampling strategy must define the applicable project-specific equipment, the percent of randomly selected equipment to be tested, the failure rate threshold, and recourse plan if excessive failures are discovered.

The Mechanical, Electrical, TAB, and Controls Contractors will review and comment on the efficiency and safety of the proposed test steps, and the Facilities Management Commissioning Authority will review for completeness and rigor. The Commissioning Manager will incorporate Facilities Management Commissioning Authority's and the Contractors' recommendations as appropriate. It is the review activity that helps prevent surprises in the field on test day. Upon incorporation of the accepted Facilities Management Commissioning Authority and Contractor comments, the Commissioning Manager will issue final FPTs for use in the system functional performance testing process.

Refer to Section 7 of the MCP for examples of both Prefunctional Checklists and Functional Performance Test Procedures. These examples are intended to communicate format and level of rigor. The actual project checklists and test procedures will be customized to match the final design requirements for each system.

#### 1.6.4 ACCEPTANCE PHASE ACTIVITIES

##### **Acceptance Phase Commissioning Coordination Meetings**

The Commissioning Manager will plan, facilitate and document Acceptance Phase Commissioning Coordination Meetings. These meetings will be heavily focused on system readiness for Functional Performance Testing and scheduling of that testing. Acceptance Phase Commissioning Coordination Meetings will be held as frequently as deemed necessary by the Commissioning Manager to keep the Commissioning process on track for completion prior to Substantial Completion.

##### **Test, Adjust, and Balance (TAB) Report Review**

The TAB Contractor will prepare a balancing report documenting that all air and hydronic systems have been adjusted and are within acceptable design values. The Facilities Management Commissioning Authority and the Commissioning Manager will review the report submitted by the TAB Contractor, concurrent with the Design Team as the TAB Contractor completes work on individual systems (i.e., not all systems need to be balanced before the reporting process begins). The Commissioning Manager will verify that all required data has been collected, that the measured results are in compliance with the design documents, and that any non-compliance items have been resolved and rebalanced prior to the start of Functional Performance Testing.

The Facilities Management reviewers will submit their comments to the Commissioning Manager who will consolidate all comments and forward them to the Design Team. The Design team will address these comments, incorporating them as appropriate into their formal TAB report review response to the Contractor. The Design Team will provide written responses to each TAB report review comment to the Commissioning Manager.

Refer to Section 7 of the MCP for an example of the Document Review Template.

##### **O&M Training Delivery**

Operation and Maintenance (O&M) Training delivery will include equipment specific training and training on the Building Automation System (BAS).

After the Training Agendas have been reviewed and accepted by the Facilities Management Commissioning Authority, the Commissioning Manager will convene a meeting with the Contractors and the AU Commissioning Coordinator to schedule the individual O&M Training sessions. The training events will be coordinated for the convenience of the trainees, i.e., between shifts, small amounts of training at a time to accommodate trainees' other responsibilities, etc. Training will be concurrent with equipment start-up by the Contractor.

As a minimum, no training event will be offered less than two (2) times, and will be scheduled on separate days. Training sessions may be offered on the same day if at least one session is video recorded and with the approval of AU Commissioning Authority.

The Contractor will formally document each training session and the acceptance of the training. Documentation of Facilities Management acceptance will require that someone representing the trainees formally and in writing accept each training session as complying with that session's Training Agenda. The Commissioning Manager will collect this documentation in the form of fully executed Training Agendas and include them as part of the Final Commissioning Report.

The Commissioning Professional will schedule and coordinate the video recording of the O&M Training sessions with assistance from the American University Commissioning Coordinator.

### **Prefunctional Checklists Completion**

The prefunctional checklists are used to document that the systems are fully installed, connected, started-up, programmed, integrated and have successfully passed their respective Functional Performance Tests in a contractor-only dry run. Fully executed Prefunctional Checklists are the Contractor's validation that the systems are ready for successful Functional Performance Testing witnessed by Facilities Management and the Commissioning Manager. The Prefunctional Checklists will be documented in writing by personnel representing the responsible Contractors; multiple Subcontractors will need to sign-off on each system's checklist.

These checklists are primarily inspections and procedures to prepare the equipment or system for initial operation (e.g., oil levels, fan belt tension, labels affixed, gauges in place, sensor calibration, etc.). However, some checklist items entail simple testing of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). Each piece of equipment is to receive full checkout by the Contractors. No sampling strategies will be permitted. All building automation system trend logs required for a system must be programmed and collecting data before the PFCs are completed and submitted by the Contractors.

### **Functional Performance Test Plans**

The Commissioning Manager will prepare and distribute Functional Performance Test Plans prior to the start of Functional Performance Testing. This will allow the Construction Team to review the proposed testing schedule; to understand which test procedures will be conducted during a specific testing period; to schedule the appropriate people to be in attendance for each test; and to verify that the necessary equipment is available when testing begins.

The Facilities Management Commissioning Authority will schedule Facilities Management staff to participate in and witness Functional Performance Testing based on the schedule outlined in each Test Plan.

### **Functional Performance Testing**

Functional Performance Testing is the technical culmination of the Commissioning process for systems acceptance by the Facilities Management Commissioning Authority and should be performed prior to Substantial Completion.

The Commissioning Manager will field-direct, witness, and document the Functional Performance Test Procedure (FPT) for each system to be commissioned. Although the Commissioning Manager directs the tests, the Contractors will manipulate the systems and controls in accordance with the FPTs reviewed and accepted by all team members before the start of testing. The Facilities Management representatives will witness and participate in the Functional Performance Testing, as determined by Facilities Management, to understand how the systems operate and how optimal performance can be maintained.

### **Trend Log Review**

The Contractor will download and submit electronic trend data to the Commissioning Manager for review at a time scheduled by the Facilities Management Commissioning Authority and the Commissioning Manager. This may be prior to the start of Functional Performance Testing, immediately following Functional Performance Testing, or after occupancy.

The trend data will be submitted in editable spreadsheet format and in color graphs designed as specified in the Prefunctional Checklist for each affected system.

Any trend logs demonstrating performance not meeting the construction document requirements will be re-run, following remediation of the problems, and re-submitted to the Commissioning Manager for review.

### **Commissioning Action List**

The Commissioning Manager will maintain a Commissioning Action List - starting in the Design Phase and continuing through the Warranty Phase - to track the status of all Commissioning-related items. The Commissioning Action List includes process-related and technical-related issues associated with successful completion of the Commissioning process.

For each deficiency found during Functional Performance Testing, the Commissioning Manager will add the item to the Commissioning Action List. The Commissioning Action List is the vehicle for communicating, tracking, and documenting the status and correction of each deficiency.

The Commissioning Manager shares the Commissioning Action List with the Contractors who inform the Commissioning Manager in writing upon correction of each problem with an explanation of what was done to resolve the issue. If the Functional Performance Test demonstrates a system performs as designed but does not meet the OPR criteria for that system, the associated Commissioning Action List item will be assigned to the Design Team to engage them in the issue resolution process.

Upon notification of the completion of a Commissioning Action Item, the Commissioning Manager will schedule re-testing for the affected system to verify satisfactory resolution of the deficiency.

Refer to Section 7 of the MCP for the Commissioning Action List template.

### **Functional Performance Re-Testing**

The Commissioning Manager will field-direct, witness, and document Functional Performance Re-Testing for each system that failed to pass its initial FPT. For systems tested with a sampling strategy, as defined in the Final Functional Performance Test Procedures, additional samples will need to be tested during re-testing if the failures of the initial sample exceed the failure rate threshold.

The extent and level of rigor of retesting will be as the Commissioning Manager deems necessary to confirm successful resolution of the initial deficiencies without sacrificing performance elements which had originally passed the system FPT.

Although the Commissioning Manager directs the re-tests, the Contractors will manipulate the systems and controls. Facilities Management representatives will witness and participate in the Functional Performance Re-Testing as determined by Facilities Management.

### **1.6.5 WARRANTY PHASE ACTIVITIES**

#### **Warranty Information Hand-off**

The Contractor and the AU Construction Manager will provide warranty information to the Facilities Management Commissioning Authority for the commissioned systems. The warranty information will be transferred prior to Substantial Completion and will include, but not be limited to, master equipment list; warranty start and end dates; manufacturer contact information; extended warranty (if any) details; planned maintenance activities required to keep equipment under warranty; etc. The Facilities Management Commissioning Authority will review and approve the warranty information submitted at the end of construction for compliance with the specifications.

#### **Occupant Training Delivery**

The Commissioning Manager will facilitate the scheduling and delivery of Occupant Training with the Facilities Management Commissioning Coordinator and representatives of the building occupants. The training events will be coordinated for the convenience of the trainees, i.e., between shifts, manageable amounts of training at a time to accommodate trainees' other responsibilities, etc.

The Commissioning Manager will lead the Occupant Training sessions with participation by the Facilities Management Commissioning Authority.



The Facilities Management Commissioning Coordinator will schedule and coordinate the video recording of the Occupant Training sessions.

### **Deferred Testing**

Functional Performance Tests (FPTs) may need to be deferred until after Substantial Completion for a variety of reasons. The most common reasons include (1) HVAC systems may need to have different weather conditions than those at the end of construction and (2) commissioned systems may need to have a load put on them before testing can be considered meaningful. FPTs that occur after Substantial Completion will be conducted, documented, and tracked in a manner identical to the Acceptance Phase process.

### **As-Built Documentation Review**

The AU Construction Manager will provide the Facilities Management Commissioning Authority with as-built documentation including, but not limited to, (1) record installation drawings and (2) the final building automation system controls manual. The as-built building automation system controls manual will include the final "as commissioned" system schematics, sequences of operations, set points, and alarm limits.

These documents will be reviewed by the Commissioning Manager and Facilities Management staff. The Facilities Management reviewers will submit their comments to the Commissioning Manager who will consolidate all comments and forward them to the AU Construction Manager for resolution by the Design and Construction Teams.

### **Commissioning Report**

Following resolution and/or acceptance of all Commissioning Action Items, the Commissioning Manager will prepare the Commissioning Report. The report will be a compilation of documentation (both technical and process-related) associated with the Commissioning process. It will be prefaced with an Executive Summary documenting the final system status compared to the Owner's Project Requirements document.

The Commissioning Report will include at least the following sections:

1. Introduction
2. Executive Summary
3. Owner's Project Requirements
4. Basis of Design
5. Commissioning Plan
6. Commissioning Specification Section
7. Commissioning Action List
8. Commissioning Coordination Meeting Minutes
9. Warranty Phase Check-up Meeting Minutes
10. Design Review Comments
11. Submittal Review Comments
12. TAB Report Review Comments
13. As-Built Documentation Review Comments
14. O&M Manual Review Comments
15. O&M Training Plan
16. O&M Training Agendas (fully executed)
17. Systems Training Agendas
18. Occupant Training Agendas
19. Prefunctional Checklists (fully executed)
20. Functional Performance Test Plans
21. Blank Functional Performance Test Procedures

The Commissioning Manager will submit the Commissioning Report to the Facilities Management Commissioning Authority for review.

The Commissioning Manager will amend the Commissioning Report at the end of the Warranty Phase to document pertinent Warranty Phase activities, findings, decisions, etc.

### **Systems Manual & On-Going Commissioning Plan**

The Commissioning Manager will collect and compile the Systems Manual & On-Going Commissioning Plan, based on American University standards for this document. At a minimum, these document shall include the following for the commissioned systems:

1. Owner's Project Requirements
2. Basis of Design
3. Integrated Building Systems Operating Instructions
4. System Schematic Diagrams
5. As-Built Control Sequences of Operation and Initial Setpoints
6. Planned Maintenance Activities and Recommended Frequencies
7. Recommended Control System Sensor & Actuator Calibration Frequencies
8. Recommended Building Automation System Trend Logs for On-Going Commissioning Monitoring and Evaluation
9. Recommended System Re-Testing Frequencies
10. Blank Functional Performance Test Procedures for Re-Testing

In the Design Phase the Commissioning Manager will prepare an outline of the Systems Manual & On-Going Commissioning Plan along with assigned roles and responsibilities for project team members to produce the various elements of the document. These requirements will be incorporated into the Commissioning Specification and included in the bid documents.

During the Construction Phase, the Commissioning Manager, Design Team, and Construction Team will prepare a preliminary schedule of when each element will be submitted to the Commissioning Manager over the course of the project.

The Commissioning Manager will submit the Systems Manual & On-Going Commissioning Plan to the Facilities Management Commissioning Authority for review.

The submissions shall be in an electronic format compatible with the rest of the Systems Manual and On-Going Commissioning Plan sections (Adobe PDF and/or Microsoft Excel). It shall be formatted for printing no larger than 11 inches by 17 inches and preferably 8.5 inches by 11 inches.

### **Warranty Phase Check-up & Meeting**

No later than 2 month before the end of the Warranty Phase, a warranty meeting will be planned, facilitated, and documented by the Commissioning Manager. This meeting is an opportunity for Facilities Management and other AU Department representatives to provide feedback on the effectiveness and efficiency of the new equipment and systems. The Design Team and Construction Team are required to participate in the warranty meeting.

The Facilities Management Commissioning Authority will oversee the collection of operations issues, concerns, challenges, etc., throughout the Warranty Phase in order for the warranty meeting to be as comprehensive and meaningful as practical.

Information received by the Design Team and Construction Team will be used to track and correct warranty-related issues; to contribute to future Owner's Project Requirements documents; and to refine American University's project delivery process.

## 1.6.6 ON-GOING COMMISSIONING ACTIVITIES

### **On-Going Commissioning Activities**

AU Facilities addresses changes in occupancy, use, maintenance and repair and makes periodic adjustments and reviews of building operating systems and procedures essential for optimal energy efficiency and service provision.

## PART II — OTHER COMMISSIONING REQUIREMENTS

### 1.5 SUBMITTALS

A. Contractor shall submit the name of person(s) assigned as Commissioning Coordination Supervisor within two (2) weeks of construction notice to proceed. Contractor shall submit the following information for each assigned Commissioning Representative:

- i. Company Name
- ii. Name
- iii. Title
- iv. Years of Experience
- v. Office Phone Number
- vi. Cell Phone Number
- vii. Fax Number
- viii. E-Mail Address

B. Each Contractor shall submit the name of person(s) assigned as representatives to Commissioning Team within two (2) weeks of construction notice to proceed. Each Contractor shall submit the following information for each assigned Commissioning Representative:

- i. Company Name
- ii. Name
- iii. Title
- iv. Years of Experience
- v. Office Phone Number
- vi. Cell Phone Number
- vii. Fax Number

C. E-Mail Address

Equipment submittals and shop drawings

- i. Submit a list of all required submittals to the Commissioning Professional prior to submitting any equipment submittals for review.
- ii. Commissioning Professional will identify submittals for which copies shall be submitted to the Commissioning Professional.
- iii. Submit copies of selected submittals to Commissioning Professional, Owner, and Owner's Facilities Management for review.
- iv. Submit copies of selected submittals to Commissioning Professional, Owner, and Owner's Facilities Management for review.

- D. Master Construction Schedule: Incorporate all commissioning milestones into the Master Construction Schedule. See “Q” below for a listing of minimum milestones for inclusion in the Master Construction Schedule.
- i. Submit Master Construction Schedule with the inclusion of the commissioning milestones no later than eight (8) weeks after Construction Notice-to-Proceed.
  - ii. Submit updated Master Construction Schedule to the Commissioning Professional at a minimum once per month.
- E. Submit copies of Construction Meeting Minutes, Requests for Proposals (RFP), Requests for Information (RFI), Addenda, Proposal Requests (PR), etc., to the Commissioning Professional.
- F. Submit a single set of preliminary operation and maintenance manuals for systems being commissioned to the Commissioning Professional for review. Submit within eight (8) weeks after all submittals for systems to be commissioned have been accepted.
- G. Submit a single set of revised operation and maintenance manuals four (4) weeks after receiving comments from the Commissioning Professional.
- H. Submit the full quantity of final operations and maintenance manuals to the Commissioning Professional a minimum of four (4) weeks prior to start of owner training. The full quantity of manuals to be submitted to the Owner, as defined in the general specifications execution requirements and shall be required only after review and approval of a single set.
- I. Submit equipment training session agendas to the Commissioning Professional for approval no later than eight (8) weeks after acceptance of associated equipment submittals. Refer to the Training Plan Example and the Training Agenda Example in the Commissioning Plan.
- J. Submit the specific date, time and place for individual training sessions no later than four (4) weeks prior to the scheduled training sessions.
- K. Submit detailed functional performance testing schedule to the Commissioning Professional at least four (4) weeks prior to the start of testing.
- L. Submit fully executed Prefunctional Checklists to the Commissioning Professional upon completion and at least two (2) working days before the scheduled start of functional performance testing for the respective system. System functional performance testing shall not commence until its system is documented to be ready for testing.
- M. Submit estimated completion dates and status updates to outstanding items on the Commissioning Action List to the Commissioning Professional weekly.
- N. Submit warranty details for commissioned systems at least four (4) weeks prior to substantial completion.
- O. Submit as-built documentation no later than two (2) weeks following substantial completion.
- P. Materials — Provide tools, services and instruments required to test and adjust equipment and to verify compliance with design documents. Refer to individual Functional Performance Test Procedures for the requirements of each procedure.
- Q. Commissioning scheduling — Include the following commissioning milestone activities in the master schedule (not a separate commissioning schedule):

- Operations and maintenance manual submissions
- Equipment training agenda submission
- Training delivery
- Testing and balancing
- Equipment training sessions
- Prefunctional checklist completion
- Functional performance testing
- Deficiency correction
- Functional performance retesting (as necessary)
- System manual and on-going commissioning plan submissions
- Warranty information submission
- As-built documentation submissions

- R. Re-testing — The contractor is responsible for the owner's additional costs associated re-testing activities requiring an additional trip to the project site, unless the deficiency discovered during the initial functional performance testing could not have been identified as part of the dry-run testing by the contractors. The owner's additional costs include, but are not limited to, the commissioning professional's time and expenses (at cost) to direct, witness, and document the re-testing activities.
- S. Deficiency tracking/corrective actions
- i. Perform corrective actions for resolution of deficiencies found during, but not limited to, the following activities:
    - Site observations
    - Test and balance
    - Prefunctional checkout
    - Functional performance testing
  - ii. During Functional Performance Testing, a deficiency is defined as equipment that does not function as expected and more than five (5) minutes is required to correct the problem.
  - iii. During construction or testing anyone finding deficiencies may document the deficiencies on a Commissioning Action List (CAL) (refer to Commissioning Plan) within one working day of discovery. The deficiency shall then be forwarded to the Commissioning Professional.
    - i) Deficiency Identification Process (by Commissioning Professional)
    - ii) Date
    - iii) Comment Generator
    - iv) Responsible Party
    - v) Description of deficiency
    - vi) Estimated Completion Date
    - vii) Distribute copies to:
      - (1) Contractor
      - (2) Owner's Facilities Management Staff
  - iv. Corrective Action Completed (by Contractor)
    - i) Date of correction
    - ii) Description of final equipment status or corrective action performed
    - iii) Name of person(s) performing the work
    - iv) Contractor to inform the Commissioning Professional who will update the Commissioning Action List
    - v) Commissioning Professional distributes updated copies to:
      - (1) Contractor
      - (2) Owner's Facilities Management Staff
  - v. Verification of Corrective Action Completion (by Commissioning Professional)
    - i) Date of correction
    - ii) Description of final equipment status or corrective action performed
    - iii) Name of person(s) performing the work
    - iv) Contractor to inform the Commissioning Professional who will update the Commissioning Action List
    - v) Commissioning Professional distributes updated copies to:
      - (1) Contractor
      - (2) Owner's Facilities Management Staff

T. Commissioning documentation

- i. Commissioning Action List Template (Reference Commissioning Plan)
- ii. Document Review Template (Reference Commissioning Plan)
- iii. Training Plan Example (Reference Commissioning Plan)
- iv. Training Agenda Example (Reference Commissioning Plan)
- v. Example Prefunctional Checklists (Reference Commissioning Plan)
- vi. Example Functional Performance Test Procedures (Reference Commissioning Plan)

**END OF SECTION 01 91 1**

01 93 00	Facility Maintenance
01 93 16	Recycling Programs
02 24 00	Environmental Assessment
02 24 13	Natural Environment Assessment
02 24 13.13	Air Assessment
02 24 13.43	Water Assessment
02 24 13.73	Land Assessment
02 24 23	Chemical Sampling and Analysis of Soils
02 24 43	Transboundary and Global Environmental Aspects Assessment

— **END OF DIVISION 1** —

## **DIVISION 2 — EXISTING CONDITIONS**

The American University Campus has unique architectural and exterior spatial design qualities, especially around the Friedheim Quadrangle. All Site work shall follow current LEED guidelines for Site Selection as applicable to the particular project requirements at the University.

### **SPECIFIC DESIGN PARAMETERS**

The design of new buildings, renovation of existing facilities and site design projects shall accomplish the following:

1. Adhere to the AU Campus Plan which can be accessed online via <http://www.american.edu/finance/PPM/2011-Campus-Plan.cfm>
2. Respect the historic fabric and detail of the Campus and integrate each built project into the surrounding Campus context.
3. Emphasize safe and attractive pedestrian circulation within the Campus and arrival into the Campus to provide:
  - a. clear arrival sequence
  - b. accessibility as required by Americans With Disabilities Act (ADA): durable slip- resistant materials, site lighting and emergency telephones, screening of service functions, orientation to and framing of special views
  - c. Accommodate safe and convenient vehicular circulation, arrival, drop-off and parking.
4. Provide safe, attractive and functional outdoor spaces.
5. Provide suitable horticultural soils, drainage and irrigation to support successful horticultural development and sustainability.
6. Emphasize the use of plants for energy conservation and ecological appropriateness.
7. Retain mature trees wherever possible, particularly where they occur in groups, through creative use of retaining walls, bio-retention, grading and other site design techniques.

### **SITE DESIGN STANDARDS**

All campus site designs shall meet the campus wide standards established by the University for landscaping, irrigation, parking, drainage and utilities. All site design shall comply with all applicable DC codes and applicable sections of current LEED guidelines.

— **END OF DIVISION 2** —

## DIVISION 3 — CONCRETE

Concrete design shall be in accordance with the latest edition of the DC Building Code and comply with requirements of the American Concrete Institute (ACI); specifically, the requirements of ACI-301, ACI-318 for reinforced concrete structures, ACI 3xx for hot weather construction and ACI-306 for cold-weather construction. Design strength shall be appropriate to the use intended, but shall be a minimum 3000 psi (at 28 days).

### CONCRETE

#### MATERIALS

The Contractor shall provide a design mix from a commercial testing laboratory approved by the Consultant, using samples of aggregates and cement approved for use. Cost of the design mix preparation shall be borne by the Contractor.

Admixtures in concrete used for building design shall be approved by the Owner and shall be in accordance with requirements of the project, relative to hot weather, cold weather, pour schedules, sustainability and other special project requirements.

Perlite and vermiculite are not permitted for use in structural concrete; fly ash is preferred.

In support of project LEED requirements and AU sustainability goals, consider the following:

- Require fly ash, slag cement, silica fume and/or another pre-consumer recycled material for concrete. Require post-consumer recycled material in the aggregate.  
<http://greenlivingideas.com/2008/12/21/can-concrete-be-eco-friendly/>
- Set an overall target as per the LEED formula so:  $(\text{Product Cost} * \text{Preconsumer \%} * 0.5) + (\text{Product Cost} * \text{Post-Consumer \%}) \geq \text{to } 20\% \text{ of total concrete spend}$
- Slag cement dramatically reduces embodied energy and greenhouse gas emissions in concrete. Most slag cement in the U.S. is recovered at iron blast furnaces located within the U.S. or Canada.
- Silica fume is a byproduct of producing silicon metal or ferrosilicon alloys. One of the most beneficial uses for silica fume is in concrete. Concrete containing silica fume can have very high strength and can be very durable.
- For all materials included in CSI specification sections 2–10, provide the total hard cost of each material (excluding labor and equipment). Be sure to include manufacturing and extraction locations and manufacturer's data, and/or product information confirming the product's sustainable attributes (such as percentage of recycled content, certifications).

Curing components used in slabs shall be compatible with applied finishes, including vinyl flooring and carpeting. Moisture content in slab construction shall be measured by the Contractor prior to installation of these finishes; all installation will be performed in accordance with manufacturer's requirements.

### PRE-CAST CONCRETE

Design of pre-cast concrete panels shall be approved by the Owner through the use of finish samples or mock-ups. Colors and texture shall be in context with existing architectural elements on Campus. Sealing compounds, matrix design, finish and joint sealers shall be a consideration in the long-term maintenance of pre-cast concrete systems.



## TESTING

Testing services for concrete are to be paid for by the Owner and conducted by an independent testing laboratory selected by the Owner. Laboratory-cured test specimens and field-cured specimens shall be used to confirm the quality and strength of the concrete material. A list that includes the type, quantity and frequency of tests shall be kept for all tests.

## SEALANT

All sealants must be low-VOC in accordance with LEED requirements.

— **END OF DIVISION 3** —

#### **DIVISION 4 — MASONRY**

Concrete Masonry Units, brick and other masonry units exposed to view shall be approved by the Owner on the basis of compatibility in color and texture with existing exterior building materials on Campus. Sample panels shall be constructed in order to obtain approval by the Consultant and the Owner. Design of masonry walls shall be in accordance with current building code and applicable American Society for Testing and Materials standards.

Masonry units shall match or compliment adjacent buildings as closely as possible. Careful consideration will be given by the Consultant to design of the wall with regard to cavity wall construction, flashing details, control joints, mortar joint details and wall materials. Masonry shall be measured for moisture presence prior to installation of final paint coatings.

#### **STONE**

Bluestone used in Campus walks shall match the texture, color and size of existing units

#### **RENOVATION PROJECTS**

In renovation projects involving exterior stone, brick, or other masonry: existing units shall be carefully removed and reused if possible. If new material is needed, it shall closely match the existing wall. Masonry joint repairs for older structures shall be made in accordance with requirements of historic structures, with regard to proper mortar mix, color range and proper pointing procedure.

#### **CLEANING OF MASONRY**

Cleaning agents shall include diluted detergents, nonmetal bristle brushes, potable water and non-acid washing solutions. The use of abrasive brushes or cleaning agents is not permitted. Sandblasting of masonry is not permitted.

Prevention of efflorescence is of critical importance in the mortar mix design and installation.

— **END OF DIVISION 4** —

## **DIVISION 5 — METALS**

Steel-framed structures shall be designed in accordance with the D.C. Building Code and in accordance with American Institute of Steel Construction specifications. Steel joists shall be designed in accordance with the Steel Joist Institute standards. Welding requirements shall be in accordance with the American Welding Society standards for certified welders. To the extent possible, steel products should be made with recycled material.

All exterior exposed ferrous material, including ornamental frames, steel gratings, stairs, handrails, plaques and structural elements shall be hot-dipped galvanized after fabrication and protected from corrosion by a method acceptable to the Owner.

Using screws to attach metal roof decks to structures is recommended, but attachment of metal decks by welding is allowed, with the condition that the welding be inspected and approved by the Consultant prior to installation of the final roof covering. Composite deck assemblies also shall be inspected by the Consultant.

Anchorage of structural elements or ornamental assemblies shall be clearly detailed. Bolt sizes shall be indicated.

Where downspouts are utilized in the building design, cast iron boots shall be provided to connect downspouts to underground drainage lines.

Tolerances, connections, attachment to metals, coping and clearances shall be detailed on the construction documents.

Metal materials/ products shall contain the maximum amount of recycled content allowed that retains material integrity and contain as much locally harvested and processed or extracted and processed material (within 500 miles) as feasible. Any adhesives or sealants used must comply with maximum allowable VOC requirements as defined by the applicable reference standard (e.g. SCAQMD). Submit product cut sheets indicating recycled content, place of origin, and VOC levels. Track all purchases as a % of total spend complying with each sustainability criterion.

— **END OF DIVISION 5** —

## DIVISION 6 — COMPOSITES, PLASTICS, AND WOOD

Wood structural design and finish materials shall be in accordance with the D.C. Building Code, applicable National Fire Protection Association requirements and FSC (Forest Stewardship Council) requirements for wood products from managed forests. Wood trim materials shall be the type and grade of wood suitable to the intended purpose and design, with consideration given to long-term maintenance and intended final finishes.

Wood, composite, and plastic materials/ products shall contain the maximum amount of recycled content allowed that retains material integrity, contain as much locally harvested and processed or extracted and processed (within 500 miles) material, rapidly renewable material, and FSC-certified content as feasible. Any adhesives or sealants, paints or coatings must comply with the maximum allowable VOC requirements as defined by the applicable reference standard (e.g. SCAQMD). Composite and agrifiber products must contain no added urea formaldehyde resins. Contractor shall submit product cut sheets indicating recycled content, place of origin, rapidly renewable material, FSC-certified wood content, VOC levels, and urea formaldehyde resin limits, as applicable. Track all purchases as a % of total spend complying with each sustainability criterion.

### ROUGH CARPENTRY

Preservative-treated lumber shall be used in damp areas and shall be used when in contact with concrete, masonry, plaster and roof blocking. Material shall be kiln-dried to a maximum 15% for plywood and 19% for lumber moisture content after treatment.

Truss systems shall be designed in accordance with the building code. The Consultant shall carefully consider anchorage, joint connections and bracing in the design of the truss system. Heavy timber or laminated timber shall not be exposed to weather. Design load data for truss design shall be shown on the project drawings.

Blocking and grounds shall be installed plumb and in alignment, in order to ensure proper fit of subsequent finish material (such as wood trim, gypsum board or plaster), treated with fire retardant chemicals to provide a flame spread classification of 25 or less.

### FINISH CARPENTRY

Finish wood material shall conform to requirements of the Architectural Woodwork Institute (AWI) quality standards, premium grade unless approved otherwise. Forest Stewardship Council (FSC) wood products shall be used. Endangered tree and plant species, including redwood shall not be permitted.

Wood trim with transparent finish shall be appropriate to the design of the building or project. Painted or concealed wood trim shall be fir, birch or poplar.

Particleboard is not permitted for use in any application including cabinets, carpentry, countertops and sheathing.

Blocking and finish material shall be installed to allow for natural wood movement and building movement.

Countertops with sinks shall be solid surfacing material or quartz composite. Countertops in dry areas can be laminate.

— **END OF DIVISION 6**

## DIVISION 7 — THERMAL AND MOISTURE PROTECTION

The Consultant must consider the effects of environmental design factors; that is, the degenerative forces exerted on roofing systems and wall systems by exterior and interior conditions. These forces include sunlight exposure, rainfall, ice, snow, wind, the chemical environment and the installation environment. The task is to select components that will withstand such environmental factors and integrate these components into a complete system and integrate Indoor Environmental Quality, Environment and Atmosphere requirements from the current LEED rating system in use.

Building occupancy factors should be considered in the design of roofing systems and wall systems. Humidity and occupancy help determine the necessity for vapor retarders and venting. Any occupancy with a chemical function, such as laboratories, will require special consideration. The system should be designed so that temperature and relative humidity can be controlled. Particular attention must be paid to operating costs.

Thermal and moisture protection materials/ products shall contain the maximum amount of recycled content allowed that retains material integrity, contain as much locally harvested and processed or extracted and processed (within 500 miles) material, and FSC-certified content as feasible. Any adhesives or sealants must comply with the maximum allowable VOC requirements as defined by the applicable reference standard (e.g. SCAQMD). Submit product cut sheets indicating recycled content, place of origin, FSC-certified wood content, and VOC levels, as applicable. Track all purchases as a % of total spend complying with each sustainability criterion.

### VAPOR RETARDERS

Vapor retarders should be used only when absolutely necessary, as they tend to hide leaks in a roof system until large areas of insulation become wet. This results in an increase in the size of the damaged roof area, which translates into an increased cost for repairs.

### INSULATION

No other component of a building has a greater influence on the life-cycle costs or greater effect on other building components. Thus, careful thought must be given to thermal insulation, insulation type, location its durability, flammability and formaldehyde content. When renovating or fitting out an existing space, a thorough inspection and careful consideration must be given to the presence or condition of existing insulation to determine what repairs, replacement or new installations are necessary. It is important to ensure damaged insulation is removed and new insulation is properly installed, secured and sealed in accordance with industry standards and manufacturer's requirements.

"R" factors and "U" factors shall be determined by the Consultant in accordance with Energy and Building codes. Do not simply specify that roof insulation must meet a certain "R" or "U" factor for the roof structure; the Consultant should decide on the insulation best suited to the project, make the calculation and specify a thickness that enables the project to meet ASHRAE 90.1 requirements per LEED guidelines of minimum energy performance prerequisite (EAp2) and project building target for optimized energy performance (EAc1).

Density of insulation must be sufficient to allow foot traffic or other traffic on the roof. Resistance to water, liquid and vapor shall be specified. Select and install insulation for reuse in re-roofing. Specify roof insulation by type and manufacturer. Specify minimum density or compressive strength. Specify roof insulation in order to obtain a "total system" warranty from the roofing manufacturer. Specify application criteria. Insulation shall be two or more layers, with joints staggered. Mechanical attachment is prohibited except on a steel metal deck; in this case, mechanically attach the first layer and fully adhere the next.

The Consultant must specify a "Class A" fire rated roof assembly on all University buildings. The assembly shall include both the deck and the insulation systems. Material used shall not contain asbestos.

## SHINGLES AND ROOFING TILES

### General Design

The NRCA Roofing Manual and standards set by the Sheet Metal and Air Conditioning Contractors National Association (SMACNA), the National Slate Association, and the American Society for Testing and Materials (ASTM) shall constitute the minimum basic roofing criteria for the following roofing systems and materials:

- A. asphalt shingles
- B. slate
- C. tile
- D. metal
- E. architectural metal roofing
- F. asphalt built-up roofing
- G. fiberglass shingles

Architectural metal and structural standing-seam roofing shall have a minimum slope of 4 inches per foot. Copper, lead-coated copper and terne-coated stainless steel are preferred.

Limit the use of exposed fasteners through the panels to end and side panels. Specify systems that do not penetrate the panels. Use continuous no-seam panels. Avoid skylight panels due to problems with leaks, condensation and safety concerns.

## EXTERIOR WALL ASSEMBLIES

There are two important factors in designing exterior walls that should be incorporated into the roofing system:

1. Ensure that with the addition of the specified thickness of insulation, tapered insulation and associated crickets and saddles, there is a minimum 8" clear flashing height
2. Precautions should be taken to ensure that water cannot migrate from the exterior walls or curbs into the roofing system

Parapet walls and interior roof curbs should be part of the roof deck, not independent of the roof deck. Incorporate parapet walls in the building design if possible. This will provide greater resistance to wind uplift and provide a safer place for maintenance personnel to work. Keep the roof shape as simple as possible.

Two-piece, through-wall flashings 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. Weep-holes should be provided on top of the through-wall metal to allow escape of any water entering the wall above the metal.

The exterior wall assembly or interior curbs shall be independent of the roofing system. Design the assembly so it will not interfere with future re-roofing of the building.

## ROOFING

Several factors repeatedly show up during the inspection of roofs that have failed prematurely. They include inappropriate use of materials, poor drainage systems, poor details for installation of roof accessories, damage by construction traffic and poor access to all parts of the roof area. The design of a roof should incorporate these fundamental features: appropriate and proven materials, good drainage and drains, good accessory details, proper protection and good access to the roof and areas around roof-mounted equipment.

The cardinal rule of roof design is to provide slope for rapid and dependable drainage. The second-highest priority for a roofing system is puncture resistance. Design the roofing system and all other components (i.e., mechanical equipment and wall assemblies) to allow for re-roofing in the future. Ease of maintenance should be an important part of the roofing design. Design the roofing system to comply with Factory Mutual (FM) or Underwriters Laboratories (UL) standards. Criteria must be considered as they affect insurance requirements for American University.

## RE-ROOFING

Re-roofing projects are basically the same as new construction, except that thorough investigation is needed to determine conditions of the existing building, and projects must consider the condition and usability of existing flashings.

The top priority during re-roofing is to determine the weaknesses of the existing system and design them out of the new roof. Re-roofing over an existing roof is prohibited, except in special situations. Protect building components from damage during the re-roofing process.

## DRAINAGE

Watershedding roofs with a slope greater than four (4) inches per foot shall be specified whenever practical. Low slope roofs shall be sloped a minimum of  $\frac{1}{4}$ " / ft. Avoid locating long skylights, HVAC units and other obstructions perpendicular to the slope. Furnish crickets where necessary to provide drainage around obstructions. Valleys should not be located over a beam-column line.

## DRAINAGE

Comply with current building codes for primary and secondary drainage. Do not locate drains adjacent to roof columns, adjacent to walls that support decks or adjacent to walls that are extended to the roof deck. Locate drains symmetrically in order to simplify the tapered insulation design.

## OVERFLOWS

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

Scuppers should be sloped outward and downward. An overflow scupper should be designed so that no more than 6 inches of water will accumulate at the inlet if the drain fails to work.

## EXTERNAL DRAINAGE SYSTEMS

Materials, gauges, shapes and details shall follow the recommendations in the SMACNA Architectural Sheet Metal Manual. The Consultant may reference this manual in the Contract Documents but shall not substitute that reference for appropriate specifications and details. External drainage systems shall not incorporate pop rivets and caulking in their design.

## INTERNAL DRAINAGE SYSTEMS

A sump created by tapered insulation should be provided at the drain to lower it below the level of the roof.

Vertical leaders must have expansion joints at the drains if there is any possibility of deck movement. Horizontal leaders must be insulated to prevent condensation from forming and dripping to the ceiling. Drains and slopes should be shown on a separate architectural roof plan. Key elevations and slope arrows should be given to the roofing contractor.

## DRAIN TYPE

Drain receivers should be used on metal decks and other types of decks that may need the distributed loading for a secure connection to the deck. Threaded drains do not leak as often as hot-poured or caulked drains.

## PENETRATIONS

Minimize penetrations through the roof membrane. Route the penetrations through side walls when possible. Use curbs; do not use pitch pockets. Reference the NRCA manuals for approved details.

## ACCESSIBILITY TO ROOF

Walkout access from a stairwell extension is preferred. Access from a penthouse is also acceptable. Doors and hatches providing roof access shall have locks.

Provide hose bibs and electrical outlets on the roof for maintenance purposes. On a large roof, multiple access points at opposite ends will prevent unnecessary backtracking. When stairways are not required, a roof scuttle shall be provided. It shall be a minimum 2'x 3' in size and have a fixed ladder.

## FASTENERS

Fasteners must meet UL/FM standards and be approved by the roofing manufacturer for the application and system rating. Fasteners must meet FM 4470 standard for corrosion resistance, and must have a mechanism to prevent back-out.

## DECKING

Deck selection should be made in close regard to the assembly category selected and may often dictate system component type. Because the deck is the foundation of the roof system, consideration for design should be based on stability.

## FLASHING AND SHEET METAL

All flashing should be detailed to permit thermal movement and to shed water "mechanically" by lapping. The detail shall be designed without the use of sealants. Thermal expansion will generally, over time, exceed the performance capacity of most sealants.

Keep the roof "clean" of penetrations and equipment. Do not install a metal roof if there is equipment that needs to be maintained or if there is an excessive number of penetrations planned.

Keep the roof design simple and sustainable. Use continuous panels if possible, rather than joining smaller panels using exposed fasteners.



All sheet metal materials should be designed for easy removal without interfering with building operations. No conduit or piping should be attached to coping covers. Where pipes cross over flashings or wall tops, there should be sufficient clearance to permit removal of metal without disturbing the pipes. All metals used in the roofing assembly shall be of the same type and material. Preferred materials: copper, stainless steel, terne-coated stainless steel and aluminum.

Mechanical or interlocking joints are preferred to ensure that wide metal sections stay in contact and do not admit water through open laps at metal joints.

Wood blocking attached on the perimeter of the roof must be pressure treated and provided in strict accordance with FM requirements for an I-90 rating.

With the use of metal gravel guards and fascia, temperature movements in heavy gauge metal must be considered. If heavy gauge metal is used, gravel guards should not be heavier than 24 to 26 gauge stainless steel, 16-ounce copper or 30 to 40 mil aluminum in maximum 10' lengths. Hook strips should be one gauge heavier than the fascia.

Gutters should be designed so they can be replaced without damaging the roof edges. SMACNA and NRCA Manuals for sustainable treatments shall be used as a reference for details. Details and dimensions shall be shown, not simply referenced from the manuals. Do not call for "...design and installation in accordance with SMACNA Manual."

#### ROOF SPECIALTIES AND ACCESSORIES

If approved by the Owner, roof-mounted equipment must be supported on a properly constructed curb or an elevated metal frame.

Curbs must extend either a minimum of 8 inches above the finished roof surface or above the height of any emergency overflow pipe or scupper. See NRCA Details "IL-2" and "N" for fan curbs and equipment requiring a continuous edge curb.

Metal frames should be used to support heavy equipment or structures above the roof surface. Clearance below equipment shall be as suggested by NRCA Detail "M-1."

Provide approved walkway pads up to and around equipment requiring frequent service or inspection. Location of pads to be confirmed by the Owner.

#### JOINT SEALERS

Caulking should be reserved for sealing joints in vertical surfaces between relatively stable components of the building. It should not be used where significant water will stand or regularly run across the joint.

— **END OF DIVISION 7** —

## DIVISION 8 — OPENINGS

### GENERAL

Doors, Windows and other openings are critical to efficient building envelopes and effective building security. Ensure that security features are coordinated with Division 28 requirements located within this document.

Ensuring tight seals around openings and their frames is essential to their performance and the building envelopes integrity. Insulation, flashing, gaskets and other water/vapor seals must be of high quality, highly durable, appropriate for the application and installed in accordance with industry standards and manufacturer's recommendations. In renovation and fit out projects such components no longer in serviceable condition shall be repaired or replaced. Windows, Doors or Openings no longer able to maintain envelope integrity shall also be identified, costed and considered for replacement as part of design efforts.

All doors shall have a minimum 3'-0" width and 7'-0" height.

All doors shall have locking hardware approved by the security representative of American University. Openings materials/ products shall be built with FSC Certified wood cores and veneers and/or contain the maximum amount of recycled content allowed that retains material integrity, contain as much locally harvested and processed or extracted and processed (within 500 miles) material, and rapidly renewable content as feasible. Any adhesives/sealants, paints/coatings, and/or composite wood must comply with the maximum allowable VOC requirements as defined by the applicable reference standard (e.g. SCAQMD). Any composite and agrifiber products must contain no added urea formaldehyde resins. Submit product cut sheets indicating recycled content, place of origin, rapidly renewable material content, FSC-certified wood content, VOC levels, and urea formaldehyde resin limits, as applicable. Track all purchases as a percentage (%) of total spend complying with each sustainability criterion.

All exterior doors and jambs should be hollow metal (steel) or aluminum and glass (storefront systems) made from recyclable material. Steel doors shall be a minimum of 16 gauge; jambs shall be a minimum of 14 gauge.

All exterior handicap door access operator switches must be completely protected from the weather. Door controls and push plates must be hard wired. Door operators must work with card readers where applicable.

Doors in high-traffic areas, loading docks, mechanical rooms, and corridors must be designed to include metal door edge guards and protection plates on both sides. The frame and door hardware shall be designed to accept this additional weight. See entryway walk off mat requirements in Division 12 Furnishings.

### METAL DOORS AND FRAMES

Fire-rated doors required to be B-Label classification shall be made of recycled metal. On labeled fire doors, all closers shall be of a "non-hold-open" type approved by Underwriters Laboratories (UL). Fire rated doors that open to corridors and contain glass shall use 1/4" UL fire-rated tempered glass. Where specified or scheduled, doors shall be provided with either aluminum or steel moldings to secure glass in accordance with glass opening sizes as shown on approved shop drawings.

### AUTOMATIC DOOR OPERATORS

Automatic door operators for doors 350 pounds or less shall be Stanley Magic-Force, no exceptions. . For doors heavier than 350 pounds, the Consultant will request product and/or performance information from Facilities Management.

## FLOOR AND JAMB ANCHORS

The number of anchors provided on each jamb shall follow manufacturer's recommendation for commercial applications. Floor anchors shall be securely welded or screwed inside each jamb, with two holes provided at each jamb for anchorage.

Frames for installation in masonry walls shall be provided with adjustable wire type jamb anchors. Anchors shall be not less than 0.156" diameter steel wire.

Frames for installation in stud partitions shall be provided either with steel anchors of not less than 18 gauge thickness, securely welded inside each jamb, or insert type with notched clip to engage stud inserted to back of the frame as identified above.

## WOOD AND LAMINATE DOORS

Provide doors that meet or exceed the minimum standards of the Architectural Woodwork Institute (AWI) Quality Standards, Section 1300 (latest edition) and FSC Certified Wood Standards for Veneer Doors.

## FABRICATION AND STORAGE

Stave lumber doors shall be AWI specification symbol SLC-5. Wood used in construction of the doors shall be thoroughly seasoned, low-density, non-resinous, kiln-dried hardwood with moisture content between 5% and 8%.

## FIRE-RATED FLUSH WOOD DOORS

Type and construction shall be the standard of the manufacturer, with the following exceptions:

1. Provide balanced construction by furnishing manufacturer's laminated stile edge for improved screw holding to both stiles of all C-Label and B-Label doors
2. Stile edge split resistance shall exceed 751 pounds, in accordance with ASTM D143-52

## SOUND-RETARDANT DOORS

Doors shall have the AWI specification symbol SR.

Sound Transmission Class (STC) shall be not less than 32 as tested by Riverbank Acoustical Laboratories in accordance with requirements of ASTM E90 and E413. Doors shall be five-ply and shall be the standard of the manufacturer, with matching edge strips bonded to particleboard or stave lumber core with resin glue.

Doors shall be furnished complete with automatic threshold-sealing-device gaskets. Doors shall be not less than 1 3/4" (unless otherwise stated), according to the manufacturer's standard, in order to provide the sound transmission class specified.

## HARDWARE

Prepare steel frame units to receive mortised and concealed hardware (including cutouts, reinforcing, drilling and tapping) in accordance with the final finish Hardware Schedule and templates provided by the hardware supplier. Comply with requirements of ANSI A115.1.

## WINDOW ASSEMBLIES

In large window assemblies, install a double balance in order to provide a window that is easier to open and to decrease the frequency of repairs.

Plastic materials are not acceptable.

All screws and other miscellaneous fastening devices incorporated in the product shall be concealed within the window assembly.

Minimum warranties:

- A. Windows shall be warranted against defects in material and workmanship for a period of one (1) year from date of installation
- B. Insulating glass shall be warranted to be free from obstruction of vision by film formation or dust collection between the interior surfaces of the glass panes for a period of ten (10) years from date of installation pigmented organic finishes of the window and related component parts shall be warranted against blistering, cracking, peeling or chipping for a period of fifteen (15) years from the date of installation
- C. Where natural ventilation strategies are used, LEED and ASHRAE standards must be met to comply with applicable code and regulatory requirements, and shall support AU's continuous commissioning LEED prototype for Indoor Air Quality (IAQ).

#### OVERHEAD COILING DOORS

All overhead doors shall be by Overhead Door Company due to in-place service contract.

#### EXTERIOR ENTRANCE DOORS

Preferred entrance doors are Fiberglass Reinforced Polyester (FRP) Exit Door Systems by Special-Lite or approved equal.

#### APPROVED HARDWARE, NO EXCEPTIONS

Div.	Section	Selection Criteria	Accepted Examples	Technical Owner	Key Stakeholders
8	Openings				
8	Access Panels		Style M; Style ATR; Style UFR by Milcor	PPM – K. Hesse	
8	Coiling Doors		Counter Doors 651 Series by Overhead	PPM – K. Hesse	
8	Aluminum Entrances and Window Wall		Entara; 1600 Wall System by Kawneer	PPM – K. Hesse	
8	Fiberglass Reinforced Polyester (FRP) Exit Door Systems	Internal bolted framework-not welded with FRP foamed in place.	Special-lite	FM – E Grandos	FM
8	Aluminum Entrance Doors	Internal bolted framework-not welded	Special-lite	FM – E Grandos	FM
8	Door Hardware		Hinges, Continuous Hinges, Architectural Door Trim by Hager		PPM – K.Hesse

8	Door Hardware		Cylinders, Locksets, Latchsets, by Best Access Systems	PS - M. Caraker	
8	Door Hardware		Exit Devices, Electric Strikes by Von Duprin, Inc.	PS - M. Caraker	
8	Door Hardware		Surface Closers; Concealed Closers; Power-Assist/Blow Open Operators by LCN Closers	PS - M. Caraker	PPM – K.Hesse
8	Door Hardware		Automatic Flush Bolts, and Auxillary Hardware by Rockwood Manufacturing Co.	PS - M. Caraker	
8	Door Hardware		Pivots by Rixson	PS - M. Caraker	
8	Door Hardware		Overhead Stops by Glynn-Johnson		
8	Door Hardware		Custom Push-Pull Bars by Blumcraft of Pittsburgh		PPM – K. Hesse
8	Door Hardware		Weather-stripping, Seals, Thresholds by Pemko, Inc.		
8	Glass and Glazing		FireLite Plus by Nippon Electric Glass Co Ltd	PPM – K. Hesse	
8	Glass and Glazing		Pyrostop 90-102 by Pilkington	PPM – K. Hesse	
8	Glass and Glazing		Viraspan; Silkscreen Pattern, Screen 5023 by Viracon	PPM – K. Hesse	
8	Glass and Glazing		Saflex Interlayer Clear by Solutia Inc.	PPM – K. Hesse	

<b>Application</b>	<b>Part # for Mortise Locks (Specify Hand)</b>	<b>Part # for Cylindrical Locks (OAK)</b>	<b>Part # for Cylindrical Locks (Schlage)</b>
Passage Function	Schlage L9010-06N-626	1CL-3-PA-0-H2-A-626	ND10S-RHO-626
Privacy Function	Schlage L9440-06N-626	1CL-3-PR-0-H2-A-626	ND40S-RHO-626
Entry/Office Function	Schlage L9050-GD-06N-626	1CL-3-EN-1-H2-A-626-LC	ND53HD-RHO-626
Dormroom/Entry/Office with deadbolt	Schlage LV9453-GD-06N-626	N/A	N/A
Classroom Function w/ Thumbturn Toggle	Schlage L9050-GD-06N-626	N/A	N/A
Classroom Function w/o Thumbturn Toggle	Schlage L9070-GD-06N-626	1CL-3-CL-1-H2-A-626-LC	ND94HD-RHO-626
Storeroom Function	Schlage L9080-GD-06N-626	1CL-3-ST-1-H2-A-626-LC	ND96HD-RHO-626
Single Cylinder Dead Bolt	N/A	1DB-3-K-1-SC-626-LC	B660HD-626

**Keys and Key Cores:** All keys and key cores are to be provided by the AU Lock Shop. DPS needs to meet with the occupants at least eight (8) weeks in advance to discuss the keying plan and order or cut and pin the keys/cores. Once we have a count of the doors that will require key cores, we will provide a quote so you can make the appropriate allowance in the project budget.

**Door Closers:** LCN 1460, 4040, and 4111 series closers are acceptable. The part numbers will vary greatly depending on the various door applications.

**Panic Devices/Crash Bars:** Von Duprin 99 series devices are acceptable. The part numbers will vary greatly depending on the various door applications. Exceptions can be made for special doors such as narrow stile store fronts or all glass doors. Please use a Von Duprin product in these instances.

**Automatic Door Operators and Disability Hardware:** Stanley products are the current standard.

— END OF DIVISION 8 —

## DIVISION 9 — FINISHES

### GENERAL

The Consultant shall consider the use of the space and long-term maintenance requirements in the selection of finishes.

D.C. Building Code and National Fire Protection Association (NFPA) requirements shall be adhered to for materials and installation.

All finishes should follow LEED and ASTM guidelines for VOC content, off-gassing, adhesive content, caulking compounds, asbestos and lead content, recyclability, face fiber and backing content (carpets), biodegradability and green cleaning. MSDS sheets must be available for all finish products.

Finishes shall contain the maximum amount of recycled content allowed that retains material integrity, contain as much locally harvested and processed or extracted and processed (within 500 miles) material, rapidly renewable material, and FSC-certified content as feasible. Any finishes (such as adhesives/sealants, paints/coatings, and/or composite wood) must comply with the maximum allowable VOC requirements as defined by SCAQMD. Submit product cut sheets indicating recycled content, place of origin, rapidly renewable material content, FSC-certified wood content, and VOC levels, as applicable. Track all purchases as a % of total spend complying with each sustainability criterion.

Some existing walls, ceiling tile, insulation, floor tile and acoustical plaster contain asbestos or are finished with lead-based paint. The Owner generally surveys the project during the planning process to determine which areas need to be abated prior to the beginning of construction.

### CONCRETE FLOORS

Concrete floors shall be examined, and tested if required, for the presence of moisture or foreign materials prior to application of new finishes. New concrete slab areas shall be designed with curing compounds or other admixtures to be compatible with final floor finishes.

### LATH AND PLASTER

Many of the walls on Campus are plaster. In renovation projects, it is preferred to patch plaster with a plaster material compatible with the existing material. When existing plaster ceilings are penetrated directly for mechanical or electrical work, the plaster shall be patched tightly in order to maintain the existing fire and acoustical protection.

Exterior plaster shall be reinforced with galvanized metal lath and the tie wires shall be stainless steel. Exterior plaster shall be designed as cement plaster or stucco, according to the use of the space.

### GYPSUM WALLBOARD

Drywall construction generally shall be designed to be consistent with the institutional nature of the Campus, with regard to use and abuse by the occupants and the function of the space.

Wood flooring is not recommended for use in facilities except for gymnasiums, special performing-arts areas or areas where wood floors already exist because of inherently high maintenance needs.

### RESILIENT FLOORING

Existing vinyl asbestos tile to remain in place shall not be penetrated by core drilling, attachment of equipment or by any other manner.

Solid (un-patterned) colors are not recommended due to scratching and maintenance considerations except possibly for use in border designs or accent strips. Vinyl tile shall not be used in high-moisture

areas. Seamless flooring, with a minimal number of joints, is recommended for laboratory areas and to meet LEED requirements. The Consultant, in conjunction with AU's Project Manager, shall research the type of chemicals used in laboratory areas to determine the appropriate type of flooring and joint design. Rubber base is recommended, and shall be a minimum .080 gauge cove type for use with direct-glue-down carpet or vinyl flooring. In laboratory areas, use an "integral" base with flooring if seamless flooring is chosen.

## TERRAZZO

Terrazzo used in public areas shall employ non-slip aggregate or finish. The Consultant shall consider expansion joint design and placement in coordination with structural movement of the building. Exterior terrazzo is generally not recommended. Terrazzo is not recommended for toilet areas. Integral terrazzo cove-type base is recommended.

## CERAMIC TILE

Ceramic tile floors and walls shall be designed to conform to the requirements of the Tile Council of America and the American National Standards Institute for wear, installation and sustainability. Ceramic tile with a "non-slip" finish shall be recommended for toilet areas, and ceramic wall tile shall be employed around floor-mop receptors.

Grouts shall be selected for long-term service and cleanability, as well as for flexural and tensile strength and sustainability. Generally, acrylic latex emulsions shall be used in general-use areas, and epoxy additives used for chemical-resistant or food-preparation areas.

Floor drain design shall be coordinated with tile installation, and the tile shall be cut neatly around the floor drain.

## CARPET

The Owner may elect to purchase carpet directly from the mill and have the Contractor install it, or the Owner may require the Contractor to supply and install the carpet. Traffic patterns, use of the space and maintenance requirements must be considered in the selection of carpet. The use of carpet tile, modular tile or border accent tile are preferred, when appropriate.

Carpets must meet requirements of the Carpet and Rug Institute's Green Label Plus program and carpet cushions must meet requirements of the Carpet and Rug Institute's Green Label program, or other comparable LEED-compliant standards.

## FLOOR COVERINGS:

All floor coverings will meet the FEA Flammability Standard, ASTM D-2859, and Standard Test for Flammability of finished textile floor covering materials, commonly referred to as the "Pill Test". Floor coverings utilized may be Class I (minimal radiant flux of 0.22 w/sq. cm) according to NFPA 253, standard method of test for critical radiant flux of floor covering systems using a radiant heat energy source. LEED and Green Source guidelines shall be followed for floor coverings.

## CEILING PANELS

Panels shall generally be a directional fissured design, unless a special design is necessary to a "feature" area. Panels shall be smooth vinyl when used in high-moisture locations such as food-preparation and toilet areas.

Concealed spline ceilings are not recommended. Return air plenums are not desirable, but where they occur, hold-down clips shall be provided at ceiling panels. Corner trim shall be provided where grid changes direction at wall. Light fixtures, smoke detectors, sprinkler heads, speakers and fire horns shall be centered within tiles. Check with Facilities Management for individual building standards



## PAINTING

Substrate preparation is of utmost importance. Surfaces shall be adequately prepared for painting by filling, scraping, sanding, caulking, priming, cleaning or brushing; the presence of any moisture in areas to be painted is unacceptable. Although epoxy paint is desirable in high-moisture or abuse areas, its curing time and odor must be accounted for in potentially sensitive areas. Pre-finished (factory finished) items shall not be painted. Fire protection devices shall not be painted.

Sherwin Williams shall be specified for all projects. Specialty products considered on a case-to-case exception basis only.

Paints, stains, and finishes certified to Green Seal GS-11, GS-43, GS-47 and EcoLogo 047 are required when available.

On previously painted surfaces, a minimum of one coat of finish paint shall be provided. If patching is required, a primer and at least two finish coats shall be used. Paints are to be applied by brush or roller; spray painting is not permitted.

## WALL COVERINGS

Wall coverings are generally not recommended, unless as designed in feature areas and approved by the Owner. The Consultant shall consider the following in selecting wall coverings:

- A. Type 1 commercial vinyl or reinforced fabric required
- B. Flame spread must be 25 or less
- C. Good cleanability
- D. Low maintenance

## WASHROOM ACCESSORIES

AU Housekeeping provides the following washroom accessories: soap dispensers, paper towel dispensers, tissue dispensers, and sanitary item dispensers. The project provides all other washroom accessories.

— **END OF DIVISION 9** —

## DIVISION 10 — SPECIALTIES

### GENERAL

Specialty items typically receive frequent use and shall be designed with this factor in mind. The Consultant also shall consider mounting these items to walls and floors in order to achieve low maintenance.

All items shall have a factory finish, with no field painting required. Stainless steel items shall conform to standards of the American Society for Testing and Materials (ASTM) and the American National Standards Institute for Type 304 stainless steel. Chrome-plated items shall conform to ASTM B456 standards for nickel and chromium electro-deposited on base metal. Cold rolled steel sheet material shall conform to the requirements of ASTM A366.

Specialty items shall contain the maximum amount of recycled content allowed that retains material integrity and contain as much locally harvested and processed or extracted and processed (within 500 miles) material as feasible. Any adhesives/sealants, paints/coatings, and/or composite wood must comply with the maximum allowable VOC requirements as defined by SCAQMD. Carpets must meet requirements of the Carpet and Rug Institute's Green Label Plus program and carpet cushions must meet requirements of the Carpet and Rug Institute's Green Label program. Submit product cut sheets indicating recycled content, place of origin, rapidly renewable material content, FSC-certified wood content, and VOC levels, as applicable. Track all purchases as a % of total spend complying with each sustainability criterion.

Fasteners shall be concealed. Fasteners located against or inserted into walls should be galvanized; exposed fasteners should be stainless steel.

### VISUAL DISPLAY BOARDS

Marker boards shall be white porcelain-type boards, for use with felt-tipped markers made from sustainable material.

Chalkboards shall be porcelain enamel steel with matte writing surface and minimum 1/4" thick hardboard backing.

Tackboards shall be cork surfacing on minimum 1/4" thick hardboard backing.

Markerboards and chalkboards generally shall have aluminum trim and continuous chalk troughs.

### LOCKERS

Metal lockers shall consist of minimum 16 gauge bodies and door frames of cold rolled, recycled steel with baked enamel finish. Lockers shall be placed on a concrete base, or approved alternative and shall have sloped tops or built into the wall and provision for padlocks. Number plates and interior coat hooks shall be furnished. In some instances, wood lockers with melamine interior and laminated plastic exterior finish shall be considered.

### TOILET COMPARTMENTS

Partitions and doors shall be made of recycled phenolic material, and shall be anchored to the floor or ceiling mounted and provided with overhead bracing and an approved handrail. (Side panels and door panels shall be a minimum 1" thick. Stainless steel plinths (movable for cleaning) on pilasters shall be provided.)

## TOILET AND BATH ACCESSORIES

Toilet Accessories (tissue dispensers, towel dispensers and soap dispensers and sanitary napkin disposals) will be provided by the Owner and installed by the General Contractor. Other toilet or bath accessories provided and installed by the General Contractor shall be made of stainless steel, with provision for concealed mounting. Units shall be mounted in accordance with the D.C. Building Code and the requirements of the Americans with Disabilities Act (ADA). Tissue dispensers must be mounted so they are clear of the compartment's grab bars and "door swing," and should not be mounted with screw heads visible on the wall of adjacent compartments. Provide blocking in walls as necessary for mounting of equipment. Handicap showers shall be fully accessible and designed in accordance with the D.C. Building Code and ADA requirements, and shall have a hinged seat, flexible shower spray and soap dispenser.

## SIGNAGE

Current signage shall be replaced with signage conforming to ADA requirements as part of the Owner's phased program of accessibility upgrades or during renovation projects, whichever occurs first. Larger projects may require the use of a building directory, which shall be a type in which information can be changed without special tools. Directional signage shall be considered part of the signage system for each project. In some instances, the use of cast bronze plaques with raised letters is required for a dedicatory function. Text for the plaque shall be furnished by the Owner.

A uniform system of signs for the Campus is necessary for ease of maintenance and replacement. American University has adopted exterior and interior sign standards. All campus signage projects must follow the current sign standards. The designer should consult with the Facilities Planning and Development.

Emergency evacuation diagrams shall be provided for all buildings per IFC 404.3.2.

## 10 14 10 — MECHANICAL ROOM SAFETY ALERT DRAWINGS

### PART 1 - GENERAL

#### 1. SUMMARY

- a. Description: Safety Alert Drawings shall be updated by contractors or engineers performing new and/or renovation work that will, upon completion of construction, render the current Safety Alert Drawings obsolete.
- b. Purpose: To accurately locate, identify, update and catalogue electrical, mechanical, and plumbing equipment that are vital to proper building operations and to provide equipment operators and service/repair persons with a list of safety precautions that are applicable for that particular electrical and/or mechanical room.
- c. Quality Assurance: Safety Alert Drawings shall be original or updated, produced, and provided in accordance with this specification by the responsible party as indicated by the contract documents.

#### 2. SECTION REQUIREMENTS

- a. Provide:
  - i. One hard copy of each newly updated or original Safety Alert Drawing for approval by American University before mounting and final installation.

### PART 2 – PRODUCTS

#### 1. MATERIALS

- a. Mounting Boards: Approved drawings shall be mounted on "gator" board and laminated.
- b. Drawings shall be clean and free of debris.

- c. Lamina shall cover the front, edges, and 1 ½ -inches of the backside of the drawings.
  - d. Drawings with wrinkled lamina or entrapped debris are not acceptable.
2. SIGNS
- a. Format:
  - b. Drawings shall be large enough to clearly display all text and equipment symbols; and sizes are determined by the location of the drawing in the room. Drawings shall be sized to permit unobstructed installation in mechanical/electrical rooms.
  - c. Drawings shall be one of the following drawing sizes, decided by the University Project Manager and based on the site:
    - i. 24"x 36"
    - ii. 18"x 24"
    - iii. 11"x 17"
  - d. File names shall contain the building name, room type, and room number. For example, a drawing file created for Anderson Hall mechanical room T126A would be "anderson\_mech\_t126a.dwg".
  - e. American University shall provide an example drawing in electronic format that will contain the standard border, layers, fonts, pen tables, equipment symbols, equipment names, and general layout of a standard safety alert drawing.
3. DRAWING REQUIREMENTS:
- a. The architectural layout of all drawings shall be orientated to coincide with the drawing location within room.
  - b. The drawing location shall be clearly shown on the drawings and selected so that it is visible as the room is entered or shortly thereafter.
  - c. The section of the drawing labeled "ALERT PRECAUTIONS THIS ROOM" shall contain all alert precautions present in that mechanical and/or electrical room.
  - d. Equipment names conform to the American University standard: building abbreviation-floor abbreviation-equipment abbreviation and equipment number. For example, air handler 001 located on the terrace level of Anderson Hall would be labeled: AH-TL-AHU001. New equipment names and numbers are assigned by Facilities Management.
  - e. All equipment shall be shown using the correct standard mechanical symbol. A brief description of each equipment item shall be listed below the equipment name. Important information to include in the description shall include, but are not limited to: equipment function, motor hp, voltage/phase, areas served by air handlers, fluid type of service for pumps (chilled water, etc...), location of nearest disconnect, and equipment served by electrical panels.
  - f. A leader line shall be shown from the equipment name to the location of the equipment symbol. Larger equipment items such as chillers, cooling towers, and boilers may have the equipment name placed inside the equipment symbol.
  - g. As required to save space on drawings, equipment schedules may be used to convey pertinent equipment information.
  - h. All motor control centers (MCC) shall be located on the drawings. In addition to this an elevation detail drawing accurately portraying the location and name of each motor controller shall be shown on the drawing.
4. EXISTING DRAWING FILES:
- a. Existing drawing files, provided by American University, shall retain the same cad file name, drawing name, drawing size and general format unless a change is requested by the American University project manager.
  - b. Existing drawing files shall be edited to show changes as a result of construction. Items of importance include, but are not limited to architectural layout; deletion of electrical,

mechanical, or plumbing equipment; and the addition of electrical, mechanical or plumbing equipment. Date of revision must be shown on revised drawings.

## PART 2 - EXECUTION

### 1. INSTALLATION:

- a. American University shall update all equipment tags as required. The contractor/engineer shall perform a field visit to verify the locations and equipment tags of all equipment.
- b. Create or edit Safety Alert Drawings in accordance with the drawing requirements of this specification.
- c. Submit updated/new Safety Alert Drawings to the American University for approval.
- d. Upon approval, mount drawings in accordance with this specification and install at location designated by American University. Install flat, to the subsurface, with one (1) pan head stainless steel screw in each corner of drawing.
- e. Submit an electronic copy of all Safety Alert Drawings on a compact disk in AUTOCAD format.

## FIRE EXTINGUISHERS/CABINETS

Fire extinguishers and cabinets must meet the D.C. Building Code and be approved by American University's Facilities Management (FM), and must meet the FM's Guidelines for Fire Alarm and Fire Suppression Systems Standards and Specifications, including recyclable material usage. The Owner will provide all fire extinguishers, to be installed by the General Contractor. Cabinets will be provided and installed by the GC. Although not required by code, pantries and kitchen areas should have small extinguishers.

A fire extinguisher shall be provided in each pantry or common kitchen area where a microwave or other heating appliance is installed.

## VENDING AREAS

The Consultant shall consider the long-term maintenance of the walls and floors in designated vending areas. Slip-resistant tile or commercial-grade sheet vinyl flooring shall be employed in these areas. Facilities Management (FM) coordinates the placement of vending machines and the Consultant shall coordinate electrical, plumbing and the placement of card reader wiring items with this office. Project vending area shall consider placement of outlets, drainage, visual placement of the units, accessibility to the units, floor texture at area of machines (vinyl flooring or nonskid hard surfacing is recommended), adequate lighting and adequate ventilation.

FM STANDARDS - See attached

## SERVICE CLOSETS (10 57 00)

The Designer shall provide, in the design of every new building, the following provisions and spaces, with net areas as indicated in the Service Space Allocation Division.

Service closets containing floor-mop receptors shall incorporate the following:

- mop receptors shall contain a waterproofing membrane on the floor, installed prior to placement of the basin
- built-in mop receptors shall be lined in ceramic tile and/or ceramic tile wainscot shall be provided on the walls of the service closet to a height of 6 feet above the floor

- shelving shall be provided for storage of housekeeping supplies

#### CUSTODIAL EQUIPMENT ROOMS

Minimum Size: 60 square feet per 22,000 sq. ft. of gross area.

Location: Room should be strategically located on all floors.

Shape: Room shall be rectangular.

#### DRY TRASH ROOMS

Shall be located directly off the loading dock and from a corridor. They shall be of fireproof construction and shall be protected with sprinklers.

#### WET WASTE OR HAZARDOUS WASTE ROOMS

If required by the building usage, shall be located directly off the loading dock and from a corridor. Room shall be fireproof and shall provide other protection as determined by the nature of the waste material. Designer should consult with the American Environmental Health and Safety Office before the design process begins. Provide 60 sq. ft minimum for chemistry or similar laboratory facilities.

#### FACILITIES MAINTENANCE CONTROL ROOM

Minimum size 80 square feet can serve a building size up to 80,000 gross square feet. 100 square feet size room will serve a building over 80,000 square feet up to 175,000 gross square feet. 160 square feet size room will serve a building having over 175,000 gross square feet.

—END OF DIVISION 10 —

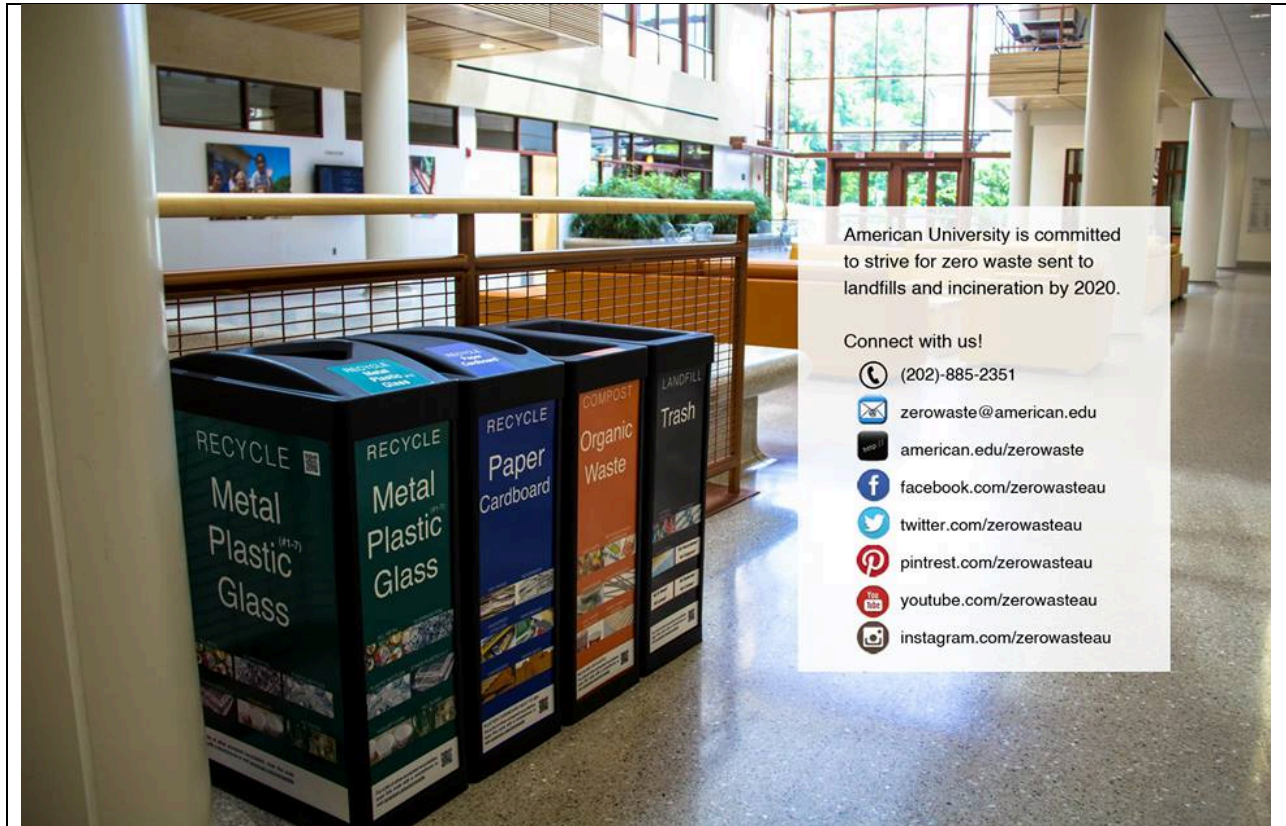
**DIVISION 11—EQUIPMENT**

**DIVISION 11 82 13 – SOLID WASTE BINS**

GENERAL: INSERT

SCOPE: 1.1

**11 82 13 – SOLID WASTE BINS – ZERO WASTE INTERIOR CONTAINER SPECIFICATION**



For purchase of interior zero waste bins, please first contact Zero Waste Coordinator:

[zerowaste@american.edu](mailto:zerowaste@american.edu)




Standard and specifications for indoor waste containers on campus. New construction, renovation projects, replacement bins will be required to purchase these containers with project funding to meet American University's Zero Waste goal and policy. ([www.american.edu/zerowaste](http://www.american.edu/zerowaste))

Manufacturer

**ErgoCan** (SNS Films, LLC), based in Ohio  
[www.ergocan.com](http://www.ergocan.com)

Containers are made from recycled plastic with interchangeable panels for when programs update or change. Container itself is also recyclable.

- 30 gallon containers are typically used for most academic and administrative spaces, especially in hallways near offices and small lounges.
- 40 gallon containers are typically used in residence halls, outside large lecture halls, and in spaces with food and beverage options that carry disposable serve ware (to-go containers, cups, napkins, utensils, etc.)
- 60 gallon containers are rarely used – but may be feasible for large events or stadium events.

Specs	<ul style="list-style-type: none"> <li>• EC1119 30 gallon – Dimensions : 11"Wx19"Lx30"H</li> <li>• EC1818 40 gallon – Dimensions: 17.75"Wx17.75"Lx30.25"H</li> <li>• EC2626 60 gallon – Dimensions: 26"Wx26"Lx35"H</li> </ul>	
Cost	<p>30 gallon - EC1119 \$90.00 each.  40 gallon – EC1818 \$195.00 each.  60 gallon- EC2626 \$315.00 each.</p> <p>Cost includes assembled container, printed panels, and lids.  Shipping extra Price breaks for large quantities: Call or e-mail.</p>	
Contact	<p>Manufacturer  Terry Netterfield  (419) 842-1004  <a href="mailto:tnetterfield@ergocan.com">tnetterfield@ergocan.com</a>  <a href="http://www.ergocan.com">http://www.ergocan.com</a></p>	<p>AU Zero Waste Coordinator  Helen Lee  202-885-2351  <a href="mailto:helenlee@american.edu">helenlee@american.edu</a>  <a href="http://www.american.edu/zerowaste">http://www.american.edu/zerowaste</a></p>
Material	<b>Mixed Paper &amp; Cardboard</b>	<b>Metal, Plastic, Glass (MPG)</b>
		
Lid	  <p>EC1119S, Paper recycle Lid (30g)  EC1818S, Paper recycle Lid (40g)</p>	  <p>EC1119D, Diamond Recycle Lid (30g)  EC1818D, Diamond Recycle Lid (40g)</p>
Material	<b>Organic Waste (Compost)</b>	<b>Landfill (Trash)</b>
		
	  <p>EC1119F – Funnel Lid (30 g)  EC1818F – Funnel Lid (40 g)</p>	  <p>EC1119F – Funnel Lid (30 g)  EC1818F – Funnel Lid (40 g)</p>



**11 82 13 – SOLID WASTE BINS – ZERO WASTE EXTERIOR CONTAINER SPECIFICATION**



Standard and specifications for exterior waste containers on campus. This bin is also used as a standard by the District of Columbia. New construction, renovation projects, replacement bins will be required to purchase these containers to meet American University's Zero Waste goal and policy. ([www.american.edu/zerowaste](http://www.american.edu/zerowaste))

**Victor Stanley SD-42**

[www.victorstanley.com/product/sd-42/](http://www.victorstanley.com/product/sd-42/)

Exact specifications can be found in the AU Design and Construction Standards Sharepoint, Shared Documents: Exterior Waste Bin Standard Victor Stanley sd42 Specs.pdf

Side-Door Opening

.375 x 1 in (10 x 25 mm) Bars, Bottom Recessed Pedestal

Landfill Containers utilize "Black" color with an open or "Convex" lid.

Single-Stream Recycling Containers utilize "Green" color with a "Recycle" Lid.

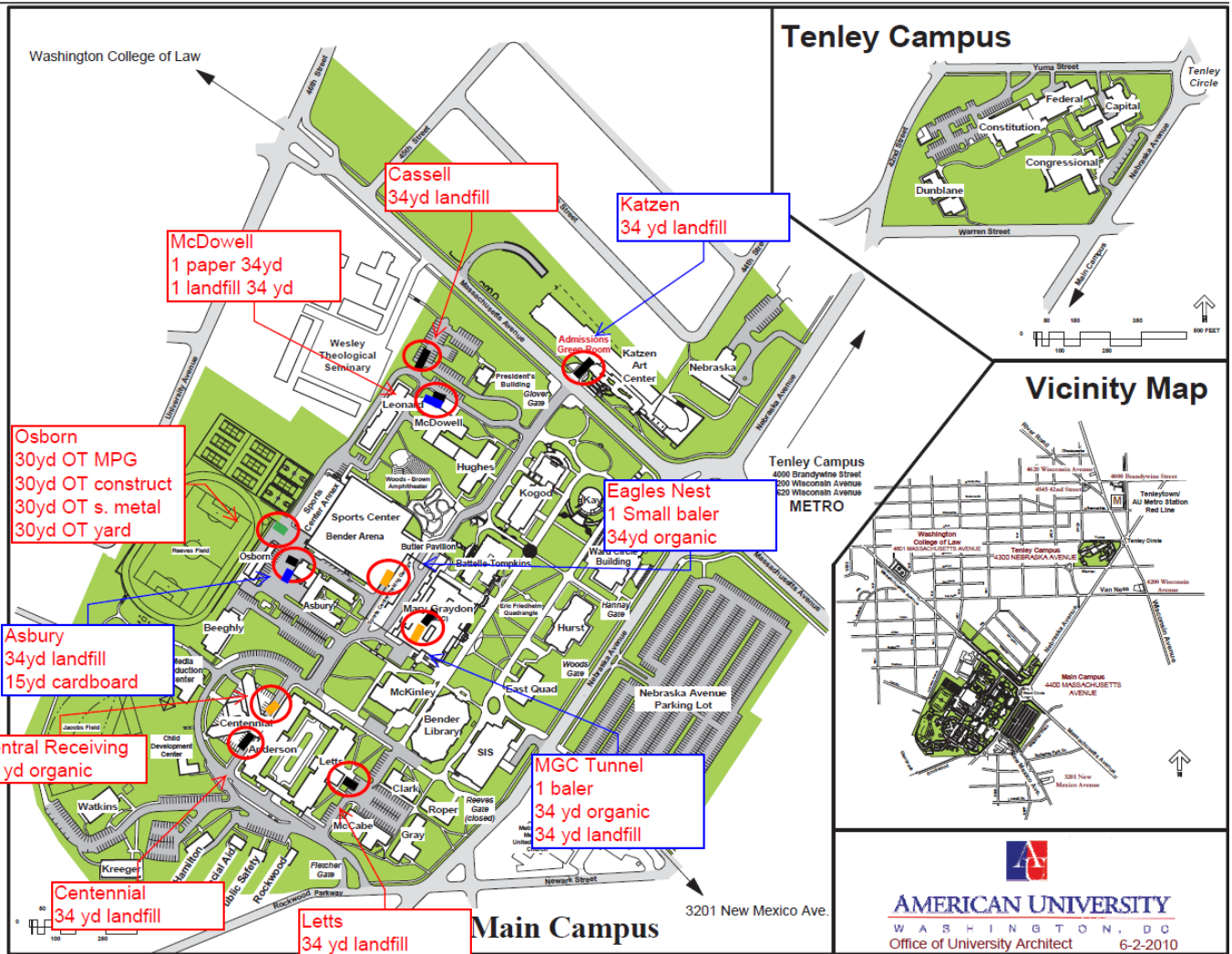


CONVEX

RECYCLE

**11 82 23 – RECYCLING EQUIPMENT**

# 11 82 26 – FACILITY WASTE COMPACTORS



American University participates in a dual stream recycling program. Metal/Plastic/Glass (MPG) is separated from Paper and Cardboard to get the most amount of rebate back possible. This also prevents paper from getting downcycled and preserve as much of the quality of the paper as possible. Finally, weights are more accurately attained since estimation is not required in dedicated streams. Organic waste, which represents up to 45% of campus waste stream, is also separated.

All waste is collected in AU's standard Zero Waste Interior Containers as outlined above in 11 82 13. These materials are then transported to either toters or designated compactors outside. All materials hauled off campus by a contractor is only large open tops or 34 yd compactors. The map above outlines the different waste streams collected on campus.

- 34yd compactor for organic waste
- 34yd compactor for landfill
- 34yd compactor for paper
- 15yd open top for cardboard loose and bails
- 30yd open top for metal/plastic/glass (so you don't smash the glass..)
- 30yd open top for yard waste compost
- 30 yd open top for c&d recycling
- 30 yd open top for scrap metal recycling

Materials are either directly tossed into open top or compactor containers, otherwise staged in 95 gallon totes. Housekeeping and internal recycling staff transport waste from totes to a dedicated compactor on site. Contractors working on campus will be required to abide by American University's Zero Waste Policy and separate their waste accordingly.

## **11 82 36 – FACILITY WASTE BALERS**

American University owns and operates two cardboard balers on campus. The larger baler is located in the Mary Graydon Center tunnel. Wax cardboard cannot be recycled in this baler but can be composted in our organic waste 34 yd compactor. Cardboard should always be flattened down and evenly placed in the baler. A box cutter is conveniently attached to the baler. When the baler is full, please contact 202-885-2FIX to put in a work ticket to empty the baler. To prevent any pest issues, food and liquids must be emptied from the boxes. Spills must be wiped and cleaned off, as it can attract fruit flies, honeybees, yellowjackets and other pests. A video tutorial on how to operate the cardboard baler at MGC can be found here: <http://youtu.be/l6TjurI56u8>

The second mini cardboard baler is located at the Sports Center (aka Eagles Nest Loading Dock). Cardboard generated from Bender Arena, Bookstore, P.O.D., and other food vendors inside the tunnel are brought down to the Sports Center cardboard baler to be baled. This area is the 2<sup>nd</sup> largest generator of cardboard on campus with the bookstore just upstairs. Wax cardboard cannot be recycled in this baler but can be composted in our organic waste 34 yd compactor. Cardboard should always be flattened down and evenly placed in the baler. A video tutorial on how to operate this baler can be found here: [http://youtu.be/gPKFTTraz\\_M](http://youtu.be/gPKFTTraz_M)

Cardboard bales are picked up by internal AU recycling staff and transported to the 15 yd open top designated for cardboard recycling. Loose and baled cardboard are collected in this open top which has a covered lid to protect from weather elements. Cardboard is sent to an off-campus recycling facility.

### **GENERAL**

Special equipment shall be designed with the following considerations:

- maintenance and service life
- education of users regarding proper operation of equipment
- warranty provisions
- replacement parts
- recycled content

### **FOOD SERVICES EQUIPMENT**

Where food service areas are part of the project, the designer shall consult with Planning and Project Management and Office of Campus life (OCL) for design and layout of the space. Food service equipment may be purchased by American University and provided to the Contractor for connection. Refrigerators, microwave ovens and coffee makers used in lounges or break rooms may be purchased by the Owner. The designer shall provide dedicated electrical circuitry for these items.

### **LOADING DOCK EQUIPMENT**

Dock bumpers shall be provided at loading areas. Loading dock edges shall be provided with steel angle edging with steel anchors concealed in concrete. The use of motorized dock levelers is not recommended; the Consultant shall accomplish proper driveway back-up clearance for vehicles on "flat grade" to the dock area, at the height of the vehicles most commonly serving the building.

Dumpsters shall be furnished by the Owner. Waste Compactors shall have push button controls totally enclosed with dock-fed hopper, guide rolls/stop and hinged breaker bar teeth.

## SECURITY EQUIPMENT

Card readers, communicating devices for readers and cabling to the devices are normally provided by the Owner. Installation and conduit are provided by the Contractor. The Consultant shall coordinate areas of access with the user and with the Public Safety Office.

Security cameras in exterior areas are furnished by the Owner, and conduit and wiring to the camera location are provided by the Contractor. The Owner is responsible for mounting and connecting the cameras. THHN (14 gauge) shall be provided by the Contractor.

## PARKING CONTROL EQUIPMENT

The Owner currently contracts with parking control vendors to supply this equipment. The Contractor shall supply conduit and wiring to the site of the equipment, and the Owner is responsible for the installation and final connection. The Owner shall supply equipment drawings and electrical requirements to the Consultant for reference. Provision should be made for Card Reader equipment to be set in a 3/4" conduit to run from the stand to the gate box.

## LABORATORY EQUIPMENT

Movable equipment, such as balances, refrigeration equipment, centrifuges and other portable laboratory equipment, may be purchased by the Owner. The Consultant shall closely coordinate the electrical and plumbing tie-ins for this equipment.

Fume hoods and bio-safety hoods may be purchased by the Owner and installed by the Contractor. The Consultant shall give special attention to ventilation requirements, particularly taking into consideration the types of chemicals used in the laboratories, air-velocity sensing devices and the need for emergency back-up power. Motorized elements such as fans shall be designed to provide protection suited to the type of chemicals used. Safety of the user is of highest priority in hood sash (and opening) design and in the design of ventilating storage cabinets. New fume hood design strategies have been demonstrated to reduce energy use by 75% , while maintaining or enhancing safety. Therefore, High Performance, energy efficient fume hoods (e.g. VAV system equipped with a sensor-based auto sash closure) are required. Casework generally shall comply with requirements of Division 6 with regard to wood construction and as a basis for manufactured casework. Casework designed for storage of sensitive equipment or for chemical storage shall have locks.

Eye washes, shower washes and fire extinguishers shall be supplied in laboratory areas. In some cases, wall-mounted fire blankets shall be required. Eye washes and emergency showers must meet the requirements of the American National Standards Institute (ANSI), as specified in the latest edition of ANSI Z358.1. See specification provided by Risk Management.

Vacuum and air connections shall be employed in laboratory areas, and gas connections shall be employed where required. Vacuum breakers shall be provided on faucets. Laboratory casework shall be placed with at least 5 feet between benches to allow for handicap accessibility.

Refrigeration equipment used in laboratory areas may be purchased by the Owner and installed by the Contractor. Refrigeration equipment used for critical experimentation must be placed on emergency electrical back-up service.

## ENERGY STAR

Energy Star rated equipment is required for commercial dishwashers, fryers, griddles, hot food holding cabinets, ice machines, ovens, refrigerators and freezers, and steam cookers as well as any other product category as ratings become available. See [http://www.energystar.gov/index.cfm?c=products.pr\\_find\\_es\\_products](http://www.energystar.gov/index.cfm?c=products.pr_find_es_products).

(Will also add mention of EPEAT & ENERGY STAR for computers, imaging equipment, etc. in relevant section. DRO))

Div.	Section	Selection Criteria	Accepted Examples	Technical Owner	Key Stakeholders
11	<b>Equipment</b>				
11	Residential Appliances		See list provided by Housing and Dining Services of acceptable residential appliances	HDP – C. Ladue	FM PPM Housekeeping RMEHSO
11	Projection Screens		Cosmopolitan Electrol by Da-Lite Screen Company, Inc.	AVSS	FM - D. Adkins PPM
11	Dishwasher/Refridgerator		Bosch	HDP – C. Ladue	OPPM FM Housekeeping RMEHSO
11	Student Housing Furniture	Low- no VOC	GreenGuard, Green Seal, EcoLogo	PPM – K. Hesse	HDP FM Housekeeping RMEHSO
11	Compact Storage Units		Various Lines by Spacesaver	PPM – K. Hesse	HDP FM Housekeeping RMEHSO

— END OF DIVISION 11 —

## DIVISION 12—FURNISHINGS

### GENERAL

Furnishings are usually supplied by the Owner. The Owner typically contracts with private vendors who make field measurements, manufacture and install the items. These items include:

- window blinds
- draperies, selected by the Owner and used in certain areas; the Consultant shall coordinate the design of support alcoves and proper substrates to provide for the mounting hardware and rods\*
- movable rugs
- interior plants
- artwork
- movable furniture and accessories; in larger projects, the Owner may employ the Consultant to assist in the selection of these items through an interior design contract
- upholstered furniture and components utilized may be Class I or Class II according to NFPA 260, standard method of tests and classification system for cigarette ignition resistance of upholstered furniture and will have a peak rate of release limit of 500 kw in accordance with NFPA 261, standard method of test for determining resistance of mock-up upholstered furniture material assemblies to ignition by smoldering cigarettes.

The furnishings listed above shall be included as part of the overall interior design considerations for the project, and shall be included on color presentation boards as required.

Note on Curtains, draperies and window dressings: All fabrics will be flame resistant. Flame resistant fabrics must pass both the large and small scale tests in accordance with NFPA 701, standard methods of fire tests for flame resistant textiles and films.

Furnishings shall contain the maximum amount of recycled content allowed that retains material integrity, contain as much locally harvested and processed or extracted and processed (within 500 miles) material, rapidly renewable material, and FSC-certified content as feasible. Any adhesives/sealants must comply with the maximum allowable VOC requirements as defined by SCAQMD. Composite and agrifiber products must contain no added urea formaldehyde resins. Submit product cut sheets indicating recycled content, place of origin, rapidly renewable material content, FSC-certified wood content, VOC levels, and urea formaldehyde resin limits, as applicable. Track all purchases as a % of total spend complying with each sustainability criterion.

### MANUFACTURED EQUIPMENT

Built-in theater, auditorium and classroom seating shall conform to requirements of the D.C. Building Code, with respect to spacing, egress and fire-resistant classifications. The decision to purchase the seating outside the construction contract shall be made by the Owner.

The requirements of manufactured casework are similar to casework requirements described in Division 6. On larger projects, the Owner may require mock-up assemblies for review by the user, prior to manufacture. Mock-ups shall include all represented items associated with the assembly, including sinks, backsplashes, finish and hardware.

### ENTRANCE MATS

Entrance mats shall be designed according to the following criteria:

- non-slip surface
- wearability and service life (no rotting or mildew)
- ability to clean foot traffic on textured nylon or polypropylene surfaces without "tracking"
- drainage of recessed area

- maintenance and cleaning of recessed areas and mat
- replacement of parts
- color fastness of "colored" mats; drying capability of mats
- stability of the mat system (no "rattling" of slats when walked upon)
- fire resistance

The design of recessed mat systems employing aluminum-edge "slat" type grating or full- perforated rubber or vinyl is not recommended.

Entryway systems (grilles, grates, mats) must be at least 10' long in the primary direction of travel to capture dirt and particulates entering the building at all public entry points. Consult with American University Housekeeping for selection.

Mat systems should be appropriate for the climate, should have high void volume within fibers, solid backings, fire-retardant ratings that exceed DOC-FF-1-70, and electrostatic propensity levels of less than 2.5 KV. Systems with recycled-content and rubber backings are preferable.

Div.	Section	Selection Criteria	Accepted Examples	Technical Owner	Key Stakeholders
12	Furnishings				
12	Furniture		Various Lines by Misc Manufacturers	PPM. - K.Hesse	FM Housekeeping RMEHSO
12	Office Furniture	Totally Chlorine Free, Processed Chlorine Free, Low- non Toxic		PPM –K.Hesse	FM Housekeeping RMEHSO

—END OF DIVISION 12 —

## **DIVISION 13—SPECIAL CONSTRUCTION**

### **GENERAL**

Spaces requiring special purpose rooms, vibration control, radiation protection, gas storage systems and special security systems shall be considered in the programming of specialized structures or in areas of ultra-sensitive experimentation.

### **PRE-ENGINEERED STRUCTURES**

The University's design philosophy prohibits pre-engineered buildings within the main boundaries of the Campus, unless specifically approved by the Owner. In some cases, structures of this type may be used off Campus, where storage or distribution is of primary concern.

**END OF DIVISION 13**



## DIVISION 14—CONVEYING EQUIPMENT

### GENERAL

Elevators shall be easy to maintain and service. Maintenance of finish materials is of particular concern, given the frequent use of most elevators. Installation shall take place based upon the latest applicable code governing conveyance systems.

The Contractor shall provide the University with the final inspection report indicating that the elevator installed complies with all appropriate state and fEal codes and regulations. This includes all associated items provided by the manufacturer.

### CAR ENCLOSURES

Emergency telephones shall dial into the Public Safety Department telephone number. For elevators that will have utility use, cars may be furnished with removable wall pads and hooks, as well as with handrails. The Designer is to clarify with the Owner.

Cars shall contain a lighted floor indicator above the door or in the return column; soffit mounting is not acceptable. An electrical receptacle for housekeeping purposes shall be provided in the corridor adjacent to the elevator landing on each floor. Interior cab finish companies shall fall under the control of the elevator installation contractor. Cab finishes shall be determined and approved by the University approved architect.

Elevators must be in compliance with the requirements of the Americans with Disabilities Act (ADA).

### MACHINE ROOMS, PIT AREAS AND PENTHOUSES

Where equipment is subject to severe or sudden vibrations, sound-deadening material shall be used to isolate any sounds or vibrations from the supporting floor or wall. Machine rooms shall comply with the latest applicable code with regards to its dimensions, fire protection and atmospheric control.

Access to pits and machine rooms shall be built in accordance with the D.C. Code for Elevators.

### ELEVATOR CONTROLLERS

Elevator controllers shall be non-proprietary in their design. This is defined as having equipment that in which at least three elevator companies can work on without the use of special tools, passwords and any more technical expertise than is already possessed. Typical non-proprietary manufacturers are ones such as Motion Control or GAL. Proprietary manufacturers are ones such as OTIS, Thyssen-Krupp, and Kone. Although the aforementioned companies tend to offer their own manufactured systems which are proprietary, if specified, these can install non-proprietary systems.

All necessary tools for the purpose of monitoring and or adjusting elevator controllers shall be provided by the installation company. This includes any special software or handheld devices normally used.

### ELEVATOR DOOR EQUIPMENT

Elevator door equipment shall be from GAL using the closed loop door operator MOVFR system

### TRACTION ELEVATORS

When the building design prevents the use of a penthouse machine room or the decision is to not install hydraulic elevators, the installation of Machine Room Less (MRL) traction type elevators can be installed. MRL elevators shall be such that it will not require proprietary tools or equipment to be serviced.

All traction machines shall be in compliance with the Office of Sustainability and be equipped with regenerative drives.

## HYDRAULIC ELEVATORS

Hydraulic elevators can be of either a single jack system or a dual post jack system. Choice of which jack to install is dependent on ground conditions. To protect elevator single jack units, the casing and any underground piping shall have an approved coating designed to resist electrolytic and chemical corrosion. The jack shall be installed in a double bottom cylinder. The Consultant shall inspect the casing prior to back-filling.

## VERTICAL WHEELCHAIR LIFTS

The Consultant should submit complete product information to the Project Manager for approval prior to ordering the lift and constructing the surrounding areas. The information should cover major components; lift dimensions, control diagrams, surrounding construction configurations and electrical connections. The Consultant shall submit to the Owner a certificate indicating that the lift complies with the applicable D.C. Code. This includes all associated items provided by the manufacturer.

Self-closing gates and associated items at top and bottom levels, along with all "electromagnetic" and mechanical hardware, shall comply with the D.C. Vertical Wheelchair Lift Code.

The lift's rated speed shall not exceed 40 feet per minute.

The following guidelines for platforms and ramps shall be observed:

- a. platforms shall be at least 36" wide and have an inside area of not more than 12 square feet
- b. platform surfaces shall be constructed of material that is relatively smooth and skid-proof
- c. ramps shall be provided as required for access to platforms
- d. ramps shall be designed and constructed as required by the D.C. Vertical Wheelchair Lift Code
- e. platforms shall be designed and constructed to prevent wheelchairs from leaving the platforms prematurely

## STAIRLIFTS

Stairlifts shall comply with all applicable elevator and ADA codes. Design shall be in accordance with the conditions in which it is installed. If a stairlift is intended to be exposed to the outside elements then the design and or equipment shall be such that all operating components will resist corrosion or complication due to the elements.

— **END OF DIVISION 14** —

## DIVISION 21—FIRE SUPPRESSION

### GENERAL

Fire detection and alarm systems are critical in assuring life safety and to protect American University owned property. It is imperative that they perform their vital function properly and reliably. These standards are applicable to new installations of fire and smoke detection and alarm systems in all Campus facilities, as well as all modifications, upgrades and renovations to existing systems.

### SPRINKLER AND STANDPIPE SYSTEM MONITORING

Standpipe installation shall comply with NFPA 14 and whenever possible, installed as a dry system. Sprinkler installation shall comply with NFPA 13 or 13R and Appendix D: Standards for Automatic Sprinkler Systems.

Each water-flow switch will be provided with an integral 20 to 40 second time delay device to prevent nuisance alarms from surges in water pressure. Permanent provision shall be made for testing each switch by water flow equivalent to that from a standard 1/2 inch sprinkler head.

Separate water-flow switch (es) shall be provided for each floor, just downstream of every cutoff valve, on each riser.

Sprinkler supervisory circuits for monitoring valve tamper are limited to no more than three valves each, either on one floor or one riser. Other sprinkler system supervisory functions, such as dry pipe/pre-action system hi-low air pressure monitoring, must be on individual circuits. (See 1.24) Rooms housing sprinkler control valves will be marked with a white sign with red letters stating "Sprinkler Controls Inside". All sprinkler control valves shall be numbered and identify what section of the sprinkler it controls.

Inspector's test valves will be located at the highest point and whenever possible, piped to ground level and outside of the building with the appropriate 1/2" test fitting installed on the end of the pipe. Test valve discharge will not flow onto or across any sidewalk, stairs or public walkways.

Post indicator valves will be provided for each sprinkler system. Post indicator valve control shall be tied into the FACP on a separate module and wired in such a manner as to activate the "Trouble Alarm". Standpipe flow switches shall be tied into the FACP on a separate module and wired in such a manner as to activate the "General Fire Alarm". Each standpipe flow switch will be provided with a spring loaded ball type check valve or an integral 15 to 20 second time delay device to prevent nuisance alarms from surges in water pressure. Standpipe tamper switches shall be tied into the emergency alarm system on a separate module and wired as to activate the "Trouble Alarm". Operation of the tamper switch shall not affect the operation of the flow switch and shall not activate the General Fire Alarm.

Standpipe control valves shall be enclosed in a cabinet or room and clearly marked by a white sign with red letters stating, "Fire Department Use Only". Standpipe fire hoses will not be installed in the hose cabinets, however, each standpipe connection must match District of Columbia Fire Department threads and diameter.

### KITCHEN EXHAUST HOOD EXTINGUISHING SYSTEMS

All kitchen exhaust hood extinguishing systems shall be Ansul R-102 Wet Suppression System - no other suppression system will be specified or installed without the approval of the OESO-Fire Safety Division. Each system shall comply with NFPA 17A and NFPA 96.

Systems shall be interconnected with the fire alarm, on a dedicated zone. The exhaust fan must continue running after the system has been discharged to remove smoke, but the supply fan shall stop. Appliances under the kitchen hood must have their gas or electric fuel automatically shut off upon agent release. Both of these functions are normally performed directly by the extinguishing system, through

mechanical linkage to the gas valve and via internal micro- switches controlling shunt trip breakers. All shut down devices shall require manual reset prior to fuel or power restoration. Initiation devices shall be fusible link rather than electrical devices. For standardization of hood suppression systems, reduction of maintenance costs and to simplify training for emergency response personnel, Public Safety has approved the following suppression system for installation in Campus facilities:

A "Puff Test" shall be performed and witnessed by OESO Fire Safety personnel and District of Columbia Fire Marshall.

Div.	Section	Accepted Examples	Technical Owner	Key Stakeholders
<b>21</b>	<b>Fire Suppression</b>			
21	Fire Alarm System	MXL/MXLV by Siemens Cerberus	FM – B. Johnson	PPM
21	Smoke Detectors	1275 by Kiddie	FM Zones	FM/B. Johnson, PPM
21	Exit Signs	LE-EL N Emergency LED by Lithonia	FM –B. Johnson	PPM, FM Zones
21	Wheelchair Lift (Exterior)	Garaventa	FM - S. Kriesten	RMEHSO
21	Wheelchair Lift (Interior)	Wheel-O-Vator	FM - S. Kriesten	RMEHSO
21	Generators (Diesel)	Cummins	FM – B. Johnson	OPPM Risk Mgmt

— **END OF DIVISION 21** —

## DIVISION 22—PLUMBING

### GENERAL

Refer to spec and design spreadsheet for details.

#### 22 30 00 Plumbing Equipment

#### 22 42 00 Commercial Plumbing Fixtures

The following flow and flush rates are required minimums for all new and replacement plumbing fixtures. Indoor plumbing renovations must include plumbing fixture replacements compliant with the flush and flow rates below.

<b>Fixture</b>	<b>Flow / Flush Rate</b>
Water closet	1.28 / .08 GPF dual flush
Urinal	.125 GPF (pint flush) urinal
Lavatory faucet	0.5 GPM
Kitchen / janitorial sink	2.2 GPM
Shower	1.5 GPM

Refer to the Product and Performance Guide for preferred examples.

For residence halls and high-traffic areas, low-flow toilets must incorporate a pressure-assisted technology (as opposed to the standard gravity-fed option).

Accepted example: [FlushMate.com](http://FlushMate.com)

#### 22 45 00 Emergency Plumbing Fixtures

##### Requirements

The need to install a safety shower or eyewash is dependent upon the planned use of the space. All new construction and renovation projects that require installation of a safety shower or station must ensure that the equipment complies with the most recent ANSI Z358.1 standard. Final design approval should be obtained from the Risk Management office.

All installations shall meet the following standards:

- ANSI Z358.1 (most recent publication)
- OSHA – 29 CFR 1910.151(c)
- Americans with Disability Act of 1990

#### 22 45 13 Emergency Showers

An emergency shower is required in any area that contains or will contain more than 2.5 liters of caustics or corrosives that could cause injury to the skin or eyes. The product's Safety Data Sheets should be reviewed for any language that refers to the substance as an "injurious corrosive." Some examples of areas that require eyewash equipment are: battery changing or charging stations, wet laboratories, pesticide mixing stations, chemical or pesticide storage areas, and fine art studios.

Hand-held emergency drench hoses are not acceptable alternatives to plumbed emergency showers.  
Emergency shower placement

In an area where an emergency shower is required as stated above, the shower must be placed as follows:

- Emergency showers should be accessible within 10 seconds from any point in the work area, with the maximum travel required being 50 feet.
- Within a single-room laboratory (of standard size), one shower is acceptable.
- The shower should be no more than 50 feet away from the nearest laboratory entryway.

### **Design Requirements**

- The shower must be plumbed and provide potable, tempered water between 60°F and 100°F, with an ideal sustained temperature of 85°F.
- Equipment must be made of stainless steel and/or high impact plastic.
- The shower must be able to be activated in one second or less and stay activated without further use of the operator's hands. It must stay activated until manually shut off.
- The eyewash must deliver at least 20 gallons of water per minute.
- The water pressure should be 30 psi.
- At a height of 60 inches above the floor, the spray pattern must be at least 20 inches in diameter.
- Water service to the shower must be equipped with a ball valve and lever handle. The valve must be accessible with a 6-foot ladder to provide shut-off capability in order to service the fixture. The valve's handle shall be able to be turned/manipulated without the need for tools or equipment. A single valve shall serve to shut of both the hot and cold water.
- Exposed piping subject to damage must have PVC jacketing.
- Outdoor equipment must be equipped with freeze protection.

A sign shall be placed above each emergency shower that reads "Emergency – Safety Shower" and contains the safety shower symbol. The background may be white or green with black or white writing. The sign must be large enough and placed high enough above the station so that it can be easily seen and read from anywhere within the immediate space.



#### Configuration

- The shower may not be located directly over or within three feet of electric power sources such as outlets, switches or power supply panels, regardless of whether or not they are Ground-Fault Circuit Interrupted (GFI).
- The center of the showerhead must be at least 24 inches away from obstructions (walls, benches, etc.)
- The activation pull shall not be more than 69 inches from the floor.
- The activation pull must be located out of the normal pathway in the room to minimize the likelihood of accidental activation, preferably within two inches of a wall or bench.
- The shower may not be obstructed by other permanent or temporary structures.
- Strainers are recommended in the hot and cold water lines ahead of the tempering valves and eyewashes or showers.
- The showerhead shall be between 82 and 96 inches from the floor.
- It is preferred the shower be located near a floor drain, and the floor shall be sloped toward the drain. Floor drains with removable plugs are acceptable. Floor units not plumbed to a drain, the waste connection must point away from the wall.

#### 22 45 16 Eyewash Equipment

An emergency eyewash station is required in any area that contains or will contain caustics or corrosives that could cause injury to the eyes. The product's Safety Data Sheets should be reviewed for any language that refers to the substance as an "injurious corrosive." Some examples of areas that require eyewash equipment are: battery changing or charging stations, wet laboratories, mechanical spaces, housekeeping store rooms, theater set design studios, photography dark rooms, chemical or pesticide storage areas, and fine art studios.

Hand-held eyewash bottles and self-contained eyewash stations are not acceptable alternatives to plumbed eyewash units.

#### Emergency eyewash placement

In an area where eyewash equipment is required as stated above, the eyewash station must be placed as follows:

- Eyewashes should be accessible within 10 seconds from any point in the work area, with the maximum travel required being 50 feet.
- If the eyewash station cannot be reached within 10 seconds or 50 feet, whichever is less, another eyewash station must be installed.

- The eyewash station must be present within the same contiguous area as the hazard. It must be positioned such that the user does not have to travel to a different room to use.
- The eyewash unit may be combined with safety showers or sink-mounted, as long as it still meets the design requirements discussed below.

#### Design requirements

In an area where eyewash equipment is required, the eyewash station must be designed to the following specifications:

- The eyewash must be plumbed and provide potable, tempered water between 60°F and 100°F, with an ideal sustained temperature of 85°F.
- Equipment must be made of stainless steel and/or high impact plastic.
- The eyewash must be able to be activated in one second or less and stay activated without further use of the operator's hands. It must stay activated until manually shut off.
- Nozzles must have caps that protect them from airborne contaminants. The caps must automatically discharge upon activation without additional operator effort.
- The eyewash must deliver at least 0.4 gallons of water per minute.
- The water pressure should be 30 psi.
- Exposed piping subject to damage must have PVC jacketing.
- Outdoor units must be equipped with freeze protection.

A sign shall be placed above each eyewash station that reads "Emergency – Eye Wash Station" and contains the eyewash symbol. The background may be white or green with black or white writing. The sign must be large enough and placed high enough above the station so that it can be easily seen and read from anywhere within the immediate space.



#### Configuration

- The eyewash may not be located directly over or within three feet of electric power sources such as outlets, switches or power supply panels, regardless of whether or not they are Ground-Fault Circuit Interrupted (GFI).
- The eyewash must be installed with sufficient space to allow the user to hold their eyelids open with both hands while the eyes are being rinsed
- Nozzles should be positioned between 33 and 45 inches from the floor, and at least 6 inches from the wall or nearest obstruction. The nozzles must be easily accessible to the operator with no



obstructions. Combination drench hose/eyewash units must be positioned so that the eyewash can be activated without having to manipulate the drench hose.

- Strainers are recommended in the hot and cold water lines ahead of the tempering valves and eyewashes or showers.
- The eyewash should be located above a sink or floor drain. For units with a waste connection that is not plumbed to a drain, the waste connection should point away from the wall.

#### 22 45 19 Self-Contained Eyewash Equipment

Self-contained eyewash equipment may not be used in new construction or major renovation projects. Self-contained eyewashes may only be used in areas that have changed occupancy but have not undergone renovation. The Risk Management office must be notified prior to the installation of a self-contained eyewash station.

#### 22 45 29 Hand-Held Emergency Drench Hoses

A hand-held emergency drench hose may serve as an additional piece of safety equipment, but may not replace an emergency shower where one is required. Refer to section 22 45 13 to determine if a safety shower is required.

#### 22 47 00 Drinking Fountains and Water Coolers

##### 22 47 13 Drinking Fountains

All drinking fountains must accommodate a refillable water bottle. Fountains that accommodate reusable water bottles come at two price points, glass fillers and bottle filling stations. The filling stations have advantages with speed, visibility, sanitation, and vandalism-prevention, however they are more expensive. New buildings are required to have water bottle filling stations. During renovation projects, water fountains must either be replaced with filling stations or modified with glass fillers in low traffic areas. Accepted examples of each are below:

Filling Stations:

- Elkay EZH2O
- Oasis Versafille
- Halsey-Taylor HYDROBOOST Retro-Kit HTHB-HAC-RF-NF8
- Example photo:



Div.	Section	Selection Criteria	Accepted Examples	Notes	Technical Owner	Key Stakeholders
22	Plumbing					
22	Ball Valves	Valve Construction: Adjustable Packing Gland Blow-Out Proof Stem Design PTFE Seats and RPTFE Stem Packing Chromium Plated Ball or Stainless Steel ball (Full Port) Performance Rating Maximum Pressure: 400 psi CWP, 125 psi SWP Maximum Temperature: 400°F Vacuum Service to 29 in. Hg	Preferred Manufacture: Apollo		FM - J. Allen	PPM FM Zones
22	Butterfly Valves	High performance positive shut off on pressure or vacuum with zero leakage	Keystone, Hammond, Milwaukee		FM - J. Allen	PPM FM Zones
22	Faucets	0.5 gpm or less	Chateau 4601 by Moen		FM Zones	PPM OS
22	Shower Controls	1.5 gpm or less	-		FM Zones	PPM OS
22	Flushmeters	1.28 gpf- toilet/ pint flush (0.13 gpf - urinal)	Sloan UPPERCUT® Manual Dual-Flush; Sloan Royal 116-1.28 Flush Valve; Sloan Royal 186		FM Zones	PPM OS
22	Toilets	1.28 gpf			FM Zones	PPM OS
22	Urinals	Pint flush (0.13 gpf)	WEUS-1000-1001-0.125 by Sloan		FM Zones	PPM OS
22	Garbage Disposal		Badger 5 by Insinkerator		FM Zones	
22	Copper Piping	Type "L" thickness or better			FM - J. Allen	PPM FM Zones
22	PVC	DWV - schedule 40 Potable Water - Schedule 80			FM - J. Allen	PPM FM Zones
22	Liquid Pretreatment		NALPREP 2578 by Nalco	No Exceptions	FM - J. Allen	PPM FM Zones
22	Corrosion Inhibitor		Trasar Trac 107 by Nalco	No Exceptions	FM - J. Allen	PPM FM Zones
22	Closed System Water Treatment		3D Trasar System by Nalco	No Exceptions	FM - J. Allen	PPM FM Zones
22	Open Loop System Water Treatment		3D Trasar System by Nalco	No Exceptions	FM - J. Allen	PPM FM Zones
22	Chemical Containment & Delivery System		Mini Plus or Micro Base Tank by Nalco (Sized based on chemical volume)	No exceptions	FM - J. Allen	PPM FM Zones
22	Water Treatment controller		Nalco 3D Trasar	No exceptions	FM - J. Allen	PPM FM Zones

22	Bath Lavatories	0.5 gpm or less	Sinks - Various Products by Delta		FM Zones	PPM OS
22	Showerheads	1.5 gpm or less			FM Zones	PPM OS
22	Toilet Flush Valves	1.28 gpf toilet valves; 0.13 urinal valves	WEUS-1000-1001-0.125 by Sloan		FM Zones	PPM OS
22	Toilet Partitions		Yemm & Hart		FM Zones	PPM Housekeeping
22	Water Fountains	Filling stations in high traffic areas; goose-neck fillers in low-traffic areas	EZ H2O to Go (bottle filler) by Elkay; Hydro Boost (bottle filler) by Halsey Taylor; Aqua Pointe (bottle filler) by Oasis		FM Zones	OS

Glass fillers:

- "Goose-neck"
- Example photo:



— END OF DIVISION 22 —

## DIVISION 23—HVAC

### GENERAL

For all new construction and renovation projects, the Mechanical and HVAC design shall comply with local and state codes and with the latest codes and guidelines of the following organizations:

- a. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
- b. American National Standards Institute (ANSI)/ASHRAE 62.1-2007 Ventilation for Acceptable Indoor Air Quality (We should be using at least 62.1-2007 which is a LEED requirement for NC and EB (IEQp1) rather than this earlier standard. CO)
- c. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Standards for Ductwork Design
- d. ANSI/American Industrial Hygiene Association (AIHA) Z9.5-1992 Laboratory Ventilation
- e. ANSI/ASHRAE 110-1985 Method of Testing Performance of Laboratory Fume Hoods
- f. American Society for Testing and Materials
- g. National Board of Fire Underwriters
- h. National Fire Protection Association (NFPA)
- i. National Electrical Code
- j. National Electrical Manufacturers Association
- k. Occupational Safety and Health Administration (OSHA)
- l. American Society of Mechanical Engineers (ASME)

The Consultant shall provide a written description of how the entire system is designed to operate. This narrative also shall describe how project objectives are being met. It shall be provided in a format that can be easily understood by a lay person, the end user.

For renovations, the systems selected shall be compatible with the existing building's mechanical systems. The integrity of the basic existing building system shall not be compromised, except where agreed to by the Owner.

The cold water supply and sewage systems serving the American University Campus are maintained by the Central Plant Operations (CPO).

For site work, the Consultant shall indicate all existing underground work such as piping, valves, manholes, electric wiring and telephone, whether new connections are being made or not. Profiles of all storm and sanitary sewers need to be shown to facilitate coordination with the crossing of other utilities. Plumbing design shall be compatible with the latest version of the National Energy Act as amended to include water conservation requirements. Energy conservation measures shall be incorporated into all projects.

Piping and plumbing equipment design and selection shall allow for anticipated future building expansion. The Consultant shall evaluate piping that might be subject to freezing and provide proper freeze protection as necessary.

Water or sanitary piping will not be allowed in telephone rooms, electric equipment rooms and closets, elevator machine rooms, emergency generator rooms or over motor control centers. In addition, sanitary drainage piping shall not be run at the ceiling of any food- preparation or serving area. Water and gas piping shall not be run under buildings where access is not readily available. The Consultant shall allow for normal expansion and contraction of the piping system. In addition to specifications, the drawings shall indicate expansion joints or pipe swings where required.

All water systems shall be designed to be fully drainable.

## MECHANICAL EQUIPMENT ROOMS

New mechanical equipment rooms (MER's) shall be designed to have access from the outside, via an opening large enough to facilitate the removal of the largest piece (or component) of equipment therein. It is desirable that access by truck be incorporated where possible.

American University requires that the Consultant minimize the visual impact of any equipment that must be located on building roofs. Where placement of such equipment is unavoidable, it shall be designed so that penetration of the roofing system is minimized. Adequate maintenance access shall be provided. Rooftop walkways, access to the roof by a service elevator and other necessary measures shall be included.

For renovation projects that involve small equipment rooms, direct access to the rooms from a corridor or a public space is required.

Equipment should not be installed above ceilings. Where this is unavoidable, or where units are installed in concealed locations, there should be auxiliary drain pans independently piped to drains and access panels to allow for full service and equipment removal. Auxiliary drain pans shall be independently supported. Submit calculations to the owner to verify structural adequacy.

Ample space shall be provided for service access to all equipment, including pulling tubes for converters, chillers and air-handling unit coils.

Lifting eyes shall be provided in equipment rooms in which the moving of heavy equipment is anticipated and for above ceiling equipment.

MER's shall be well lighted with fluorescent lighting and be switched at each exit.

All mechanical equipment rooms shall be equipped with duplex convenience outlets suitable for operating small tools and drop-cord trouble lights.

Floor drains are required. MER's above the lowest floor shall be curbed to prevent flooding. Provisions for domestic water services for maintenance purposes shall be provided.

Provide thermostatically controlled ventilation as required.

The system design should be such that it meets the needs of the application. The Consultant shall select equipment that is consistent with the design and application of the system. Mechanical systems shall be designed to accommodate future functional space changes.

## STEAM RELATED DESIGN CRITERIA

American University owns and operates a Steam Plant that provides steam for the Main Campus and the Tenley Campus. The Project Manager and Consultant shall coordinate work with Physical Plant Operations (PPO). The steam demand for any new construction or renovation shall be submitted to PPO for verification of whether the existing steam distribution system will be adequate to meet the new demand.

New systems connecting to the main campus steam distribution system are to be designed to work with medium pressure steam (45 to 65 Psig) without the use of reducing stations or safety valves. Four pipe buildings requiring reheat in summer shall include means for providing heating water when steam is not provided via the main steam plant. Steam condensate shall be pumped back to the Steam Plant.

## CHILLED WATER RELATED DESIGN CRITERIA

The desired cooling medium for air conditioning systems is chilled water, but the system should be applicable. American University currently does not have a central chilled water plant, but some mini chilled water loops support two or three buildings.

For renovation projects, the Consultant shall verify that the existing chilled water system will support the new load. Renovations to existing chillers and towers shall require careful and realistic scheduling so as

to minimize system impact at the building. New systems connecting to a campus chilled water loop shall use a plate and frame heat exchanger between the building and the central chilled water loop. Chilled water systems and related terminal equipment shall be designed for a minimum 12 degree temperature differential.

To meet winter cooling loads, a water side economizer can be employed in some special applications where the use of 100% outdoor air is not possible. Plate and frame heat exchangers are strongly recommended for this application. Use of a side stream filter is strongly recommended for the cooling tower side of the system.

Special attention shall be paid to fresh air requirements for ventilation. Criteria for minimum fresh air shall follow the latest ASHRAE guidelines. Consideration should be given to "ON demand I.A.Q." such as CO2 sensors.

To satisfy system requirements for outdoor air, a minimum outside air louver shall be provided for air-handling units.

The location of outside air intakes shall be chosen for proper separation from any exhaust outlets to prevent cross contamination.

Air conditioning systems should make use of re-circulated air from spaces where no air contamination exists, such as offices and classrooms.

#### SOUND AND VIBRATION CONTROL

Outdoor equipment such as cooling towers, fans, and air-cooled condensers shall not produce noise levels that will be objectionable to facility occupants. The dB level required to meet this goal shall be specified

HVAC equipment located in the building shall be carefully evaluated for sound level. If sound levels are expected to be higher than recommended in ASHRAE guidelines, sound control devices are required. Room terminal units such as variable volume terminals shall be selected for low sound levels. Air supply diffusers and registers shall have sufficiently low air velocity to meet low sound criteria. Air noise from a supply outlet is not acceptable.

Appropriate vibration isolation of equipment, piping and ductwork shall be specified. Mechanical equipment rooms shall be placed preferably at ground level and away from occupied spaces to minimize transmission of vibrations into the building.

#### BUILDING AUTOMATION SYSTEM

American University has standardized its automated building control systems. The standard specifications shall be followed on all projects. The standardization of building control systems does not relieve the Consultant from providing schematic control diagrams and descriptions of the sequence of operation for all systems.

Generator exhaust should be ducted to discharge above the roof at a location remote from any air intakes. In special applications, exhaust discharge can be located at ground level in a protected manhole away from pedestrian traffic.

Fuel oil tanks for emergency generators shall be mounted above ground.

#### MECHANICAL SYSTEMS AND ENERGY CONSERVATION

The minimum accepted standards for energy conservation as described in the District of Columbia Building Code will not only be met, but exceeded, where possible.

Life cycle cost/present worth analysis that assesses the total cost of a system over its entire useful life will be used and is required on Capital Projects.

Building functions that require 24-hour-per-day operation, such as libraries, security stations, laboratories, shall be served by a system separate from that of offices or classrooms, which may be subject to different operating schedules.

Heat recovery shall be incorporated for all systems with 100% outdoor air.

— END OF DIVISION 23 —

## DIVISION 24—AUTOMATED INTEGRATION

The AU standard for automated integration includes the au bas specification and control drawings, which are attached as addenda to this document. Preparation of any design, construction, or related documentation pertinent to automated integration must include the bas specifications and control drawings.

### GENERAL

The Building Automation System (BAS) manufacturer shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems and complete temperature control system as specified herein. This shall be a direct extension to the existing American University Building Automation System. No other tie-in will be acceptable.

All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.

### QUALITY ASSURANCE

The BAS system shall be designed and installed, commissioned and serviced by personnel who are employed by the manufacturer and factory trained. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

BAS shall comply with UL 916 PAZX and 864 UDTZ, and other subsystem listings as applicable, and herein specified, and be so listed at the time of bid. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, and Governing Radio Frequency Electromagnetic Interference and be so labeled.

### COMMUNICATION PROTOCOL STANDARD

BACnet communications protocol stands for Building Automation and Control Networks. One of its primary appeals is that it provides "interoperability" among different vendor's equipment. This frees the building owner from dependence on one vendor when the time comes for system integration or expansion.

American University BAS standard defines BACnet protocols as below:

Building main controllers BLN (Building level Network) should be BACnet IP

Building FLN (Floor level network) devices:

-TEC (Terminal equipment controller) prefer BAC/IP. BACnet/MSTP might be accepted on case by case basis.

- VFD (Variable frequency drive) should be BACnet/IP
- Chillers control interface or gateway device should be BACnet/IP
- Building main heat exchanger control interface or gateway device should be BACnet/IP

The BACnet standard continues to be maintained by ASHRAE's SSPC-135 committee and enhancements are frequent; therefore American University will design systems per the latest ASHRAE standards requirements.



## ENERGY MANAGEMENT AND CONSERVATION

Central Plant Operations (CPO) has standardized automated building control systems for Academic/Administrative facilities. Alterations and additions shall incorporate the standard system established for that facility. New construction shall specify the manufacturer(s) approved by Facilities Management.

Facilities Management has established the preferred systems and manufacturer(s) for various building systems. Consultation with Facilities Management is required for all projects including mechanical, plumbing, electrical, building automation and control, and Fire Alarm and Detection Systems.

## ENERGY CONSERVATION

American University is committed to an aggressive Energy Conservation Program (including a formalized Building Temperature Policy), and any design project must be designed with state-of-the-art energy conservation design standards as published by A.I.A., A.S.H.R.A.E., and the District of Columbia. Major energy consuming systems and equipment will be specified and purchased based on a Life Cycle Cost Analysis (LCCA) provided by the Consultant, and a Present Worth Analysis (PWA) performed by the Consultant and the Project Office.

The American University Design Guidelines contain many references to energy conservation and energy efficiency. This appendix **(Where is this appendix? CO)** is a summary of the major areas of concern and should be used as a "checklist" for design reviews. This list does not include every item necessary to provide a fully energy efficient design that meets the American University standards, nor does it relieve the Consultant from the responsibility for the design.

The energy efficiency of systems and equipment is an essential part of the University's design philosophy. Careful evaluation of energy conservation measures shall begin early in the design phase and continue throughout the design process.

The minimum standards for energy conservation as set forth by the District of Columbia or other prevailing standards will be exceeded wherever possible.

Any questions or problems concerning energy conservation that cannot be resolved by the Consultant should be referred to Facilities Management early in the design process.

## RENOVATION PROJECTS

The purpose of the following list is to serve as a source for ideas about how existing buildings may be made more energy efficient. Renovation projects usually arise due to some change in building usage or to deal with specific building issues or systems. Energy efficient measures should always be considered within the scope of a particular renovation project.

### BUILDING ENVELOPE

#### BUILDING TIGHTNESS

Cracks may open around doors or windows, or in foundations. Air infiltration from outside must eventually be conditioned by the HVAC system increasing operating costs.

#### HVAC

Specify high efficiency chillers, sized to operate in the most efficient regions of their system curves. Incorporate economizer cycles on air handling unit design and increase outside sources for economizer operation where possible. The Energy Management Computer System utilizes enthalpy control for economizer operation.

Variable Air Volume and Variable Speed Drives for fans and pumps should be required for building HVAC systems. Air and water balance should be an integral part of all system work.

Specify Premium Efficiency AC motors whenever possible. This includes seasonal equipment such as hot water and chilled water pumps. The payback period for premium efficiency motors can be amazingly short. Don't forget air compressors and exhaust fans should be included. Power Factor correction is also worth considering. Power Factor correction must be considered in the design.

In buildings with pneumatic control systems, check condition of air compressors, refrigerated air dryers, air lines. Air leaks on pneumatic systems increase air compressor run time and operating costs. On steam converters and piping, verify integrity of insulation and check for steam leaks and steam traps in need of repair or replacement.

#### CONDUCTORS AND CABLES FOR AUTOMATED INTEGRATION (25 05 13)

All control wiring MUST be in separate conduit, minimum size to be ½ inch.

Div.	Section	Selection Criteria	Accepted Examples	Notes	Technical Owner
25	Integrated Automation				
25	Electrical Distribution (Main) Meters	No exception	Nexus 1500	Options to be specified by FM	FM - E. Peng
25	BTU Flow Meters	No exception	FlexusBTU by Flexim Ultrasound Meters	Options to be specified by FM	FM - E. Peng
25	Flow Only Meters	No exception	Flexim Ultrasound Meters	Options to be specified by FM	FM - E. Peng
25	Electric Submeters	No exception	Shark	Options to be specified by FM	FM - E. Peng
25	BTU Flow Meter	<p>Ultrasonic Btu Flow Meter to meet the following performance characteristics:</p> <ul style="list-style-type: none"> <li>● Matched Flow Transducers and Temperature sensors</li> <li>● NIST traceable 1% "wet flow calibration" – certificate included</li> <li>● NIST traceable matched temperature accuracy 0.03oF – certificate included</li> <li>● Low Flow capability 0.03ft/sec (beyond other meter types)</li> <li>● Solid coupling pad – "no maintenance"</li> <li>● Communication protocols – Modbus RTU, Modbus TCP, BACnet MSTP, BACnet IP, 4-20ma, 0-10v, pulse relay</li> </ul>	Flexim	No Exception	jallen

25	Flow Meter	<p>Ultrasonic Flow Meter to meet the following performance characteristics:</p> <ul style="list-style-type: none"> <li>● Matched Flow Transducers</li> <li>● NIST traceable 1% “wet flow calibration” – certificate included</li> <li>● Low Flow capability 0.03ft/sec (beyond other meter types)</li> <li>● Solid coupling pad – “no maintenance”</li> <li>● Communication protocols – Modbus RTU, Modbus TCP, BACnet MSTP, BACnet IP, 4-20ma, 0-10v, pulse relay</li> </ul>	Flexim	No Exception	jallen
25	Steam Flow Meter	<p>Steam Flow Meter to meet the following performance characteristics:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Standard Accuracy: <math>\pm 0.5\%</math> of rate (certain fluids and Reynolds number applications require specific calibrations to achieve this value).</li> <li><input type="checkbox"/> Repeatability: <math>\pm 0.1\%</math></li> <li><input type="checkbox"/> Flow Ranges: 10:1 and greater</li> <li><input type="checkbox"/> Standard Beta Ratios: 0.45 to 0.80, special betas available</li> <li><input type="checkbox"/> Max Pressure: up to 20,000 psi (1,380 bar)</li> <li><input type="checkbox"/> Max Temperature: up to 1,600° F (870° C)</li> <li><input type="checkbox"/> Installation Piping Requirements: Typically 0-3 diameters upstream and 0-1 diameters downstream</li> </ul>	McCrometer V-Cone	No Exception	jallen

— END OF DIVISION 25 —

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## DIVISION 26—ELECTRICAL

### GENERAL

American University's facilities on Campus are owned, operated and maintained by the University. Electrical service to each facility is by connection to the University's electrical distribution system which is managed by Facilities Management (FM). All electrical designs must be reviewed and approved by the FM Director and/or a designated representative.

All electrical designs shall comply with national, state and local codes. The Consultant shall incorporate into the design, as a minimum, the industry standards and design criteria in the following references:

- a. National Fire Protection Association (NFPA) Standard 70 National Electrical Code
- b. American National Standards Institute (ANSI) Standard C2 National Electrical Safety Code
- c. Standard Handbook for Electrical Engineers
- d. American Electricians Handbook
- e. NFPA 20 Installation of Centrifugal Fire Pumps
- f. NFPA 30 Flammable and Liquid Combustible Code
- g. NFPA 37 Stationary Combustion Engines and Gas Turbines
- h. NFPA 72 Fire Alarm Systems
- i. NFPA 78 Lightning Protection Code
- j. NFPA 101 Life Safety Code
- k. NFPA 110 Emergency and Backup Power System
- l. National Electrical Manufacturers Association (NEMA) standards for Materials and Products
- m. ANSI standards
- n. Underwriters Laboratories (UL) Fire Resistive Directory
- o. D.C. Building Code
- p. D.C. Division of Facility Service Guidelines

The Consultant shall be guided by the following principles when creating the design and when specifying equipment, methods and materials:

- design shall meet all Owner objectives
- equipment and materials specified shall be well-suited for the specific application
- equipment and materials shall be high-quality products from approved manufacturers, selected for ease of installation, durability, low maintenance and high reliability
- electrical systems shall be sized to accommodate future loads
- electrical system components shall be energy efficient when compared to standard products by the same manufacturer
- All conductors are to be copper

For renovation projects, the systems and components selected shall be the same as the existing building's electrical systems. The integrity of the building system shall not be compromised.

Life cycle cost/present worth analyses that assess total costs of certain electrical components over their useful life may be required on selected projects.

### LABELING

Label electric circuits using proper AU identification format using the following electrical labeling color scheme:

White letters on black for normal power. This is the standard identification for building systems and equipment.

White letters on orange for critical power. This is for building systems and equipment (legally required critical) and optional emergency power. White letters on red. This is for life safety systems only.

## ENERGY CONSERVATION

Conformance with IECC requirements, NEMA premium motors

The minimum standards for energy conservation as set forth by the District of Columbia will be exceeded, wherever possible.

## CALCULATIONS

All circuits shall be sized for the load to be served. Panel board schedules shall show the load on each circuit, as well as sizing calculations (including connected load, spare capacity and demand factors) used to calculate panel or switchboard size.

All power riser and one-line diagrams shall show the available short circuit currents at the service and each distribution point in the system. Switchboard and panel schedules shall indicate the available short circuit at the equipment.

On large projects where continuity of service is a critical issue, the Consultant shall provide the Owner with a selective coordination study. The study will show (using time current curves) the coordination among all main, feE and branch circuit over current protection equipment.

## PRODUCT STANDARDS

All equipment and materials shall be certified as conforming to industry standards by a third- party laboratory service approved by the District of Columbia. These shall include but not be limited to the following:

- Underwriters Laboratories
- Electric Testing Laboratory
- National Electrical Manufacturers Association
- American National Standards Institute
- Certified Ballast Manufacturers
- Institute of Electrical and Electronic Engineers

All equipment and material shall bear the mark of the respective third-party laboratory service. Generally, provide NEMA 1 enclosures indoors and NEMA 3R enclosures outdoors.

## ELECTRICAL DESIGN STANDARDS

26 01 00 Operation & Maintenance of University Electrical Distribution System

All Electrical Work performed on campus must be permitted in accordance with DCRA requirements and under a DCRA provided Electrical Permit. All projects on campus involving electrical work (regardless of voltage) shall be coordinated with the University's Master Electrician and AU's Commissioning Coordinator. Projects performed under the Master Electrician's Operations and Maintenance permit shall

not proceed from engineering to procurement and construction without the approval of AU's Master Electrician and Director of Energy and Engineering.

The Consultant shall coordinate with the AU's Project Manager for specific information concerning those items and work to be provided under the Contract Documents.

Sources, Connections and Outages for Temporary Lighting and Power shall be coordinated with the AU's Master Electrician. Refer to TEMPORARY LIGHT AND POWER (01 51 13) & (01 51 26)

AU's Planning and Project Management (PPM) Division must pre-approve the placement of any equipment that will be visible from outside the facility.

#### 26 01 10 Operation & Maintenance of Medium Voltage Electrical Distribution System

The primary system is rated at 13, 200volts, 3 phase wire. Additions to the system are installed and maintained by Facilities Management.

#### 26 02 00 – Installation of Electrical Systems

Install wires and cables according to the NECA's "Standard of installation."

Remove existing wire from raceway before pulling in new wire and cable.

Wiring at Outlets: Install with at least 12 inches (300 mm) of slack conductor at each outlet.

Outdoors Wiring Methods, shall be as follows:

- a. Exposed: Rigid steel or intermediate metal conduit.
- b. Concealed: Rigid steel or Intermediate metal conduit or EMT
- c. Underground, Single Run: Rigid nonmetallic conduit.
- d. Underground, Grouped: Rigid nonmetallic conduit, concrete encased.
- e. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid or Motor-Driven Equipment): Liquid-tight flexible metal conduit, not exceeding 24" length.

Indoors Wiring Methods (e.g. raceways) shall be as follows:

- a. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid or Motor-Driven Equipment): Flexible metal conduit, except in wet or damp locations use liquid tight flexible metal conduit, not exceeding 24" length.2. Use conduit, tubing, or MC cable in applications allowed by NEC.
- b. Damp or Wet Locations: Rigid steel, PVC, or Intermediate metal conduit.
- c. Exposed (including unfinished interior spaces): Electrical metallic tubing, or Rigid metallic conduit.
- d. Concealed: Electrical metallic tubing, Rigid metallic conduit or MC cable except as otherwise indicated.
- e. Concealed Connections from JBox in Ceiling Space to Light Fixtures Not exceeding 6 feet length: MC cable, or flexible metal conduit.

Conceal wiring, unless otherwise indicated, within finished walls, ceilings, and floors.

Boxes and Enclosures: In damp or wet locations use NEMA 250, Type 3, Type 4, stainless steel.

Use raceway fittings compatible with raceway and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

Raceways Embedded in Slabs: Install in middle third of the slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.

Install exposed raceways parallel to and at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

Join raceways with fittings designed and approved for the purpose and make joints tight. Use bonding bushings or wedges at connections subject to vibration. Use insulating bushings to protect conductors. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb (90-kg) tensile strength. Leave not less than 12 inches (300 mm) of slack at each end of the pull wire.

Install raceway sealing fittings where required by the NEC and at wiring entrances to refrigerated spaces. Locate at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

Stub-up Connections for Equipment: Extend conductors to equipment with [rigid steel] [intermediate metal] conduit; flexible metal conduit may be used 6 inches (150 mm) above the floor. Install a separate green ground conductor in all raceways and conduits.

#### 26 05 19 – Low Voltage Electrical Power Conductors and Cables

All circuits abandoned or not used are to be located, identified, disconnected, and taken back to the source.

### WIRES AND CABLES

Conductors: Copper.

Building Wires: Type THHN/THWN or XHHW, minimum conductor size #12 for branch circuits.

Armored Cable up to No.2 AWG: Type MC with green insulated copper ground conductor.

Cable No. 1 AWG and Larger: In conduit or EMT with green insulated copper ground conductor.

Connectors and Splices: Wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated.

Single Conductor Plenum Coaxial: 75-ohm characteristic impedance, solid bare copper central conductor, foamed PTFE dielectric, 100 percent coverage copper, double-braid shield, PTFE jacket, suitable for installation in air-handling spaces.

Twisted-Pair Plenum: No. 24 AWG, 7-strand, copper conductors; PTF insulation; overall aluminum/polyester shield and No. 22 AWG copper drain wire; PTFE jacket; suitable for use in air-handling spaces.

#### 26 05 26 Grounding and Bonding for Electrical Systems

All electrical equipment, devices and raceways shall form a continuously grounded system. Neutral and ground shall be bonded only at the service entrance or at the secondary side of a separately derived system.

Every feE and branch circuit raceway shall contain a green insulated copper equipment grounding conductor.

All emergency power systems shall be configured and grounded as separately derived systems. Electrical boxes and enclosures shall be bonded to ground double locknuts and ground bushings. Each wiring device shall be grounded by means of a separate code-size copper conductor connecting the device ground terminal to the branch circuit panel board ground bus. The conduit system shall not be relied upon for grounding.

#### 26 05 29 – Hangers and Supports for Electrical Systems

Lighting fixtures shall be tied (with tie wire) to deck above ceiling, supported at diagonal, opposing corners.

MINERALLAC STRAPS ARE NOT ACCEPTABLE; one-hole straps are acceptable.

#### 26 05 33 – Raceways and Boxes for Electrical Work

Remove existing abandoned wiring & conduit designated as obsolete by AU authorities. Firestop all penetrations through floors, walls and ceilings.

#### RACEWAYS

Wireways: Screwed cover type, with manufacturer's standard finish.

Surface Metal Raceway Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating suitable for painting.

Surface Nonmetallic Raceway: Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.

Outlet and Device Boxes: Sheet metal boxes, except use cast-metal boxes at exterior, interior exposed, and interior damp locations.

Floor Boxes: Cast metal or Sheet metal, fully adjustable, rectangular.

Pull and Junction Boxes: Sheet metal boxes, except use nonmetallic, cast aluminum or cast steel boxes with gasketed covers at exterior and interior damp locations.

#### 26 05 43 Underground Ducts and Raceways for Electrical Systems

AU does not permit Medium Voltage electrical distribution overhead or exposed on campus. All Medium Voltage electrical distribution systems shall be installed underground in ductbanks. All other electrical distribution shall be concealed in conduit or as otherwise approved. No cabling shall be direct buried. Actual routing and installation outside the buildings shall be coordinated by the FM Project Manager with AU's Master Electrician and Director of Energy & Engineering.

#### 26 20 00 Low-Voltage Electrical Transmission

#### 26 21 00 Low-Voltage Electrical Service Entrance

Provide only one service entrance per building, except where otherwise specifically permitted by the Owner. Service entrance equipment shall be switchboard, panelboard. Overcurrent protection for the entire building shall be by single main device.

Service entrance switchboards shall have at least 20% spare breaker spaces, each fully provisioned and sized for estimated future loads.

Service entrance panelboards shall have at least 20% spare 3-pole spare breaker spaces, each fully provisioned and sized for one-half of estimated future loads.

If ground fault protection is provided on the main over current protection device, ground fault also shall be provided on feE devices in the same switchboard or panel board. All ground fault equipment shall be adjustable. (Initial settings shall be 20% of device rating, with 6-cycle time separation between main and feE devices.)



Over current protection devices with ground fault will be circuit breaker only.

26 22 00 Low-Voltage Transformers  
26 22 13 Low-Voltage Distribution Transformers

Transformers shall be the standard product of an approved transformer manufacturer. They shall be of live-front, loop-feed configuration and pad-mounted design with voltage taps and a 4-position switch conforming to the Owner's standard specification.

#### DRY-TYPE TRANSFORMERS

Insulation shall be NEMA ST20 Standard for 220 degrees C. UL component recognized insulation system. For transformers rated 112.5 KVA and below, the insulation shall be rated 115 degrees C. rise above 40 degrees C. ambient. For transformers rated over 112.5 KVA, the insulation shall be rated 80 degrees C. rise above 40 degrees C. ambient.

Transformer enclosures shall be indoor-type, completely enclosed with drip-proof ventilated openings, steel with factory standard finish. Transformers less than 30 KVA three-phase or 25 KVA single-phase may have non-ventilated enclosures. Provide a concrete housekeeping pad, minimum 4" thick.

#### PRODUCTS

##### MANUFACTURED UNITS

General-Purpose, Dry-Type Transformers, 600 V or less:

- Comply with NEMA ST 20 and list and label as complying with UL 1561.
- Two-winding type, three-phase units using one coil per phase in primary and secondary.
- Enclosure: Indoor, ventilated, Outdoor, ventilated, rain tight, NEMA 250, Type 3R.
- Wall-Mounting Brackets: Manufacturers standard for units up to 75 kVA.
- Taps: Standard; for transformers 25 kVA and smaller, provide 2 taps 5 percent below rated high voltage.

#### EXECUTION

##### INSTALLATION

Arrange equipment to provide adequate spacing for access and for cooling air circulation. Mount transformers larger than 75 kVA on concrete bases or 6" steel channels.  
All wiring terminations are to be high-pressed type.

##### TESTING AND ADJUSTING

Perform visual and mechanical inspections and electrical tests stated in NETA ATS. Adjust taps after installation to obtain indicated secondary voltage.

26 24 00 Switchboards & Panelboards

Motor branch circuits shall be 480-volt, three-phase, wherever possible.  
Provide disconnect switches near the motor and motor controller. Individual combination starters are not permitted. Motor control centers shall have combination starters.

All motor circuits shall be dedicated circuits, except for small fractional horsepower exhaust fans that can be easily served and controlled from local lighting and power circuits.

## REQUIREMENTS

Manufactures: Cutler-Hammer, General Electric, or Square-D  
Flush and/or Surface mounted.

Load Capacity: Main breaker capacity and number of circuit breakers that panel will accommodate shall be made clear on Drawings.

Front: Shall be secured to box with concealed trim clamps, or hinged to box with standard door within hinged cover.

Doors: Shall have concealed hinges, flush catches, and tumbler locks, all keyed alike.

Bus: Shall be hard drawn copper of 98 percent conductivity.

Molded-Case Circuit Breakers: NEMA AB 1, bolt-in, full module type. Single handle for multipole circuit breakers. Appropriate for application, including Type SWD for repetitive switching lighting loads and Type HACR for heating, air-conditioning, and refrigerating equipment.

Fusible Switches: NEMA KS 1, Type HD, with [rejection] clips to accommodate indicated fuses, handle lockable.

Motor Controllers: NEMA ICS 2, Class A combination controllers.  
Contactors: NEMA ICS 2, Class a combination contactors.

## INSTALLATION

Install panelboards and accessory items according to NEMA PB 1.1. Indicate installed circuit locations on typed directory.

Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated. Revise or delete paragraph below to suit Project.

Future Circuit Provisions at Flush Panelboards: Stub four empty 3/4-inch (19-mm) conduits from panelboard into accessible or designated ceiling space and four empty conduits into raised floor or space below floor.

Wiring in Panelboard Gutters: Arrange conductors into groups bundle and wrap with wire ties. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL486B.

Perform visual and mechanical inspections and electrical tests stated in NETA ATS.  
26 24 19 – Motor Control Centers

## SECTION REQUIREMENTS

Submittals: Product Data.

Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.

Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.

## PRODUCTS

### CONTROLLERS AND ACCESSORIES

Manual Motor Controllers: NEMA ICS 2, general purpose, Class A with toggle action and overload element, in each phase. Hand-off-automatic switch and "on" pilot light in cover.

Magnetic Motor Controllers: NEMA ICS 2, Class A, full voltage, noreversing, across the line, unless otherwise indicated; with integral control transformer. Hand-off-automatic switch and "on" pilot light in cover. Combination Controller: Factory-assembled combination controller and fusible disconnect switch. Overload Relay: Ambient-compensated type with inverse-time-current characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect, adjusted for duty cycle.

Multispeed-Motor Controller: Match controller to motor type, application, and number of speeds. Provide speed selector switch.

Reduced-Voltage Motor Controllers: Matching type of motor and load with appropriate (e.g. star-delta, part-winding, other) type controller.

Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

All Motor Control Centers to have an electronic power meter. Manufacturer: Shark, or Nexus

### EXECUTION INSTALLATION

Use manual controllers for fractional-horsepower single-phase motors, unless otherwise indicated. Install independently mounted motor-control devices.

Install indicated fuses in each fusible switch.

Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.

Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control

Devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

### TESTING

Perform visual and mechanical inspections, and electrical tests stated in NETA ATS.

## 26 27 00 LOW-VOLTAGE DISTRIBUTION EQUIPMENT

For new buildings, the power distribution system shall have separate life safety and emergency lighting. Power and mechanical loads into dedicated panel boards shall have dedicated feEs originating from the service entrance equipment.

## 26 27 26 WIRING DEVICES

## GENERAL

### SECTION REQUIREMENTS

- Submittals: Product Data
- Comply with NEMA WD 1
- Comply with NEC

### PRODUCTS

#### DEVICES

General: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

Color: Ivory unless otherwise indicated.

Receptacles: Heavy Duty grade, NEMA WD6, Configuration 5-20R unless otherwise indicated.

Ground-Fault Circuit Interrupter Receptacles: Feed-through type, with integral duplex receptacle; for installation in a 2-3/4-inch- (70-nuu-) deep outlet box without an adapter, Configuration 5-20R.

Transient Voltage Surge Suppressor Receptacles: Duplex type, with integral TVSS in line to ground, line to neutral, and neutral to ground; meets IEEE C62.41 Category B test with nominal transient-suppression clamp level of 500 V and minimum single transient pulse energy dissipation of 140 J line to neutral, and 70 J line to ground and neutral to ground.

Snap Switches: Heavy-duty, quiet type, 277 Volts rated.

Incandescent Lamp Dimmers: Modular, 120 V, 60Hz with audible and electromagnetic noise filters and continuously adjustable slide, single-pole with soft tap or other quiet switch, min. 600 Volts rated.

Fluorescent Lamp Dimmers: Modular, compatible with dimmer ballasts, with audible and electromagnetic noise filters and capable of consistent dimming to a maximum of 10 percent of full brightness. Include trim potentiometer.

Dimming System: Factory assembled dimming/relay panel, NEMA 1 grade, and low voltage control stations and interface panel. Dimmers to provide a smooth and continuous "square law" dimming curve throughout the entire dimming range. Dimming ballasts will be provided with the fixtures.

Wall Plates, Finished Areas: Satin-finish stainless steel, fastened with metal screws having heads matching plate color. Provide standard-size Type 304 stainless steel wall-plates which are compatible with the switches. Provide Stainless steel screws for securing the devices to the wall plates.

Wall Plates, Unfinished Areas: Galvanized steel with metal screws.

Floor Service Fittings: Modular, above-floor, dual-service units suitable for wiring method used.

Multi-outlet Assemblies: Components produced by a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles. Metallic raceway with No. 12 AWG wire. One receptacle per 12 inches (300 mm).

AUTOMATIC WALL SWITCH shall:

- a. be Manufactured by Novitas or Watt Stopper
- b. be Ivory-colored, decorator-style, low-profile, UL-listed automatic light switch which replaces and fits into a single-gang wall switch outlet box.
- c. have the following features:

- a. 277-volt AC, manual-on, 60 to 1200 watt (ballast load), single level lighting control with 180- degree coverage for 900 (maximum) square feet.
- b. Digital time-delay adjustable covering at least the interval from 90-seconds to 30-minutes.
- c. Adjustable unit sensitivity from 20-percent to 100-percent.
- d. Integrated Light Level Sensor.
- e. LED for sensitivity calibration.
- f. Compatible with electronic ballasts.

CEILING-MOUNTED ULTRA-SONIC DETECTORS shall:

- a. be White-colored, 24-volt, AC, 20-milliampere, UL-listed sensor for use with companion relay/power supply.
- b. be configured such that where the ultrasonic signals of one sensor can interfere with the operation of an adjacent unit, provide detector units with different operating frequencies.
- c. have the following features:
  - i. 360-degree single-directional, 1000 square-foot coverage.
  - ii. Temperature and humidity resistant solid-state, crystal-controlled 25-kilohertz detector.
  - iii. Logic Key/On by-pass.
  - iv. Adjustable time delay covering at least 30-seconds to 12-minutes.
  - v. Adjustable sensitivity

DUAL TECHNOLOGY OCCUPANCY SENSORS shall:

- a. be White-colored, 24 VDC, 28-milliampere, UL and CUL listed for use with power pack.
- b. have the following features:
  - i. PIR and Ultrasonic technologies
  - ii. Integrated light level sensor 2.5 to 430 foot coverage
  - iii. Single pole, double-throw isolated relay
  - iv. 40kHz+/- 0.006% frequency ultrasonic
  - v. Adjustable time-delay of 15 sec to 15 min.
  - vi. LED indicator for both technologies
  - vii. Adjustable sensitivity

COMBINATION RELAY/POWER SUPPLY shall:

- a. be Junction-box mounted, UL-listed, 277 volt primary, 24-volt DC secondary, 100-milliampere secondary, Self-contained transformer/relay unit .
- b. have relay contacts rated 277-volts, shall open when the room is unoccupied, and close when the room is occupied.

WALLPLATES

- a. Where unit sensor and manual wall switch are located side-by-side, provide common wall-plate and barriered switchbox.

PART 3- EXECUTION

INSTALLATION

- a. Install devices and assemblies plumb and secure.

- b. Mount devices flush, with long dimension vertical, and grounding terminal of receptacles on top unless otherwise indicated. Group adjacent devices under single, multigang wall plates.
- c. Protect devices and assemblies during painting.
- d. Install wall plates when painting is complete.
- e. Install wall-mounted devices vertically and in accordance with NEC and recognized industry practices. Mounting heights shall be as noted on the contract Drawings for switches. Ceiling-mount sensors to backplates secured to ceilings.
- f. Where automatic wall switches are shown adjacent to wall switches, the automatic switch (indicated as OS) shall be connected to control all of the lighting in the room. The manual switch shall be connected between the output leg of the occupancy sensor switch and the switched leg to the outside-lamp ballasts and act as an override-to-off switch. The inside lamp ballasts shall be connected directly to the output of the occupancy sensor.
- g. In rooms with ceiling-mounted occupancy sensors (indicated as OSI) and suspended ceilings, surface mount the occupancy sensors to the center of ceiling tiles. Connect the power supply/relay unit to the normal power source, and connect the relay contacts in series with the line side of both wall switches for the inside and outside lamp ballasts. The switches shall act as "override-to-off."
- h. Wiring from ceiling-mounted sensors to relay/power supplies shall be with plenum-rated, limited-energy, three-conductor, and #18 through #22 copper conductors. Coordinate with other work, including ceiling installation, painting, wiring and box installation. Notify the Owner's Representative of location discrepancies before roughing-in device and then obtain a new location as necessary.
- i. Wall-mounted devices shall be installed after wiring is complete.
- j. Install cover-plates and devices after painting is complete.
- k. Install wall-mounted devices and combination relay/power supplies to electrical boxes which are clean and free of building material, dirt and debris.
- l. Provide electrically continuous, tight ground connections for the automatic switches.
- m. Ground the hex green grounding screw of the switching device to the ground wire of the branch circuit.

## TESTING

- a. Test all automatic switches and all sensors for proper operation. Adjust sensitivity and time-delay of all sensors and demonstrate adjustment and operating procedures to Owner.

## 26 28 00 Low Voltage Circuit Protective Devices

### ENCLOSURES

- a. Hinged-Cover Enclosures: NEMA 250, steel enclosure with continuous hinge cover and flush latch. Finish inside and out with manufacturer's standard enamel.
- b. Cabinets: NEMA 250, Type 1, unless otherwise indicated.

## 26 28 16.13 – Circuit Breakers

- A. Manufacturer: Cutler-Hammer, General Electric, or Square-D
- B. Enclosed, Molded-Case Circuit Breaker: NEMA AB 1, with lockable handle and thermal-magnetic trip unless otherwise indicated.
  - i. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated.

- ii. Interrupting Rating: Exceeds available fault current.
  - iii. Thermal-Magnetic Circuit Breakers, 225 A and Larger: Trip units [interchangeable within frame size] [with adjustable magnetic trip].
  - iv. Electronic Trip Unit Circuit Breakers, 400A and Larger: Field-adjustable, short-time and continuous-current [and ground-fault trip] settings.
  - v. Current-Limiting Trips: Let-through ratings less than NEMA FU 1, Class RK-5.
  - vi. Enclosure: NEMA AB 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
  - vii. Circuit breaker to be bolt-in type.
- C. Perform visual and mechanical inspections and electrical tests stated in NETA ATS.

26 28 16.16 Enclosed Switches

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in closed position.

26 32 00 Packaged Generator Assemblies

26 32 13 Engine Generators, Cummings is the acceptable generator.

GENERAL

SCOPE

- A. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, digital voltage regulator, and all auxiliary systems required for automatic operation.
- B. Provide factory testing, on-site startup by a supplier authorized by the equipment manufacturers, and on-site testing of the system.
- C. The generator set manufacturer shall warrant all equipment provided under this section, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator set.

CODES AND STANDARDS

- A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable.
- B. The generator set shall include necessary features to meet the requirements of these standards.
  - i. IEEE 446 - recommended practice for emergency and standby power systems for commercial and industrial applications.
  - ii. Nfpa 37 standard for the installation and use of stationary combustion engines and gas turbines.
  - iii. Nfpa 70 - national electrical code. Equipment shall be suitable for use in systems in compliance to articles 700, 701, and 702.

- iv. Nfpa 110 emergency and standby power systems. The generator set shall meet all requirements for level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit. Component level type tests will not be allowed to substitute for this requirement.
- C. The generator set and supplied accessories shall meet the requirements of the following standards:
- i. Nema publication mg1, part 32 - the alternator shall comply with the requirements of this standard.
  - ii. UI 1236 - battery charger.
  - iii. UI 2200 - the generator set shall be listed under ul 2200 or submit evidence of an independent third party certification process to verify compliance as furnished.
  - iv. Diesel and gas engines shall be epa tier 3 certified all engines diesel or gas shall include a valid epa engine certificate of compliance.
- D. The control system for the generator set shall comply with the following requirements:
- i. En 50082-2, electromagnetic compatibility generic immunity requirements, part 2: industrial.
  - ii. En 55011 limits and methods of measurement of radio interference characteristics of industrial, scientific and medical equipment
  - iii. Fcc part 15, subpart b.
  - iv. IEC 8528, part 4 - control systems for generator sets.
  - v. IEC std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
  - vi. UL 508 - the entire control system of the generator set shall be ul 508 listed and labeled.
  - vii. UI 1236 - battery chargers.
- E. The generator set manufacturer shall be certified to iso 9001 international quality standard and shall have third party certification VERIFYING QUALITY ASSURANCE IN design/development, production, installation, and service, in accordance with iso 9001.

#### Acceptable manufacturers

- A. Manufacturer shall be Cummins power generation, no substitutes.

#### Submittals

- A. Submit three copies of each shop drawing.
- B. A maximum of two marked copies will be returned to the manufacturer, or one additional reproducible copy may be submitted to be marked and returned for manufacturer's use.
- C. Identify each item submitted using applicable specification section number and paragraph reference.



- D. Submittals shall be clear and legible and shall include the following:
  - i. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.

#### Manufacturer's emergency power system operating and maintenance instruction manuals

- A. Operating and maintenance instruction manuals covering the entire emergency power system including the transfer scheme.
- B. Framed operating instructions shall be mounted on or near the unit.
- C. Manufacturer's certification of prototype testing.
- D. Manufacturer's published warranty documents.
- E. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
- F. Interconnection wiring diagrams showing all external connections required, with field wiring terminals marked in a consistent point-to-point manner.
- G. Manufacturer's installation instructions.

#### SERVICE AND SUPPORT

- A. The manufacturer of the generator set shall maintain service parts inventory at a central location that is accessible to the service location 24 hours per day, 365 days per year.
- B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
- C. The manufacturer shall maintain model and serial number records of generator set provided for at least 20 years.

#### WARRANTY

- A. The generator set and associated equipment shall be warranted for a period of not less than 5 years or 1500 hours from the date of commissioning against defects in materials and workmanship.
- B. The warranty shall be comprehensive. No deductibles will be allowed for travel time, service hours, repair parts cost, etc.

#### TRAINING:

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided.
- B. The training program shall be not less than 4 hours in duration, the class size shall be limited to 5 persons, and the training shall occur at the owner's site.
- C. Training date shall be coordinated with the facility owner.

#### PRODUCTS

##### GENERATOR SET

## A. RATINGS

- i. The generator set shall operate at project design voltage at 1800 rpm and shall be three phase, 4 wire and 60 hertz.
- ii. The generator set shall be sized for project load (kwh), operating at 0.8 pf, standby rated, based on site conditions of: altitude 1000 ft., and ambient temperatures up to 104 degrees f. These ratings shall be increased if necessary to carry full continuous and motor starting loads of the actual equipment provided. Any other changes necessitated by a change in generator capacity shall also be made.
- iii. The generator set rating shall be based on emergency service.

## B. PERFORMANCE

- i. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
- ii. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
- iii. The diesel engine-generator set shall accept a single step load of 100 percent nameplate kw and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
- iv. Motor starting capability shall be a minimum of 105% of design load.
- v. The generator set shall be capable of recovering to a minimum of 90 percent of rated no load voltage following the application of the specified kva load at near zero power factor applied to the generator set. Maximum voltage dip on application of this load, considering both alternator performance and engine speed changes shall not exceed 15 percent.
- vi. The alternator shall produce a clean ac voltage waveform, with not more than 5 percent total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3 percent in any single harmonic, and no third order harmonics or their multiples. Telephone influence factor shall be less than 40.
- vii. The generator set manufacturer to be shall be certified by the engine suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.

## C. CONSTRUCTION

- i. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.
- ii. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. All active control components shall be installed within a ul/nema 3r enclosure. There shall be no exposed points in the control enclosure (with the door open) that operate in excess of 50 volts.

## D. CONNECTIONS

- i. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical terminations. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
- ii. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.
- iii. Generator set control interfaces to other system components shall be assembly. Made on a permanently labeled labels describing connection terminal block point functions shall be provided.

## ENGINE AND ENGINE EQUIPMENT

- A. The engine shall be diesel, 4 cycle, radiator and fan cooled. Minimum displacement shall be 661 cubic inches (10.8 liters), with 6 cylinders. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable.
- B. Engine accessories and features shall include:
  - i. An electronic governor system shall provide automatic isochronous frequency regulation.
  - ii. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, and accelerating to rated speed.
  - iii. The governing system shall include a programmable warm up at idle and cooldown at idle function. While operating in idle state, the control system shall disable the alternator excitation system.
  - iv. Skid-mounted radiator and cooling system rated for full load operation in 122 degrees f ambient as measured at the alternator air inlet.
  - v. Radiator fan shall be suitable for use in a system with 0.5-inch h2 O static restriction. Radiator shall be sized based on a core temperature that is 20 degrees f higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/ fan operation in a controlled environment.
  - vi. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50 ethylene glycol/water mixture prior to shipping. Rotating parts shall be guarded against accidental contact.
  - vii. Electric starter shall be capable of three complete cranking cycles without overheating.
  - viii. Lubrication oil pump shall be positive displacement, mechanical, full pressure type.
  - ix. Lubrication oil filters shall be full flow type with replaceable spin-on canister elements and dipstick oil level indicator.
  - x. Fuel pump shall be an engine driven, mechanical, positive displacement type.
  - xi. Fuel filter shall include a replaceable spin- on canister element.
  - xii. A fuel cooler, suitable for operation of the generator set at full rated load in the ambient temperature specified, shall be provided if required for operation due to the design of the engine and the installation.
  - xiii. Air filter shall be replaceable dry element type with restriction indicator.
  - xiv. Supply and return fuel lines shall be flexible type.
  - xv. Engine mounted battery charging alternator, shall be 40-ampere minimum, with solid-state voltage regulator.
  - xvi. Coolant heater
    - a. Provide engine mounted, thermostatically controlled, coolant heater(s) for engine. Heater voltage shall be 208 volts, single phase.
    - b. The coolant heater shall be ul 499 listed and labeled.
    - c. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall include provisions to isolate the heater for replacement of the heater element without draining the

coolant from the generator set. Quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

- d. The coolant heater shall be provided with a dc thermostat, installed at the engine thermostat housing. An ac power connection box shall be provided for a single ac power connection to the coolant heater system.
- e. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 104 degrees f in a 40 degrees f ambient, in compliance with nfpa 110 requirements, or the temperature required for starting and load pickup requirements of this specification.
- f. Provide vibration isolators as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.
- g. Starting and control batteries shall be lead acid type, 24 volt dc, sized as recommended by the engine manufacturer, complete with battery cables and connectors. The batteries shall be capable of a minimum of three complete 15-second cranking cycles at 40 degrees f ambient temperature when fully charged.
- h. Provide critical grade exhaust silencer for engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The exhaust system shall be installed inside the genset enclosure according to the engine manufacturer's recommendations and applicable codes and standards.
- i. Exhaust system shall include a minimum 18 inch long flexible steel exhaust connection for each
- j. Exhaust outlet to silencer.
  - a. Exhaust silencer shall reduce noise 25-35 decibels as compared to the generator's open exhaust.
  - b. Provide a threaded drain hole.
- k. Provide an ul listed 10 amp voltage regulated battery charger. The charger may be located in the automatic transfer switch, or may be wall mounted, at the discretion of the installer. Input ac voltage and dc output voltage shall be as required. Charger shall be equipped with float, taper and equalize charge settings. Operational monitors shall provide visual output along with individual form c contacts rated at 4 amps, 120 volts ac, 30 volts dc for remote indication of:
  - a. Loss of ac power - red light.
  - b. Low battery voltage - red light.
  - c. High battery voltage - red light.
  - d. Power on - green light (no relay contact).
- l. Charger shall include an analog dc voltmeter and ammeter, 12 hour equalize charge timer, and ac and dc fuses.

## AC GENERATOR

- A. The ac generator shall be: synchronous, four pole, 2/3-pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet nema mg1 temperature limits for class h insulation system and shall be ul 1446 listed. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees centigrade.
- B. The generator shall be capable of delivering rated output (kva) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.
- C. A permanent magnet generator (pmg) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The pmg and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300 percent of rated current for not more than 10 seconds.
- D. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

## GENERATOR SET CONTROL

- A. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.
- B. The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.
- C. The generator set mounted control shall include the following features and functions:
  - a. Control switches
    - i. Mode select switch: the mode select switch shall initiate the following control modes. When in the run or manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the off position the generator set shall immediately stop, bypassing all time delays. In the auto position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
    - ii. Emergency stop switch: switch shall be red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
    - iii. Reset switch: the reset switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
    - iv. Panel lamp switch: depressing the panel lamp switch shall cause the entire panel to be lighted with dc control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.
  - b. Generator set ac output metering: the generator set shall be provided with a metering set including the following features and functions:
    - i. Digital metering set, 1 percent accuracy, to indicate generator rms voltage and current, frequency, output current, output kw, kwh, and power factor. Generator output voltage shall be available in line-to-line and line- to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
    - ii. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 100 percent of rated load, in 10 percent increments. The control shall display hours of operation at less than 30 percent load and total hours of operation at more than 90 percent of rated load.
    - iii. The control system shall log total number of operating hours, total kwh, and total control on hours, as well as total values since reset.
  - c. Generator set alarm and status display
    - i. The generator set control shall include led alarm and status indication lamps. The lamps shall be high intensity led type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:
    - ii. The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the genset. They shall also be configurable for color, and control action (status, warning, or shutdown).
    - iii. The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.
    - iv. The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.

- v. The control shall include an amber common warning indication lamp.
- d. The generator set control
  - i. Shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:
    1. Low oil pressure (warning)
    2. Low oil pressure (shutdown)
    3. Oil pressure sender failure (warning)
    4. Low coolant temperature (warning)
    5. High coolant temperature (warning)
    6. High coolant temperature (shutdown)
    7. High oil temperature (warning)
    8. Engine temperature sender failure (warning)
    9. Low coolant level (warning)
    10. Fail to crank (shutdown)
    11. Fail to start/overcrank (shutdown)
    12. Overspeed (shutdown)
    13. Low dc voltage (warning)
    14. High dc voltage (warning)
    15. Weak battery (warning)
    16. Low fuel (warning)
    17. High ac voltage (shutdown)
    18. Low ac voltage (shutdown)
    19. Under frequency (shutdown)
    20. Over current (warning)
    21. Over current (shutdown)
    22. Short circuit (shutdown)
    23. Over load (warning)
    24. Emergency stop (shutdown)
  - e. Four (4) configurable conditions
  - f. Provisions shall be made for indication of 4 customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above- specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

#### ENGINE STATUS MONITORING

- A. The following information shall be available from a digital status panel on the generator set control:
  - i. Engine oil pressure (psi)
  - ii. Engine coolant temperature (degrees f)

- iii. Engine oil temperature (degrees f)
- iv. Engine speed (rpm)
- v. Number of hours of operation (hours)
- vi. Number of start attempts
- vii. Battery voltage (dc volts)
- viii. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

#### Engine control functions

- A. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles. Initial settings shall be for cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
- B. The control system shall include an idle mode control, which allows the engine to run in idle mode in the run position only. In this mode, the alternator excitation system shall be disabled.
- C. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
- D. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
- E. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.
- F. The control system shall be equipped with dry contacts that receive power from the battery system and that are controlled to provide 24-volt output to a solenoid valve in the fuel oil supply line from the fuel oil tank. Contacts shall provide power to energize and open the solenoid valve and allow fuel oil flow when generator receives start signal and remove power to de-energize the solenoid valve to stop fuel oil flow when generator shuts down.

#### ALTERNATOR CONTROL FUNCTIONS

- A. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase rms sensing and shall control buildup of ac generator voltage to provide a linear rise and limit overshoot.
- B. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric led readout to indicate setting level.
- C. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110 percent of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of nfpca 70, article 445.
- D. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches

the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of nfpA 70, article 445.

- E. Controls shall be provided to monitor the kW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
- F. An ac over/under voltage monitoring system that responds only to true rms voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110 percent of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130 percent. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85 percent for more than 10 seconds.

#### OTHER CONTROL FUNCTIONS

- A. A battery monitoring system shall be provided which initiates alarms when the dc control and starting voltage is less than 25 volts dc or more than 32 volts dc. During engine cranking (starter engaged), the low voltage limit shall be disabled, and dc voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

#### CONTROL INTERFACES FOR REMOTE MONITORING

- A. The control system shall provide 4 programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown, (4) load shed command.
- B. A fused 10 amp switched 24 volt dc power supply circuit shall be provided for customer use. Dc power shall be available from this circuit whenever the generator set is running. (3) a fused 10 amp 24 volt dc power supply circuit shall be provided for customer use. Dc power shall be available from this circuit at all times from the engine starting/control batteries.

#### OTHER EQUIPMENT TO BE PROVIDED WITH THE GENERATOR SET

- A. The generator set shall be provided with a connection box for free conductors to three individually mounted circuit breakers outside of generator enclosure, no generator mounted circuit breaker is required.
- B. Outdoor weather-protective sound attenuated enclosure
  - i. The generator set shall be provided with an outdoor sound attenuated enclosure, with the entire package listed under ul 2200. Sound rating not to exceed 75.8 dba at 7 meters. The package shall comply with the requirements of the national electrical code for all wiring materials and component spacing. The total assembly of generator set, including the enclosure shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an exterior ambient temperature of 100 degrees f. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. To limit access of rodents openings shall be screened into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.
  - ii. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two step electrocoating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:
    - a. Primer thickness, 0.5 to 2.0 mils
    - b. Top coat thickness, 0.8 to 1.2 mils
    - c. Glossi per astm 0523-89i 80 percent plus or minus 5 percent
    - d. Gloss retention after one year shall exceed 50 percent



- e. Crosshatch adhesion, per astm 03359-93, 4b-5b
  - f. Impact resistance, per astm 02794-93, 120-160 inch- pounds
  - g. Salt spray, per astm b117-90, 1000 plus hours
  - h. Humidity, per astm 02247-92, 1000 plus hours
  - i. Water soak, per astm 02247-92, 1000 plus hours
- iii. Painting of hoses, clamps, wiring harnesses, and other non- metallic service parts will not be acceptable. Fasteners used shall be corrosion resistant and designed to minimize marring of the painted surface when removed for normal installation or service work.
  - iv. Enclosure shall be constructed of minimum 12 gauge steel for framework and 14 gauge steel for panels. All hardware and hinges shall be stainless steel.
  - v. A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.
  - vi. The enclosure shall include the following maintenance provisions:
    - a. Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves
    - b. External radiator fill provision

#### Sequence of operation

- A. Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control.
- B. The generator set shall complete a time delay start period as programmed into the control.
- C. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:
  - i. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate "fail to crank" shutdown.
  - ii. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate "fail to start."
  - iii. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.
  - iv. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous state.
  - v. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.
  - vi. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.
  - vii. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

#### FACTORY TESTING

- A. The generator set manufacturer shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.
- B. Factory testing may be witnessed by the owner and/or the owner's representative. Costs for travel expenses will be the responsibility of the owner and/or representative. Manufacturer shall provide two weeks notice prior to factory testing.

- C. Generator set factory tests on the equipment shall be performed at 100 percent rated load and rated power factor for four hours. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady- state governing, single step load pickup, and function of safety shutdowns.

## 26 50 00 LIGHTING

### LIGHTING BRANCH CIRCUITS

- A. Wherever possible, lighting branch circuits shall be 277-volt, single-phase. When 120/208 voltages are used, provide separate circuits for lighting loads only.
- B. Lighting branch circuits may be arranged as three-phase conductors, one neutral conductor and one grounding conductor for each home-run.

### INSTALLATION

- A. Set units level, plumb, and square with ceiling and walls, and secure.
- B. Support for Recessed and Semi-recessed Grid-Type Fluorescent Fixtures: Install ceiling support system rods or wires at a minimum of 2 rods or wires for each fixture, located not more than 6 inches (150 mm) from fixture corners.
- C. Support for Suspended Fixtures: Brace pendants and rods over 48 inches (1220 mm) long to limit swinging. Support stem-mounted, single-unit, suspended fluorescent fixtures with twin-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.
- D. Air-Handling Fixtures: Install with dampers closed.
- E. Lamping: Where specific lamp designations are riot indicated, lamp units according to manufacturer's written instructions.

## 26 51 00 Interior Lighting

### 26 51 13 Interior Lighting Fixtures, Lamps, and Ballasts

- A. Submittals: Product Data for each luminaire, including lamps.
- B. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- C. Coordinate ceiling-mounted luminaires with ceiling construction, mechanical work, and security and fire-prevention features mounted in ceiling space and on ceiling.

### FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs, sharp corners, and edges. Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
- C. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
- D. Lighting fixtures shall be selected and designed to meet requirements of ASHRAE Standard 90.1-2010 for lighting power densities (in watts per square foot) and in accordance with the recommendations of the Illuminating Engineering Society of North America (IESNA). Lighting design levels should not exceed power density or IES standards. These standards are readily available and take into account the type of visual activity in a space, and also the age range of the users of the space.

- E. Incandescent lamps are prohibited unless explicitly approved by the university. Suitable replacements can usually be found among the many varieties of compact fluorescent lamps. Varieties are now available which approach the color of incandescent light.
- F. Use electronic ballasts and T8 lamps in fluorescent light fixtures. They combine the best quality of light with the most energy savings. All electronic ballasts are not created equal. Compare manufacturer's warranties.
- G. Occupancy sensors should be considered where spaces are occupied intermittently. They can be inexpensively installed in individual offices, classrooms, and small to moderate size conference rooms.
- H. Lighting design shall emphasize accessibility for re-lamping, cleaning and maintenance. The location of fixtures over hazardous chemicals, mechanical equipment and laboratory benches shall be avoided. Special provisions shall be made for lamps located in high-ceiling areas for lowering or otherwise solving the maintenance problem.

## LUMINAIRES

- A. Fixture Type : Designer shall provide a fixture schedule with a description or manufacturers and model numbers. Including special features and accessories.
- B. General lighting shall be fluorescent T-8, using AU standard lamp GE F28T8/XL/SPX41/ECO or equivalent (e.g. 28 Watt, Color Temperature 4100K, CRI 82, Life 42K hrs., Mean Lumens 2585, Low Mercury) accept as otherwise approved by AU.2. Mounting: [Recessed ceiling] [Recessed wall] [Semi-recessed] [Pendant] [Surface ceiling] [Surface wall] [Suspended].
- C. Nominal Dimensions: <Insert nominal length, width, and height in inches (millimeters).>
- D. Lamps: <Insert quantity and description if not indicated elsewhere.>
- E. Ballast Types and Features: (Electronic) [Dimming].
- F. Lens: <Describe types, materials, and features.>
- G. External Finish: <Insert descriptions.>
- H. Trim and Hardware: [Spring-loaded door latches] <Insert description of trim items and hardware>.
- I. Other Features: <Insert description.>
- J. Life safety, exit and night lighting fixtures shall not be equipped with switches. All other light fixtures shall be switched or controlled. Office, conference and other administrative or presentation spaces shall have dual-level switching.
- K. Source low-mercury lamps for indoor and outdoor fixtures as well as both hard-wired and portable fixtures. Mercury-containing lamps shall contain no more than 90 picograms per lumen hour, with a target of 70 picograms per lumen hour or less where available. (Some lamps it's unavoidable to get less than 90 picograms/lumen hour for the bulb, the target is meant to be across the building, but I'm not sure how to specify that. I suggest we set a lamp purchasing product standard for often-purchased T-8 lamps, if we don't have one. Here's my suggestion for T-8 and could also suggest a lower mercury CFL, metal halide, etc.: GE Ecolux® Starcoat® T8, only 36 picograms per lumen hour.  
<http://genet.gelighting.com/LightProducts/Dispatcher?REQUEST=COMMERCIALSPEC&PRODUCTCODE=26668-CO>)
- L. CFLs should comply with the voluntary industry guidelines for maximum mercury content published by the National Electrical Manufacturers Association (NEMA).

## 26 52 00 EMERGENCY LIGHTING

- A. Life safety power circuits shall include fire alarm, warning systems and emergency communication systems.

- B. Life safety lighting circuits shall include emergency exit lighting and exit signs. Backup power shall be provided by an emergency generator.
- C. In facilities with emergency generators, provide separate dedicated wiring circuits.
- D. Light fixtures with in-fixture battery/inverter packages shall be prominently marked.
- E. Life safety, exit and night lighting fixtures shall not be equipped with switches.

26 53 00 EXIT SIGNS

- A. Exit signs are to be LED.
- B. General Requirements – Comply with UL 924 and the following:
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack. Sealed, maintenance-free, nickel-cadmium battery and fully automatic, solid-state charger with sealed transfer relay.
- D. Manufacturer: Lithonia Lighting
- E. Model: LX W 3 R EL N
- F. Sign material: Steel
- G. Sign colors: White single stencil, red lettering
- H. Lettering Size: ¾” stroke X 6” high.

26 56 00 EXTERIOR LIGHTING

- A. New construction may include some outside area lighting for landscape and security. All street and parking lot lighting will be approved by the Project Manager, AU's Master Electrician and Director of Public Safety. To make utility connections, the Project Manager will schedule all interruptions of services.
- B. Walkway lights are Spring City “Washington Standard” LED. Color Temperature shall be 5,000 Kelvin.
- C. Building entrances, walkways and parking areas shall be properly illuminated for safety and security. Exterior lighting fixtures shall utilize the American University standard fixture to the extent possible on the Campus grounds. Small exterior auxiliary or service spaces may be illuminated with fluorescent fixtures equipped with cold weather ballasts. (Will add LEED SSc8 (EB:O&M) for guidance on exterior lighting requirements to avoid light pollution including shielded and low wattage fixtures. CO)
- D. Exterior and site lighting fixtures shall be served by separate circuits controlled by a photocell. Parking lot and other area lighting fixtures shall be circuited separately from stairway, porch or canopy lights; however, the same photocell may control both kinds of lighting.
- E. Site lighting circuits shall be served by PVC conduit with THHN/THWN copper wire. Circuits shall be buried a minimum of 18 inches deep. Poles and fixtures shall be grounded. Facilities Management will specify parking lot lights and emergency phone poles for installation by the Contractor.

Div.	Section	Accepted Examples	Technical Owner	Key Stakeholders
26	Electrical			
26	Underground Switchgear	Vista by S&C Electric Company	FM – B. Johnson	

26	Concrete Vaults	Trenwa- for S&C Switch	FM - B. Johnson	
26	Imbiber Beads	Imbititive Technologies	FM - B. Johnson	
26	Panel Boards	General Electric; Cutler-Hammer; Square D	FM - B. Johnson	
26	Dimming Systems	Lutron	FM - B. Johnson	
26	Emergency Generator	Cummins	FM - B. Johnson	
26	Fire Alarm Equipment	MXL Panels by Siemens	FM - B. Johnson	
26	Lighting	Belaro by Beta-Calco	PPM – B. Johnson	FM – B. Johnson FM Zones
26	VFD	ABB or Danfoss		

— END OF DIVISION 26 —

## DIVISION 27—COMMUNICATIONS

American University has many different voice, data and video requirements that rely on a high quality, reliable and flexible wiring infrastructure to meet the ever changing demands of its faculty and staff. During the planning and implementation stages for any American facility or renovation, you will come in contact with one or several representatives from American's communication service group, Office of Information Technology (OIT).

For ease of coordination, please contact one of the American University OIT analysts or the project manager. In turn, they will coordinate a team of communication engineers, technicians and support personnel to meet the scope of the project. It is extremely important that the analyst be contacted during the early planning stages to insure all aspects of communication requirements are met.

The diversified options vary from building to building and require a great deal of planning. This team will work with the occupants, contractors, and project managers during the planning stages and provide them with the space requirements for communication room(s), distribution design assistance/approval and cost estimates. They will also be responsible for the coordination of all communication wiring and equipment. All wiring will be supplied by American and installed by American OIT unless otherwise stated. Wiring, connectors and terminations will be provided by and installed by American OIT and these costs will be budgeted by American into the project by the office of the University Architect.

### AMERICAN UNIVERSITY OFFICE OF INFORMATION TECHNOLOGY COORDINATION

Contact AU OIT before beginning work on the design of a renovation or new facility. OIT will coordinate data and voice communications for the project.

### BUILDING COMMUNICATIONS SERVICE ENTRANCE

All communications cabling on the American campus is installed in underground ducts encased in concrete. This duct system follows a master plan developed several years ago with FM and is placed in designated utility corridors. During the process of schematics, American OIT will specify the route and building entrance location. At that time, American OIT will assist in developing the best size and number of conduits to anticipate ultimate requirements for service and emergency needs. Construction drawings shall provide for an equal number of conduits extending from a manhole 5'-0" outside the building and will terminate in the building's main entry communications room (BCR) as described later in this booklet. In this room and as close to the entrance conduit as possible, a minimum of one (1) #4 copper ground cable is required.

Where the entrance conduits penetrate the foundation, footings or outside walls, rigid metallic conduit shall be used. Plaster fiber ducts or aluminum conduit will not be accepted. At the point of exit, a minimum of 2'-0" ground cover must be maintained.

If existing conditions should alter this setup, an American OIT Communications Analyst should be notified and alternatives worked out.

### COMMUNICATION ROOMS

A single communications room (BCR) may serve a floor area as large as 20,000 square feet provided it serves only the telephone and data needs on the same floor and that additional satellite rooms (LCRs) are provided on other floors. Connecting conduit is required to ensure that the greatest distance from any communications outlet to the nearest communication room does not exceed 300 linear feet.

Minimum space requirements for communication rooms are listed below along with general notes to be taken into account during planning and design. Please note each project is different and larger space requirements may be needed for communication rooms because of the user's expanded voice/data requirements or size of the facility. Once again, early consultation with the American OIT communications analyst is a must to ensure size of communication rooms are adequate to meet user and facility needs.

## BUILDING MAIN ENTRY COMMUNICATION ROOM (BCR)

BCR shall be:

- A. A minimum of 150 sq. ft. (minimum width 6') and will provide a 2 foot clearance on each side for telephone equipment 19" racks on which data electronics and power equipment are normally mounted. This room size will provide service to approximately 20,000 square feet of building.
- B. A single, solid door 3'-0" in width with a 180 degree hinge shall be provided and mounted to swing outside the room if possible by code.
- C. Located off a corridor or an area not associated with business offices and other high activity areas.
- D. A well sealed tile floor is required. (Absolutely no carpeting)
- E. Open, non-finished ceiling spaces are preferred. HVAC ducts, plumbing lines (water, soil, or steam), sprinkler heads and piping installed through this space will not be acceptable. No utilities except those serving the room may occur in or above this room.
- F. All internal wall surfaces shall be lined with unpainted pressure treated fire retardant 3/4" plywood 8' high.
- G. Fluorescent light fixture(s) will be required.
- H. If emergency power is available in the building, these circuits shall be connected to this power source and labeled. Contractor shall indicate on drawings whether emergency power is a generator or a UPS.
- I. Conduits entering these spaces shall penetrate the closet walls at a height above the plywood panels and extend only far enough to install bushings. Overhead ladder racks shall be designed, provided and installed by American OIT to support wiring.
- J. Fire stops around cables will be sealed or plugged with fiberglass one inch (1") thick topping of water plug cement or equivalent. Unused conduits will be plugged and capped for fire proofing as specified above.
- K. A minimum of 15,000 BTU of cooling is required and the room shall be positive with respect to corridor or area adjoining these rooms. Auxiliary air conditioning units may be required in closets with a large number of data/phone electronics devices.
- L. Supply a ground connection from a cold water pipe or building ground system utilizing a minimum #6 bare copper conductor. Leave 6' coil in each room.

(Caution: Room square footage is dependent on equipment serving the building. Contact

American University OIT for exact footage.)

## INTRA-BUILDING DISTRIBUTION SYSTEM

In all buildings at American University, communication horizontal and vertical distribution systems are an absolute necessity in meeting and in keeping pace with the occupants' voice, data, and video communications needs.

### HORIZONTAL

New buildings should be designed to include a means for an open cable tray communication distribution system. Due to the different styles and types of cable tray systems available, American e-operations must review and approve the type of system recommended.

Minimum standards require the tray to be a minimum of 12" wide and 4" deep. Tray shall be open on top and suspended from the ceiling by supporting rods in the middle of the tray or as recommended by the manufacturer. No rod threads should be exposed in the cable tray due to easy damage of cable when

being pulled. To deter the use of plenum cable, open wire-ways can only be used in air return spaces for very special cases.

A minimum of one inch (1") conduit shall be used from the cable tray to the user's communication outlet to house communications cabling.

Renovation projects are very different in nature and require very early consultation with a AU Tele/Video Communications analyst to insure all existing and future requirements are met for communication distribution systems in consultation with the Project Manager.

#### VERTICAL

New multi-level buildings should be designed with communication rooms (LCRs) placed one above the other in a vertical fashion to facilitate vertical distribution systems. The size and quantity of conduit between each of the communication rooms will depend on the size and functionality of the building. Early consultation with an American e-operations analyst is required to insure all requirements are met.

— **END OF DIVISION 27** —



## DIVISION 28—ELECTRONIC SAFETY AND SECURITY

### SECURITY SYSTEMS

The American University Department of Public Safety has established security standards and emergency notification standards for all University buildings. These standards encompass the technology and physical security features required to protect the AU community and buildings. While the standards reflect best business practice and represent industry standards, they are applied based on security assessments of plans for newly constructed buildings and major renovations and take into account planned uses of each facility and its occupants. These assessments and the application of these standards are intended to foster a uniform level of security associated with university structures, both within and exterior to the buildings. The standards, or variations of the standards, are applied based on recommendations of the Department of Public Safety.

The Department of Public Safety Physical Security Unit also maintains lists of approved security hardware and will provide the information upon request. This hardware is standardized across campus and variations from the list must be approved by the physical security manager.

All security and emergency notification system designs for new buildings and major renovations are prepared in partnership with the Planning and Project Management department. Application of these standards to existing buildings/locations on campus as of November, 2012, will be at the direction of the Department of Public Safety based on a risk and threat analysis.

American University's electronic security program is comprised of three primary sub-systems; access control, intrusion detection and close circuit television systems. All systems are managed by the Department of Public Safety (DPS). The Emergency Notification Systems are comprised of two sub systems: A system that permits DPS to make public announcements of emergencies affecting the university, and a system that allows individuals to contact DPS to report an emergency.

### EXTERIOR DOOR CONTROL AND MONITORING

Provide conduit path from door area to security panel closet or equivalent for card readers, door contacts and associated equipment. This applies to all exterior doors.

All security design documentation and security equipment shall require prior approval by the Department of Public Safety's physical security manager and be furnished by the security contractor unless otherwise noted.

### INTERIOR ACCESS CONTROL, MONITORING, AND CCTV

All security design documentation and security equipment shall require prior approval by the Department of Public Safety's physical security manager and be furnished by the security contractor unless otherwise noted.

### CARD READER SYSTEMS

Public Safety is responsible for all integration and daily management of the Software CCure 9000 Management System for academic, administrative and housing facilities. This includes termination, installation, maintenance and monitoring of all equipment associated with this system. This also includes providing all card reader equipment. The Consultant or Project Manager should consult with the university's physical security manager during the design and construction phases of any project that includes card readers.

## DOOR SECURITY

The design should provide 3/4" conduit from the door area to a designated location in a communications closet. The Contractor is to pull the wire specified or provided by the Department of Public Safety (DPS) from security panel closet to door area. In security panel closet, contractor is to provide and install 3/4" fire-rated plywood on wall where the Access Control panel will be mounted.

If the security panel closet is separate from the telephone entry room, provide 2" conduit connecting them. Provide 1" conduit from the security panel closet to the fire alarm control panel. In security panel closet, provide one dedicated 120-volt duplex receptacle for required power. This power is to be on the emergency generator for the building if a generator is present. Refer all questions or concerns to the physical security manager.

All buildings requiring electronic security locking hardware must be Fail Secure in functionality unless otherwise noted. The physical security manager must approve all work prior to installation.

## CLOSED CIRCUIT CAMERA SYSTEM

Public Safety is responsible for the integration and daily management of the Genetec Security Desk/Omicast video management system. This includes termination, installation, maintenance and monitoring of all equipment associated with this system. The Consultant or Project Manager should consult with the university's physical security manager during the design and construction phases of any project that includes a requirement for video monitoring equipment.

## DETAILS

Contractor shall provide typical installation drawings prior to the commencement of any work for approval by the physical security manager. The contractor shall also provide as-built drawings after the installation is complete.

## CONTACTS

Questions concerning the University's Security Management System guidelines should be addressed to:  
Physical Security Manager (202) 885 2527.  
Electronic Detection and Alarm 28 30 00

Fire Detection and Alarm 28 31 00

## PART 1 – GENERAL

### RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### SUMMARY

- A. The system shall include all wiring, raceways, terminal cabinets, pull boxes, outlet and mounting boxes, initiating devices, alarm indicating devices, annunciators, printers, control equipment, and all other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described.

- B. Related Standards: The following standards contain requirements that relate to this Section:  
"Fire Protection" for water-flow, pressure, or tamper switches connected to fire alarm system.

## DEFINITIONS

- A. Alarm-Initiating Device: A manual station, smoke detector, heat detector, flame detector, or sprinkler water-flow switch.
- B. Alarm Signal: Signifies a state of emergency requiring immediate action. Pertains to signals such as the operation of a manual station and the operation of a sprinkler system flow switch.
- C. Class A Wiring: Circuits arranged and electrically supervised so a single break or single ground fault condition will be indicated by a trouble signal at the fire alarm control panel (FACP) and the circuit will continue to be capable of operation for its intended service in the faulted condition no matter where the break or ground fault condition occurs.
- D. Class B Wiring: Circuits electrically supervised such that a single break or a single ground fault condition will be indicated by a trouble signal at the FACP no matter where the break or ground fault condition occurs.
- E. Hard-Wired System: Alarm, supervisory, and initiating devices directly connected, through individual dedicated conductors, to a central control panel without the use of multiplexing circuits or devices.
- F. Multiplex System: One using a signaling method characterized by the simultaneous or sequential transmission, or both, and the reception of multiple signals in a communication channel, including means for positively identifying each signal.
- G. Supervisory Signal: Indicates abnormal status or need for action regarding fire suppression or other protective system.
- H. Trouble Signal: Indicates that a fault, such as an open circuit or ground, has occurred in the system.
- I. Zone: A building area which has all initiating devices located within it programmed to initiate an alarm and to give a common visual location indication on the system annunciator.

## SYSTEM DESCRIPTION

- A. General: This specification intends to describe an integrated fire detection and voice evacuation system to be intelligent device addressable, analog detecting, low voltage and modular with multiplex communication techniques in full compliance with all applicable codes and standards. The features described in this specification are a requirement for this project and shall be furnished by the successful contractor.
- B. Signal Transmission: Multiplex signal transmission dedicated to fire alarm service only.
- C. Audible Alarm Indication: By sounding of voice evacuation via speakers.
- D. System connections for alarm-initiation and alarm-indicating circuits: Class B wiring.
- E. Functional Description: The following are required system functions and operating features:

- i. **Priority of Signals:** Accomplish automatic response functions by the first zone initiated. Alarm functions resulting from initiation by the first zone are not altered by subsequent alarms. The highest priority is an alarm signal. Supervisory and trouble signals have second- and third-level priority. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all alarm signals regardless of priority or order received.
- ii. **Non-interfering:** Zone, power, wire, and supervise the system so a signal on one zone does not prevent the receipt of signals from any other zone. All zones are manually re-settable from the FACP after the initiating device or devices are restored to normal. Systems that require the use of batteries or battery backup for the programming function are not acceptable.
- iii. The system shall monitor all alarm initiating and supervisory devices, initiate audible and visual alarm, supervisory and trouble signals, initiate automatic elevator recall, de-energize magnetic door holders, initiate shutdown of air handling units whether in automatic or hand operation, close respective fire/smoke dampers, operate smoke control systems, operate smoke relief hatches, provide alpha/numeric display of alarm, supervisory and trouble conditions at the fire alarm control panel, provide a hard copy record of system events, provide LED annunciation at all remote annunciators, and transmit required signals to a remote central station.
- iv. **Silencing at FACP:** Switches provide capability for acknowledgment of alarm, supervisory, trouble, and other specified signals at the FACP; and capability to silence the local audible signal and light a light-emitting diode (LED). Subsequent zone alarms cause the audible signal to sound again until silenced in turn by switch operation. Restoration to normal of alarm, supervisory, and trouble conditions extinguish the associated LED and cause the audible signal to sound again until the restoration is acknowledged by switch operation.
- v. Loss of primary power at the FACP sounds trouble signal at the FACP and indicates at the FACP when the system is operating on an alternate power supply.
- vi. **Annunciation:** Manual and automatic operation of alarm- and supervisory-initiating devices is annunciated both on the FACP and on the annunciator, indicating the location and type device.
- vii. **FACP Alphanumeric Display:** Displays plain-language description of alarms, trouble signals, supervisory signals, monitoring actions, system and component status, and system commands.

- viii. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. The same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity adjustment schedule changes are recorded by the system printer.
- F. Recording of Events: Record all alarm, supervisory, and trouble events by means of the NCC-WAN printer. Printouts are by zone, device, and function. When the FACP receives a signal, the alarm, supervisory, and trouble conditions are printed. The printout includes the type of signal (alarm, supervisory, or trouble) the zone identification, date, and the time of the occurrence. The printout differentiates alarm signals from all other printed indications. When the system is reset, this event is also printed, including the same information concerning device, location, date, and time. A command initiates the printout of a list of existing alarm, supervisory, and trouble conditions in the system.
- i. Permissible Signal Time Elapse: The maximum permissible elapsed time between the actuation of any fire alarm or fire-detection system alarm-initiating device and its indication at the FACP is ten seconds.
  - ii. Circuit Supervision: Indicate circuit faults by means of both a zone and a trouble signal at the FACP. Provide a distinctive indicating audible tone and (LED) indicating light. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP is 200 seconds.

#### SYSTEM OPERATION:

- A. Activation of any system fire, security, supervisory, trouble, or status initiating device shall cause the following actions and indications in the Fire Command Center and at the Department of Public Safety NCC Network Command Center.
- B. Fire Alarm Condition:
  - i. Sound an audible alarm and display a custom screen/message defining the building in alarm and the specific alarm point initiating the alarm.
  - ii. Log to the system history archives all activity pertaining to the alarm condition.
  - iii. A simultaneous message shall be delivered via all alarm speakers including those installed in stairways and elevators informing occupants of the imminent shutdown of elevator circuits and the expected high traffic load in the stairwells.

- iv. An automatic announcement or tone evacuation signal shall be capable of interruption by the operation of the system microphone to give voice evacuation instructions overriding the pre-programmed sequences.
- v. Status lights next to speaker selection switches on the control panel shall indicate speaker circuit selection.
- vi. Audible signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmed to flash until system reset or alarm silencing, as required by the AHJ.
- vii. A signal dedicated to sprinkler system waterflow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow equal to a single head.
- viii. Activation of any smoke detector in a single elevator lobby or an elevator equipment room shall, in addition to the actions described in 1.5.A. above, cause the recall of that bank of elevators to the 1st floor and the lockout of controls. In the event of recall initiation by a detector in the first floor lobby, the recall shall be to the alternate floor as determined by the AHJ. Furthermore, any single device activation in a Residence Hall will trigger this same "lobby" recall response.
- ix. Where indicated on drawings heat detectors in elevator shaft and machine rooms shall activate an elevator power shunt trip breaker. The heat detectors shall be rated at a temperature below the ratings of the sprinkler heads in respective locations to insure that the power shall be shut off before activation of sprinkler system.
- x. Remote LCD annunciators shall display the alarm condition via unique messages as required by the system owner. LED type annunciator displays, conventional and graphic style shall indicate alarm zoning as specified.
- xi. System operated duct detectors as per local requirements shall accomplish HVAC shut down.
- xii. Door closure devices shall operate by floor or by local requirements.
- xiii. Activation of Stairwell pressurization, Smoke purge, and damper control shall be as required and operated as per local requirements.
- xiv. Print alarm conditions on NCC-WAN printer located at DPS.

C. Supervisory Condition:

- i. Display the origin of the supervisory condition.
  - ii. Activate supervisory audible and dedicated visual signal.
  - iii. Audible signals shall be silenced from the control panel by the supervisory acknowledge switch.
  - iv. Record within system history the initiating device and time of occurrence of the event.
  - v. Print supervisory condition to system printer.
  - vi. Remote LCD annunciators shall display the supervisory condition via unique messages as required by the system owner. LED type annunciator displays, conventional and graphic style shall indicate alarm zoning as specified.
- D. Trouble Condition:
- i. Display the origin of the trouble condition.
  - ii. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.
  - iii. Audible signal shall be silenced from the fire alarm control panel by a trouble acknowledge switch.
  - iv. Trouble reports for primary system power failure to the master control shall be automatically delayed for a period of time equal to 25% of the system standby battery capacity to eliminate spurious reports as a result of power fluctuations.
  - v. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.
  - vi. Print trouble condition to system printer.
  - vii. Remote LCD annunciators shall display the trouble condition via unique messages as required by the system owner. LED type annunciator displays, conventional and graphic style shall indicate alarm zoning as specified.

## 1.6 SUBMITTALS

- A. No substitutions of equipment or materials shall be allowed.
- B. Submittals must be signed by NICET Level IV Senior Engineering Technologist employed by Siemens Industry, Inc., 6435 Virginia Manor Road, Beltsville, MD 20705. Point of contact is Ross A. Wehrs, SET (301) 848-4394. Email – [ross.wehrs@siemens.com](mailto:ross.wehrs@siemens.com)
- C. Provide six (6) sets of complete submittals which shall include drawings of all annunciator panel graphics, schematic wiring drawings of the control panel showing internal and external control panel wiring and all devices. Sequence of operation, annunciator wiring and faceplate drawings, specification sheets for all equipment, all devices, and battery calculations shall be provided. Drawings of the control panel and graphic annunciator panel(s) shall be done on 30" x 42" sheet size. Partial submittals will not be accepted.
- D. Submittals shall be provided in accordance with project submittal schedule.

- E. If re-submittals are required, they shall be provided within two (2) weeks after the date of notification. If re-submittals are not received by the Engineer in two (2) weeks, the supplier will be considered non-responsive and subsequent submittals from the supplier will not be reviewed. The Contractor shall then provide submittals from another equipment supplier within two (2) weeks as directed by the owner at no change in contract price.
- F. The cost of review of any submittals after two (2) submittals have been disapproved shall be paid by the Contractor to the Engineer. The Contractor shall then deliver a purchase order to the Engineer before any submittals will be reviewed.

## RECORD DOCUMENTS

- A. The As-Built drawings shall include one (1) complete set of 30" x 42" contract base sheet drawings with any and all changes included and noted. The approved contract panel drawings and graphic annunciator panel drawings shall also be provided on 30" x 42" 3 mil mylar film. The Conduit Plan shall show the device address for all intelligent/analog initiating devices. The As-Built drawings shall be kept up to date continuously by the electrician in charge of the system installation. These drawings shall be reviewed on a weekly basis for accuracy and completeness.
- B. The Operation and Maintenance Manual shall include a complete set of equipment, component and device specification and data sheets as well as a reduced size paper copy (11" x 17") of the complete set of system drawings described in specification section 1.6 A. A copy of the NFPA 72 Test Report/Certificate, the printer record of all test activity including the sensitivity readings for all intelligent/analog smoke detectors, the required system and component warrantee papers, and the name and address of the installer shall be included. The manual shall be bound in a black three ring loose leaf binder with dividers and a table of contents. Four (4) duplicate sets are required.
- C. Six (6) sets of keys to all locks shall be provided in a proper key box or binder with each set of keys properly and legibly marked and tagged. Loose keys will not be accepted.
- D. All documents and items described above shall be submitted for approval and turnover prior to the final testing and system certification with the exception of the NFPA 72 Test Report/Certificate which shall be delivered by hand to the owner within two (2) days of the actual test and acceptance.

## QUALITY ASSURANCE

- A. Qualifications of the Installer: The system shall be installed by an electrical contractor experienced in the installation of fire alarm systems.
- B. The name of the electrician who will be responsible for the fire alarm system installation shall be submitted for the owner's approval before any work is started on the system. The qualifications



and experience of the proposed individual shall also be included. The Owner approved fire alarm installation electrician shall remain on this project until the fire alarm system is accepted by the owner.

- C. The services of a technician who has been trained and certified by the manufacturer of the equipment being supplied shall be provided to supervise the installation, adjustments, tests and final connections and certification of the system.
- D. The system control panel, annunciators, devices specified, and their installation and operation shall conform to the most stringent applicable requirements of the following publications and this specification unless otherwise noted:
  - i. NFPA 70 The National Electric Code
  - ii. NFPA 72 The National Fire Alarm Code
  - iii. NFPA 90A
  - iv. BOCA, as adopted
- E. The control panel, annunciators, all initiating and indicating devices and all other devices connected to the system shall be UL Listed as provided and shall bear UL labels for the applicable NFPA fire alarm standards for which the equipment is to be used.
- F. Specifications govern over drawings. Any conflict between the specifications and the drawings shall be brought to the attention of the Engineer at least 48 hours before the bid date and time or the decisions of the Engineer shall be final.

#### OPERATING INSTRUCTIONS

- A. Upon the completion of all work and of all tests, the Contractor shall furnish the necessary skilled labor for providing operating instructions of all systems and equipment for a period of one (1) day of eight (8) hours for each building or as otherwise directed. During this period, instruction will be given to the owner or his representative in the full operation, adjustment and maintenance of all equipment furnished or provided.

#### ACCEPTANCE OF SYSTEM

- A. Total acceptance of the system will only be made after the required tests, complete record document package and the instruction period have been provided.

#### GUARANTEE

- A. The Contractor shall guarantee labor, materials and equipment provided under this contract against system defects for a period of one (1) year after the date of final acceptance of this work by the Owner.

- B. Service shall be provided by the equipment supplier during the guarantee period seven (7) days a week including holidays and shall be provided within four (4) hours after notification. All repairs shall be effected within twenty-four (24) hours after notification.
- C. Should the Contractor fail to comply with the above requirements, the Owner will then have the option to make the necessary repairs and back charge the Contractor without any loss of warranty or guarantee as provided by the contract.
- D. Any guarantee which is in conflict with the above will not be acceptable.

#### MANUFACTURERS

- A. Manufacturers: The only acceptable supplier for the fire alarm equipment to be used on this project is Siemens Building Technologies, Incorporated. Contact Ross Wehrs at 301-848-4394. Email [ross.wehrs@siemens.com](mailto:ross.wehrs@siemens.com). The equipment shall be Siemens type MXLV.

#### MANUAL PULL STATIONS

- A. Description: Single-action type, fabricated of plastic, and finished in red with molded, raised-letter operating instructions of contrasting color.
- B. Stations shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring.
- C. The manual stations shall be addressable and identifiable by the master fire alarm control panel.
- D. Address assignments shall be set electronically and shall reside within the station within non-volatile memory. Devices using rotary switches, pins, jumpers or staples are not acceptable.
- E. Manual stations shall be Siemens model MSI-10.
- F. Above each station mount a Siemens model 5-F card and frame.
- G. Where necessary, stations shall be surface mounted.

#### ADDRESSABLE INTERFACE UNITS:

- A. Furnish and install intelligent addressable interface modules for the monitoring of contact type initiation devices and for the control of electrical devices, where required.
- B. The modules shall be addressed, tested and programmed prior to installation using a UL listed programmer/tester.
- C. The modules shall incorporate triple technology microprocessor chips including analog, digital and EEPROM technologies on the same chip.
- D. Intelligent addressable interface modules shall be Siemens models TRI-S, TRI-D and TRI-R, as appropriate.

## SMOKE DETECTORS

- A. Area Smoke Detectors: The area smoke detectors furnished for use on this project shall be intelligent analog type photoelectric detectors listed for use in environments as covered by Factory Mutual, UL 268 and UL 268A and shall be installed according to the requirements of NFPA 72 for open area coverage.
- B. The detector shall be a Siemens Fire Safety FP-11 addressable, photoelectric detector which shall be compatible with the Siemens Fire Safety MXL control panel.
- C. Smoke Detectors, Light Refraction
- D. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes.
- E. The detector shall be designed to eliminate calibration errors associated with field cleaning of the chamber.
- F. Detectors shall be programmable as application specific, selected in software for a minimum of eleven specific environmental fire fingerprints unique to the installed location. These fire fingerprints shall eliminate the possibility of false indications caused by dust, moisture, RFI/EMI, chemical fumes, air movement and other deceptive phenomena while factoring fire burn rates, obscuration rate changes and hot/cold smoke phenomenon into the alarm decision to give the earliest possible real alarm condition report.
- G. Other analysis techniques which rely on priority matrix or counting zone logic to monitor multiple detectors in a protected area shall be deemed unacceptable.
- H. Detector programming shall be accessible in personal computer-based system configuration software. It shall also be accessible through a password-protected function at the fire alarm control panel keypad to allow changes without the need for a computer.
- I. Detection technologies using time delays such as alarm verification or alarm confirmation to verify the existence of an alarm condition shall not be considered acceptable.
- J. The detector manufacturer shall have an installed base of a minimum of 500,000 detectors using the technology employed to demonstrate the product acceptability.
- K. The awarding authorities will entertain an alternate bid specifying a deduct amount per detector as well as a unit cost per detector for furnishing multi-sensor detectors using a minimum of three sensing elements.
- L. The detector shall be addressed, tested and programmed by the contractor prior to installation using a UL listed programmer/tester.
- M. The detector readout shall yield a discreet electrical value for status tracking and logging to assist in determining maintenance and cleaning requirements. After installation it shall be possible obtain a sensitivity reading for a detector at the control panel without removing the detector from its base. Additionally, the sensitivity settings of individual detectors shall be manually adjustable from the control panel.

- N. Plug-In Arrangement: Detector and associated encapsulated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection requires no springs for secure mounting and contact maintenance. Terminals in the fixed base accept building wiring.
- O. The detector shall display a steady LED when in the alarm state when the system is operating from either normal or standby power.
- P. Duct Smoke Detector: Light refraction-type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. The photoelectric detector head for use in air duct housings shall incorporate all of the operating features as described above for area smoke detectors and shall be specifically UL listed for installation in air duct sampling housings for the detection of smoke in HVAC system ducts. The detector shall be a Siemens Fire Safety model FP-11. The air duct housing shall include an addressable relay for shutdown of the associated air handling unit and shall be a Siemens Fire Safety model AD2-P with series ST sampling tubes sized as appropriate for the HVAC ductwork.

#### OTHER DETECTORS

Addressable Thermal Detector: Thermal detectors shall be of the intelligent, rate-compensated type rated at 135 degrees. Detectors shall be constructed to compensate for the thermal lag inherent in conventional type detectors and shall alarm at the set point of 135 degrees Fahrenheit. The detector shall be addressed, tested and programmed prior to installation using an UL listed programmer/tester. Thermal detectors shall be Siemens Fire Safety model FPT-

#### UNIVERSAL DETECTOR BASES:

Detector bases shall be Siemens model DB-11, low profile twist lock type with screw clamp terminals and self-wiping contacts. Bases shall be installed on an industry standard, 4" square or octagonal electrical outlet box. Where selective localized control of electrical devices is required for system operation, furnish and install a Siemens model DB-11XRS detector base with software programmable relay integral to the base. Detectors located within dormitory rooms shall be furnished with model ADBX-11 audible base.

#### FIRE ALARM SYSTEMS

##### NOTIFICATION APPLIANCES

- A. General: Supply notification appliances for mounting as indicated. Provide terminal blocks for system connections.
- B. Furnish and install where shown on the drawings, audible/visual signals, Siemens type SLP70MCS Speaker/Strobe with the following characteristics and capacities:
  - i. Field selectable power taps of .25, .5, 1, and 2 watts and driven at 70.7vrms.
  - ii. Mounts to standard 4" square 1.5" deep electrical outlet box.
- C. Pressure type screw terminals with capacity to use up to 12AWG wire for speaker connection.

- D. Visual alarm signals shall meet the minimum light intensity of 75 candela as required by the Americans with Disabilities Act and shall be UL 1971 listed for 15, 30, 60, 75, or 110 candela as indicated on the contract drawings.
  - i. Visual signals shall be mounted at a height of 80 inches above the highest level of the finish floor or six inches below the ceiling, whichever is lower.
- E. Furnish and install where shown on the drawings, audible signals, Siemens type SLP70C ceiling mounted speakers with the following characteristics and capacities:
  - i. Field selectable power taps of .25, .5, 1, and 2 watts driven at 70.7vrms.
  - ii. Mounts to a standard 4" square, 1.5" deep electrical outlet box.
  - iii. Pressure type screw terminals with capacity to use up to 12AWG wire for speaker connection.
- F. Furnish and install where shown on the drawings, visual signals, Siemens type U-MCS Strobes with the following characteristics and capacities:
- G. Visual alarm signals shall meet the minimum light intensity of 75 candela as required by the Americans with Disabilities Act and shall be UL 1971 listed as 15, 30, 60, 75, or 110 candela, as indicated on the contract drawings.
  - i. Visual signals shall be mounted at a height of 80 inches above the highest level of the finish floor or six inches below the ceiling, whichever is lower.
- H. The evacuation signals shall be available in flush, semi-flush, or surface versions as required for signal locations shown on the contract documents. Signals shall be mounted using a listed outlet box.

#### MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Electromagnet operates from a 120-V a.c. source, and requires no more than 3 watts to develop 25 lbs. holding force.
- B. Material and Finish: Match door hardware.

#### FIRE ALARM CONTROL PANEL (FACP)

- A. Fire alarm control panel shall be designed for mounting as indicated on the drawings.
- B. The control panel shall be Siemens model MXLV, modular in construction and shall include, but not limited to, the hardware, software and firmware required to perform the following major system functions:
  - i. Surface mounted steel cabinet with indicator viewing window, hinged door and cylinder lock, dead front construction, and factory finished in baked enamel.
  - ii. System power supplies, including necessary transformers rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the

system in a worst case condition with all devices in alarm and all local indicating appliances active without exceeding the listed ratings. The system devices shall display normal and alarm conditions consistently whether operating from normal power or reserve (standby) power.

- C. System 16 bit core processor, with internal operating system processing incoming alarm signals and issuing output commands required as a result of the alarm reception by system programming or manual commands. Total system response time shall not exceed 2.5 seconds on a system configured to the maximum capacity. All system processors shall be supervised by individual watchdog circuitry furnishing automatic restart after loss of activity. Systems with a single watchdog circuits for all processors shall not be acceptable.
- D. Selectable Style"4" or Style"7" system digital communication capabilities required for the control panel to communicate with remote circuit interface panels, annunciators, and displays. All communications shall be conducted in a digital format. Systems processing signals using pulse width or voltage level techniques are not considered acceptable.
- E. Selectable Style"4", Style"6" or Style "7" with loop isolator analog signaling circuitry required to communicate with, and receive alarms from 120 points, consisting of a maximum of sixty intelligent analog alarm initiating and sixty intelligent controllable output devices. Provide model ALD-2 I analog loop driver.
- F. For control of air handling units and elevators there shall be provided a Controllable Relay Module, Model CRM-4. The module shall be system interconnected by a card edge connector and shall be operable by the MXL control unit. It shall contain four independent relays, fitted with form "C" contacts, rated at 2 amps 28VDC/120 VAC resistive. All relays shall be supervised for coil open or shorted conditions.
- G. Mother boards shall be used to plug in the following modules for system expansion: ALD-2I Analog Loop Driver, CRM-4 Relay Module, CZM-4 Conventional Zone Module, CSM-4 Indicating Module, and CMI-300 CXL/MXL Interface Module. Mother Board shall be Siemens model MOM-4.
- H. The integrated voice system shall be configured for dual channel operation, permitting the simultaneous transmission of digitally recorded alarm evacuation messages and live voice announcements to different areas of the building.
- I. The Audio Control Module model ACM-1 is the master control module for all voice related functions. This module shall have a supervised tone generator capable of providing a variety of tones for use in the system. The ACM-1 shall also include a microphone preamplifier for use with the MMM-1 Microphone master module. The pre-amplifier shall use an automatic gain control circuit to assure distortion free live voice announcements. A back-up pre-amplifier shall be provided with automatic transfer if primary pre-amplifier fails.

- J. The Master Microphone Module model MMM-1 shall provide firefighters with the means of sending voice messages to specific audio zones or all zones. The microphone and the press-to-talk switch shall be supervised. This module contains a local speaker with volume control to monitor selected audio channels.
- K. The Output Control Module model OCC-1 controls the voice system modules plugged into the OMM-1 module. Commands received from the MXL system through the RS485 network are processed by this module. This module sends signals to the other modules in the system through the OMM-1 bus to carry out the action requested by the MXL program. The OCC-1 supervises up to 11 modules under its control. Each module supervised by the OCC-1 responds with its status. This status information is then sent to the MXL as required.
- L. The Output Master Module model OMM-1 is the card cage for the following MXLV modules: DMC-1, OCC-1, ASC-1, ASC-2, and the Z series output modules. The OMM-1 shall provide screw terminals for field and inter-panel wiring. Terminals shall be capable of using up to 14 AWG wire.
- M. A manual control and annunciator model VSM-1 shall be provided in quantities required by the system. The module shall have multiple colored LED's (Red, Green) flashing and steady for indicating status of switch activity. LED's shall have positive feedback for actions selected. AccuLINK programming software shall be used to map switches to functions and any number of zones as required performing system operation outlined in the specifications and drawings. Systems using multiple switches to activate groups of zones or functions shall not be acceptable.
- N. A Terminal Block Module model TBM-1 shall be provided for interface between internal and field wiring. The module shall be capable of connecting audio risers either in "Style Y" (Class B) or "Style Z" (Class A), and telephone riser in Class B type wiring. This module shall have an RCA type jack for connection to an external audio source such as back ground music. The module shall have an RCA type output jack for connection to an external audio recording unit. AccuLINK shall configure the operation of this output to become active whenever the microphone is pressed.
- O. Provide, as required, Strobe Zone Cards model ZC1-8B. Each card shall provide 8 zones "Style Y" (Class B) for 24 VDC strobe lights. The maximum current shall not exceed 1.5 amps.
- P. Provide, as required, Speaker Zone Cards model ZC2-8B. Each card shall provide 8 zones "Style Y" (Class B) for two channel speaker operation.
- Q. Provide, as required, Zone Amplifier Cards model ZAC-30. Each card shall provide a 30 watt audio amplifier with supervised integral speaker zone(s) which may be wired as either Style Y or Z or "A/B".
- R. The enclosure for the system shall provide complete dead front construction. Operator control modules shall be on a frame hinge mounted to provide easy access to wiring and system plug in cards.

- S. The system display shall consist of an 80 character back lighted alphanumeric super twist LCD display readable at any angle. Thirty two character customer defined custom messages shall describe the location of the active device. Additionally, the display shall include LED indicators for "ALARM", "AUDIBLES SILENCED", "SUPERVISORY", "TROUBLE", "SECURITY", "POWER ON" and "PARTIAL SYSTEM DISABLED". There shall be dedicated touch activated tactile membrane switches with audible feedback for "ALARM ACKNOWLEDGE", "AUDIBLE SILENCE", "SUPERVISORY ACKNOWLEDGE", "TROUBLE ACKNOWLEDGE", "SECURITY ACKNOWLEDGE", "RESET", "DISPLAY HOLD" and "DISPLAY NEXT". The system display shall further include touch activated membrane switches, programmable to perform a minimum of twelve custom functions and a ten digit keypad for the pass code entry to perform programming and maintenance functions. The display shall be a Siemens model MKB-2.
- T. Software defined logic module as required for each alarm initiation point, capable of controlling any combination of the system output functions using as logic factors; counting, verification, time, day, holiday, type of device, "and", "or", "not", "timer", "all", "any", flip-flop, D latch, and up to 32 levels of programming shall be possible.
- U. Software logic modules and system database shall be programmed using a DOS compatible program on any IBM compatible computer. It shall be possible to program or edit the system database off site after downloading from the control panel.
- V. Selective chronoLINK, up to 800 events, shall be stored in flash memory and displayed, printed or downloaded by classification for selective event reports. AccuLINK shall allow selection of events to be logged, including; inputs, as alarm, trouble, supervisory, security, status changes and device verification; outputs, as audible control and output activation; actions, as reset, set sensitivity, arm/disarm, override, password, set time and acknowledge. Audible and visual indications shall be generated when memory is 80% and 90% full to allow downloading of data. The system shall be programmable circular logging, assuring that at least the last 400 events will always be stored in non-volatile memory.
- W. EnviroLINK software driven logic for adjusting the alarm threshold windows on detectors to compensate for accumulating contamination and keep detector response sensitivity constant. The software shall compensate for either over-sensitized or de-sensitized units, raising a system flag when a detector approaches the allowable limits of adjustment, indicating a requirement for cleaning.
- i. EnviroLINK values shall be stored in non-volatile memory allowing activation of all tracking functions within 90 seconds of system initiation from a "cold boot". During the boot sequence, alarms from detectors programmed with the feature shall be suppressed. When the full data history is active all devices shall be checked and any active alarms displayed.



- ii. The control panel shall place each detector in the system in an alarm condition, transparent to the system user, every twenty four hours as a dynamic check of the accuracy of the alarm threshold setting. Upon reception of the alarm report, the system detector shall be restored to its pretest state.
  - iii. The system shall be capable of monitoring the state of detectors and displaying a message when a detector is approaching the limits of adjustment as a result of contaminates. A second message shall be displayed when the detector reaches the limits of adjustment due to these contaminates.
  - iv. The system shall be capable of recognizing that a detector has been cleaned, initiating a series of tests to determine if the cleaning was successful and display a detector cleaned message, readjusting that detectors normal sensitivity setting reference.
- X. Communication between the MXL and NCC-WAN shall be provided by a CMI-300 MXL option module. The CMI-300 shall plug into any available ½ slot on an MOM-2/MOM-4 card cage. This interface board shall translate signals from the MXL network to Siemens Fire Safety NCC-WAN modem module HUB-4. The CMI-300 shall allow alarm and trouble information to be transmitted from the MXL to the NCC-WAN as well as allowing manual execution of commands from the NCC-WAN to the MXL and system report generation such as device sensitivity listing. It shall be capable of either a Style 4 or Style 6 wiring configuration using 18 AWG 2-conductor cable with a distance limitation of approximately 8 miles. It shall also be capable of use with dedicated data grade, conditioned telco. lease lines, 600 Ohms balanced, 2 wire, full duplex, with no distance limitation. MXL to NCC- WAN communication is also possible on fiber optic cable at distances up to 10,000 feet between fiber optic interface modules. All communication between the MXL and the NCC-WAN shall be fully supervised by the CMI-300. The contractor shall make all final connections at the MXL and at the NCC-WAN located in Public Safety.

#### NCC-WAN COLOR GRAPHICS

- A. Provide additions to existing color graphics software to include (insert the name of the building) in the campus-wide system.
- B. The owner will provide to the contractor a set of floor plans on a computer diskette to be used in producing these changes.
- C. The contractor shall provide all CADD work, technician time, and coordination with public safety to make the additions.
  - i. The CADD work shall include a minimum of 3 zoom screens (per device, per zone, per floor) and all icon production and placement.

- D. The completed graphic additions shall be added to each of AU's NCC-WAN stations (AU currently has a primary station located in public safety and a secondary station in Facilities Management) by a factory trained and certified technician.
- E. The contractor shall coordinate the schedule for the graphics work to minimize the impact on the Department of Public Safety

#### FIRE ALARM SYSTEM POWER SUPPLIES

- A. System primary power
  - i. Primary power for the FACP and the secondary power battery chargers shall each be obtained from the power panel board. Circuit breakers shall be fitted with a suitable guard, requiring removal of a screw to open, and used only for fire alarm. Each circuit used for fire alarm purposes shall be permanently labeled for function.
  - ii. MXLV power supply and battery charging shall be provided by the MMB-1 main board and an MPS-6, or MPS-12, power supply, as necessary.
  - iii. MXLR/MXLRV power supply and battery charger shall be provided by the PSR-1 remote power supply and an MPS-6 or MPS-12 power supply.
- B. System secondary power
  - i. Components include valve-regulated, recombinant lead acid battery, charger, and an automatic transfer switch. Battery nominal life expectancy is 10 years minimum.
  - ii. Battery capacity is adequate to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. At the end of this period, the battery has sufficient capacity to operate the system, including alarm-indicating devices in either alarm or supervisory mode for a period of 5 minutes.
  - iii. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.
- C. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining the batteries at full charge. In the event batteries are fully discharged, the charger recharges them fully within four hours. Charger output is supervised as part of system power supply supervision.
- D. Automatic transfer switch transfers the load to the battery without loss of signals or status indications when normal power fails.

#### REMOTE CIRCUIT INTERFACE PANELS

- A. Remote circuit interface panels shall be Siemens type MXLR or MXLRV, and shall consist of an enclosure, a PSR-1 Remote Power Supply, NET-4 or NET-7 digital communications circuitry, mother boards either MOM-4 or OMM-1, batteries and hardware, modules and circuitry described for inclusion in the fire alarm control panel as required to function as specified.

- i. Circuit interface panels shall, when required, include CZM-4 conventional zone module, ALD-2I analog loop drivers, CSM-4 indicating appliance circuits, CRM-4 output circuitry to perform actions, ZC-1 series strobe circuits, ZAC-30 zone amplifier cards, and ZCT-8B firefighter telephone circuits.
- B. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the default mode.
- C. Circuit interface panels shall support remote system displays, annunciators and printers.

#### DEVICE PROGRAMMING UNIT (DPU):

- A. The programming tool shall program the intelligent devices with usage and device addresses. The unit shall test both the loop wiring for grounds, opens and shorts. Systems not having this ability shall, tests all the above items and provide a written report documenting the testing procedure as required in the submittal section.
- B. The system programmer shall print labels for all addressable devices and contain the complete SLC circuit and device numbers. The unit shall be model number DPU INTELLIGENT DEVICE PROGRAMMER/TESTER.

#### REMOTE COMMAND CENTER

- A. Operation: Through the use of the remote command center keypad, the operator may acknowledge events, silence audible, and reset the system. The menu driven display allows the listing to the display and optional printing of a wide range of data including the detector voltages, sensitivity settings, event log, system status, and more. In addition password access allows the operator to perform control and test functions such as changing smoke detector sensitivity settings, disarming input and output devices, manually controlling relays, executing display and lamp test, walk test, etc. A locked enclosure door restricts access to the keypad controls. The only keys accessible without opening the door are the HOLD and NEXT display control keys.
- B. The remote command center shall be located next to the Graphic Annunciator and shall be Siemens model RCC-1.

#### GRAPHIC ANNUNCIATOR

- A. Provide a Graphic Annunciator Panel which shall have a plan view of the typical floor shown in the proper perspective as shown on the drawings. Floor, device type and zone LED's shall be provided for each fire alarm and supervisory zone as listed in the specifications and as shown on the drawings. A lamp test push button shall be mounted on the face plate. Operation of the lamp test push button shall light all LED's and sound a Sonalert. A fire alarm control panel trouble actuated LED with Sonalert and a supervisory actuated LED with Sonalert, and,

momentary key operated silencing switches shall be provided. Provide a "Power On" LED for the fire alarm control panel on the face of this annunciator panel. The face plate frame shall be welded for rigidity and shall be mounted flush to the wall. Annunciators shall be as detailed on the contract drawings as manufactured by H.R. Kirkland.

- B. Annunciator shall incorporate Siemens model MOI-1 Output Interface and Siemens model MOD-16 Output Drivers, as required.

#### PULL BOXES AND TERMINAL CABINETS

- A. Pull boxes shall be Hoffman NEMA type 1 hinged cover cabinets only. Sizes as shown on the fire alarm system drawings. Paint all pull box doors red and label "F/A PULL BOX.
- B. Terminal cabinets shall be Hoffman NEMA type 1 hinged cabinets with a painted steel removable sub-plate and "T" handle latch. No locks are required. Each terminal cabinet shall have a factory painted red finish. Provide on the door of each terminal cabinet a red lamacoid nameplate with 3/4" white letters to read "Fire Alarm Terminal Cabinet #\_". Flush cabinets shall be the same type except for factory supplied flush mounting trim. Provide one (1) IDEAL (389-061) terminal block per wire entering and leaving the terminal cabinet, plus 10% spare terminal blocks. Mount terminal blocks vertically and use the appropriate terminal block mounting channel and terminal block end plates (89-062) as recommended by the manufacturer. Each terminal shall be properly identified and the respective Terminal Cabinet Directory as shown in the drawings shall be attached to the inside cover with an adhesive backed vinyl envelope.

#### EXECUTION

##### SCOPE

- A. The system shall electrically supervise all wiring between the control panel and all initiating and indicating devices.
- B. The system shall be capable of differentiating between a system trouble condition and the activation of a supervisory device.
- C. A complete NFPA 72 test shall be done and a system status report issued prior to the start of any modification to existing functional fire alarm systems.

##### EQUIPMENT INSTALLATION

- A. All wiring shall be installed in conduit except as shown. All conduits, cabinets and device back boxes shall be recessed unless shown otherwise on the drawings and as directed by the engineer.
- B. The center of all manual stations shall be mounted at (4.0) feet above the floor level, unless requirements of the Americans with Disabilities Act dictate otherwise.

- C. All space detectors shall be located on the suspended ceilings, except as noted. If suspended ceilings do not exist, the detectors shall be mounted on the slab.
- D. All detectors shall be centered in the ceiling tiles and back boxes and conduits shall be recessed in areas with suspended ceilings. The back boxes and conduits for detectors on the slab shall be surface mounted with conduits run perpendicular/parallel to the walls.
- E. All detectors shall be located at the highest point on the ceiling or slab except as specifically noted.
- F. Exact location of all automatic detectors shall be as directed by the manufacturer's representative.
- G. Detectors shall not be located within three (3) feet of on in the direct air stream from supply air diffusers.
- H. Detectors shall not be mounted on or within three (3) feet of doorways, beams, columns or walls, except smoke detectors at doors with door holders shall be mounted between two (2) and four (4) feet from the doors.
- I. The electrical contractor shall furnish and wire the duct detectors. The mechanical contractor shall install the duct detectors.
- J. Equipment mounting heights shall be in accordance with the requirements of the local fire alarm codes, handicapped codes and the Americans with Disabilities Act. Visual signals shall be mounted eighty (80) inches above the finished floor or six (6) inches below the finished ceiling, whichever is lower.
- K. All manual stations located at egress doors shall be located adjacent to and within five (5) feet of the respective egress doors.
- L. All detectors mounted on suspended ceilings shall be connected to pull boxes mounted on the slab with Greenfield which shall be long enough to move the detector five (5) feet in any direction. Only insulated throat greenfield connectors shall be provided.
- M. Detector bases shall be mounted on ceiling outlets so that indicator lamps are visible from the floor below, or from the nearest equipment aisle, or from the doorway entering the room, as applicable.
- N. The conduit, device back boxes, pull boxes, terminal cabinets, panels and wiring as shown on the Fire Alarm System drawings shall be installed as shown. The device back boxes and conduit wire fill shall be in compliance with NFPA-70 (NEC).
- O. Provide conduit marking tape at each conduit end and at 20 foot intervals in all accessible areas. Use (RWC) type tape (red and white checkered), only.
- P. Provide white lamacoid nameplates on the ceiling grid with 1/4" red letters to identify all above ceiling devices.
- Q. The existing fire detection and alarm system shall remain operational at all times, except that when work is being performed on the system during normal working hours only those portions

actually undergoing modification shall be out of service. All existing detectors in the construction area shall be bagged with plastic bags during the working hours and debugged after working hours.

- R. At the end of each work day, and before workmen leave the site, proper operation of the system shall be demonstrated to the designated Owner's representative.
- S. The existing system which is being replaced shall be removed only after the new system is accepted by the owner. This existing equipment shall be turned over to the owner or disposed of as directed.

## WIRING INSTALLATION

- A. All alarm initiating devices and supervisory initiating devices shall be connected on Style 4 two (2) wire Signaling Line Circuits (SLC). Unsupervised wiring (point wires) shall not be permitted. Parallel branch circuit wiring shall be permitted on the addressable SLCs.
- B. All notification appliances shall be connected on Style Y two (2) wire electrically supervised circuits.
- C. All wiring shall be in accordance with applicable code and shall conform to manufacturer's recommendations.
- D. No splicing of wires is permitted except on terminal blocks in annunciators, control panels or properly labeled terminal cabinets as shown on the drawings. The use of wire nuts or similar type devices is not permitted. All devices shall have terminals for each wiring connection. No splicing of any type shall be permitted in pull boxes, to include crimp terminals.
- E. TESTING
  - A. Prior to the acceptance test of the project by the Owner, a factory-trained technician from the equipment supplier shall inspect, test and adjust the complete Fire Alarm System according to NFPA-72 including, but not limited to, the following:
    - i. Visual inspection of all equipment.
    - ii. Verification of alarm, supervisory and trouble signals at all receiving locations and circuits, including audible and visual alarms, annunciators, control panels, and central monitoring control panel.
    - iii. Test each alarm initiation device for alarm and correct annunciation.
    - iv. Test each alarm bell and strobe light for proper operation.
    - v. Test the sensitivity of each smoke detector with a manufacturer's detector test set (the fire alarm control panel shall be UL listed for this purpose). Retain a printed recorded of all firing voltages. Correlate firing voltage records to the device addresses as shown on the as-built drawings.
    - vi. Test the operation of each magnetic door holder, elevator recall, damper closure and smoke control



**DIVISION 33—UTILITIES**

**GENERAL**

To facilitate ongoing energy tracking and benchmarking, any new energy source added to a new or renovated building shall be metered at least at the building level so that all energy consumption (e.g. electricity, gas) in the building is fully metered following new construction and/or whenever a new source (e.g. solar hot water, waste-fuel generator, solar PV, etc.) is added.

Metering and data collection shall continue uninterrupted during all facility alteration & addition and renovation projects.

<b>Div.</b>	<b>Section</b>	<b>Accepted Examples</b>	<b>Next Review (Max. 24 Months)</b>	<b>Technical Owner</b>	<b>Key Stakeholders</b>
<b>32</b>	<b>Exterior Improvements</b>				
32	Exterior Paving	Vast Pavers by VAST Enterprises	Jul-14	FM Landscape Architects	OS
32	Exterior paving	EcoPremier by Wausau	Jul-14	FM Landscape Architects	OS
32	Exterior Screening	Perforated Metal of Wire Mesh by McNichols	Aug-14	FM Landscape Architects	
32	Roofing and Exterior Wall Systems	Various Lines by Fabral	Sep-14	FM Landscape Architects	FM-M. Griffin
32	Trellis system for plants	Greenscreen	Oct-14	FM Landscape Architects	FM-M. Feist

— **END OF DIVISION 33** —





*Cassell Hall*

## Equipment Numbering Scheme

**First Identifier** – Identifier for the building that the equipment is associated with. This will be consistent with the established AiM building identifier codes existing in the AiM system.

**Second Identifier** – Floor location of the equipment if the building is multi-level, having more than a basement and a first floor.

**Third Identifier** – Type of equipment that is being identified. Abbreviated equipment type code consistent with existing AiM established codes.

**Fourth identifier** – This will indicate the incremental number of the item according to the location. The incrementing should begin with the lowest physical level of the building.

### Examples of Asset Codes for AiM:

If there are 3 VAV units on the first floor and 3 on the third floor and 2 Fan coil units on the first floor and 5 on the third floor in Anderson Hall the AiM asset numbering codes will be:

AH-01-VAV001 VAV BOX  
AH-01-VAV002 VAV BOX  
AH-01-VAV003 VAV BOX

AH-03-VAV004 VAV BOX  
AH-03-VAV005 VAV BOX  
AH-03-VAV006 VAV BOX

AH-01-FCU001 FAN COIL UNIT  
AH-01-FCU002 FAN COIL UNIT

AH-03-FCU003 FAN COIL UNIT  
AH-03-FCU004 FAN COIL UNIT  
AH-03-FCU005 FAN COIL UNIT  
AH-03-FCU006 FAN COIL UNIT  
AH-03-FCU007 FAN COIL UNIT

### Resolution of equipment not associated with buildings.

There are some items identified as equipment that are not associated with any building. These are equipment items for the Grounds Maintenance Operation (mowers, tillers, clippers, etc.). Other items are unique to the housekeeping operation (vacuums).

## Equipment and Building Code Schematic

Asset Tag # Coding Schematic			Building Coding Schematic	
Asset Type	Acronym	Asset Tag Format	Building Code	Building Name
ACTUATOR VALVE	AVLV	XX-XX-AVLV###	AH	Anderson Hall
AERATOR	ARTR	XX-XX-ARTR###	ASB	Asbury Building
AIR CLEANER	AIRCL	XX-XX-AIRCL###	BCC	Media Production Center
AIR COMPRESSOR	AIRCP	XX-XX-AIRCP###	BE	Beeghly Building
AIR CONDITIONING UNIT	ACNU	XX-XX-ACNU###	BL	Bender Library
AIR DRYER	AIRDY	XX-XX-AIRDY###	BP	Butler Pavilion & Arcade
AIR HANDLERS	AHU	XX-XX-AHU###	BT	BATTELLE-TOMPKINS
ALARM PANEL-SECURITY	ALPNL	XX-XX-ALPNL###	BW	Brandywine Building
AUTOMATIC DOOR CLOSER	ADC	XX-XX-ADC###	CB	Constitution Bldg.
BACKFLOW PREVENTER	BFP	XX-XX-BFP###	CDC	Child Development Ctr.
BATHROOM EQUIPMENT	BTHEQ	XX-XX-THEQ###	CH	Capital Hall
BATHROOMS SUPPLY FAN	FAN	XX-XX-FAN###	CK	Clark
BATTERY/BATTERY RACK	BATT	XX-XX-BATT###	CN	Centennial Hall
BATTERY CHARGER	CHGR	XX-XX-CHGR###	CO	Congressional Hall
BLEACHERS-Moveable	BLCH	XX-XX-BLCH###	CS	Costume Shop
BLOWER	BLWR	XX-XX-BLWR###	DH	Dunblane House
BOILERS	BOILR	XX-XX-BOILR###	FA	Financial Aid Bldg.
BOLLARD	BLLRD	XX-XX-BLLRD###	FH	FEal Hall
BUILDING CONTROL PANEL	BLDCP	XX-XX- LDCP###	GR	Gray Hall
CARD READER	CRDR	XX-XX-CRDR###	HA	Hamilton
CHILLER	CHILL	XX-XX-CHILL###	HF	Hockey Field
COMMERCIAL BAKER CART	CART	XX-XX-CART###	HH	Hughes Hall
COMMERCIAL BEER COOLER	CLR	XX-XX-CLR###	HU	Hurst
COMMERCIAL CHOPPER	CHPR	XX-XX-CHPR###	KA	Katzen Art Center
COMMERCIAL COFFEE URN	URN	XX-XX-URN###	KB	Kogod School of Business
COMMERCIAL COLD LINE	CLIN	XX-XX-CLIN###	KR	Kreeger
COMMERCIAL CONVEYOR	CNVR	XX-XX-CNVR###	KS	Kay Spiritual Life Ctr.
COMMERCIAL COUNTERTOPS	CNTP	XX-XX-CNTP###	LTH	Letts Hall
COMMERCIAL DISH DISPENSER	DSPR	XX-XX-DSPR###	LH	Leonard Hall
COMMERCIAL DISH MACHINE	DSHM	XX-XX-DSHM###	MCB	McCabe
COMMERCIAL DISPOSAL	DISP	XX-XX-DISP###	MGC	Mary Graydon Center
COMMERCIAL EXHAUST HOOD	EXHD	XX-XX-EXHD###	MH	McDowell Hall
COMMERCIAL FREEZER	FRZR	XX-XX-FRZR###	MK	McKinley
COMMERCIAL FRYER	FRYR	XX-XX-FRYR###	MPF	Multi-Purpose Field
COMMERCIAL FRYER FILTER	FFLTR	XX-XX-FFLTR###	MS	Tenley Maintenance Shop
COMMERCIAL RANGE	RNG	XX-XX-RNG###	NH	Nebraska Hall
COMMERCIAL GRILL	GRLL	XX-XX-GRLL###	NLH	New Lecture Hall
COMMERCIAL HOT LINE	HLIN	XX-XX-HLIN###	NMA	New Mexico Ave.
COMMERCIAL HOT/COLD LINE	HCLIN	XX-XX-HCLIN###	OS	Osborn
COMMERCIAL ICE MACHINE	ICEM	XX-XX-ICEM###	PB	Presidents Building
COMMERCIAL KETTLE	KTL	XX-XX-KTL###	PR	President Residence
COMMERCIAL MIXER	MXR	XX-XX-MXR###	PS	Public Safety

COMMERCIAL OVEN	OVEN	XX-XX-OVEN###	RB	Rockwood Bldg
COMMERCIAL PIZZA PRESS	PPRS	XX-XX-PPRS###	RH	Roper Hall
COMMERCIAL PROCESSOR	PPRCR	XX-XX-PPRCR###	SC	Sports Center/Bender Arena
COMMERCIAL REFRIGERATOR	REF	XX-XX-REF###	SCA	Sports Center Annex
COMMERCIAL RICE COOKER	RCKR	XX-XX-RCKR###	SIS	School of International Service
COMMERCIAL SKILLET	SKLT	XX-XX-SKLT###	SV	Washington College of Law
COMMERCIAL SLICER	SLCR	XX-XX-SLCR###	TB	Transmitter Building
COMMERCIAL SOUP WELL	SPWL	XX-XX-SPWL###	VM	Vehicle Maintenance Shop
COMMERCIAL STEAMER	STMR	XX-XX-STMR###	WA	Watkins
COMMERCIAL TOASTER	TSTR	XX-XX-TSTR###	WCB	Ward Circle Building 1998
COMMERCIAL WARMER	WRMR	XX-XX-WRMR###	WCL	Washington College of Law
CONDENSER UNIT	COND	XX-XX-COND###	WIS	4200 WISCONSIN AVENUE
CONVERTERS	CONV	XX-XX-CONV###	WS	Wesley Seminary
COOLING TOWER	CLGTR	XX-XX-LGTR###		
DEHUMIDIFIER	DHUM	XX-XX-DHUM###	<b>Floor Information</b>	
DOMESTIC HOT WATER HEATER	WH	XX-XX-WH###	BL	Basement Level
DOOR	DOOR	XX-XX-DOOR###	TL	Terrace Level
DRYER (APPLIANCE)	DRYR	XX-XX-DRYR###	LL	Lower Level
DRY PIPE SPRINKLER SUPPLY	SPKLR	XX-XX-PKLR###	01	First Floor
DX UNITS	DX	XX-XX-DX###	02	Second Floor
ELECTRIC SERVICE SWITCH	DSCS	XX-XX-DSCS###	03	Third Floor
ELECTRICAL PANELS	ELCPN	XX-XX-LCPN###	04	Fourth Floor
ELEVATOR	ELEV	XX-XX-ELEV###	05	Fifth Floor
EMERGENCY GENERATOR	GENR	XX-XX-GENR###	06	Sixth Floor
EMERGENCY SHOWER STATION	SHSTA	XX-XX-HSTA###	07	Seventh Floor
EXHAUST HOOD	EXHD	XX-XX-EXHD###	08	Eighth Floor
EXPANSION TANK	TANK	XX-XX-TANK###	PH	Penthouse
EYE WASH	EYEW	XX-XX-EYEW###	RF	Roof
EYE WASH KIT	EYEK	XX-XX-EYEK###		
FAN COIL UNIT	FCU	XX-XX-FCU###		
EXHAUST FAN	EXFAN	XX-XX-XFAN###		
SUPPLY FAN	SFAN	XX-XX-SFAN###		
CIRCULATION FAN	CFAN	XX-XX-CFAN###		
RETURN FAN	RFAN	XX-XX-RFAN###		
FANS	FAN	XX-XX-FAN###		
FILTER	FLTR	XX-XX-FLTR###		
FIRE ALARM PANEL	FAP	XX-XX-FAP###		
FIRE EXTINGUISHER	FIRX	XX-XX-FIRX###		
FIRE HYDRANT	FHYD	XX-XX-FHYD###		
FIRE PUMP	PUMP	XX-XX-PUMP###		
FIRE-ANNUNCIATOR PANEL	FAAP	XX-XX-FAAP###		
FIRE-NOTIFICATION DEVICE	FND	XX-XX-FND###		
FUEL TANK-BOILER	TANK	XX-XX-TANK###		

FUEL TANK-EMER. GENERATOR	TANK	XX-XX-TANK###
GREASE TRAP	GTRP	XX-XX-GTRP###
HEATER	HTR	XX-XX-HTR###
HUMIDIFIER	HUMD	XX-XX-HUMD###
HVAC ROOM CONTROL	RMCNT	XX-XX-MCNT###
IRRIGATION CLOCK	IRRCLK	XX-XX- RRCLK###
KEYPAD-ALARM	KYPD	XX-XX-KYPD###
LADDER-FIXED	LDDR	XX-XX-LDDR###
LIGHT POLE	LTPL	XX-XX-LTPL###
LIGHTING	LITE	XX-XX-LITE###
MAIN FIRE PUMP	PUMP	XX-XX-PUMP###
METERING DEVICE	MTD	XX-XX-MTD###
MOTION DETECTOR	MOTD	XX-XX-MOTD###
OVEN (APPLIANCE)	OVEN	XX-XX-OVEN###
PANIC BUTTON	PNCBT	XX-XX-NCBT###
POOL CHEMICAL FEE	PCFDR	XX-XX-CFDR###
PUMP	PUMP	XX-XX-PUMP###
RADIATOR, STEAM	RADR	XX-XX-RADR###
REFRIGERATOR	REF	XX-XX-REF###
REHEAT COIL	DHC	XX-XX-DHC###
ROOF TOP UNIT (HVAC)	RTU	XX-XX-RTU###
SHUTTER, ROLL-UP	SHTTR	XX-XX-HTTR###
SOLAR WATER HEATING SYSTEM	SLRW	XX-XX-SLRW###
SPRINKLER SYSTEM (WET or DRY)	SPKLR	XX-XX-PKLR###
STEAM CONDENSATE PUMP SET	STCND	XX-XX-TCND###
STEAM STATION	STSTA	XX-XX-STSTA###
TANK	TANK	XX-XX-TANK###
TRANSFORMER	TRNF	XX-XX-TRNF###
TRAP-GREASE	GTRP	XX-XX-GTRP###
TRAP-STEAM	STTRP	XX-XX-TTRP###
VALVE	VLV	XX-XX-VLV###
VARI AIR VOLUME BOX	VAV	XX-XX-VAV###
VARIABLE FREQUENCY DRIVE	VFD	XX-XX-VFD###
VENTILATOR	VENT	XX-XX-VENT###
WASHER (APPLIANCE)	WSHR	XX-XX-WSHR###
WATER FOUNTAIN	WF	XX-XX-WF###
WATER TREATMENT SYSTEM	WTSYS	XX-XX-TSYS###
WINDOWS	WDW	XX-XX-WDW###
HEAT RECOVERY SYSTEM	HRU	XX-XX-HRU###
HOOD FIRE SUPPRESSOR SYS.	HDSP	XX-XX-HDSP###
CHAIN SAW		
CLIPPERS		
CONTACT		
DOOR HARDWARE		
DRILL		
EDGER		

ELECTRIC STRIKE		
EXTRACTOR		
FRONT END LOADER		
GROUNDS EQUIPMENT		
HYDRAULIC SYSTEM		
LABORATORY EQUIPMENT		
MAGNETIC LOCK		
MISCELLANEOUS-VM		
MOTORIZED ATHLETIC EQUIP.		
MOWER		
ORGAN		
PARKING GATE/BOX		
PARTITION		
PLUMBING-ACCESSORIES		
PLUMBING-LAVATORIES		
PLUMBING-SERVICE SINK		
PLUMBING-SHOWER/TUB		
PLUMBING-SINKS		
PLUMBING-TOILETS		
PLUMBING-URINALS		
POOL HEATER/DEHUMIDIFER		
POOL-CHEMICAL FEE		
POOL-FILTERS		
POOL-HEATERS		
POOL-PUMP		
PRESSURE WASHER		
Pool Accessories		
Push Mower		
ROLLER		
ROOF		
SCRUBER		
SHREDDER		
SITE DRAIN		
SMOKE STACK		
SPRAY TANK		
SPREADER		
SPRINKLER HEAD		
STREET SWEEPER		
THATCHER		
TILLER		
TRACTOR		
TRIMMER		
TURF-TRUCKSTER		
Tiller		
UTILITIES-ELECTRIC		
UTILITIES-GAS		
UTILITIES-WATER		

## Space Numbering Guidelines

Hopefully this outline will help attain the important goal of general numbering order- making it easier for a visitor to a building to find a space. It may be helpful to imagine a person appearing at the entrance and asking herself “So how do I find room...?”

Another important goal of this outline is to make it easy to find space types in a report that is ordered by room number. When a person is examining a space report, their focus is usually a specific space or group of spaces at a time. For example, a planner might be concerned with office space sizes- seeing all office spaces with numbers in the lower spectrum would be helpful to their analysis. On the same hand, a network engineer may be concerned with finding network and server closets to implement upgrades. Using the attached Nomenclature Guidelines, one can ensure ease of use for both the visitor and the planner.

### Numbering Spaces in a New Building

Using the “Nomenclature Guidelines” provided in the following section to complete the steps below.

#### Step One

From the most likely entrance to that floor and in a clockwise direction, number spaces not requiring a room number sign. These are usually ancillary spaces like restrooms, service closets and hallways. If these space types can be found on the adjacent floor level, try to use existing number sequences (see section 6, “Space Numbering for New and Renovated Spaces”).

#### Step Two

Next, from the entrance again, and in a clockwise direction, number primary spaces requiring a room number sign. These are generally office spaces, conference rooms and assembly areas. Be certain to read section 2a, “Space Numbering for New and Renovated Spaces.”

#### Final Steps

Double-check for missed spaces and common spaces that may change function. When a space changes its overall function, a new number should be assigned. Here are some examples:

1. When a hallway connects different office areas, separately number the hallways. If a hallway continues from a public area through a door to another area, separately number the hallways. This is because office space is considered “private areas” and the portion of the hallway in the public area public circulation while the other portion of the hallway is office circulation. Doors are almost always an indication of privacy or separation.
2. When a lounge area connects to a hall, assign a separate number for the lounge area
3. Use one number for both the waiting and reception areas because the receptionist is directly responsible for the waiting area. The only exception to this is clinic waiting areas.
- 4.

#### Nomenclature Guidelines

Where ever possible, use the following as a guide for general consistency in numbering and renumbering spaces. Following these guidelines will minimize the occurrence of the task (and cost) of renumbering space in the future, as well as provide a simplified method for determining the likely location of a space on a layout. When space numbers are changed due to renovation, please be certain to send notification to the Planning and Project Management department. This will help improve the accuracy of system that report and project university space use. If further guidance is needed, contact the Planning and Project Management department.

Space Numbering for New and Renovated Spaces  
Use these guidelines for new buildings and renovations

1. The syntax for room numbers should be:

**{Floor ID} {Number} [Suffix] [Sub Suffix]**

*Wherein,*

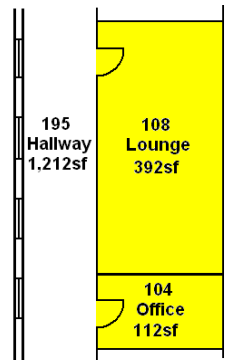
- a. **{Floor ID}** is a sequence of letters and/or numbers that represent the identity of the floor. See **Figure D** below for a list of common Floor IDs at AU.
- b. **{Number}** this is a unique space numbering sequence that follows the floor ID, the first beginning with "00," the highest value being "99." **See item 9 below** for an exception to this rule.
- c. **[Suffix]** this is a letter that only follows the room sequence to indicate a subset of space. See **Figure F** below for a sample of its use.
- d. **[Sub Suffix]** this is a number that follows the suffix letter to indicate a subset of a subset of space. See **Figure G** below for an example.

2. **All spaces should be numbered** including closets, storage, lounges, electrical, mechanical and open spaces whose doors meet the floor. Stairwell and elevator shafts should be numbered as well.

- a. **The sequence for primary spaces** should be flexible to allow for future renovation of single spaces into multiple spaces. For example, the space number of an office numbered 104 that is adjacent to a lounge with separate access to the same corridor should be numbered 108 to allow for future renovation that may separate that lounge into multiple spaces with separate access to the corridor. As a reference, skip one room number for every 13 feet of hallway space between doors, should numbering allow (see Figure A).

- b. **Secondary spaces** should be numbered as follows: **60's**- Mechanical (plumbing, electrical, telecom, data); **70's**- Support (rest room, custodial, storage, etc.); **80's**- Circulation (corridors, study space and lounges, **excluding** multi-function spaces); **90's** - Stair & Elevator Shafts.

**Figure A**

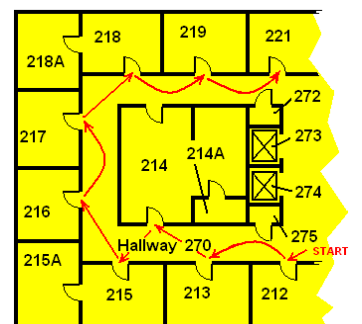


This will help ensure that integers for numbering primary spaces are ample and easier to locate.

- c. Spaces with collapsible or accordion walls should be numbered as if the wall were permanent to accommodate scheduling multiple events in the larger space.
3. The floor that contains the main or most commonly used entrance to the building should be the **first floor**. This will make it easier for a person find the exiting floor in case of an emergency.
4. **For buildings on the "Quad"**, the "quad entrance" should be the "main entrance," hence the first floor should be at the "quad entrance level."

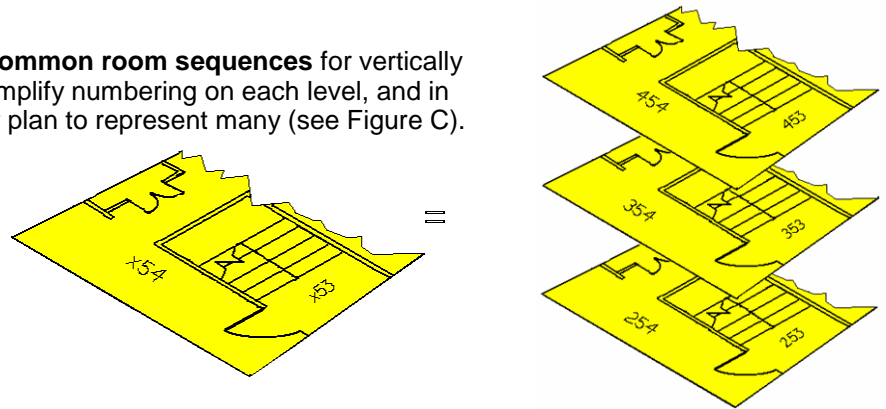
5. **Room numbering should begin** from the building entrance, then continue from the left and go in a clockwise direction. Rooms are numbered using the "post office system." That is, even numbers to the right of the corridor; odd numbers on the other side. In the case where there is a "donut" or multi-donut corridor pattern, with common use areas (with few doors) inside the "donut" and comparatively large number of doors facing the center of the donut, number the adjacent spaces sequentially when there are no doors facing those spaces (see Figure B). Remember to number ancillary spaces first to avoid errors (See 2a above).

**Figure B**





6. Wherever possible, one should use **common room sequences** for vertically adjacent, stacked spaces. This will simplify numbering on each level, and in some cases, provide for a single floor plan to represent many (see Figure C).



**Figure C**

7. The main entrance of each floor should be assigned the beginning number of the floor sequence. For example, the first floor entrance would be 100, 200 for the second and 300 for the third floor entrance.
8. A Floor IDs should be utilized to represent each floor, followed by a sequential space number. Use the following list determine Floor ID:

Floor	Description	Note
E	Rooftop Elevator	These letters represent the uppermost levels.
R	Roof	
A	Attic	
PH	Penthouse	
M	Mezzanine	For multiple levels, add a number, i.e., M1, M2...
2	Second Floor	
1	First Floor (Entry	
G	Ground Floor	
LL	Lower Level	
T	Terrace Level	
ST	Sub Terrace Level	
B	Basement Level	Never used for residential space- use Terrace or Sub Terrace
P	Parking Level	This level is generally located below the 1 <sup>st</sup> floor; however this may also be at roof level. Successive above-ground
P1	Parking Sub Level 1	Successive below ground parking level numbers increase as the levels go deeper.
P2	Parking Sub Level 2	
P3	Parking Sub Level 3	

**Figure D**

9. The Floor ID should be followed by two digits for the space number. The first one or two digits refer to the floor number; the remaining digits refer to the space number (see Figure E).

**Exceptions:**

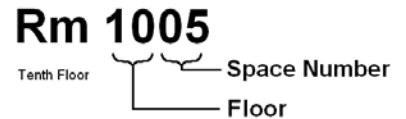
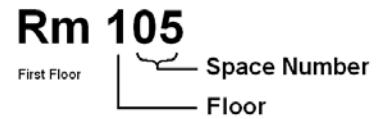
- a. **If a building has more than 100 spaces on any given floor**, one should consider separating areas into suites and following the related numbering system (see item 10 below). If the suite system is not practical, use the Floor ID followed by four digits for the space number. Once reaching a level that requires the previously mentioned exception, all floors above that level must use four digit space numbers to avoid duplicate room numbers (see Figure E).
- b. **If the floor uses a one or two letter Floor ID (e.g., “B,” “ST”)**, one and two digit space numbers may be used on the same floor, e.g., **Figure E**  
 B1 can be used instead of B01ST9 can be used instead of ST09

This exception is possible because duplication of a room number cannot occur with letter-only Floor IDs.

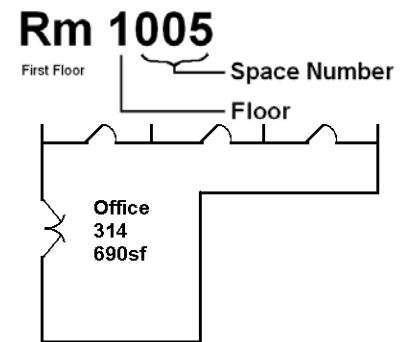
10. **Rooms accessed through another room (nested rooms)** should use the “suite system.” Whenever possible, rooms are numbered sequentially in a clockwise pattern from the main suite entrance using the number of the main space, followed by an alphabetical suffix (see Figure F).

11. **Closets and utility rooms** connected directly to a numbered space with a suffix (e.g., A, B, C...) should use the same number and suffix as the larger space, followed by a secondary suffix beginning with the number “1” and continuing to “9.” If numbering is required beyond “9,” continue with the capital letter “A,” continuing through “Z” for remainder of these spaces, e.g., 314C1, 314C2...314C9, 314CA, 314CB (see Figure G).

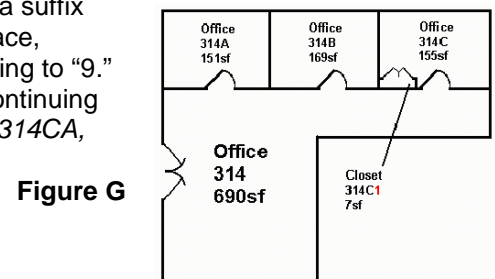
**Common Numbering Sequence**  
(floors with 100 or fewer spaces)



**Super Building Exception**  
(floors with more than 100 spaces)



**Figure F**



One should keep in mind that renumbering vacant and occupied spaces in a logical, orderly fashion is necessitated for the sake of simplicity, to aid emergency personnel in locating spaces in case of emergency and minimize the confusion visitors and service personnel may experience when looking for a space.

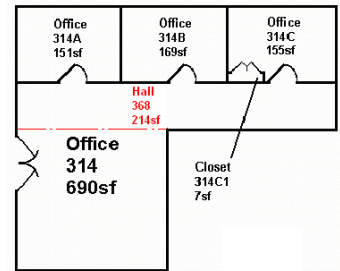
While in some instances these guidelines may be difficult to follow, one should always weigh the need to support the three points mentioned above against the need to control costs and the possible inconvenience to persons intended to occupy those spaces.

## Numbering Space Boundaries and Retail/Tenant Spaces

Retail and tenant space boundary identifiers are important for planners and decision makers to visualize how space is being used for spaces with temporary or invisible boundaries. These boundary identifiers are included in the drawings for the university's floor plan book.

1. **Short dash followed by a long dash** are the preferred marking to indicate space boundaries.(Fig. H)

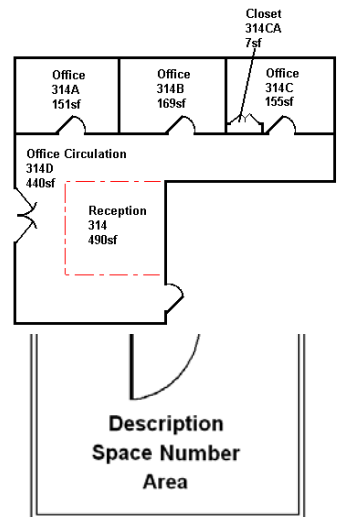
Figure H



2. **Add an office circulation path around or between workspaces** that share a common area between offices. If there is a sitting area near the reception desk, include this area as the receptionists'.(Fig. I)

Figure H

Figure I



3. **Space information label order:** always use the format: Local Use Description, Space Number and Area Measurement. Follow the area measurement, omitting any spaces, with the letters "sf" to signify square feet. See figures J, K.

4. **Tenant & retail space do not require individual space numbering.** All space in the tenant retail areas, regardless of function, is coded as merchandise facility, so separate space numbers are unnecessary. However, indicating the purpose of each space may be shown for general information. Additionally, the entire rental space within the outer wall boundaries should be measured, ignoring walls and fixtures and consistent with BOMA standards. Include this value in parenthesis beneath the space value, which is based on PFICM measurement criteria.

Figure J

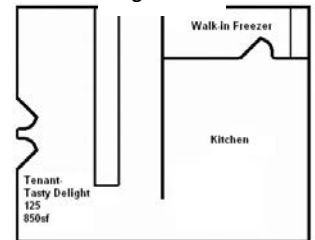


Figure K

### Addendum to Space Numbering Guidelines

#### Numbering Cubicles or Private Rooms in a Suite

**Syntax for private rooms: {Room Number} [Suffix] [Sub Suffix]**

**Syntax for cubicle spaces: {Room Number} – {Cubicle #} [Suffix] [Sub Suffix]**

*Note: “{}” indicate required, “[]” indicate optional*

*Where,*

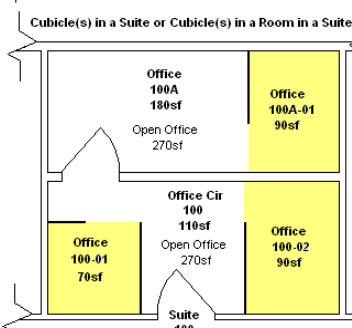
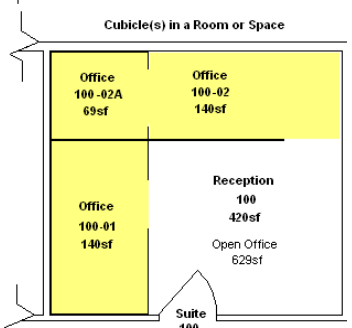
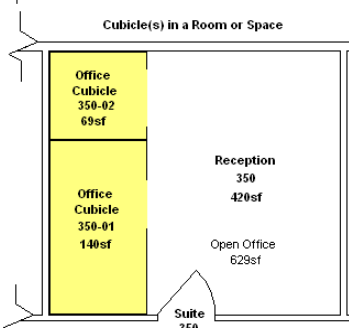
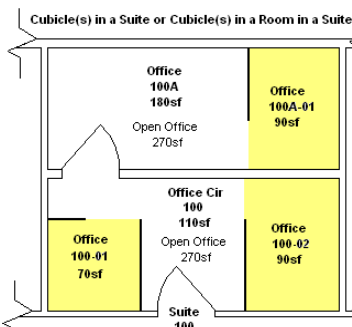
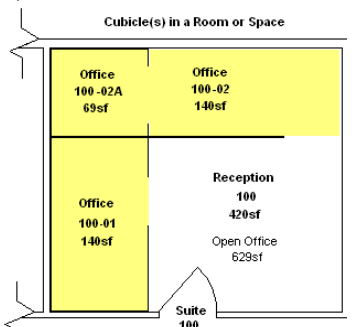
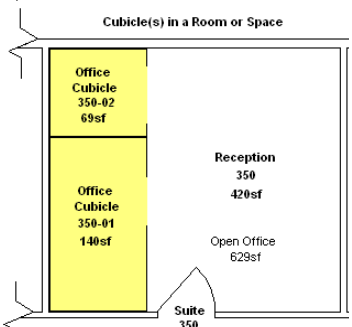
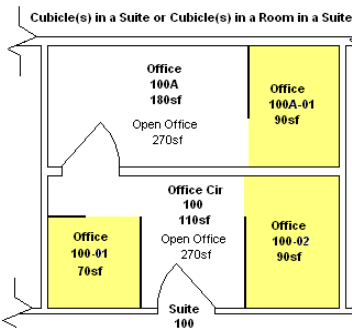
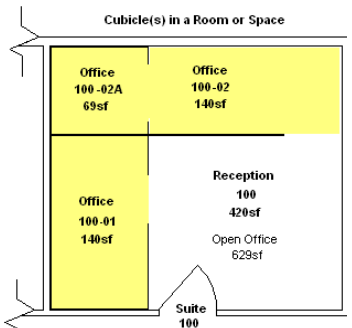
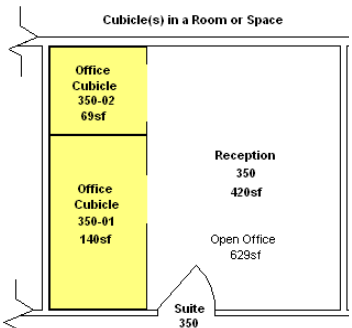
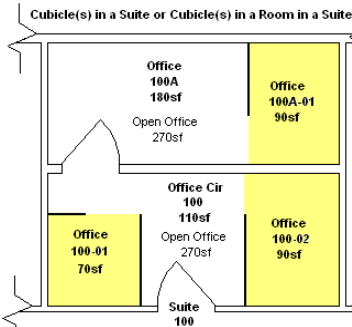
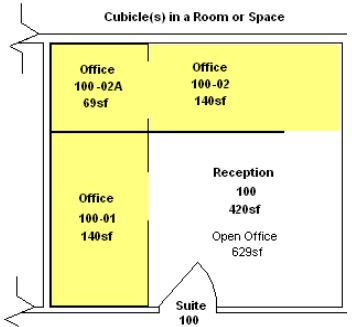
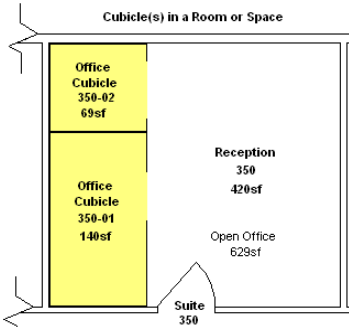
**{Room Number}** a unique number for the room or suite that contains rooms and/or cubicles. Room Numbers are covered in detail in the core document “Space Numbering Guidelines,” eg., 245, 119, T19

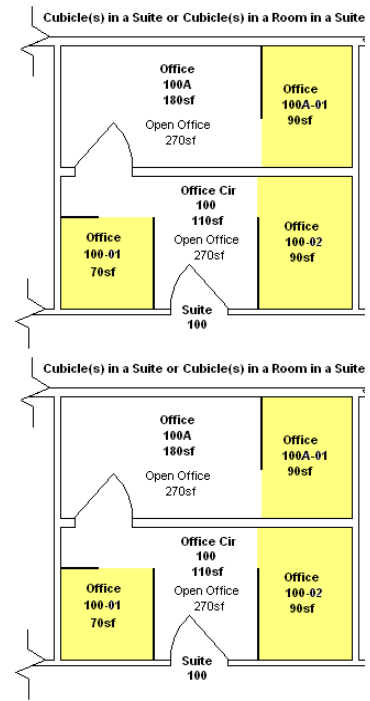
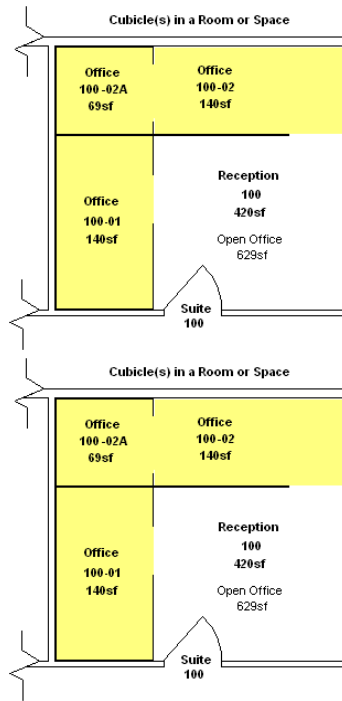
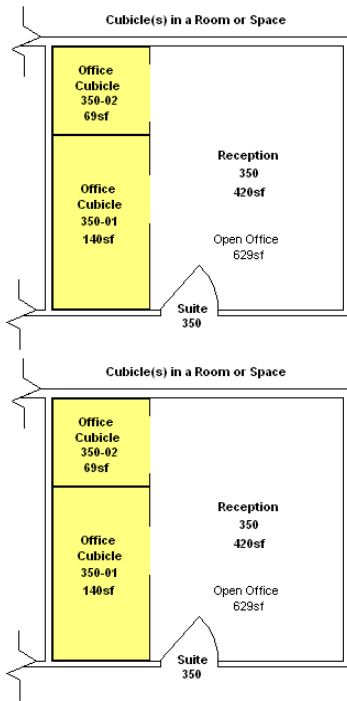
**[Suffix]** in the case of a private room within a private room or suite, this is a letter that follows the number to indicate a subspace of that room number. In the case of cubicle within a cubicle, it is a letter that follows a hyphenated two-digit number, eg., 119**E**, T19**B**, B45-13**A**

**[Sub Suffix]** a number that follows the suffix to indicate a subset of a subset of space. This typically occurs for closets or ancillary spaces inside a room within a suite, eg.,: 245**A1**, 119**E1**, T19**B3**

A private room is a space that is enclosed by four walls and typically includes at least one door. Numbering private rooms within a room or suite is covered in detail in the core document “Space Numbering Guidelines.” However, this document emphasizes that private rooms in a room or suite **should always** be followed with a letter suffix. In the case where the room is a cubicle (this includes “invisible wall” spaces), the number **should always** be followed by a hyphen and a two-digit number beginning with “-01”The only exception to this convention are the previously-numbered spaces in suite 350 in the 3201 New Mexico building, where there are also more than 24 private rooms.

In addition, whenever possible, one should include the total open office square feet near the suite number, in regular (not bold) lettering in the floor plan. This information can be helpful for managing the design elements within the open office space. Below are examples of implementations of these guidelines in factious buildings.





**Fig. 1** Cubicles in an open office suite 100 would be numbered 100-01, 100-02, etc.

**Fig. 2** A cubicle that is a sub space of another cubicle would be numbered by adding a sub-suffix letter. In this example, the subspace of 100-02 is 100-02A.

**Fig. 3** A private office in suite 100 would be numbered 100A, and a cubicle inside of 100A would be numbered 100A-01. The suffix "A" distinguishes the cubicle within 100A from the cubicles in the open office space external to 100A.

The first private room to the left of the entrance of suite 100 would be numbered **100A**. If there were (or a likelihood of more than 24 private offices in that suite, it would be numbered **100-01**.

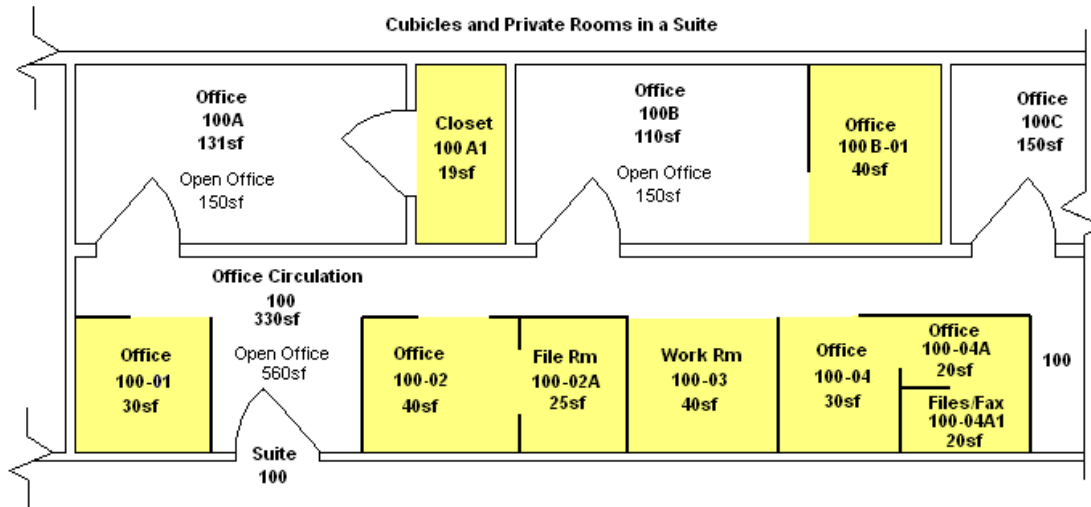


Fig. 4 Here is a configuration that employs all the elements discussed, in proper convention. Notice that the full Office Circulation label is not repeated for long spaces or a space that flows around several adjacent, separately numbered spaces. This helps the observer to understand that those areas are a part of 100. It also helps eliminate repetitious labeling that may become unsynchronized after several floor plan revisions. Also note the suffix letters “I” and “O” should be omitted, as they could easily be confused with the numbers one and zero.

Without a floor plan, one can typically use these conventions to ascertain how a space is situated:

<p>Number Followed by a Letter</p>	<p><b>100A:</b> a private room inside a room or suite 100</p> <p><b>100A1:</b> a space inside a private room, inside room or suite 100.</p> <p><b>100A-01:</b> a cubicle inside a private room, inside room or suite 100</p> <p><b>100A-01A:</b> a cubicle that is a part of, and can only be accessed through cubicle 100-01</p>
<p>Hyphenated Room Number</p>	<p><b>100-01:</b> a cubicle inside a room or suite 100.</p> <p><b>100-01A:</b> a cubicle that is a part of another cubicle (and can only be accessed through that cubicle) inside a room or suite 100.</p> <p><b>100-01A1:</b> a cubicle that is a part of another cubicle (and can only be accessed through that cubicle) that’s part of another cubicle inside a room or suite 100.</p>

IMPORTANT NOTE: as these are guidelines for new plans, there may be instances where preexisting room numbers may supersede this convention.

PM/JDM, Rev 6/7/20

**PROJECT CLOSEOUT FORM**

TO: DIRECTOR, FACILITIES MANAGEMENT DEPARTMENT

FROM: PROJECT MANAGER

PROJECT#:

PROJECT DESCRIPTION:

PROJECT BUDGET:

FINAL BUDGET: \$

FINAL ACTUAL: \$

PROJECT SCHEDULE / DATES: (check and date applicable items)

PROJECT INITIATION DATE:

PLANNING/DESIGN START DATE:

PLANNING/DESIGN COMPLETE DATE:

CONSTRUCTION START DATE:

CONSTRUCTION COMPLETE DATE:

CERTIFICATE OF SUBSTANTIAL COMPLETION:

CERTIFICATE OF OCCUPANCY:

CLOSE OUT NOTIFICATION SENT:

PUNCH-LIST COMPLETED (CERTIFICATE):

NOTICE OF CLOSE-OUT:

CERTIFICATE OF PAYMENT AND LIEN WAVERS:

CONSENT OF SURETY FOR FINAL CONTRACTOR PAYMENT:

CONSULTANT/CONTRACTOR EVALUATION FORM:

EXECUTION OF ALL CHANGE ORDERS TO THE CONTRACT:

FINAL PAYMENT TO A/E:

AS-BUILT DRAWINGS TO CAD SERVICES:

O&M MANUALS DISTRIBUTED:

WARRANTY MANUALS DISTRIBUTED:

CERTIFICATE OF FINAL PAY APPLICATION (this event signifies final completion):

COMMENTS:

SUBMITTED BY:

DATE:



**CONSULTANT EVALUATION FORM**

SECTION I FIRM	SECTION II PROJECT DATA		
Firm Name / Location	Project No.	Project Name	
Project Architect Project Engineer	Description		
SECTION III CONSULTANT RATING			
A. Design Phase	Below Expectations	Met Expectations	Exceeds Expectations
Timely submission of documents and reports			
Adequacy and timeliness of cost estimate			
Coordination and cooperation with FM and Other University personnel			
Adherence to program documents			
Client satisfaction			
Quality of design			
Coordination of Documents			
Documents Quality			
Completion of design within allotted time			
Completion of design within allotted budget			
Scheduling, evaluation, and advice			
B. Construction Phase			
Timely assistance with interpretation of documents			
Errors/omissions requiring construction changes			
Assistance with claims and disputes			
Clear and timely assistance with modifications			
Schedule Quality			

Estimates Quality			
Communication and Coordination with Contractors and FMD			
'As-Built' drawing management			
Compliance with Design Guidelines			
OVERALL PERFORMANCE			
SECTION IV NARRATIVE			
Comments regarding Consultants performance: (use reverse side if necessary)			
SECTION V PREPARED BY:			
(Project Mgr.)			
(Date)			

### CONTRACTOR EVALUATION FORM

SECTION I FIRM		SECTION II PROJECT DATA	
Contractor Name / Location	Project No.	Project Name	
Project Description			
SECTION III CONTRACTOR RATING			
Construction Phase	Below Expectations	Met Expectations	Exceeds Expectation
Job Site Mobilization			
Job Site Organization and Cleanliness			
Job Schedule Management and Adherence			
Job Site Safety			
Quality of Field Supervision			

Adherence to Plans/Specifications			
Quality of Construction and Workmanship			
Sub-Contractor Performance			
Environmental Protection			
Compliance with MWBE requirements			
Coordination with sub-contractors			
Timely and accurate submission of As-built documents			
Coordination and cooperation with FMD and other University personnel			
Completion of project within allotted time			
Completion of project within allotted budget			
Post Construction			
AS-BUILT Drawings			
Warranty Management			
Close Out Process			
OVERALL PERFORMANCE			
SECTION IV NARRATIVE			
Comments regarding Consultants performance: (Use reverse if necessary)			
SECTION V PREPARED BY:			
(Project Mgr.)			
(Date)			

ATTACHMENTS

1. Division 25 - BAS Specification
2. Division 25 - Control Drawings
3. Equipment and Building Code Schematic
4. Equipment and Pipe Identification Color Charts